City Research Online

City St George's, University of London

Citation: Selim, G. M. (1980). The audit of management information systems: The internal audit role and the semantic differential technique. (Unpublished Doctoral thesis, The City University)

This is the accepted version of the paper.

This version of the publication may differ from the final published version. To cite this item please consult the publisher's version.

Permanent repository link: https://openaccess.city.ac.uk/id/eprint/37140/

Copyright and Reuse: Copyright and Moral Rights remain with the author(s) and/or copyright holders. Copies of full items can be used for personal research or study, educational, or not-for-profit purposes without prior permission or charge, unless otherwise indicated, provided that the authors, title and full bibliographic details are credited, a hyperlink and/or URL is given for the original metadata page and the content is not changed in any way. For full details of reuse please refer to City Research Online policy.

City Research Online: http://openaccess.city.ac.uk/ publications@citystgeorges.ac.uk

THE CITY UNIVERSITY BUSINESS SCHOOL
LONDON

THE AUDIT OF MANAGEMENT INFORMATION SYSTEMS: THE INTERNAL AUDIT ROLE AND THE SEMANTIC DIFFERENTIAL TECHNIQUE

by

GEORGES MICHEL SELIM

No access should be allowed to this thesis until the 1st January 1995 without the permission of Mr. Andrew D. Chambers or Mr. G.M. Selim

A THESIS SUBMITTED FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY
August, 1980

TABLE OF CONTENTS

	PAGE
List of Tables	11
List of Figures	32
Acknowledgements	33
Abstract	35
CHAPTER I DESCRIPTION OF THE STUDY	
1.1. Introduction	38
1.2. Purpose of the study	42
1.3. Why is this study necessary?	43
1.4. Limitations	46
1.5. Hypotheses	47
1.6. Methodology	48
1.6.1. Research method	48
1.6.2. Field data gathering	49
1.6.3. Data analysis techniques	50
1.7. Outline of the study	50
CHAPTER II MANAGEMENT INFORMATION SYSTEMS: REVIEW OF THE LITERATURE	
2.1. Introduction	57
2.2. Framework for perceiving MIS	57
2.2.1. Managerial structure and the MIS	59
2.2.2. MIS subsystems	61
2.2.3. MIS as a sequential process	61
2.2.4. The dynamic nature of the MIS	64

TABLE OF CONTENTS
(continued)

PAGE

CHAPTER II (continued)

2.3. Misinformation systems 65

2.4. Auditing MIS 70

2.4.1. History of internal auditing 70
2.4.2. Aims of internal auditing 72
2.4.3. Types of internal audits 76
2.4.4. The role of internal auditors in relation to MIS 79

2.5. Methods of measuring the value of management information 84

2.5.1. Quantitative information value models 86
2.5.2. Studies based on observation of actual results 96
2.5.3. Studies based on information users' perceptions 100

2.6. Studies of the attributes of information 107

2.7. Summary and conclusions 112

CHAPTER III 'MIS AUDIT' QUESTIONNAIRES - METHOD AND PROCEDURE

3.1. Introduction 124

3.2. Developing the questionnaires 124

3.2.1. Number of auditing staff 125
3.2.2. The audit of MIS 126
3.2.2.1. Companies auditing MIS and the type of audit performed 126
3.2.2.2. Audit plans 126
3.2.2.3. Characteristics of MIS auditors 127
3.2.2.4. Audit scope 127
3.2.2.5. Audit recommendations 128
3.2.2.6. Benefits of the MIS audits 128
3.2.2.7. Ideal MIS audits 129

TABLE OF CONTENTS
(continued)

PAGE

CHAPTER III (continued)

3.2.3. Managers' satisfaction with MIS 130
3.2.4. Manager-Auditor working relationship 130
3.2.5. Internal Auditors' evaluation 131
3.3. Population 131
3.3.1. Sample plan 133

3.4. Procedure 134
3.4.1. Pilot study 134
3.4.2. Administration of the questionnaire 136
3.4.3. Tabulating responses 137

CHAPTER IV EMPIRICAL FINDINGS RELATING TO MIS AUDIT

4.1. Introduction 142

4.2. Response analysis 142
4.2.1. Survey response 142
4.2.2. Survey bias 144
4.2.3. Statistics used to analyse data 156

4.3. Number of auditing staff 157

4.4. The audit of MIS 158
4.4.1. Companies auditing MIS and the type of audit performed 159
4.4.2. Audit plans 161
4.4.3. Characteristics of MIS auditors 165
4.4.4. Audit scope 167
4.4.4.1. Audit scope in general terms 167
4.4.4.2. Review of internally generated reports 170
4.4.4.3. Review of the overall efficiency and effectiveness of MIS 178

TABLE OF CONTENTS
(continued)

PAGE

CHAPTER IV (continued)

4.4.5. Audit recommendations 184
4.4.6. Benefits of the MIS audits 185
4.4.6.1. Rating of the benefits in comparison with the cost 186
4.4.6.2. Responses and rankings of the benefits of the audits 187
4.4.6.3. The influences of the audit 196
4.4.7. Ideal MIS audits 198

4.5. Managers' satisfaction with the MIS 213

4.6. Manager-Auditor working relationship 216
4.6.1. MIS-Manager-Auditor working relationship 216
4.6.2. Manager-Auditor working relationship 218

4.7. Internal auditors' evaluation 222

4.8. Companies' published data 223

4.9. Summary and conclusions 226

CHAPTER V INFERENTIAL ANALYSIS OF SELECTED ASPECTS OF MIS AUDITS

5.1. Introduction 230

5.2. General rules applied in hypotheses testing 230

5.3. Analysis of hypotheses: results and comments 230
5.3.1. Hypotheses relating to the number of auditing staff 231
5.3.2. Hypotheses relating to the characteristics of the companies auditing MIS and the approach (type) used in this audit 235

TABLE OF CONTENTS
(continued)

PAGE

CHAPTER V (continued)

5.3.3. Hypotheses relating to the audit plans 249
5.3.4. Hypotheses relating to the audit scope 260
5.3.5. Hypotheses relating to the benefits of the MIS audits 262
5.3.5.1. Hypotheses relating to the influence of MIS audits 263
5.3.5.2. Hypotheses relating to the benefits (as scales and ranked) of MIS audits 270
5.3.6. Hypotheses relating to the ideal MIS audits 276
5.3.7. Hypotheses relating to the manager-auditor working relationship 286

5.4. Summary and conclusions 288

CHAPTER VI 'EVALUATION OF M.I.' QUESTIONNAIRE - METHOD AND PROCEDURE

6.1. Introduction 310

6.2. Factors used to select a company as a field site 310

6.3. Choosing Company XXX 313
6.3.1. Details of company XXX 313
6.3.2. Details of reports "A" and reports "B" 314
6.3.2.1. The "A" reports 314
6.3.2.2. The "B" reports 314

6.4. Developing the questionnaire to investigate: 315
6.4.1. Details of the respondent's job 315
6.4.2. Objectives of the reports 316
6.4.3. Monetary evaluation of the reports 316
6.4.4. Semantic differential instrument 317
6.4.5. Custom tailored reports 326
6.4.6. Respondents' involvement with, and attitudes towards, the reports. 328

TABLE OF CONTENTS
(continued)

		PAGE
CHAPTER VI (continued)		
6.5.	Sample selection	329
	6.5.1. Sampling plan	329
6.6.	Procedure	331
	6.6.1. Initial meeting with company XXX's representative	331
	6.6.2. Agreed timetable for pilot study and administration of the questionnaire	332
	6.6.3. Pilot study	333
	6.6.4. Administration of the questionnaire	334
	6.6.5. Tabulating responses	335
CHAPTER VII	EMPIRICAL FINDINGS RELATING TO THE EVALUATION OF M.I.	
7.1.	Introduction	339
7.2.	Response rate	340
	7.2.1. Response rate by strata	340
	7.2.2. Survey bias	341
7.3.	Statistics used to analyse data	342
7.4.	Characteristics of the respondents	343
7.5.	Monetary value	346
	7.5.1. Introduction	346
	7.5.2 Overall statistical results	346
	7.5.3. Individual manager's monetary value estimates	349
	7.5.4. Managers' bases for monetary value estimates	352
	7.5.5. Net system value	358
	7.5.6. Methodological considerations	360

TABLE OF CONTENTS

(continued)

		PAGE
CHAPTER VII (continued)		
7.6.	Semantic differential	361
	7.6.1. Introduction	361
	7.6.2. Overall score results	362
	7.6.3. Individual score results	365
	7.6.4. Individual scale results	371
7.7.	Custom tailored (Ideal) reports	375
	7.7.1. Introduction	375
	7.7.2. Analysis of monetary value estimates	375
	7.7.3 Analysis of semantic differential value scores	381
7.8.	Degree to which reports meet control and planning needs	387
7.9.	Parts reviewed in the reports	390
7.10.	Summary and conclusions	394
CHAPTER VIII	FACTOR ANALYSIS OF S.D. SCALES	
8.1.	Introduction	417
8.2.	Factor analytic procedures: the problems of choice	420
	8.2.1. Introduction	420
	8.2.2. The preparation of the correlation matrix	421
	8.2.2.1. Parametric or non-parametric measures of association?	422
	8.2.2.2. Spearman's (R_s) or Kendall's τ (Tau)?	427
	8.2.3. The extraction of initial factors	428
	8.2.4. Factors for rotation	429
	8.2.5. Rotation of factors	430
	8.2.6. Factor scores	433
	8.2.7. Summary	435

TABLE OF CONTENTS
(continued)

PAGE

CHAPTER VIII (continued)

8.3. Factor analysis results 436
8.3.1. Treatment of data 436
8.3.2. Constructing a matrix to be used as input data 437
8.3.3. Results for reports "A" 437
8.3.3.1. Final solution 473
8.3.3.2. Factor pattern correlations 479
8.3.4. Results for reports "B" 486
8.3.4.1. Final solution 519
8.3.4.2. Factor pattern correlations 530
8.3.5. Results for the two sets of reports combined 536
8.3.5.1. Final solution 561
8.3.5.2. Factor pattern correlations 566
8.3.6. Summary and conclusions 571

CHAPTER IX RELIABILITY COEFFICIENTS OF THE SCALES MEASURING THE VALUE AND ATTRIBUTES OF M.I.

9.1. Introduction 591

9.2. Statistics chosen for analysis 594

9.3. Reliability coefficients results 595
9.3.1. The value-applicability scale 597
9.3.2. The value-need scale 599
9.3.3. The quantity-attribute scale 602
9.3.4. The accuracy or reliability-attribute scale 605
9.3.5. The timeliness-attribute scale 606
9.3.6. The format-attribute (experimental) scale 606

9.4. Summary and conclusions 607

TABLE OF CONTENTS
(continued)

PAGE

CHAPTER X INFERENTIAL ANALYSIS OF THE NEW APPROACH TO THE EVALUATION OF M.I.

10.1. Introduction 612

10.2. General rules applied in testing hypotheses 612

10.3. Analysis of hypotheses: results and comments 613

10.3.1. Hypotheses relating to managers' estimates of the monetary value and S.D. scores of the reports 613

10.3.1.1. Analysis of hypothesis one 613

10.3.1.2. Analysis of hypothesis two 618

10.3.1.3. Analysis of hypothesis three 627

10.3.1.4. Conclusions and discussion of the results of the first three hypotheses 631

10.3.1.5. Analysis of hypothesis four 632

10.3.1.6. Analysis of hypothesis five 641

10.3.2. Hypotheses relating to some factors which may influence managers' perceptions of the reports 651

10.3.2.1. Analysis of hypothesis six 651

10.3.2.2. Analysis of hypothesis seven 655

10.3.2.3. Analysis of hypothesis eight 658

10.3.2.4. Analysis of hypothesis nine 661

10.3.3. Hypotheses relating to managers' position in the organisational hierarchy 665

10.3.3.1. Analysis of hypothesis ten 665

10.3.3.2. Analysis of hypothesis eleven 668

10.3.3.3. Analysis of hypothesis twelve 669

10.3.4. Hypotheses relating to the amount of budgetthe manager is responsible for 670

10.3.4.1. Analysis of hypothesis thirteen 670

10.3.4.2. Analysis of hypothesis fourteen 672

10.3.4.3. Analysis of hypothesis fifteen 674

TABLE OF CONTENTS
(continued)

PAGE

CHAPTER X (continued)

10.3.5. Hypotheses relating to the number of parts in the reports reviewed by managers 675

10.3.5.1. Analysis of hypothesis sixteen 675

10.3.5.2. Analysis of hypothesis seventeen 678

10.3.6. Hypothesis relating to manager's satisfaction with the reports meeting their control and planning needs 680

10.3.6.1. Analysis of hypothesis eighteen 680

10.4. Analysis of remaining questionnaire data 684

10.5. Summary and conclusions 696

CHAPTER XI SUMMARY, CONCLUSIONS, RECOMMENDATIONS OF THE STUDY, AND RECOMMENDATIONS FOR FURTHER RESEARCH

11.1. Introduction 703

11.2. Summary of the study 703

11.2.1. Summary of the methodology 703

11.2.2. Summary of the results 704

11.3 Conclusions and recommendations of the study 713

11.4. Recommendations for further research 719

APPENDICES 723

BIBLIOGRAPHY 827

LIST OF TABLES

TABLE		PAGE
4.1.	Analysis of response rates to the questionnaires	143
4.2.	T-test for non-response bias in the internal auditors' questionnaire	146
4.3.	Median test for non-response bias in the internal auditors' questionnaire	147
4.4.	Fisher exact probability test for non-response bias in the internal auditors' questionnaire	149
4.5.	T-test for non-response bias in the managers' questionnaire	150
4.6.	Median test for non-response bias in the managers' questionnaire	151
4.7.	Fisher exact probability test for non-response bias in the managers' questionnaire	152
4.8.	T-test for non-response bias in the MIS managers' questionnaire	153
4.9.	Median test for non-response bias in the MIS managers' questionnaire	154
4.10.	Fisher exact probability test for non-response bias in the MIS managers' questionnaire	155
4.11.	Number of auditing staff employed by companies	158

TABLE		PAGE
4.12.	Companies auditing MIS and the type of audit performed	160
4.13.	Frequency of MIS audit	162
4.14.	Proportion of the internal audit department's time spent in MIS audit	163
4.15.	Number of auditors involved in an MIS audit	164
4.16.	Personnel from outside the internal audit department working in the audit of MIS	165
4.17.	Education and experience of MIS auditors	166
4.18.	Auditors' ranking of the categories and items, inside each category, representing the elements of audit of MIS	168
4.19.	Internal auditors reviewing reports to determine whether they meet managers' needs, and the methods used	170
4.20.	Respondents' satisfaction with the method(s) used by internal auditors in reviewing internally generated reports	173
4.21.	Other departments reviewing reports to determine whether they meet managers' needs	175
4.22.	Method(s) used by the other departments in reviewing internal reports to determine whether they meet managers' needs	176
4.23.	Respondents' satisfaction with the method(s) used by the other departments in reviewing internally generated reports	177

TABLE		PAGE
4.24.	Internal auditors reviewing and reporting on the overall efficiency and effectiveness of the MIS	179
4.25.	Respondents' satisfaction with the method(s) used by internal auditors in reviewing MIS for their overall efficiency and effectiveness	180
4.26.	Other departments reviewing and reporting on the overall efficiency and effectiveness of MIS	183
4.27.	Internal auditors' rating of audit benefits compared with costs	186
4.28.	Managers' and MIS managers' rating of audit benefits compared with costs	186
4.29.	Internal auditors' ranking of benefits from past operational audits	189
4.30.	Internal auditors' ranking of benefits from past compliance audits	191
4.31.	Managers' ranking of benefits from past audits of MIS	192
4.32.	MIS managers' ranking of benefits from past audits of MIS	193
4.33.	Respondents' perceptions of the effects of MIS audits on managers' confidence in the data they receive	196
4.34.	Respondents' perceptions of MIS audits effects on management decisions	196
4.35.	Respondents' perceptions of MIS improving because of past audits	197

TABLE		PAGE
4.36.	Respondents' perceptions of the scope of the ideal MIS operational audits	200
4.37.	Respondents' satisfaction with the MIS in their company	214
4.38.	Internal auditors' and MIS managers' perceptions of their working relationship	217
4.39.	MIS managers' opinions about being audited	217
4.40.	Internal auditors' and managers' perceptions of their working relationship	219
4.41.	Managers' opinions about being audited	220
4.42.	Managers' perceptions of their level of understanding MIS audits	221
4.43.	Method(s) of evaluating the internal audit department	222
4.44.	Companies' financial and non-financial data	225
5.1.	Testing of hypotheses related to the size of the audit department and company and audit variables	232
5.2.	Testing of hypotheses related to the characteristics of the companies auditing their MIS and the relationship between these audits and the respondents' perceptions of their benefits	237
5.3.	Testing of hypotheses related to the approach used in the audit of MIS and audit and company variables	242

TABLES PAGE

5.4. Testing of hypotheses related to the difference between respondents' perceptions of the audit scope (in general), the benefits and influences of the audits, and the ideal MIS audits, as a result of their difference in the approach they use to perform the audit 247

5.5. Testing of hypotheses related to the intensity of MIS audits and company variables, audit variables, audit scope and effects of the audits. (Intensity as measured by the proportion of the department's total available time spent on these audits) 250

5.6. Testing of hypotheses related to the intensity of MIS audits and company variables, audit variables, audit scope and effects of the audits. (Intensity as measured by the number of auditors performing the audits) 257

5.7. Median test between respondents in their degree of satisfaction with the methods used by auditors in reviewing reports to determine whether they meet managers' needs 261

5.8. Testing of hypotheses related to managers and MIS managers views about the influences of the MIS audits 263

5.9. Median test results for H8.4 to H8.6 265

5.10. Testing of hypotheses related to the influences of the MIS audits and the manager-auditor working relationship 268

5.11. Testing of hypotheses related to the benefits - scaled against costs - of MIS audits as perceived by managers and MIS managers and their working relationship with auditors; satisfaction with MIS 272

TABLE		PAGE
5.12.	Median test between managers and MIS managers in their rankings of the benefits arising from the audit of MIS	275
5.13.	Median test results between respondents as to their perceptions of the ideal MIS audits	277
V.I.	Median test results related to H4.1	293
V.II.	Median test results related to H4.2	296
V.III.	Median test results related to H4.3	297
V.IV.	Median test results related to H4.4	298
V.V.	Median test results related to H4.5	299
V.VI.	Kendall's τ (Tau) correlation coefficients results between intensity of MIS audits and scope of the audit	302
V.VII.	Kendall's τ (Tau) correlation coefficients results between intensity of MIS audits and benefits of operational audits	306
V.VIII.	Kendall's τ (Tau) correlation coefficients results between intensity of MIS audits and benefits of compliance audits	307
V.IX.	Kendall's τ (Tau) correlation coefficients results between intensity of MIS audits and the influences of the audits	308
6.1.	Word survey results	321
6.2.	Attribute scales	324
7.1.	Responses received	341

TABLE		PAGE
7.2.	Description of respondents' characteristics (by strata)	345
7.3.	Monetary value descriptive statistics (by strata)	347
7.4.	Monetary value descriptive statistics (by groups)	348
7.5.	Individual manager's monetary value estimates for reports "A"	350
7.6.	Individual manager's monetary value estimates for reports "B"	351
7.7.	Managers' bases for monetary value estimates for reports "A"	353
7.8.	Managers' bases for monetary value estimates for reports "B"	356
7.9.	Estimated mean of the population for reports "A" (by strata)	359
7.10.	Estimated total monetary value for reports "A" (by strata)	359
7.11.	SD - Overall statistical results (by strata)	363
7.12.	SD - Overall statistical results (by groups)	364
7.13.	Semantic differential score for each respondent in department type "A"	365
7.14.	Semantic differential score for each respondent in department type "B"	366
7.15.	Semantic differential score for each respondent in department type "C"	367

TABLE		PAGE
7.16.	Semantic differential score for each respondent in department type "D"	368
7.17.	Semantic differential score for each respondent in department type "E" for reports "A"	369
7.18.	Semantic differential score for each respondent in department type "E" for reports "B"	370
7.19.	S.D. scale results for reports "A" - all respondents	373
7.20.	S.D. scale results for reports "B" - all respondents	374
7.21.	Monetary value descriptive statistics for custom-tailored reports (by strata)	376
7.22.	Monetary value descriptive statistics for custom-tailored reports (by groups)	377
7.23.	T-test results for monetary value estimates of actual versus hypothetical reports (by strata)	379
7.24.	T-test results for monetary value estimates of actual versus hypothetical reports (by groups)	380
7.25.	Wilcoxon matched pairs signed ranks test for SD value scores of actual versus hypothetical reports (by strata)	384
7.26.	Wilcoxon matched pairs signed ranks test for SD value scores of actual versus hypothetical reports (by groups)	385
7.27.	How well reports "A" and reports "B" provide information to monitor performance	388

TABLE		PAGE
7.28.	How well reports "A" and reports "B" provide information for planning future operations	389
7.29.	Parts reviewed regularly in reports "A"	391
7.30.	Parts reviewed regularly in reports "B"	392
VII.I	Annual monetary value estimates of the managers' willingness to pay for reports "A" - ranked	400
VII.II	Annual monetary value estimates of the managers' willingness to pay for reports "B" - ranked	401
VII.III.	SD scale results for reports "A" - Departments type "A"	402
VII.IV.	SD scale results for reports "A" - Departments type "B"	403
VII.V.	SD scale results for reports "A" - Departments type "C"	404
VII.VI.	SD scale results for reports "A" - Departments type "D"	405
VII.VII.	SD scale results for reports "A" - Departments type "E"	406
VII.VIII.	SD scale results for reports "A" - Group 1	407
VII.IX.	SD scale results for reports "A" - Group 2	408
VII.X.	SD scale results for reports "B" - Departments type "A"	409
VII.XI.	SD scale results for reports "B" - Departments type "B"	410

TABLE		PAGE
VII.XII.	SD scale results for reports "B" - Departments type "C"	411
VII.XIII.	SD scale results for reports "B" - Departments type "D"	412
VII.XIV.	SD scale results for reports "B" - Departments type "E"	413
VII.XV.	SD scale results for reports "B" - Group 1	414
VII.XVI.	SD scale results for reports "B" - Group 2	415
8.1.	Skewness and Kurtosis for SD scales (All respondents)	424
8.2.	Reports "A" - Factor 1 (N=71)	440
8.3.	Reports "A" - Factor 2 (N=71)	441
8.4.	Reports "A" - Factor 3 (N=71)	442
8.5.	Reports "A" - Factor 4 (N=71)	443
8.6.	Reports "A" - Factor 5 (N=71)	444
8.7.	Reports "A" - Factor 6 (N=71)	445
8.8.	Reports "A" - Factor 7 (N=71)	446
8.9.	Reports "A" - Factor 8 (N=71)	447
8.10.	Reports "A" - Factor 9 (N=71)	448

TABLE		PAGE
8.11.	The four unstable bi-polar adjectives and the factors on which they had their highest loadings shown with different factor analysis methods and different types of rotation	450
8.12.	Productive-Unproductive loadings on factor 4 and factor 9	453
8.13.	Kendall's τ (Tau) correlation coefficients for the bi-polar adjectives having their highest pattern loadings on factor 4	454
8.14.	Current-Outdated loadings on factor 9 and factor 6	456
8.15.	Kendall's τ (Tau) correlation coefficients for the bi-polar adjectives having their highest pattern loadings on factor 3	458
8.16.	Kendall's τ (Tau) correlation coefficients for the bi-polar adjectives having their highest pattern loadings on factor 6	459
8.17.	Kendall's τ (Tau) correlation coefficients for the bi-polar adjectives having their highest pattern loadings on factor 9	459
8.18.	Confirmed-Unconfirmed loadings on factor 8 and factor 1	461
8.19.	Kendall's τ (Tau) correlation coefficients for the bi-polar adjectives having their highest pattern loadings on factor 1	463
8.20.	Kendall's τ (Tau) correlation coefficients for the bi-polar adjectives having their highest pattern loadings on factor 8	464
8.21.	Kendall's τ (Tau) correlation coefficients for the bi-polar adjectives having their highest pattern loadings on factor 8	465

TABLE		PAGE
8.22.	The loadings of the bi-polar adjective Accurate-Inaccurate on the different factors	467
8.23.	The loadings of the bi-polar adjective Efficient-Inefficient on the different factors	468
8.24.	Kendall's τ (Tau) correlation coefficients of the bi-polar adjective Accurate-Inaccurate with the other bi-polar adjectives having their highest loadings on factor 5	469
8.25.	Kendall's τ (Tau) correlation coefficients of the bi-polar adjective Efficient-Inefficient with the other bi-polar adjectives having their highest loadings on factor 6	471
8.26.	Kendall's τ (Tau) correlation coefficients of the bi-polar adjective Efficient-Inefficient with the other bi-polar adjectives having their highest loadings on factor 7	472
8.27.	Principal-component analysis of SD data of reports "A" (Oblique rotation -δ=0-N=71)	474
8.28.	Comparison of the initial classification of bi-polar adjectives with the factor analysis results of reports "A"	478
8.29.	Factor pattern correlations- final solution- (Reports "A")	480
8.30.	Reports "B" - Factor 1 (N=71)	488
8.31.	Reports "B" - Factor 2 (N=71)	489
8.32.	Reports "B" - Factor 3 (N=71)	490
8.33.	Reports "B" - Factor 4 (N=71)	491
8.34.	Reports "B" - Factor 5 (N=71)	492

TABLE		PAGE
8.35.	Reports "B" - Factor 6 (N=71)	493
8.36.	Reports "B" - Factor 7 (N=71)	494
8.37.	Reports "B" - the new factor 7 (N=71)	495
8.38.	The nine bi-polar adjectives and the factors on which they had their highest loadings with different factor analysis methods, and different types of rotation	497
8.39.	Kendall's τ (Tau) correlation coefficients for the bi-polar adjectives having their highest pattern loadings on the new factor 7	499
8.40.	Kendall's τ (Tau) correlation coefficients for the bi-polar adjectives having their highest pattern loadings on factor 1	500
8.41.	Kendall's τ (Tau) correlation coefficients for the bi-polar adjectives having their highest pattern loadings on factor 5	502
8.42.	Kendall's τ (Tau) correlation coefficients for the bi-polar adjectives having their highest pattern loadings on factor 1	503
8.43.	Productive-Unproductive loadings on factor 5 and factor 1	505
8.44.	Productive-Unproductive loadings on the new factor 7 and factor 1	506
8.45.	Kendall's τ (Tau) correlation coefficients for the bi-polar adjectives having their highest pattern loadings on factor 5	506
8.46.	Kendall's τ (Tau) correlation coefficients for the bi-polar adjectives having their highest pattern loadings on factor 1	507

TABLE		PAGE
8.47.	Kendall's τ (Tau) correlation coefficients for the bi-polar adjectives having their highest pattern loadings on factor 5	509
8.48.	Kendall's τ (Tau) correlation coefficients for the bi-polar adjectives having their highest pattern loadings on factor 1	510
8.49.	Informative-Uninformative loadings on factor 3 and factor 1	511
8.50.	Kendall's τ (Tau) correlation coefficients for the bi-polar adjectives having their highest pattern loadings on factor 3	512
8.51.	Kendall's τ (Tau) correlation coefficients for the bi-polar adjectives having their highest pattern loadings on factor 1	513
8.52.	Current-Outdated loadings on factor 7 and factor 1	514
8.53.	Kendall's τ (Tau) correlation coefficients for the bi-polar adjectives having their highest pattern loadings on factor 7	515
8.54.	Kendall's τ (Tau) correlation coefficients for the bi-polar adjectives having their highest pattern loadings on factor 2	516
8.55.	Kendall's τ (Tau) correlation coefficients for the bi-polar adjectives having their highest pattern loadings on factor 5	517
8.56.	Kendall's τ (Tau) correlation coefficients for the bi-polar adjectives having their highest pattern loadings on factor 4	518
8.57	Principal component analysis of S.D. data of reports "B" (oblique rotation: δ=0 -N=71)	520
8.58	Comparison of the initial classification of bi-polar adjectives with the factor analysis results of reports "B"	525

TABLE		PAGE
8.59	Comparison of the final solution results for the two sets of reports	527
8.60	Factor pattern correlations - final solution - (Reports "B")	531
8.61	The two reports together - Factor 1 (N=71)	538
8.62	The two reports together - Factor 2 (N=71)	539
8.63	The two reports together - Factor 3 (N=71)	540
8.64	The two reports together - Factor 4 (N=71)	541
8.65	The two reports together - Factor 5 (N=71)	542
8.66	The two reports together - Factor 6 (N=71)	543
8.67	The two reports together - Factor 7 (N=71)	544
8.68	The five bi-polar adjectives and the factors on which they had their highest loadings, with different factor analysis methods, and different types of rotation	546
8.69	Unstable variables	547
8.70	Kendall's τ(Tau) correlation coefficients for the bi-polar adjectives having their highest pattern loadings on factor 5	550
8.71	Kendall's τ(Tau) correlation coefficients for the bi-polar adjectives having their highest pattern loadings on factor 1	551
8.72	Productive-Unproductive loadings on factor 7 and factor 1	552
8.73	Kendall's τ (Tau) correlation coefficients for the bi-polar adjectives having their highest pattern loadings on factor 1	553

TABLE		PAGE
8.74	Kendall's τ (Tau) correlation coefficients for the bi-polar adjectives having their highest pattern loadings on factor 3	554
8.75	Kendall's τ (Tau) correlation coefficients for the bi-polar adjectives having their highest pattern loadings on factor 1	555
8.76	The loadings of the bi-polar adjective Confirmed-Unconfirmed on factors 1, 5 and 7	556
8.77	Kendall's τ (Tau) correlation coefficients for the bi-polar adjectives having their highest pattern loadings on factor 5	557
8.78	Kendall's τ (Tau) correlation coefficients for the bi-polar adjectives having their highest pattern loadings on factor 1	558
8.79	Current-Out-dated loadings on factor 7 and factor 2	559
8.80	Kendall's τ (Tau) correlation coefficients for the bi-polar adjectives having their highest pattern loadings on factor 2	560
8.81	Kendall's τ (Tau) correlation coefficients for the bi-polar adjectives having their highest pattern loadings on factor 7	561
8.82	Principal-component analysis of S.D. data of the two sets of reports together (oblique rotation - δ=0 N=71)	562
8.83	Comparison of the initial classification of bi-polar adjectives with the factor analysis results of the two sets of reports together	564
8.84	Bi-polar adjectives which changed factors in the factor analysis of reports "A", reports "B", and the"two sets of reports combined"	565
8.85	Factor pattern correlations - final solution - (The two reports together)	567

TABLE		PAGE
8.86	Comparison of factor pattern correlations (final solution) for reports "A", reports "B" and the two sets of reports together.	570
8.87	Bi-polar adjectives and the values and attributes of MIS reports they measure	579
VIII.I	Factor structure matrix for reports "A" (Oblique rotation - δ=0-N=71)	584
VIII.II	Factor pattern correlation matrix for reports "A"	585
VIII.III	Factor structure matrix for reports "B" (oblique rotation -δ=0-N=71)	586
VIII.IV	Factor pattern correlation matrix for reports "B"	587
VIII.V	Factor structure matrix for the two sets of reports together (oblique rotation - δ=0-N=71)	588
VIII.VI	Factor pattern correlation matrix for the two sets of reports together	589
9.1	Reliability coefficients of the scale measuring the VALUE - applicability of MIS reports	598
9.2	Reliability coefficients of the scale measuring the VALUE - need of MIS reports	601
9.3	Reliability coefficients of the scale measuring the QUANTITY - attribute of MIS reports	604
10.1	Kendall's τ (Tau) correlation coefficients of the monetary value of the reports and the S.D. scales	615
10.2	Kendall's τ (Tau) correlation coefficients of the S.D. scales measuring value and the S.D. scales measuring the attributes (All respondents N=71)	620
10.3	Kendall's τ (Tau) correlation coefficients of the S.D. scales measuring value and the S.D. scales measuring the attributes (N=16, group 1)	621

TABLE		PAGE
10.4	Kendall's τ (Tau) correlation coefficients of the S.D. scales measuring value and the S.D. scales measuring the attributes (N=55, group 2)	622
10.5	Kendall's τ (Tau) correlation coefficients of the S.D. scales measuring value and the S.D. scales measuring the attributes (Departments type "B" N=13)	623
10.6	Kendall's τ (Tau) correlation coefficients of the S.D. scales measuring value and the S.D. scales measuring the attributes (Departments type "C" N=10)	624
10.7	Kendall's τ (Tau) correlation coefficients of the S.D. scales measuring value and the S.D. scales measuring the attributes (Departments type "D" N=15)	625
10.8	Kendall's τ (Tau) correlation coefficients of the S.D. scales measuring value and the S.D. scales measuring the attributes (Departments type "E" N=30)	626
10.9	T-test results of monetary value estimates for reports "A" versus the monetary value estimates for reports "B"	629
10.10	Wilcoxon matched pairs signed ranks test results for the S.D. scales for reports "A" versus the S.D. scales for reports "B"	630
10.11	Kendall's τ (Tau) correlation coefficients of the S.D. scales measuring the attributes (All respondents N=71)	633
10.12	Kendall's τ (Tau) correlation coefficients of the S.D. scales measuring the attributes (group 1 N=16)	634
10.13	Kendall's τ (Tau) correlation coefficients of the S.D. scales measuring the attributes (group 2 N=55)	635
10.14	Kendall's τ (Tau) correlation coefficients of the S.D. scales measuring the attributes (Departments type "B" N=13)	636

TABLE		PAGE
10.15	Kendall's τ (Tau) correlation coefficients of the S.D. scales measuring the attributes (Departments type "C" N=10)	637
10.16	Kendall's τ (Tau) correlation coefficients of the S.D. scales measuring the attributes (Departments type "D" N=15)	638
10.17	Kendall's τ (Tau) correlation coefficients of the S.D. scales measuring the attributes (Departments type "E" N=30)	639
10.18	F-test for monetary value estimates between the different departments (Reports "A")	643
10.19	F-test for monetary value estimates between the different departments (Reports "B")	644
10.20	Median test for the scores on the S.D. scales between the different departments	645
10.21	T-test for monetary value estimates between the two groups (N=70)	646
10.22	Median test for the scores on the S.D. scales between the two groups	647
10.23	T-test for monetary value estimates between every two departments	649
10.24	Median test for the scores on the S.D. scales for managers who participated in reports design versus managers who did not participate	654
10.25	Median test for the scores on the S.D. scales for managers with previous experience in designing information systems versus those who do not have this experience	657
10.26	Pearson's P.M. correlations of number of personnel supervised and the monetary value estimates	659
10.27	Kendall's τ (Tau) correlation coefficients of number of personnel supervised and the scores on the S.D. scales	660

TABLE		PAGE
10.28	Kendall's τ (Tau) correlation coefficients of managers' experience and their scores on the S.D. scales	664
10.29	Kendall's τ (Tau) correlation coefficients of the scalar level and both the monetary value estimates and the scores on the S.D. scales	666
10.30	Kendall's τ (Tau) correlation coefficients between managers' scalar level and their satisfaction with the reports meeting their control and planning needs	668
10.31	Kendall's τ (Tau) correlation coefficients of managers' ranked budget and both their monetary value estimates and the scores on the S.D. scales	671
10.32	Kendall's τ (Tau) correlation coefficients between managers' ranked budget and their satisfaction with the reports meeting their control and planning needs	673
10.33	Kendall's τ (Tau) correlation coefficients of the number of parts in the reports reviewed by managers and both their monetary value estimates and their scores on the S.D. scales	676
10.34	Kendall's τ (Tau) correlation coefficients of the number of parts in the reports reviewed by managers and their degree of satisfaction with these reports in meeting their control and planning needs	679
10.35	Kendall's τ (Tau) correlation coefficients of managers' degree of satisfaction with the reports meeting their control needs and both their monetary estimates of the reports and their scores on the S.D. scales	681
10.36	Kendall's τ (Tau) correlation coefficients of managers' degree of satisfaction with the reports meeting their planning needs and both their monetary estimates of the reports and their scores on the S.D. scales	682

TABLE		PAGE
10.37	Median test for the scores on the S.D. scales for managers who wish to continue receiving reports "B" compared with the managers who do not wish to continue receiving them	685
10.38	Amount of detail in reports "A" and the managers preferring a summary of controllable expenses only	688
10.39	Kendall's τ (Tau) correlation coefficients between managers' rating of the amount of detail in reports "A" and their rating on the bi-polar adjective Detailed-General	690
10.40	Amount of detail in reports "B"	692
10.41	Kendall's τ (Tau) correlation coefficients between managers' rating of the amount of detail in reports "B" and their rating on the bi-polar adjective Detailed-General	694
10.42	A Summary of the results of inferential analyses	697

LIST OF FIGURES

FIGURE		PAGE
5.1.	Relationships between variables representing the audit of MIS, its effects, and characteristics of companies	290
8.1.	Intercorrelations between factors representing different aspects of MIS reports (Reports "A")	481
8.2.	Intercorrelations between factors representing different aspects of MIS reports (Reports "B")	532
8.3.	Intercorrelations between factors representing different aspects of MIS reports (The two reports together)	568

ACKNOWLEDGEMENTS

I would like to acknowledge my appreciation and thanks to all those who contributed to the completion of this thesis.

I am primarily indebted to my academic supervisor, Mr. A.D. Chambers, for his encouragement, guidance and constructive suggestions made throughout the preparation, field study and writing up stages of the thesis.

I am also greatly indebted to the managers, MIS managers, and internal auditors who participated in this research and gave of their valuable time to provide the information required. Special thanks are due to the Deputy Comptroller for his guidance and constructive recommendations.

Appreciation is also extended to the following staff of The City University:

To [redacted] for their constructive criticism and advice concerning the structuring of the study.

To [redacted] for their expert recommendations regarding pertinent statistical analyses.

To [redacted], staff of the Business School Library, and the staff of the Computing Unit for providing cooperative and helpful assistance when using their comprehensive research facilities.

To [redacted], my especial appreciation is given for her patience and care in typing this thesis.

Other informative sources were my colleagues, and I am especially grateful to Dr. S.A. Abu Ghaba for his helpful suggestions and comments.

I also wish to thank my government for the financial support that I received.

Finally, I would like to express my deepest appreciation to [redacted] for her invaluable assistance and encouragement.

ABSTRACT

This study presents the results of investigating the 'state of the art' with respect to the audit of MIS; the value attached to present tools available for use in the evaluation of MIS reports and MIS efficiency and effectiveness; the benefits of these audits as perceived by auditors and auditees; and lastly attempts to develop a new approach (tool) for use by internal auditors in the evaluation of MIS reports. Data for analysis were collected through four postal questionnaires on samples of internal auditors, managers, and MIS managers and used together with companies' published financial and non-financial data.

Statistical analysis of the data revealed that the audit of MIS is performed in a majority of the companies surveyed; that internal auditors take a management perspective in carrying out these audits; that auditees (managers and MIS managers) and internal auditors perceive benefits arising out of these audits (e.g. better decision making, more confidence in the data generated by MIS, and improvements in MIS); that auditees hold a positive attitude towards auditors and appreciate the work they perform in this context, and finally that there exists a lack of suitable, practical, and comprehensive tools or approaches for use in evaluating MIS.

Development of a new approach, to be used by internal auditors in the evaluation of MIS reports, proceeded by subjecting the data collected for this purpose to factor analysis and reliability tests, in order to test validity and reliability and thus to enhance the generalisability of this approach. The new approach developed, tested, and recommended for use comprises: (i) measures of information value, which include managers' estimates and perceptions of the monetary and non-monetary value of the reports, (ii) measures of information attributes, and (iii) measures of maximum information value (custom-tailored reports). The Semantic Differential technique was used to build scales for eliciting managers' perceptions of the value (non-monetary) and the different attributes of MIS reports. They are: quantity of the data; reliability or accuracy of the data; timeliness; format - logical presentation of data; and format - physical construction of the report.

CHAPTER 1

DESCRIPTION OF THE STUDY

1.1. Introduction

1.2. Purpose of the study

1.3. Why is this study necessary?

1.4. Limitations

1.5. Hypotheses

1.6. Methodology

- 1.6.1. Research method
- 1.6.2. Field data gathering
- 1.6.3. Data analysis techniques

1.7. Outline of the study

CHAPTER 1

DESCRIPTION OF THE STUDY

1.1. Introduction

Information provides data pertaining to self and the environment. It is the ". . . basis of all mental consciousness" (1). The importance of information is emphasised by Voich et al who state "Information is a fundamental resource of an organisation. It is so essential to the operations and management of an organisation that it is often justifiably referred to as the 'life blood of organisation', the 'fabric of an organisation', or the 'agent for sustaining organisational viability'.(2).

Information is specifically important to the manager of an organisation. In the words of Voich et al "Managers need information to define goals and to guide the operations of the organisation so as to bring about the effective and harmonious achievement of these goals."(3)

Although information is, in general, essential, different sorts or aspects of information may have specific value or worth. For example, a manager may be willing to pay a high price for information relating to an inventory, whereas the temperature in Inverness may be considered as superfluous information and consequently have no value.

Information can be regarded as a means to an end. Information has value only to the extent that ". . .sooner or later it may be brought to bear upon some open question"(4).

The importance of information for companies and organisations cannot easily be overemphasised. Unfortunately Management Information Systems (MIS) often fail to provide managers with useful and valuable information for making decisions necessary to maximise achievement of corporate goals. Common deficiencies are identified as: over or under supply of data, untimely data, and irrelevant and dispensable data.

Though a number of writers have commented on MIS problems and possible solutions, Ackoff wrote perhaps the most celebrated article "Management Misinformation Systems". Ackoff, in his article, suggested five procedures to improve MIS design. His fifth procedure is of relevance to this study, namely, that adequate control systems should be designed.(5)

A similar point was expressed by Bishop, ". . . this calls for the assignment of a senior member of planning staff to act as an 'information auditor' whose task it would be to maintain an adequate audit over all information used for planning and control purposes"(6).

Mautz and White also state that "Employees under normal conditions, require supervision . . . that they (employees) provide an adequate supply of reliable, timely information for internal management purposes . . . To strengthen the assurance that employee failure does not occur a number of specific practices and procedures tailored to the company's activities would be included in the management control system".(7)

Management's requirements for a control of MIS activities points to internal audit as the function capable of assisting the achievement of that purpose, also echoed by the Institute of Internal Auditors in their "Standards for the Professional Practice of Internal Auditing" in which they state that:

> "Information systems provide data for decision-making, control and compliance with external requirements. Therefore, internal auditors should examine information systems and as appropriate, ascertain whether:
>
> 1. Financial and operating records and reports contain accurate, reliable, timely, complete and useful information.
> 2. Controls over record keeping and reporting are adequate and effective".(8)

The theme of this study is that one type of control over MI can be achieved if the net value of a specific quantity of information can be ascertained. In other words, data must not be produced and communicated to the decision-maker unless its potential value exceeds its cost. Determining the value of information would require the analysis of the outcome of a decision-making process with possessing and not possessing the information in question. According to Feltham, the value of having the appropriate information can be ascertained if the pay off function is quantifiable through the use of quantitative techniques (9). However,

these quantitative techniques can only be used in situations involving programmed decisions.

The distinction between programmed and non-programmed decisions according to Simon is:

"Decisions are programmed to the extent that they are repetitive and routine, to the extent that a definite procedure has been worked out for handling them so that they don't have to be treated de novo each time they occur.

Decisions are non-programmed to the extent that they are novel, unstructured, and consequential. There is no cut-and-dried method for handling the problem because is hasn't arisen before, or because its precise nature and structure are elusive and complex, or because it is so important that it deserves a custom tailored treatment."(10)

Another approach to determine the value of information would be to make the measurements of the value after the consequences of using the information are known. If all other variables could be held equal, while results are observed with and without certain information, then the value of the information could be determined. The problem with this approach is centred in holding all other variables constant. In the real world this is only approximately possible, at best. Methods for isolating cause and effect are really not available.

A third approach initiated by Gallagher (11) represents a feasible and practical approach for use in evaluating management information used in making non-programmed decisions.

In this approach, the value of management information is ascertained through asking the users or decision makers for their estimates of this value. The challenge lies in developing this tentative approach into a valid and reliable tool for use for that purpose.

1.2. Purpose of the study

The major intentions of this study can be clustered into two groups:

First - The audit of MIS

In this context the following areas of interest were investigated.

(i) The 'state of the art' with respect to the audit of MIS.

(ii) The impact of the audit on manager's use of audited data.

(iii) Managers and MIS managers views on the "ideal audit" contrasted with those of internal auditors.

Second - The evaluation of management information

This was investigated through:

(i) Analysing existing techniques for measuring and evaluating management information.

(ii) Synthesising a methodology or an approach, initiated in the USA, to be used in the evaluation of management information, generated through MIS reports in a UK environment.

(iii) Testing the approach by applying it within an existing organisation.

(iv) Statistically analysing the results of the test in order to arrive at a valid and generalisable method for use by auditors (and others) with the purpose of evaluating management information used by decision-makers or managers in making non-programmed decisions.

1.3. Why is this study necessary?

"The failure to properly assess the effectiveness of implemented information systems is costing American industry millions of dollars in profit every year"(12). As an example of inefficient use, "A major New York bank had sustained losses of 14 million dollars and a possible loss of 25 million dollars in its foreign currency trading, according to the press accounts these losses had occurred without the knowledge of the top officers of the bank. This sustains that most managements still do not have the information they need to effectively plan and control . . ." (13)

The above quotations are just examples of myriad of articles written on the subject of MIS failure in providing management with the useful and valuable information(14).

As mentioned earlier, internal auditing is proposed by different authors to be one of the means through which management can achieve control over MIS. "Internal auditing is the process of appraising the information flow to the monitoring function of a system for its quality and completeness."(15).

The requirement of exercising control over MIS stems in reality from the fact that information - the end product - is and must be treated as an economic resource available to companies and organisations, hence, there exists a need for insuring its efficient and effective utilisation. One way of achieving this aim is by subjecting information systems ". . . to much the same type of cost-benefit evaluation as are other segments or aspects of organisational activity. Indeed the need for meaningful cost-benefit measurement of information systems become increasingly critical as organisational capacity to generate information continues to burgeon."(16)

"In an increasingly technological society, information costs are ascending to previously unimagined heights. Further impressive advances in electronic data processing signal an even more staggering amount of information potential. In the past, the emphasis has been on whether information required for decision-making could be developed. With ever growing capacity to generate data, the emphasis now appears to be shifting to the question of what extent this capacity can be utilised beneficially."(17)

Costs as one factor in the economic evaluation of a given set of reports - used in making non-programmed decisions - can be determined by adding up all explicit, implicit, and opportunity costs incurred in acquiring versus not acquiring the information. For the second factor,

i.e.benefits or worth, unfortunately no valid, statistically tested measure exists other than the tentative approach presented by Gallagher and the near unanimous agreement of authors and writers on this subject that users or decision makers are the ultimate parties in determining these benefits or worth, without specifying how. They imply general narrative questions may be used for this purpose(18).

In addition, no research has been conducted in the UK (to the knowledge of the author) concerning the auditing of MIS by internal auditors, with the purposes of illuminating the effects of such audits, indicating the tools used by auditors in this context, and the audit impact on auditees.

In summary, this study is necessary because it incorporates into one study key variables that have not been examined together in previous studies. These key variables are (1) an investigation of the theory and practice of auditing MIS, (2) an empirical investigation of the tools used by auditors in the performance of their audits, (3) an examination of auditors and auditees perceived working relationship, (4) the development of a new (hybrid) methodology or approach for the evaluation (quantitative and qualitative) of management information, (5) testing and validation of this new methodology for future use by auditors and others in this context.

1.4. Limitations

The test of the new approach for the evaluation of management information was performed using data collected in relation to internally generated reports for use by management in taking non-programmed decisions. These reports were computer generated. This means that the following types of reports were excluded from this part of the study, (although it can be said that this approach is applicable in these cases, at least in principle).

(i) Reports for external users.

(ii) Reports for operatives(manuals, blueprints, procedures, etc.)

(iii) One-time or unique reports.

(iv) Manually prepared reports.

The exclusion of the first type of reports was justified on the basis of cost and time required due to the great numbers and dispersion of this class of users. Operatives were excluded in order to concentrate on a single class of information users, i.e. management, so that certain generalisations about the user characteristics could be made. Unique reports or reports with very limited distribution can easily be evaluated within the company by word of mouth, moreover, MIS are developed in order to satisfy recurring demands for information. Lastly manually prepared reports were excluded since modern day trends are towards computerised information systems.

The previous statement points also to another limitation namely, that the study and test did not take into account or

explore the effect of the decision maker's psychological type on his information processing and use, and its probable effect through his attitudes on his perceptions of the value and benefits of the information.

Put another way, due to the complex variations in MIS and managers' uses of information, the approach developed in this study does not attempt to solve the whole problem of valuing information. The new method pertains to the estimate of the monetary value of management information within certain limits, and attempts to provide additional qualitative measures for sustaining the monetary estimates and also provides additional information about the quality of information for managers generated through MIS reports.

1.5. Hypotheses

Two sets of hypotheses corresponding to the two main purposes of the study were formulated and tested in this research.

Group 1: Hypotheses related to selected aspects of MIS audits

These hypotheses include:

(1) Hypotheses relating to the number of auditing staff (H1.1 to H1.8)

(2) Hypotheses relating to the characteristics of the companies auditing MIS and the approach (type) used in the audit. (H2.1 to H2.8, H3.1 to H3.8, and H4.1 to H4.5).

(3) Hypotheses relating to the audit plans (H5.1 to H5.13 and H6.1 to H6.13).

(4) Hypotheses relating to the audit scope (H7.1 to H7.2).

(5) Hypotheses relating to the benefits of the MIS audits (H8.1 to H8.12, and H9.1 to H9.6).

(6) Hypotheses relating to the ideal MIS audits (H10.1).

(7) Hypotheses relating to the manager-auditor working relationship (H11.1 and H11.2).

Group 2: Hypotheses related to the new approach for the evaluation of management information

These hypotheses include:

(1) Hypotheses relating to managers' estimates of the monetary value and semantic differential (SD) scores of the reports (H1 to H5).

(2) Hypotheses relating to characteristics of managers (H6 to H9).

(3) Hypotheses relating to manager's place in the organisational hierarchy (H10 to H12).

(4) Hypotheses relating to the amount of budget the manager is responsible for (H13 to H15).

(5) Hypotheses relating to the number of parts in the reports reviewed by managers (H16 to H17).

(6) Hypothesis relating to managers' satisfaction with the reports meeting their control and planning needs (H18).

1.6. Methodology

1.6.1. Research method

The research technique used in this study consists of two parts. The first part involves a literature search with the purpose of describing MIS, its aims and goals, problems,

and the quest for better management control of these systems. The search findings will determine whether current internal audit practices can provide such control. This examination of the literature will then move toward analysing known techniques for valuing information, and synthesising a "hybrid methodology" for use in a UK company. This hybrid method would combine parts of the approaches used by researchers and writers in this area of interest (19). The second part consists of collecting and analysing data related to the audit of MIS through the use of (i) postal questionnaires on a sample of internal auditors, managers and MIS managers,(ii) companies' published financial and non-financial data. This part also includes collecting and analysing data relating to the value of selected management information.

1.6.2. Field data gathering

The data, used in the analysis, were gathered through the use of four postal questionnaires and the collection of companies' published data from the annual reports.

The first three questionnaires collected data from internal auditors, managers and MIS managers from fifty-six companies in the UK. The fourth questionnaire was used to gather data within an existing financial institution using the perceptions of managers with respect to two sets of periodic reports.

All four instruments used to gather and collect the data were structured questionnaires, pilot tested, with the

results of this pilot test incorporated wherever practical in the final test instruments. The questionnaires in their final forms were mailed to the participants in the research project.

1.6.3. Data analysis techniques

Standard statistical methods were used in the analysis of the quantitative data in this research. These methods included both descriptive and inferential statistics. The descriptive statistics included measures of central tendency and dispersion, with the aim of describing the salient characteristics of the samples data and providing bases for estimating the population parameters or characteristics.

Inferential statistics were used to provide an objective basis for making decisions about the research hypotheses, and were used also in the construction of the different scales purported to measure the quality of management information.

1.7. Outline of the study

This study is divided into eleven chapters. The first two chapters present and provide background information for the study. Chapter I presents the purposes and need for the research together with the hypotheses formulated as the basis for the research activities of the study. Finally, a discussion of the methodology used and applied is presented. Chapter II presents the results of a thorough review of the literature in order to present a framework for perceiving MIS, to indicate the problems encountered in such systems, and to view the audit as a means of

ensuring management control of these systems, in order to improve their efficiency and effectiveness. This search of the literature then proceeds to describe and analyse existing models for measuring the value of information and the studies conducted to delineate their attributes.

The next three chapters present the results of the empirical study into the audit of MIS. Chapter III presents the questionnaires developed for this purpose, the sampling process used in the selection of internal auditors, managers, and MIS managers who participated in the study, the procedures and results of pilot testing the questionnaires, and finally their administration. Problems encountered throughout and solutions used are included. Chapter IV presents a preliminary analysis, using descriptive statistics, of the responses to the questionnaires used to elicit auditors', managers' and MIS managers' attitudes and perceptions of the audit of MIS, and their working relationships. The same type of statistics were used in analysing financial and non-financial data relating to the companies taking part in the research. Chapter V presents the results of testing the different hypotheses developed in relation to the audit of MIS. These areas include, among others, relationships between MIS audits and managers' confidence in the data provided in the reports, the effect of MIS audits on management decisions, and on MIS performance, relationships between profitability, audit intensity, and

audit frequency; audit benefits and company size; audit intensity and staff size; and the perceived value of MIS audit to auditees and non-auditees.

The following five chapters present the result of the empirical test of the methodology for the evaluation of management information. Chapter VI presents the process of selecting the field site for this part of the research, the sampling process used to select the participating managers, and lastly, the development of the questionnaire from inception to the tabulating of responses. Problems encountered and solutions used are also presented. Chapter VII presents and discusses the background details of participating managers; attitudes towards the two sets of reports investigated, and estimates of their values and attributes. Chapter VIII presents a detailed account of the procedures of factor analysing the data collected using the Semantic Differential technique in rating the value and attributes of management information generated through MIS reports. Chapter IX presents the results of testing the reliability of the different scales proposed for the evaluation of MIS reports and of testing also different experimental scales derived from the original ones. Chapter X presents the results of testing the different hypotheses formulated in relation to the methodology proposed for the evaluation of management information, and this chapter also presents the analysis of the remaining questionnaire data.

The last chapter in the thesis, Chapter XI, presents a summary of the key findings of the study, conclusions and implications drawn from the results presented previously, and recommendations of areas for further research.

REFERENCES

(1) McDonough, A.M., Information Economics and Management Systems, McGraw-Hill Book Co., Inc., N.Y., 1963, p.28.

(2) Voich, D., Jnr., Mottice, H.J., & Shrode, W.A., Information systems for operations and management, South-Western Publishing Co., Cincinnati, 1975, p.2.

(3) Ibid.

(4) McDonough, A.M., op.cit., p.20.

(5) Ackoff, R., Management Misinformation Systems, Management Sciences, Dec. 1967, pp. B.147-156.

(6) Bishop, E.B., Information for corporate planning, Management Accounting, August, 1970, p.298.

(7) Mautz, R.K., & White, B.J., Internal control - a management view, Financial Executive, June 1979, p.14.

(8) The Institute of Internal Auditors, Standards for the Professional Practice of Internal Auditing, Florida 1978, pp.300-1.

(9) See for example:

Feltham, G.A., The value of information, The Accounting Review, Vol.XLIII, October 1968, pp.684-696.

Feltham, G.A., Cost aggregation: an information economic analysis, Journal of Accounting Research, Vol.15, No.1, Spring 1977, pp.42-70.

(10) Simon, H.A., The New Science of Management Decisions, Harper & Row, N.Y., 1960, pp.5-6.

(11) Gallagher, C.A., Measurement and analysis of managers' perceptions of the value of selected management information, Unpublished DBA dissertation, Florida State University, 1971.

(12) Didis, S.K., Value analysis of information systems, Journal of Systems Management, Vol.XX, Nov. 1969, p.10.

(13) Neuschel, R.P., Strengthening management information systems, The McKinsey Quarterly, Winter 1976, p.47.

(14) See for example:

a) Neuschel, R.P., Unleashing computer power, Business Horizons, Feb.1971, pp.81-86.

b) Dearden, J., MIS is a mirage, Harvard Business Review, Vol.50, No.1, Jan/Feb 1972, pp.90-99.

c) Smith, H.C., Cost control for computers, Business Horizons, Feb. 1973, pp.73-82.

d) Agrawal, S.P., Accounting's new role in computer-based information systems, Management Adviser, July-August, 1974, pp.40-45.

e) Donalson, H., Management information or management illusion, In Bankers' Management Handbook, Edited by Handscombe, R., McGraw-Hill Co., London,1976, pp.126-143.

(15) Hibbert, G., & Graham, M., The boundaries of internal auditing, Accountancy, September 1979, p.96.

(16) Lavalle, I.H., & Rappaport, A., On the economics of acquiring information of imperfect reliability, The Accounting Review, Vol. XLIII, April 1968, p.225.

(17) Rappaport, A., Sensitivity analysis in decision-making, The Accounting Review, Vol.XLII, July 1967, p.448.

(18) See for example:

a) Rolefson, J.F., The DP Check-up, Journal of Systems Management, Vol.29, No.11, November 1978, pp.38-48.

b) Elam, P.G., User-defined information system quality, Journal of Systems Management, Vol.30, No.8, August 1979, pp.30-33.

(19) a) Gallagher, C.A., op.cit.

b) Kelly, J.A., The analysis and measurement of value of selected non-financial project management information, Unpublished DBA dissertation, Florida State University, 1974.

c) Gregory, R.H., & Van Horn, R.L., Automatic data-processing systems: Principles and Procedures, Wandsworth Publishing Co., Inc., San Francisco, 1960.

CHAPTER 2

MANAGEMENT INFORMATION SYSTEMS: REVIEW OF THE LITERATURE

2.1. Introduction

2.2. Framework for perceiving MIS

- 2.2.1. Managerial structure and the MIS
- 2.2.2. MIS subsystems
- 2.2.3. MIS as a sequential process
- 2.2.4. The dynamic nature of the MIS

2.3. Misinformation systems

2.4. Auditing MIS

- 2.4.1. History of internal auditing
- 2.4.2. Aims of internal auditing
- 2.4.3. Types of internal audits
- 2.4.4. The role of internal auditors in relation to MIS

2.5. Methods of measuring the value of management information

- 2.5.1. Quantitative information value models
- 2.5.2. Studies based on observation of actual results
- 2.5.3. Studies based on information user's perceptions

2.6. Studies of the attributes of information

2.7. Summary and Conclusions

CHAPTER II

MANAGEMENT INFORMATION SYSTEMS: REVIEW OF THE LITERATURE

2.1. Introduction

Five basic topics within the literature were reviewed in order to provide and formulate the necessary background information for this study. These topics are:

- the boundaries of MIS
- the problems of MIS
- the need for auditing MIS and current audit approaches
- methods of measuring the value of management information
- attributes of information.

Throughout this chapter the discussion and analysis of these topics will focus on voids in our knowledge which this study is expected to fill.

2.2. Framework for perceiving MIS

The twentieth century has seen vast increases in the volume of business undertaken which has resulted in a need for improved ways of collecting and communicating information. Increases in technological development have also contributed to increasing the complexity of the business environment, whilst at the same time technology has made computer based information systems possible.

Definitions of "Management Information Systems" (MIS) abound in the literature. Several papers have reviewed past definitions in order to develop a better one (1). Rather than

search for an appropriate definition, this discussion and analysis will focus on several concepts important for a correct interpretation of the term MIS. Agreement on these concepts is a prerequisite to any investigation of MIS auditing.

A management information system is devised by persons with the aim of providing managers and decision makers with information relevant to the performance of their activities and responsibilities.

Constraints on an MIS within an organisation can be either internally or externally defined. One major constraint is that organisations have limited resources and hence there is strong intra-organisational competition for allocating these resources. One outcome of this competition is the need for a cost/benefit analysis of MIS activities to determine that the organisation's primary goal of maximisation of net resources is achieved.

Information systems can be classified as either formal or informal systems. Management information systems are deemed by the researcher to represent formal systems in that they are constructed as part of the formal organisation. This is contrasted with informal information systems, systems that are not part of the formal organisational design. Informal information system, as described by an author in this area, is ". . . the ubiquitous information network established and maintained through informal interpersonal contacts among the firm's employees. Informal interpersonal communication exists to a greater or lesser extent in all

types of organisations . ."(2). Another way of looking at these informal information systems is to state that these informal channels arise simply out of a need unsatisfied through a formal channel (3). The vivid example in this case is strategic planning. The literature has made mention of using a formal management information system for such activities (4). However, at this date, it may be said that formal MIS appear to provide limited support for strategic planning activities and managers are left with the use of informal channels to acquire some of the information needed for decision making in this area of management activity.

2.2.1. Managerial structure and the MIS

No managerial structure is common to all business firms; however, several frameworks have been suggested for use in analysing roles managers play in large organisations. Probably the best known framework cited in the accounting literature is that proposed by Anthony. Professor Anthony has developed a hierarchical framework for viewing the managerial functions(5). There are three levels, namely:

"1. Strategic planning - the process of deciding on objectives of the organisation, on changes in these objectives, on resources used to attain these objectives, and on the policies that are to govern the acquisition, use, and disposition of these resources.

2. Management control - the process by which managers assure that resources are obtained and used effectively and efficiently in the accomplishment of the organisation's objectives.

3. Operational control - the process of assuring that specific tasks are carried out effectively and efficiently."

Management information systems generally provide information to managers for levels two and three, i.e. 'management control and operational control'. Attempts to provide information for level one are not reviewed in this chapter since the area is under researched. Anthony differentiates between operational control and management control by saying operational control is concerned with tasks involving little or no judgement whereas management control is concerned with managerial functions that are not specified and where the management activities are decided within the constraints of strategic plans.

Examples of activities in a business organisation relating to management control are formulating budgets, working capital planning and choosing product improvement. Examples of operational control are controlling credit extension and controlling placement of advertisements (6).

Information is vital for all activities within these two levels of management. The management information system is the primary source of this information. Anthony noted that planning and control require information although he did not view this function from a systems perspective. Instead, the process of collecting, manipulating and transmitting data, regardless of use, was termed 'information handling'(7).

2.2.2. MIS Subsystems

Management information systems can be computer based or processed and stored manually. This dissertation is directed specifically to the computer-based system. From a systems viewpoint, the management information system is not necessarily a unitary entity. It is likely to be comprised of several subsystems designed for different tasks, functions and locations (8).

For this dissertation the MIS is viewed as a number of subsystems designed to provide managers with information relating to their planning and controlling functions where these functions are limited to the activities delineated in Anthony's categories of 'management control' and 'operational control' (9).

2.2.3. MIS as a sequential process

Many authors view MIS as a system of sequential processes. The sequences presented below represent a synthesis of views (10)

Events

- can be external or internal
- can be relevant or irrelevant
- can be economic or non-economic.

External events are those which occur in the environment in which the business operates and are distinct from internal events which occur within business boundaries.

Not all events are relevant to management within an organisation and hence some provide excess data. In contrast, some relevant events may not be observed and since observation is a prerequisite to data collection, this data is missing. This dissertation is directed toward economic events only.

Data Collection

The processing or recording of particular events is the data collection procedure. This procedure is determined by system design and actual system performance. Designers of MIS incorporate the factors deemed essential to guide the system concerning which economic events are to be recorded. However, the systems design must be in accord with reality. It is necessary to develop data collection mechanisms that can be consistent with data collection policies. For example, it may be impossible to implement a data collection policy that calls for instant intelligence on market conditions.

Data collection policy should be:

- guided by managers' needs (the users)
- required to be efficient and effective
- undertaken to achieve economic goals
- considerate of costs of undercollecting against costs of overcollecting.

Major difficulties are experienced in attempts to collect data pertaining to external events. External events influence 'managerial control' and 'operational control' to an extent but their major impact is on 'strategic planning'. Since the boundaries, as defined here, of the MIS do not include strategic planning, the difficulties of collecting data with regard to external events are somehwat reduced.

With the highly dynamic external environment of most organisations; with the slow rate of change internally giving the relatively static nature of the majority of MIS, most managers seek information relating to the external environment from informal information sources, e.g. newspapers and chats at the club.

Data Storage

After the data has been collected it is processed and stored according to predetermined procedures. Policy concerning data storage is primarily concerned with:

- access (security and ease of access)
- security (protection against loss of data through physical or human events)
- destruction (removal from storage when no longer required).

Processing and storage proceeds according to the policies above.

Report Preparation

- required to meet managers' needs
- consideration of media is important.

The media by which reports are communicated varies widely and influences whether the contents are read or not. Policies relating to report preparation should be formulated with a concern for cost, quantity, format, and accuracy among others.

Communication

This stage of the process should ensure that the data is sent only to those with a 'need to know'. Data should be treated as a scarce resource and should be transmitted to those for whom its reception will aid the achievement of corporate goals.

Decision-making

The outcome of a decision is the final step in the MIS process. The outcome is measured to determine the quality of decision-making.

This research is not meant to be a guide for MIS design. Therefore, no attempt will be made to identify the optimum information system design for any particular organisation; the literature on MIS design is extensive (11). Rather, this research directs attention to the audit as a control mechanism on the MIS and to the new approach developed for its use by auditors and others in the evaluation of management information.

2.2.4. The dynamic nature of the MIS

When MIS are applied they are not static - contrarily they are dynamic. This dynamism is achieved from various sources ranging from managers, data entry personnel, programmers, professional journal researchers to system designers. Where required, designers can make necessary changes and modifications in existing policies and procedures for all stages of the process. This feedback mechanism is, however, only as good as the systems designer. As with any sequential process the total systems performance can fail with failure of any step in the sequence. It is important that MIS can be an adaptive rather than a static system. Adaptation processes are similarly required in all the subsystems of the system.

This section of the chapter has sought to delineate the concept boundaries of MIS as conceived by the author. Having reviewed the notion of MIS it is now timely to examine the literature which discusses the failure of MIS. This literature on 'misinformation' systems underscores the need for new instruments for management control. The force of this body of literature has been used as sufficient justification for the implementation of MIS audits. The major literature is reviewed below. The empirical section of this research will attempt to validate or reject these assertions.

2.3. Misinformation systems

To demonstrate the magnitude of the failure of MIS to provide users with information required to discharge their responsibilities it is in order to firstly present examples of the importance of MIS to organisational success in the modern environment.

Lindberg and Cohn used the following figures to describe the importance of MIS to American industry (12):

"- Somewhere near one-quarter of all money paid out by US companies for salaries in 1963 ($71 billion) went for paper work.

- By 1980 the American labor force will have reached 100 million, more than half of whom will be white collar workers.

- By 1980 the number of computers, reproduction departments, and automated information storage and retrieval systems in business will have at least doubled th number in 1960s.

- About three-quarters of a million words -
in the form of reports, letters, and memos -
are piled atop the typical president's
desk every month; he spends a minimum of
five hours per day just reading."*

While these data concern the US, it may be said that they describe fairly the future trend in the use of MIS in countries like the UK, and they show that "management is moving steadily away from the position in which a business can be managed by making decisions solely on the basis of first-hand observation. To the degree that personal observation declines as the basis for decision-making, dependence upon environmental information and the systems that supply it grows." (14)

---

* As a further illustration of this point, the figures below describe the official and unofficial forms and reports supplied and used at three medium size companies, and a division of a major aerospace firm:

"

Company	Official forms	Unofficial forms
Electronics Co.	566	1145
Insurance Co.	3120	2672
Aircraft Co.	2249	2683

In another instance, a division of a major aerospace firm found that data processing was preparing some 1500 different 'reports' for the accounting function alone." (13)

As to the environment in which companies are doing business, it seems relevant to use this passage:

> " 'His aggressive skills are no longer considered a key to the company's success' are the words used by a current publication to describe a displaced company president.
>
> The new president's most pressing job is to sort out the company's financial position, states the same publication. These two statements describe the vulnerable position which many companies find themselves faced with today in the battle of budget-cutting, expense-reduction, declining sales and spiraling inflationary costs.
>
> Further headlines describe the environment of today's business world as: 'A wide choice to a relatively narrow market at moderate prices'; 'There's a growing number fighting for a shrinking market'; 'Profits are too low'; 'There is no room for frills in programs designed to pull out of the economic crisis'".(15)

If we couple the above figures which show the factual and predicted use of MIS and its end product with our present environment, we may say without exaggerating that "the success of any company is greatly affected by the quality of information it has and the efficiency of its internal communications. A company reacts to emerging conditions and exploits opportunities in direct relation to the quality and the availability of its information."(16)

Nearly twenty years ago it was recognised that such systems were not designed to provide adequate information for the decision maker. Common deficiencies identified were: over information, under information and untimely information(17).

Brown echoed the same problems by stating that "... there is sometimes a tendency to produce more and faster information, on the premise that the more there is, and the faster it's

produced, the better the management decision will be. Also, I sense a tendency to produce and distribute certain types of information simply because we have the capability to do so, or because surely someone can use it, or because it doesn't involve much added cost" (18).

The communication gap between MIS personnel and decision makers or users is often cited as one of the reasons for the failure of MIS. What frequently happens is that managers may not

> ". . . reach out sufficiently to work with computer personnel. This may be because these managers think they are too busy, or because they lack enough knowledge about computers to feel comfortable in the liaison relationships. At the same time computer personnel frequently come to live too much in their own private world, with their own special technical knowledge and jargon, and tend to be too concerned with the technical achievements of the system. They may even at times come to believe that they themselves know best what the management problems are, and how they should be handled. Unfortunately, this understanding of management needs is often not that good. In any event it is the managers who have to do the actual managing. As a result of the existing gap the computer effort is often misdirected and not properly utilized." (19)

Another writer suggests other reasons behind the failure of MIS by stating "Management decision failure is not caused by either new technological advances such as the computer or a lower level of managerial competence. It is caused by not having the quantity and quality of information at the right time to answer the most important recurring questions of planning and control." (20)

Voich et al summarizes the criticisms made regarding MIS under four headings: (i) Useless information, (ii) Excessive information, e.g."Too much paper work", (iii) Untimely information, e.g. "Reports are too late to late to be of use", and (iv) Excessive processing costs. Reasons for this state of affairs given by the authors were firstly inadequate evaluation of information needs in operating activities and decisions, and secondly inadequate and/or inefficient and/or ineffective information systems (21).

Ackoff in his renowned article "Management Misinformation Systems"(22) used his consultancy experiences to identify five common and erroneous assumptions he found underlying most MIS designs, namely:

(i) "Give them more". There is often an overabundance of irrelevant data. Condensation and filtration should be an essential part of an MIS.

(ii)"MIS designers can determine manager's information requirements through interviews". The problem is that managers do not know all their information requirements.

(iii)"Information alone makes good decisions". Many MIS designers actually believe this.

(iv)"More communication means better performance". This assumption ignores the problem of information overload.

(v) "MIS does not have to be understood by managers". No MIS should even be introduced unless the users are trained to evaluate and control it.

Ackoff suggested five procedures to improve MIS design. One of these procedures was that adequate control systems should be designed. This author argues that the audit is a possible control system.

To conclude this discussion it is worthwhile stating that several management actions could be suggested as necessary for a successful MIS, and these are: (i) Top management support, (ii) user orientation and involvement, and (iii) adequate controls including audits. The last suggestion is the main subject of our discussion and analysis in the following section.

2.4. Auditing the MIS

This section of the chapter will present a very brief introduction to the history of Internal Auditing, this is followed by an examination of its functions, descriptions of the type of internal audits performed in an organisation and fianlly a presentation of the role envisaged for internal auditors in the audit of MIS.

2.4.1. History of Internal Auditing

"Internal auditing is an independent appraisal activity established within an organisation"(23). It is a function of the organisation and the internal auditors are employees of the organisation.

Although some audit functions have been practised since business began it was not really until the end of the last century and the beginning of this century that the specific occupation of 'internal auditing' came about. There

were a few exceptions, for example, internal auditing occurred as a separate job classification in the railway industry in the nineteenth century (24) but it was relatively insignificant in the majority of businesses. Most were small enough to enable their owners to be in close contact with each aspect of their business, for them to be knowledgeable concerning the operations and be able to maintain control over the different parts.

Factors which led to the developing importance of internal auditing included:

- the overall increase in size of organisations, especially manufacturing.
- ownership and management became separated.
- the firm's activities were dispersed over wider geographical areas.
- the trend to decentralise.
- expansion by means of acquiring existing companies. (25)

The history and evolution of internal auditing is often divided into three eras(26): pre 1939, 1939-1945, post 1945. Space precludes discussion of these eras, but suffice it to say these time zones were not as sharply defined as might be inferred - there are always leaders to change and transition as there are always traditionalists who lag behind.

The Institute of Internal Auditors, founded in the USA in 1941, had a charter membership of twenty four members.

This today has grown to an international organisation with a membership in excess of 20,000 in more than 100 countries throughout the world, giving evidence as to the growing importance of the internal auditing service functions for organisations.

2.4.2. Aims of Internal Auditing

An extract from the text of a speech given by Thurston in 1941 at the inaugural meeting of the Institute of Internal Auditors reveals the extent to which internal auditing has developed both in practice as well as conception. Thurston listed what he saw to be the three major functions of the internal auditor in a modern corporation (organisation). These were:

"(1) He acts as an arm of management.

(2) He sounds out and perfects the system of internal control.

(3) He directly participates in verification of financial statements." (27)

He felt that the function 'acting as an arm of mangement' had the greatest potential for future growth. Under this category he listed some of the tasks and responsibilities involved, namely:

> "He handles special assignements, acts as a direct channel of information, and as a conduit of ideas, provides a reservoir of trained executive material, verifies and maintains personnel, takes up the shock of special jobs and emergency personnel situations, perfects the budget technique, verifies compliance with the company policies, and manuals, establishes observance of laws, regulations, and contract terms, acts as coordinator, ascertains the adequacy of many types of physical property, and the propriety of their use, and in addition, performs many other functions as a direct arm of management." (28)

It is indeed salutary that the functions mentioned by Thurston nearly 40 years ago as being those which should be performed within progressive firms are even today being proposed as new practice for internal auditing.

Thurston's ideas reflected the start of a new constructive phase of internal auditing as contrasted with the protective emphasis which had been prior to his time, the total purpose of the internal auditor's protective auditing was concerned with

> ". . . . the safequarding of the company's resources from theft and fraudulent transactions - whereas in constructive auditing the internal auditors extends his service beyond the protective feature, and not only verified the authenticity and validity of charges, but used his broad knowledge of company operations to challenge their amount and necessity. The focus of the constructive type of auditing was - 'internal audit for profit' - whereby the internal auditor became just as much interested in internal controls to eliminate waste and inefficiency as in those maintained for the detection of defalcations and fraud". (29)

In reality there was no reduction in the effort spent on the protective function of internal auditing but additional efforts were expended in broadening the use of internal auditing in a constructive function.

Comparisons of the statement of the responsibilities of the Internal Auditor issued in 1947 with its revision in 1957 provides evidence of this shift in emphasis towards constructive features.

The first paragraph of the 1947 Statement appears as follows:

"Internal auditing is the independent appraisal activity within an organisation for the review of the accounting, financial, and other operations as a basis for protective and constructive service to management. It is a type of control which functions by measuring and evaluating the effectiveness of other types of control. It deals primarily with accounting and financial matters but it may also properly deal with matters of an operating nature".(30)

The 1957 revised Statement in comparison reads:

"Internal auditing is an independent appraisal activity within an organisation for the review of accounting, financial and other operations as a basis for service to management. It is a managerial control, which functions by measuring and evaluating the effectiveness of other controls." (31)

The 1957 Statement omits the sentence "It deals primarily with accounting and financial matters, but it may also properly deal with matters of an operating nature." (32)

Hence, by 1957, the concept of internal auditing as a valuable service to management in areas other than accounting and financial had become accepted. This trend has continued and is indicated in the 1971 revision of the statement. All specific mention of accounting and financial review has been eliminated.

"Internal auditing is an independent appraisal activity within an organisation for the review of operations as a service to management. It is a managerial control which functions by measuring and evaluating the effectiveness of other controls". (33)

Internal auditors conceive their function as servicing any part of the whole organisation where such protective and constructive service can be provided and be valuable for management. There are no limitations or constraints concerning the type, kind or amount of service that internal auditors

are able to provide as defined in the 1971 Statement. Thus the role of the internal auditor has changed substantially.

The expanded role of the auditor, whereby it is appropriate and acceptable for the auditor to service any operating area of the organisation, not merely the traditional financial area, is reflected in the Institute of Internal Auditors Standards for the Professional Practice of Internal Auditing issued in 1978 in which the scope of internal auditing is seen to

> ". . . encompass the examination and evaluation of the adequacy and effectiveness of the organisation's system of internal control and the quality of performance in carrying out assigned responsibilities."(34).

This was elaborated to show that:

> ".02 The purpose of the review for adequacy of the system of internal control is to ascertain whether the system established provides reasonable assurance that the organisation's objectives and goals will be met efficiently and economically.
>
> .03 The purpose of the review for effectiveness of the system of internal control is to ascertain whether the system is functioning as intended.
>
> .04 The purpose of the review for quality of performance is to ascertain whether the organisation's objectives and goals have been achieved." (35)

The above quotations indicate what should be performed in terms of audit work although ultimately it is the management of the organisation which will determine the scope of the internal audit function.

2.4.3. Types of internal audits

The following quotation aptly describes the types of internal audits performed in some organisations and depicts the future trend in this context:

> "What is being implied here is a two-dimensional evolution of internal auditing. Firstly, internal auditing is seen as evolving from an audit of compliance with external and internal procedures and regulations to one which is also concerned to appraise efficiency and effectiveness. Secondly, internal auditing is seen as evolving to embrace the audit (whether compliance, efficiency or effectiveness auditing) of all operations and not merely accounting and financial matters." (36)

In this dissertation the MIS is the subject of the audit, and both compliance and operational types of audit may be performed.

A compliance audit can be regarded as a review of actions or records of actions to determine the amount of congruence between policy and actual practice. In contrast to the compliance audits' concern with deviations from policies and procedures, the operational audit can be regarded as reviewing the policies and procedures relating to a special function and evaluating their efficiency and effectiveness in achieving corporate goals.

Traditionally the compliance audit was the audit to be performed. The compliance audit can be defined as ". . . determining whether actions have been in accordance with internal controls and procedures and with applicable external laws, regulations and practices." (37)

The following steps comprise a compliance audit of MIS.

(i) Determine MIS specifications (policies and procedures).

(ii) Review past operations to ascertain whether policies were followed.

(iii) Report on the findings.

When determining the MIS specifications, an essential area for audit attention is the internal control system. The MIS internal control system comprises all those activities performed to ensure achievement of primary objectives. Where the internal control system is viewed as a system of procedures and mechanisms to safeguard attainment of operating objectives, a review of such a system is fundamental to the compliance audit.

Lindberg and Cohn define the operational audit as ". . . a technique for regularly and systematically appraising unit or function effectiveness against corporate and industry standards by utilising personnel who are not specialists in the area of study with the objectives of assuring a given management that its aims are being carried out and/or identifying conditions capable of being improved." (38)

Dodwell views the audit as a change agent and not a control ". . . the primary objective of operational auditing is to identify those areas in which cost reduction, operating improvements or increased profitability can be achieved by the initiation or modification of administrative and operational controls or policy directives or by related corrective action." (39)

Yet Hutchinson expresses the popular view of controls when saying ". . .control functions have four separate phases. In phase one, areas of control are specified and objectives are set. The second phase develops the standard against which performance will be judged. Phase three involves the construction of the actual techniques needed to make meaningful measurements. The final step in the process consists of establishing rules that determine whether corrective action is needed and devising ways to make adjustments at appropriate times and places." (40)

The operational audit can be contained within this definition, for example, in the four phases:

1. The objectives of the audit are set to be consistent with those of the organisation.

2. The auditor develops standards to relate directly to corporate goals.

3. The auditor reviews operations and makes a comparison between the criterion and the actual performance.

4. The auditor uses guidelines (both implicit and explicit) to determine whether a particular variation between the criterion and the acutal operation requires corrective action. He then communicates the variance and may make recommendations for corrective action which the managers can choose to initiate or not.

There is a need for operational auditing and this is attested by " . . . the assumption of operational auditing responsibilities of a non-compliance variety does not imply the dropping of the traditional attesting for compliance

but is merely a recognition that, on its own, attesting for compliance is a very inadequate service for internal auditing to offer in the future."(41)

2.4.4. The role of internal auditors in relation to MIS

The audit of MIS by internal auditors is seen and accepted by those in this area as a means by which management can exercise control over this activity.

A lot of the literature identifies auditing MIS with the EDP department. Auditing this department however only provides a partial control over the MIS, namely the computer operations involved.

Lebrenton stressed the need for MIS audit using a management perspective and suggested that the audit should answer questions such as :

"(i) How effective is the operational relationship between intelligence MIS units and line units?

(ii) Are our MIS policies giving us the hoped for and planned for results?

(iii) Are the various MIS sub-systems giving us the information we need in time and at reasonable cost?" (42)

Hay sees the audit of MIS as a logical constraint and assumes that "any MIS is incomplete if it does not provide for continuing internal check to make sure that the proper data are being correctly processed and reported to the proper managers " (43). He then adds that "Internal audits must also be made to ensure that plans and policies of owners and managers are being followed and that necessary changes and exceptions are brought to the attention of appropriate managers." (44)

Johnson observes the large investment being made in computer systems and indicates the importance of management controls. The controls "could be exercised by management itself, by its internal auditors, by outside public accountants, or by consultants." (45). Johnson sees top management control being exercised through budgetary controls, short run and long run, in a manner similar to other staff departments. In depth periodic appraisal can, however, be made by auditors. He felt that these auditors should be "internal auditors", as they are the most qualified in view of their knowledge of the company's operations, its structure, its strengths and its weaknesses (46).

Johnson concluded his article with a case study. The audit objectives were general and could be adopted for an audit of almost any system:

> "1 - To evaluate the system in terms of the utility, timeliness, and accuracy of the reporting.
>
> 2 - To review the effectiveness of the present system with respect to equipment utilisation, control, cost and design.
>
> 3 - To analyze current systems to ascertain whether management's goals, as expressed in the supporting economic justification studies, were being realised." (47)

To conclude this review of notions concerning the auditors role in the audit of MIS, the Standards for the Professional Practice of Internal Auditing issued by the Institute of Internal Auditors in 1978 states that internal auditors

> "should review the reliability and integrity of financial and operating information and the means used to identify, measure, classify, and report such information.
>
> .01 Information systems provide data for decision making, control and compliance with external

requirements. Therefore, internal auditors should examine information systems and, as appropriate, ascertain whether:

.1 Financial and operating records and reports contain accurate, reliable, timely, complete, and useful information.

.2 Controls over record keeping and reporting are adequate and effective." (48)

The next part explores what is happening in the audit of MIS.

Firstly, results of surveys relating to internal audit practices (published by the Institute of Internal Auditors) show that 60% of companies surveyed in 1975 indicated that their MIS was subject to internal audit compared with only 48% of companies in 1968 survey. This increase shows a growing awareness of the importance of MIS for success in achieving company goals (49). Figures for the audit of EDP (part of MIS) were 79% and 64% respectively .(50)

In a survey of 39 internal audit departments which were advanced in their use of EDP techniques (51) Rittenberg and Davis found the audit activities performed by internal auditors could be grouped into three categories:

"1. Audit activities relating to an EDP application after it is developed.

2. Audit activities relating to data processing operations and management.

3. Audit activities relating to an EDP application while it is being developed." (52)

The survey revealed 30% of the time, on average, was spent on auditing an EDP application after it is developed. Of the five most frequently performed audit activities in this category, surveys of user's satisfaction with new accounting EDP application

(mean frequency 3.31 on 5-point scale) and surveys of user's satisfaction with recently implemented information systems (mean frequency 3.08) reflect the operational audit approach. In contrast, using audit software to interrogate files (mean frequency 3.34) reflects the traditional approach, i.e. the compliance audit approach (53).

Schwarzbach conducted comprehensive research into MIS (54). He studied a sample of manufacturing firms listed in the N.Y. stock exchange. Both internal auditors and auditee managers were surveyed. These results shed light on "the state of the art" in the audit of MIS. It is proposed in this dissertation to take this previous study steps further. MIS managers were surveyed in addition to internal auditors and auditee managers. These persons are essential to this area of study and no findings will be complete or generalisable unless this group's opinions and views are included. The sample of firms surveyed by this author was enlarged to include firms from different sectors of the economy in addition to manufacturing firms to enhance generalisability. In addition, the tools and techniques used by auditors when performing their audit activities are revealed in this study, whereas they received little mention in Schwarzbach's study. The present author sought to determine which techniques were used, and the degree of respondents' satisfaction with these tools, with the aim of illustrating that there exists a need for new techniques of evaluation for use in the process of evaluating management information generated through MIS reports.

Evidence of this general lack of tools can be seen in Lindberg and Cohn's 76-item questionnaire which they suggest can be used in the operations audit of MIS although it is very general in nature and lacks specific means for identifying the benefits of MIS (55).

The same comments concerning the general nature of Lindberg and Cohn's questionnaire applies to a list of items proposed by Sutton and Mathis for use in the audit of EDP department. Moreover, they state in their article that "user surveys" are one way of appraising the performance of EDP although they do not give any details as to how this can be performed. (56)

The lack of suitable tools was noted by Perry in a summary providing several conclusions derived from research conducted by S.R.I. for the Institute of Internal Auditors. He states that

> ". . . internal auditors are faced with the task of investigating an environment in which most of them have only limited experience, knowledge and tools".

He then adds that

> "Few current EDP audit tools and techniques are adequate to the needs of the EDP auditors as they approach the task of verifying the accuracy and completeness of data processing activities and results. New tools and techniques are needed." (57)

Due to the exploratory nature of this research, the hypotheses to be investigated in a later chapter will try to cover most possible areas of interest within the sphere of the MIS audit in order to help generate ideas and indicate possible relationships or no relationships which can be used as a starting point for future research.

To conclude this discussion it may be said that the internal audit of MIS is required as a control and there exists a need for the development and testing of tools to be used in auditing (both compliance and operational) of MIS.

This research is concerned with the development and testing of a new methodology to be used in the evaluation of management information.

2.5. Methods of measuring the value of management information

A variety of definitions of information have been offered in the literature. Some examples are ". . evaluated data in a specific situation"(58); "information is data that has been processed into a form that is meaningful to the recipient and is of real or perceived value in current or prospective decisions"(59); ". . data which after transformation via the information process reduces uncertainty related to the outcome of a particular problem, event or activity" (60).

These definitions require, implicitly or explicitly, that a specific decision-making situation be present for information to result from data (61). However, evaluation of data can occur and be produced prior to a specific problem situation resulting. Hence, Feltham defines information as the meaning that is derived from data, provided the stock of knowledge of the individual receiving the data is changed (62). His conceptualisation implies that information results from an evaluation process and it is incremental in nature. Thus the input of data to a

system of stored knowledge, when evaluated, produces information in the "transformation process" and this increment of information can be added to the prior store of knowledge.

Distinctions between data and information are relative. The input of data to a given store of knowledge can create change in the store resulting in information. If this incremental change does not occur what could be information remains data.

From this discussion, it is apparent that to measure the value of information, the original stock of knowledge and the data input to this system must be known. The value of information can be measured by the incremental change (in the original stock of knowledge) which results from the data evaluation process, where the input to the system is the data.

In this research, the stocks of knowledge consist of the stock of knowledge owned by individual managers regularly receiving the two sets of management information system reports, namely reports 'A' and reports 'B'. The reports comprise the data input, these reports being distributed at specified intervals. The value of information is obtained by measuring the value of the change in each individual's knowledge stock, which results from the evaluation of the data, as perceived by each manager.

Economists in the last century were cognisant of the fact that value in use and value in exchange were related.

The basis of value was subjective utility, where utility can be defined as the ability of a good to satisfy some need or desire (63). Hence value in use is the total utility of a good while value in exchange is the marginal utility gained through possessing an additional unit of a good. As used in this study, value is taken as marginal utility or value in exchange.

The following section describes various approaches to measuring the value of information, namely (1) quantitative information value models, (2) observation of actual results, and (3) the information user's perceptions.

2.5.1. Quantitative information value models

Management science seeks to develop models which will usefully solve problems. A large amount of research has evolved in the attempt to develop models which will present the value of information as model output. All such models assume or require knowledge concerning likely courses of actions but not of actual outcomes.

Three information models will be described. All are theoretical models and some have been tested empirically to a limited extent. They are still being developed and none has proved widely applicable. They are all offered as suppositional postulates rather than predictive models.

First - single period outcome model

Following the publication of Shannon's classic work on information theory in the Bell System Journal in 1948 (64), a subsequent article concerning information models which examined information value was presented by Ackoff in 1958(65).

Rather than using an absolute standard to measure value of information, he measured relative relationships to determine value of information. His quantitative model, presented below, reveals the concept that information causes a change of state in the receiver and that the measure of value of information is obtained by investigating and comparing the state prior to information input with the post information state.

The assumptions that accompany this operational research model are (66)

- there exists a specific problem
- alternative courses of action can be specified
- the payoff function for each course of action can be specified
- the probabilities of each outcome can be specified.

Ackoff's expected value model included four equations, developed in a sequential series and following the assumptions stated above.

The first equation identifies the value of a state of an individual

(1) $V(S) = f(P_i, E_{ij}, V_j)$

where $V(S)$ = value of a state

P_i = the probabilities of choice associated with the courses of action

E_{ij} = the efficiencies of the courses of action for each objective

V_j = the value of the outcomes to the individual.

As an example, if "expected return" is used as the state value then (67)

$$(2) \quad V(S) = \sum_{i=1}^{m} \sum_{j=1}^{n} P_i E_{ij} V_j$$

Since

$P_i E_{ij}$ = probability that outcome O_j will occur if the course of action is taken Ackoff's model reduces equation (2) to the definitional equation for expected value (68).

$$(3) \quad E(x) = \sum_{i=1}^{n} x_i P(x_i)$$

Hence, for Ackoff, the value of information is measured by its influence on the state (S) of the receiver. If $V(S_1)$ is the value of the initial state and $V(S_2)$ is the value of the terminal state, then the value of information to the receiver, ΔV, is given by the equation (69)

$$(4) \quad \Delta V = V(S_2) - V(S_1)$$

Ackoff clearly distinguishes between the quantity and value of information received by the user. The model indidates that Shannon's measure is limited to information quantity and is not relevant for value of information.

Information value is a function of both the information and the recipient (user) of the information.

Because knowledge is required to specify probabilities concerning selection of courses of action and the outcomes resulting given each course of action and relative value for each outcome for both pre-reception and post-reception of information, operationally this model is restricted to minor problems. Such knowledge required for operationalising this model is not attainable in a majority of situations.

Second - Multiperiod outcome models

Actions in the present often influence the results of some future items. Current information can be used in later decisions, for example, production scheduling or acquisition of goods and services. These require that evaluation of information should involve a multiperiod model as multiperiod situations occur frequently in decision theory. Multiperiod models usually use dynamic programming formulations because this enables compact expressions of the model and designates a procedure for its solution. Multiperiod models are rather expensive for solving routine information decisions but they are useful in providing a foundation for research and illustrate the limitations of single period models.

Gregory and Van Horn developed a model for a multiperiod situation that does not require dynamic programming or other sophisticated operational research techniques (70). The basis of value is monetary worth ". . . the value of information should be studied in terms of its relationship to operating performance of the organisation or the revenue obtained." (71). The model can be expressed as:

$$V = K \left[\frac{1}{F} \sum_{n=1}^{F} f(A,T,Y,n) - g(P,Y) \right] - h(A,F,T)$$

where V = value of information per period (dollars, sterling pounds, etc.)

K = profit in sterling pounds, dollars for making a correct decision

F = interval (periods) over which information is used

A = accuracy of information (ratio of correct decisions to total number of decisions over several time periods)

n = number of periods

T = amount of time delay in receiving information (in periods)

P = probability of making a correct decision without information

Y = number of decisions per period

h(A,F,T) = cost of information per period

f(A,T,Y,n) = expected number of correct decisions per period with the appropriate information

g (P,Y) = expected number of correct decisions per period without information.

The authors describe the procedure for using the model as:

(i) The average number of correct decisions per period (A,T,Y,n),given appropriate information, is computed.

(ii) The average number of correct decisions, g(P,Y) per period, without information, is subtracted from (i).

(iii) The difference is multiplied by K to give the average increase in revenue per period that is a result of using the information. (72)

The assumptions contained within the model are:

- variations in number of decisions (Y) are allowed from one period to another
- the payoff function (K) is constant, i.e. the decision rule employed can be specified
- each repetition of a decision has an equal probability of being correct and has an equally valuable outcome.

Limitations of this model are twofold. Firstly, it can only be used in situations where a specific correct decision exists and for which the payoff is constant. Secondly, while mutliple periods are included, the value of the payoff function (K) is constant over periods and decisions. Very few situations exist where a known, constant payoff function over multiperiods of time is involved, hence the model has very limited practical applications.

Thus, both models, single period and multiple period involve measurement of the decision-making process with and without information, both require the payoff function to be known, and both are limited to programmed decisions.

Third - information economics model

The term ' information economics' is used to identify a method involving the trade-off between the cost of additional information (new information) and the value derived from that information.

Jacob Marschack in an address to the American Economic Association in 1967 identified this new field of inquiry and described its relationship to communications engineering and statistical decision theory (73). Marschak presented a descriptive information economics model. Within the domain of his model he saw statistical decision theory as being limited. He thought it omitted the processes of encoding data into signals, the transmission of signals through the communications channel and the decoding of the signals back into messages a decision-maker would comprehend.

With statisticians, the decision is made on the basis of a message which is assumed to be the same as data produced by the enquiry. However, for the communications engineer, the sequence of encoding, transmitting and decoding messages is the important area.

The limitation with the communications engineer is that he ignores the influences of inquiry and decision-making by assuming that decoding is equivalent to decision-making and that events and data are identical. Marschack suggests that communication engineers and statistical decision theories do not optimise the system because they are concerned only with their subsystem of the overall information system flow (74).

When viewing the literature relating to quantitative methods for measuring information value, few theories appear relevant to the manager faced with the problem of attempting to quantify the value of information of an information system. In part, this is due to linguistic and epistemological problems among theorists and practitioners, but overall, the lack of application is in general due to the lack of relevance. Marschak has attempted to develop a new conceptual framework to analyse symbol processing systems. The scope of his efforts is such that it has provided a foundation for developing a useful and relevant theory of symbol processing. (75)

Feltham and Mock have identified another approach to information economics. They define information economics in terms of a branch of decision theory which explicitly

recognises that the relationship between the environment and the decision-maker is determined by the information system function (76). However, Feltham and Mock see the term information economics as being limited to denote analyses which apply decision theory to evaluation of information. The analyses relate to a broad range of information issues and give explicit consideration to information system elements (77). Hence information economics provides a formal procedure which enables managers to evaluate information alternatives.

Research in information economics has provided a number of useful concepts and examined some important issues'. For example, Feltham and Mock state that information economics formally recognises that the decision-maker need not consider all various possible states of the environment (78). Hence, differences can be ignored if they are unlikely to influence the decision-maker's analysis; a subset of the possible states may be combined into a single state, if, for each action, the payoff is the same.

The decision-maker is deemed to be primarily interested in ranking information systems in terms of their value, but knowledge may be gained through classifying and ranking information systems independent of their value for a particular decision.

They suggest that three basic categories of an information system are:(79)

- If a different signal is produced for each payoff relevant state an information system is complete.
- If some signals can be produced by more than one state, and it is known which signal a given state will produce, an information system is noiseless.
- If one state can produce one of a number of signals and one or more of these signals is produced by more than one state an information system is noisy.

Where an information system is free of cost, a complete system is most expedient because it affords perfect information. Of course, this is an unlikely situation. The relative value of alternative noise-free and noisy information systems generally depends on the elements of the decision situation. A noise-free system is not necessarily more valuable than a noisy system, even where both systems are cost free.

Noise in the system can be due to errors in observation, processing, communicating the information, or where a system does not have access to information enabling a 'noiseless' forecast of the state that will occur during the payoff period.

Information economics assumes that the selected action will be a function of the information received by the decision-maker (80). Often decision theory makes the implicit assumption that the manager's selected action will

be a decision which maximises expected payoff given the available information. This assumption defines an ideal decision rule, but often, non-optimal decision rules are applied because of prohibitive costs of using the optimal decision rule. In addition, the decision maker may be someone other than the person selecting the information system and hence use a different decision rule.

Research has broadened information economics to encompass a situation where there are several decision makers, and where their actions interact to determine the payoff. The theory of teams is the most extensive inquiry in this area(81) and while space precludes a detailed analysis, a short overview seems in order.

In the theory of teams, the same expectations regarding future states are assumed to be held by all decision-makers. Similarly, the assumption is made that the same payoff function holds over possible future outcomes. Hence, an individual decision maker is assumed to select a decision rule to maximise the expected payoff, given information and knowledge concerning the information system and the information that individual transmits to the other decision makers of the team (82). In these situations, an individual decision maker can optimally determine those observations of the accessible environment that are relevant, and information that should be transmitted to other team members.

Feltham and Mock conclude their disucssion of information economics with details of multiperiod models (83).

Since current actions usually influence the results of several future periods, information evaluation must be based on a multiperiod rather than a single period model, which implies using dynamic programming formulations. Such a technique provides compact expressions of the model and a procedure is designated for its solution. Dynamic programming models are expensive when applied to regular information decisions, but such models explicitly include the time factor. Unlike Feltham and Mock, Marschak's model does not include a time variable and hence does not allow the use of dynamic programming techniques.

To conclude this section, it is apparent that all of the models presented above require specification of a payoff function. This limits their use to programmed decisions, and eliminates them from use in this study. Such models are worthy of consideration however, since they involve considerable efforts and some achievement towards defining those variables which influence the value of information, indicating relationships among variables and attempting to measure information value (84). These models have proved useful in the clarification of issues and concepts.

2.5.2. Studies based on observation of actual results

Studies relating to information value which are included in this section are based on direct observation of the results of possessing or not possessing specific information in a decision situation. The process of direct observation means that no assumptions concerning

the effect of decision rules on actions, or the transformation of actions into results are required. However, the assumption that all factors remain the same before and after acquiring the information must be made. In such a process it is not necessary to define a decision rule or a payoff function. As the results are observed, the approach is applicable to both programmed and non-programmed decisions.

Studies included in this section involve research of two types:

- laboratory experiments which involve the use of management business games, where participants are presented with a problem with specified parameters and specific information
- actual observations within a real environment of an existing organisation.

1 - Management business games

Business games provide a useful technique to study decision makers in action and their valuations of information. Green, Halbert and Minas attempted to observe the behaviour of participants in an experimental setting. Each game involved a decision making situation in which a participant was asked to choose the better course of action out of two possible sets. The game allowed players to purchase additional information, of partial reliability, prior to them selecting a particular option. If players purchased information, the uncertainty of the decision and the payoff for a correct decision was reduced (85). The experimenter

observed how much information was purchased and the manner in which the information was used when choosing among alternatives. This research sought to discover how participants behaved when deciding how much information to buy and whether decision theory models adequately described the behaviour. If not, what were the intuitive decision rules employed by the participants? (86)

This study revealed that:

- the amount of data participants purchase is influenced by prior information. The greater the conditions of uncertainty, the more information is purchased by participants. In most cases, the disparity between actual and optimal behaviour is fairly large.

- Generally, participants elected to purchase more information than necessary for an optimal solution (87).

Further research into information buying was continued by Green, Robinson and Fitzroy (88). The decision-makers in the game were students and business men. The experiments were increased to four in number to vary the amount of information each participant received before the game began. In each experiment the participant was required to select the best course of action given a finite set of actions. As before, information could be purchased but this would reduce the payoff for a correct decision. For each situation a decision theory model exists to yield the optimum solution. A participant with knowledge of such a model and who will act rationally could determine this optimal course of action.

Findings consistent to both experiments included:

- participants purchased information although the theoretical decision payoff was equal for both purchase and non-purchase.

- Participants over-valued information and hence purchased information when non-purchase was the optimum choice.

2 - Management of Going Concern

The value of management information is best determined by observing the contribution it makes to the efficiency and effectiveness of a firm operating in the business environment. Such an approach is difficult to apply for two reasons; firstly, the benefits which result from implementation of an information system tend to accrue slowly over time and are therefore difficult to distinguish before several years have elapsed. Secondly, over such a long time period it is unlikely that conditions in the business environment and within the company will remain constant. Hence other factors may bias or influence the company's performance and conceal the effects of the information system.

Such difficulties are revealed in a research study by Greenridge (89). He investigated the influence of a new computerised information system for thirty-one small retailing companies. To estimate performance without the new system historical data was used to give projections of financial results. These projections were compared with the actual financial results one year after introducing the new information system. Mixed results were obtained.

For example, overall profits had increased but return on assets had decreased as there was a significant increase in inventories. This resulted from adverse market conditions. These influenced the increase of inventories and the decrease in sales volume.

Conclusions from this section of studies based on evaluating information through observing actual results are (i) the approach of using a simulated environment has led to generalisations regarding individuals' behaviour concerning information and the desirable attributes of information: (ii) unfortunately, the cost and analytical requirements of simulation reduce its possible application as a technique for evaluating information systems implemented in organisations: (iii) the approach of evaluating information systems within going concerns is circumscribed by difficulties in identifying cause and effect.

2.5.3. Studies based on the information user's perceptions

The first attempt to measure the value of management information, as used by decision-makers when making non-programmed decisions, through the user's perceptions was that of Gallagher (90). His research presented the results obtained through testing a new comprehensive methodological approach. This included the use of different measures to estimate (i) the value of a report, (ii) the attributes of a report, and (iii) the maximum value of a report. These measures comprise the following:

(i) Measures of information value

Gallagher suggests two subjective measures. The first measure is an estimated annual dollar value in response to the hypothetical question "Assume that your company plans to eliminate all data processing and to obtain this report from another firm on an annual subscription basis. What is the maximum amount you would recommend paying for this report for your use?" (91)

The second measure of information value is obtained by applying the semantic differential technique. (92)

In his conclusions concerning these two measures, Gallagher states that:

> "1 - A reasonable estimate of the monetary value of a specific management information system can be determined by asking each user to estimate the system's value to himself.
>
> 2 - The semantic differential technique can be employed to measure and analyse the qualitative or non-monetary value of management information systems" (93)

Before concluding, a brief introduction to the semantic differential technique seems in order. In spoken and written language, characteristics of ideas, objects and events are communicated largely by means of adjectives. This reflects the logic behind the use of the semantic differential (SD) technique in obtaining measures of attitudes and other sentiments.

The SD technique represents a very flexible approach in the sense that it can be adapted to suit any type of research or study concerned with the measurement of people's

opinions and attitudes toward a concept: this concept may be a politician, colour, data contained in a report, trade unions, cars, etc. . . . In other words, since the publication of the work by Osgood et al in 1957 (94), the SD technique has been extensively used in the field of psychology, linguistics, marketing, and many other disciplines including speech communication from whence the technique originated.

The approach uses a collection of rating scales (of seven points) anchored by bi-polar adjectives. A scale in this case can be for example important-unimportant, and a respondent's attitude toward the concept will be his rating of the concept on the scale. A facet of the flexibility of this technique is that there is no problem in finding adjectives and their opposites, as most adjectives have logical opposites, and when an opposing one is not obviously available, one can easily be generated by using "in" or "un".

(ii) Measures of information attributes

These measures are applied because of the possibility that a given report may have low value because it arrives too late, it is inaccurate or too complex, for example. That is, the intrinsic information may be highly desirable but its potential value is unrealised because of defective delivery to the user. To reveal this situation, the semantic differential technique is directed to the attributes of information. As with the previous SD measure used to obtain a non-monetary value of a report, these scales were classified intuitively by Gallagher.

Gallagher in his conclusions stated that these scales proved very helpful in eliciting the user's perceptions concerning the attributes of management information (95).

(iii) Measures of maximum information value

From the first two types of data, four possible results may accrue: (a) high value, good attributes, (b) high value, poor attributes, (c) low value, good attributes, (d) low value, poor attributes.

Result (a) indicates an excellent report. Result (b) indicates valuable information poorly delivered. Result (c) indicates a questionable report, which although well delivered should be discontinued, Result (d) indicates either:

(i) the information has little intrinsic value and the report should be considered for elimination, or

(ii) the information has high potential value but that value is destroyed through poor delivery to the user.

In order to discriminate between the above two possibilities, the two measures of information value are repeated with the following assumption , that managers could have the reports with optional attributes, that is, their format, quantity of data, timeliness and accuracy would be tailored to meet their needs (96).

In his conclusion, Gallagher states that "a reasonable estimate of the maximum possible value of a management information system can be determined from the individual

estimates of the system's users." (97)

Kelley's research (98) represents a second attempt to measure the value of management information through the users' perceptions. In this research he used Gallagher's measures within his approach to the problem. His additions to Gallagher's measures were :

(i) Two questions were added to the measures which were used to elicit the perceived value of management information to the user. Both questions concerned the monetary aspect of these measures. The first question asked the respondent to describe the basis used for establishing his monetary estimate of the selected information report. The respondent was provided with a partial set of structured responses, (to give guidelines for candid answers),together with an option of an open response. The second question, an open-ended one, sought for the reasons underlying the respondent's choice of a specific basis. (99)

Kelley in his discussion of results stated that the respondents' replies to the additional two questions demonstrated a clear and valid comprehension of the questions giving the required results. Moreover, the feasibility of including these two questions was also demonstrated (100).

(ii) Kelley included new bi-polar adjectives in the SD scales used to measure the non-monetary value of the management information. These were selected intuitively (101).

(iii) New bi-polar adjectives were included in the SD scales used to measure information attributes. These were also selected intuitively (102).

It can be stated that these two previous research studies presented a new approach which has a great potential for use in evaluating management information. This researcher has adopted the same approach with the aim of further developing and testing it in order to enable it to be used as a tool by internal auditors when they are evaluating MIS. Such a technique will improve the efficiency and effectiveness of the audit of MIS. Reasons for the researcher's choice include:

(i) Methods developed for use in evaluating management information as presented previously in this section lack the practicality and in some cases the feasibility for implementation in the context of management information supplied for use in making non-programmed decisions.

(ii) Research results using the last approach showed its potential for broad applications of measuring value and attributes of MIS reports.

Moreover, the SD technique used in this approach has the advantages of (i) yielding a single quantitative result, (ii) being easily administered, and (iii) being well documented in the literature as to its properties and reliability (103).

Research presented in this dissertation will take the previous studies further in developing this new approach. This is achieved by the following inclusions:

(i) The field site used in this part of the research is a financial institution established in the UK. This means that the environment where this approach is being conducted and tested differs from those in the previous research on two counts. The first difference is that of difference in the national culture between the USA and the UK. The second difference is the difference of sector. The UK company is a financial institution, whereas Gallagher's research was conducted in a manufacturing company and Kelley's research was conducted in a project-management organisation. This difference allows for an expansion in the breadth of previous research. This quality is urgently needed in view of the fact that to develop a new approach to evaluate management information, a need exists for different tests to be performed and conducted under varying conditions in order to justify its general application.

(ii) New bi-polar adjectives were selected and added to the scales used to measure the attributes of management information. This was performed in order to rectify the deficiencies uncovered in previous research (104), and in order to build scales which correlate highly with the value measures, a result partially achieved in Kelley's research (105).

(iii) Factor analysis of the SD data was performed in order to determine whether the bi-polar adjectives tapped the different aspects of MIS reports (value attributes) and to determine whether they were stable across different

methods used in this process. This enabled the building of scales to evaluate MIS reports through the users' perceptions of their value and attributes. Also, in order to allow generalisation of the scales, reliability tests were performed.

Such analyses were omitted in the two earlier studies.

2.6. Studies of the attributes of information

In the introduction to this chapter it was stated that a survey of the literature would include research investigating the attributes of information which influence managers and cause them to vary their subjective values of selected information. The attributes of information examined in this section are: (i) quantity, (ii) quality - format, (iii) quality - reliability or accuracy, (iv) timeliness, and (v) cost (non-monetary). These attributes were chosen as they have been used in earlier studies with some measure of success and their present use allows generalisability, a major aim of this research.

Mock utilised a business game which simulated a company within a competitive market to analyse one attribute of management information (106). The controlled factors in this experiment were that the participants, businessmen and students, were required to make management decisions on a fixed schedule and the timeliness of the data was varied. Hence, this simulation produced an environment which output empirical data on the effects of differences in timing of information availability on

decision making. The positive results indicated a high utility of timely information. Also the measure of information value was found to be statistically significantly larger than the theoretical (expected) value of timely information (when calculated as the difference in optimal payoffs using information systems with variations). From these results Mock implied that participants tended to value the timeliness of the information much higher than the expected value of timely information. Hence, participants placed a high utility value on timeliness of information because payoffs of their decisions were higher.

Haseley examined several attributes of information in a simulated business environment (107). Information attributes that were varied included quality-format of internal data; timeliness in terms of current or lagged data; and quantity defined as the completeness of data with regard to such business facets as plant cost, sales and inventory data. His results revealed that the relative ratings of the information attributes were (108):

- quantity, as the completeness of information was rated as more important than the timing of the data flows
- quality-format of the information was rated to be equally important as the timing of the data flows.

Since this was a laboratory type experiment these findings may not generalise to the real world where data flow linkings may be static or where dynamic external

environmental changes can reduce the importance of internal data flows.

When comparing the findings of these two studies it is necessary to take the limitations into consideration. Both experiments required participants to make decisions on a fixed schedule given specific data (57) and consequently limited control over the timing of their decisions. In the real world, in a majority of business situation, a manager has a relatively high degree of control over the timing and completeness of data flows. This would influence the timing of his decisions and enable him to compensate for information system deficiencies.

Gallagher used the SD technique to obtain data concerning the user's perceptions of the attributes of selected management information. Five scales to measure attributes were applied in this study (109). Two bi-polar adjectives in the quantity of information scale were designed to measure the extent to which each manager's perceived need for information of the type conveyed by the information system was satisfied. Results indicated a comparatively low mean score for this scale. Hence respondents implied the quantity of information in the report was incomplete and insufficient (110). It couldn't be discerned whether this deficiency could be transcended within information system boundaries because of lack of precision in the scales. The deficiency could have resulted from design of the input-output subsystem, a lack of adequate information from necessary sources or lack of an adequate output report.

The next scale of four bi-polar adjectives were designed to measure the manager's perception of the quality of report format. Above average mean scores indicated general satisfaction with the format of the information system output viz the report.

A third set of four bi-polar adjectives were used to measure the quality of the output (report) in terms of reliability or accuracy. Collectively, the mean of this scale was higher than the grand mean of all attribute scales together but lower than the mean of quality-format attribute scale. This latter finding may result from the fact that some managers may have provided system-oriented responses and were high in satisfaction whereas other managers were report-oriented and when recalling former report errors gave low ratings for this attribute.

Timeliness was measured with a scale of two bi-polar adjectives. The results of this scale produced widely varying means. The current-outdated bi-polar adjective received an above average mean because each monthly report contained data relating to the previous month. The timely-untimely bi-polar adjective received relatively low ratings. This suggested that users would like to receive the report sooner than that provided with previous distributions.

The final attribute measured was cost. This related to the non-economic cost, that is, the time and effort expended by the user in the extraction of information required from the report. Two bi-polar adjectives

comprising this cost scale had low mean scores. This suggested that users' expended a lot of time and effort to extract the required information from the report. Gallagher commented that the difficulties he experienced in producing a reasonable explanation for these results led him to conclude that the cost scale employed did not provide a useful measure (111).

Thus, in Gallagher's study, the users of the MIS report perceived it to be satisfactorily reliable, current and in an acceptably presented format. Lower ratings indicated less satisfaction towards report timeliness and completeness, although these attributes were still rated favourabley.

Kelley's research presented a second application of the SD technique in measuring the attributes of selected management information, and as with the previous study, he used different scales to measure the quantity of the data, quality-format, quality-reliability or accuracy, timeliness, and cost (non-monetary). Besides presenting an analysis of the results of these different scales using descriptive statistics, as did Gallagher, he also tested a hypothesis postulating a positive relationship between managers' monetary estimates of the value of the report, and its different attributes. The results of this test were mixed, but in general, they were supportive of this positive relationship and so the hypothesis was accepted (112), a confirmation of the influence of these attributes on the value of the selected management information.

The five attributes chosen for investigation by Gallagher and Kelly and argued by numerous authors to be attributes of importance (113) were chosen for use in this present research study.

2.7. Summary and conclusions

This selected review of the literature aimed to

(i) develop a concept of MIS

(ii) present reasons for MIS failures

(iii) explore the notion of the internal audit as being a means of controlling and preventing failure in MIS

(iv) indicate the inadequacy of tools used by auditors in this process

(v) sample a number of previous studies which presented methods of measuring the value of information and

(vi) examine some important attributes of selected management information.

Consideration of the MIS concept is required for use in the empirical work in this study relating to its audit. When ascertaining the problems involved in the management of MIS it is easy to see that one possible means of control is to perform an internal audit of the MIS. For this to occur, development of the new comprehensive methodological approach, which evaluates management information by asking the users to estimate this value, is undertaken in this research study.

The attributes of management information which were selected as having an important influence on the user's perceived value include quantity, quality-format, quality-reliability or accuracy, timeliness and cost (non-monetary). The influences of these attributes are investigated within this study.

REFERENCES

1. See for example:

   a - Coleman, R.J., & Riley, M.J. (eds.), MIS: Management Dimensions, Holden-Day Inc., San Francisco, 1973, pp.4-7.

   b - Kirkpatrick, D.C., General systems theory as a framework for management information systems, Unpublished DBA dissertation, University of Colorado, 1976, Chapter 3.

2. Alexander, M.J., Information systems analysis: theory and applications, Science Research Associates, USA, 1974, p.88.

3. Cushing, B.E., Accounting information systems and business organisations, Addison-Wesley Publishing Co., Massachusetts, Second Edition, 1978, p.8.

4. See for example:

   a - King, W.R., & Cleland, D.I., Competitive business intelligence systems, Business Horizons, December 1975, pp.19-28

   b - King, W.R., & Cleland, D.I., Information for more effective strategic planning, Long Range Planning, Vol.10, No.1, January 1977, pp.59-64.

   c - Voich, D. Jnr., Mottice, H.J., & Shrode, W.A., Information systems for operations and management, South-Western Publishing Co., Cincinnati, 1975.

5. Anthony, R.N., Planning and Control Systems: a framework for analysis, Harvard University, Division of Research, Boston, 1965, pp.16-19.

6. Ibid, pp.18-19.

7. Ibid, p.21.

8. Coleman, R.J., & Riley, M.J., (eds.), op.cit., p.25.

9. Donkin, R.G., Will the real MIS stand up?, Business Automation, May 1969, In Coleman, R.J. & Riley, M.J., (eds.), op.cit., p.35.

10. See for example:

    a - Voich, D., Jnr., Mottice, H.J., & Shrode, W.A., op.cit., pp.3-5.

    b - Cushing, B.E., op.cit, pp.124-154.

    c - Emery, J.C., Organisational planning and control systems: theory and technology, The Macmillan Co., Collier-Macmillan Ltd., London. 1969, pp.36-63.

    d - Bunch, J.G., & Strater, F.R., Information systems: theory and practice, Hamilton publishing Co., Santa Barbara, California, 1974, pp.26-27.

11. See for example:

    a - King, W.R., & Cleland, D.I., The design of management information systems: an information analysis approach, Management Science, Vol.22, No.3, November 1975, pp.286-297.

    b - King, W.R., Strategies for success in MIS, Working paper, Graduate School of Business, University of Pittsburgh, February 1979.

    c - Munro, M.C., A comparison of the decision analysis and data analysis methods for determining management's information needs, Unpublished Ph.D. dissertation, University of Minnesota, 1975.

12. Lindberg, R.A., & Cohn, T., Operations auditing, AMACOM, 1972, pp.89-90.

13. Adapted from EDP Analyzer, Canning Publications Inc., Vista, California, July 1968, as cited by Jancura, E.G. & Berger, A.H., Computers - Auditing and Control, Auerbach Publishers Inc., Philadelphia, 1973, p.446.

14. Lindberg, R.A., & Cohn, T., op.cit., p.90.

15. Safford, H.B., Measuring cost and potential benefits of computer projects, Data Management, September 1975, p.40.

16. Lindberg, R.A., & Cohn, T., op.cit., p.89.

17. Davidson, H.J., & Truebold, R., Accounting for decision-making, The Accounting Review, October 1961, pp.577-582.

18. Brown, J.G., Internal auditing in the seventies, The Internal Auditor, Winter 1966, p.15.

19. Brink, V.Z., Cashin, J.A., & Witt, H., Modern Internal Auditing - an operational approach, The Ronald Press Co., NY, Third Edition 1973, pp.408-409.

20. Hutchings, T.D., Profitability through organisational effectiveness, Cost and Management, July-August, 1970, p.6.

21. Voich, D., Jnr., Mottice, J.H., & Shrode, W.A., op.cit., pp.24-26.

22. Ackoff, R., Management misinformation systems, Management Science, December 1967, pp.147-156.

23. The Institute of Internal Auditors, Standards for the professional practice of internal auditing, The Institute of Internal Auditors, Inc., Florida, 1978, p.1.

24. Stettler, H.F., Auditing principles, Prentice-Hall, Inc., Englewood Cliffs, N.J., Second Edition, 1961, p.70.

25. Cashin, J.A., & Owens, G.C., Auditing, The Ronald Press Co., NY, Second Edition, 1963, pp.83-84.

26. See for example:

    a - Dooley, D.E., Internal auditing, The Internal Auditor, Vol.XIX, Summer 1962, p.12.

    b - Meigs, W.B., The development and role of internal auditing, The Accounting Review, Vol.XXVI, October 1951, p.518.

    c - Shaw, M.K., Internal auditing our promotable product, The Internal Auditor, Vol.XIX, Spring 1962, p.10.

    d - Taylor, P.J., Appraising a corporate organisation, The Internal Auditor, Vol.XIX, Winter 1962, p.28.

    e - Meyers, E.B., Operational auditing, The Internal Auditor, Winter 1966, p.17.

    f - Boman, S.H., Management looks to the internal auditor, The Internal Auditor, Vol.XIX, Spring 1962, p.19.

27. Thurston, J.B., 1941- Modern internal auditing has just been born, The Internal Auditor, Summer 1966, p.59.

28. Ibid.

29. Lemon, F.W., Where are we going as a profession?, The Internal Auditor, Summer 1966, p.91.

30. The Institute of Internal Auditors, Statement of the responsibilities of the internal auditor, The Institute of Internal Auditors, 1947.

31. The Institute of Internal Auditors, Statement of the responsibilities of the internal auditor, The Institute of Internal Auditors, 1957.

32. Ibid.

33. The Institute of Internal Auditors, Statement of the responsibilities of the internal auditor, The Institute of Internal Auditors, 1971.

34. The Institute of Internal Auditors, Standards for the Professional Practice of Internal Auditing, op.cit., pp.300-1 .

35. Ibid.

36. Chambers, A.D., Current trends in internal auditing, Proceedings of the fourth annual conference on recent developments in internal auditing, the City University Business School, London, 1979, p.177.

37. Ibid, p.173.

38. Lindberg, R.A., & Cohn, T., op.cit., p.9.

39. Dodwell, J.W., Operational auditing: a part of the basic audit, the Journal of Accountancy, June 1966, p.32.

40. Hutchinson, J.G., Organisations: theory and classical concepts, Holt, Rinehart & Winston, NY, 1967.

41. Chambers, A.D., op.cit., p.185.

42. Le Brenton, P.P., Administrative intelligence information systems, Houghton Mifflin Co., Boston 1969, p.277.

43. Hay, L.E., What is an information system? The legal, conventional, and logical constraints, Business Horizons, February 1971, pp.71-72.

44. Ibid.

45. Johnson, F.G., Operational auditing of electronic data processing, in Operational Auditing for Management Control, edited by Norbeck, E.F., and others, American Management Association, 1969, p.185.

46. Ibid, p.191.

47. Ibid, p.192.

48. The Institute of Internal Auditors, Standards for the Professional Practice of Internal Auditing, op.cit, p.300-1.

49. The Institute of Internal Auditors, Survey of Internal Auditing, 1975, The Institute of Internal Auditors, Inc., 1975, Florida, p.7.

50. Ibid.

51. Rittenberg, L.E. & Davis, G.B., The roles of internal and external auditors in auditing EDP systems, The Journal of Accountancy, December 1977, p.51.

52. Ibid, p.52.

53. Ibid, pp.52-53.

54. Schwarzbach, H.R., Auditing management information systems: an empirical investigation on the impact of management information system's audits, Unpublished DBA dissertation, The University of Colorado, 1976.

55. Lindberg, R.A., & Cohn, T., op.cit., pp.225-228.

56. Sutton, R.H., & Mathis, R.L., Performance appraisal - Part 2, Journal of Systems Management, Vol.30, No.7, July 1979, pp.11-12.

57. Perry, W.E., Auditability: a management concern, Financial Executive, June 1977, pp.25-26.

58. McDonough, A.M., Information economics and management systems, McGraw-Hill Book Co., NY, 1963, p.71.

59. Davis, G.B., Management information systems: conceptual foundations, structure and development, McGraw-Hill Book Co., NY, 1974, p.32.

60. Voich, D., Jnr., Mottice, H.J., & Shrode, W.A., op.cit.,p.6.

61. Feltham, G.A., The value of information systems, Journal of Systems management, Vol.XX, November 1969, pp.9-11.

62. Ibid.

63. Samuelson, P.A., Economics: an introductory analysis, McGraw-Hill Book Co., NY, 1967, p.417.

64. Shannon, C.E., & Weaver, W., The mathematical theory of communication, the University of Illinois Press, Urbana, 1962.

65. Ackoff, R.L., Towards a behavioural theory of communication, Management Science, Vol.IV, April 1958, pp.218-231.

66. Ibid, pp.220-222.

67. Ibid, p.223.

68. Ibid, p.222.

69. Ibid, p.223.

70. Gregory, R.H., & Van Horn, R.L., Automatic data-processing systems: principles and procedures, Wandsworth Publishing Co., San Francisco, 1960, pp.365-372.

71. Ibid, p.355.

72. Ibid, pp.365-372.

73. Marschak, J., Economics of inquiry, communicating and deciding, American Economic Review, Vol.58, No.2, 1968, pp.1-18.

74. Ibid, p.10.

75. Marschak, J., Economics of information systems, Journal of American Statistical Association, Vol.66, March 1971, pp.192-219.

76. Feltham, G.A., & Mock, T.J., Concepts of information and information systems and their impact on information system design, AIS Research paper 7001, University of California, Los Angeles, September 1970, p.13.

77. Ibid.

78. Ibid, p.17.

79. Ibid, p.18.

80. Ibid, p.20.

81. Ibid, p.21.

82. Ibid.

83. Ibid.

84. For recent works in the area of information economics, see for example:

    a - Dickson, G.R., Senn, J.A., & Chervany, N.L., Research in management information systems: the Minnesota experiments, Management Science, Vol.23, No.9, May 1977, pp.913-923.

    b - Hilton, R.W., The determinants of cost information value: an illustrative analysis, Journal of Accounting Research, Vol.17, No.2, Autumn 1979,pp.411-435.

c - Seppala, Y., The relative value of a management information system, a simulation study, Omega, Vol.8, No.1, 1980, pp.39-45.

85. Green, P.E., Halbert, M.H., & Minas, J.S., An experiment in information buying, Journal of Advertising Research, Vol.4., No.2, September 1964, pp.17-23.

86. Ibid, p.19.

87. Ibid, p.22.

88. Green, P.E., Robinson, P.J., & Fitzroy, P..T, Experiments on value for information in simulated marketing environment, Allyn and Bacon, Inc., Boston, 1967.

89. Greenridge, C.D., The effect of improved information on profitability in smaller retail firms, Unpublished PhD dissertation, Ohio State University, 1967.

90. Gallagher, C.A., Measurement and analysis of managers' perceptions of the value of selected management information, Unpublished DBA dissertation, Florida State University, 1971.

91. Ibid, p.16.

92. Ibid.

93. Ibid, p.142.

94. Osgood, C.E., Suci, G.J., & Tannenbaum, P.H., The measurement of meaning, the University of Illinois Press, Urbana, 1957.

95. Gallagher, C.A., op.cit., p.141.

96. Ibid, pp.18-19.

97. Ibid, p.143.

98. Kelley, J.A., The analysis and measurement of value of selected non-financial project management information, Unpublished DBA dissertation, Florida State University, 1974.

99. Ibid, p.91.

100. Ibid, p.141.

101. Ibid, pp.91-95.

102. Ibid.

103. See for example:

a - Snider, J.G., & Osgood, C.E.(eds.),Semantic differential technique: a source book, Aldine Publishing Co., Chicago, 1969.

b - Summers, G.F. (ed.), Attitude measurement, Rand McNally & Co., Chicago, 1970.

c - Osgood, C.E., May, W.H., & Mirron, M.S., Cross-cultural universals of affective meaning, University of Illinois Press, Chicago, 1975.

104. Gallagher, C.A., op.cit., pp.95-99.

105. Kelley, J.A., op.cit, pp.160-163.

106. Mock, T.J., The evaluation of alternative information structures, Unpublished PhD dissertation, University of California, 1969.

107. Haseley, A.F., Information and decision making in a management game, Unpublished Ph.D. dissertation, Purdue University, 1969.

108. Ibid.

109. Gallagher, C.A., op.cit., p.96.

110. Ibid, p.97.

111. Ibid, p.99.

112. Kelley, J.A., op.cit., pp.160-163.

113. See for example:

a - Emery, J.C., Cost/benefit analysis of information systems, Working paper, Wharton School of Finance and Commerce, University of Pennsylvania, 1971.

b - Hirsch, R.E., The value of information, the Journal of Accountancy, June 1968, pp.41-45.

c - Andrus, R.R., Approaches to information evaluation, MSU Business Topics, Summer 1971, pp.40-46.

d - Higgins, J.C., The value of accuracy in information for planning and control, Long Range Planning, Vol.7, No.4, August 1974, pp.67-72.

e - Paretta, R.L., The frequency of information flows: a misunderstood management variable, Management Adviser, July-August, 1974, pp.46-49.

f - Voich, D., Jnr., Mottice, H.J., & Schrode, W.A., op.cit., pp.32-34, pp.228-232.

g - Berdine, W.R., & Brickner, W.H., Strategic planning and attributes of external information, Managerial Planning, January/February 1976, pp.17-21.

h - Hilton, R.W., op.cit., pp.411-435.

CHAPTER 3

'MIS AUDIT' QUESTIONNAIRES - METHOD AND PROCEDURE

3.1. Introduction

3.2. Developing the questionnaires

- 3.2.1. Number of auditing staff
- 3.2.2. The audit of MIS
  - 3.2.2.1. Companies auditing MIS and the type of audit performed
  - 3.2.2.2. Audit plans
  - 3.2.2.3. Characteristics of MIS auditors
  - 3.2.2.4. Audit scope
  - 3.2.2.5. Audit recommendations
  - 3.2.2.6. Benefits of the MIS audits
  - 3.2.2.7. Ideal MIS audits
- 3.2.3. Managers' satisfaction with MIS
- 3.2.4. Manager-auditor working relationship
- 3.2.5. Internal Auditors' evaluation

3.3. Population

- 3.3.1. Sample plan

3.4. Procedures

- 3.4.1. Pilot study
- 3.4.2. Administration of the questionnaires
- 3.4.3. Tabulating responses

CHAPTER 3

'MIS' AUDIT QUESTIONNAIRES - METHOD AND PROCEDURE

3.1. Introduction

The aim of this chapter is to describe and discuss the development of the questionnaires; the sampling process used in the selection of internal auditors, managers and MIS managers who participated in the study; the procedures used in pilot-testing the questionnaires, the results of the pilot test, the administration of the questionnaires, and the tabulation of the responses.

3.2. Developing the questionnaires

The collection of the data required for a study of the 'state of the art' in the auditing of MIS, and for the testing of different hypotheses in this context was accomplished through mail questionnaires sent to internal auditors, managers and MIS managers. This method of collecting the data was chosen as other methods available were impractical and unfeasible. For example, a first method explored was the application of the questionnaires in one company, i.e. a field study. This was the original intention of the researcher and was explored with the officials of company XXX (where the second part of this research was applied). Unfortunately, as will be discussed later in this study, this method was unfeasible. Conducting interviews as another method of collecting data was explored too, but due to the limitations of time and effort, this method proved to be impractical.

Low response rate has been the main criticism of mail questionnaires as a method of collecting data. In order to enhance the chances of getting a high response rate, the questionnaires were designed with the aim that they were self-explanatory. For example: the inclusion of definitions in order to avoid confusing the results by the different interpretations of the respondents; by using a format which encouraged respondents' participation in the study; by including all necessary instructions; and finally by pilot testing the questionnaires so as to study respondents' opinions and reactions to the questionnaires either from a semantic point of view or from a format point of view.

Due to the exploratory nature of the study and the spacing allowed for emphasis, the internal auditors' questionnaire totalled 10 pages, while the managers' and the MIS managers' questionnaires totalled only 6 pages each since not all questions included in the former were relevant to the latter. The questionnaires are shown in Appendix A, and the following is a detailed analysis of the questions included in the test instruments.

3.2.1. Number of auditing staff. This question was included in the internal auditors' questionnaire to elicit the number of staff working either full-time or part-time in the company's UK offices. The answer to this question will be used in correlation analysis with other data from the questionnaire to test some hypotheses in a later chapter in this part of the study.

3.2.2. The audit of MIS. This section represents the main part of the study and includes different questions asked in some cases of all three types of respondents. Data will be used in testing hypotheses, and in describing the 'state of the art' in the audit of MIS.

3.2.2.1. Companies auditing MIS and the type of audit performed. Two questions provided the data needed in this context, question 3 in the internal auditors' questionnaire asked whether the audit of MIS is performed as a special assignment or as part of other audits, while question 4 asked the respondent about the type of MIS audit performed. To overcome the problems of terminology, definitions of MIS, types of audit and what is DP in relation to the MIS were provided in the introduction to the questionnaire and in the body of the two mentioned questions. No comparable questions were asked of managers and MIS managers.

3.2.2.2. Audit plans. Questions 7 to 10 in the internal auditors' questionnaire were asked to elicit information concerning the audit plans of the MIS. They included open ended questions asking how often these audits are performed, what proportion of the department's available time is taken, the number of auditors involved in an audit, and finally whether they draw on personnel from outside the department to work in this audit. If the answer was positive, the respondent was asked from where they were drawn. No comparable questions were asked of managers and MIS managers.

3.2.2.3. Characteristics of MIS auditors

Question 11 in the internal auditors' questionnaire asked for the experience and education of internal auditors performing this type of audit. Since diverse answers can be expected from this question, no structured or partially structured responses were provided. This open-ended question meant complete flexibility was afforded to the respondents in their replies to this question.

3.2.2.4. Audit scope. This area of investigation was covered by many questions asked of the three types of respondents. Question 12 in the internal auditors' questionnaire asked respondents to rank the different categories and the different items inside these categories in terms of their importance in the audit of MIS as experienced by respondents now. As the items provided cannot be assumed to be exhaustive, respondents were asked to specify and rank any other item not mentioned but which they thought was part of the audit performed: this option made the question an open-ended one.

Questions 20 and 23 in the internal auditors' questionnaire and questions 9 and 10 in the MIS managers' questionnaire asked who evaluates MIS in terms of efficiency and effectiveness (an open question about the criteria used in this context) and their satisfaction with the method used. A Likert-type seven point scale ranging from 1 as unsatisfied to 7 as highly satisfied, passing through 4 as satisfied which represents a neutral point between the two poles of the scale, was supplied for their responses.

Questions 18 and 19 in the internal auditors' questionnaire, questions 10 and 11 in the managers' questionnaire, and questions 7 and 8 in the MIS managers' questionnaire were concerned with the review (audit) of the reports in order to determine whether they meet managers' needs. They asked specifically: who does this review, the criteria used in this context, and the satisfaction with the method used (supplying a Likert-type seven point scale similar to the one previously discussed).

3.2.2.5. Audit recommendations. The literature is filled with analysis and discussions concerning what auditors can include in their audit report in terms of recommendations, and what needs to be done in this respect in order not to hinder their future audits, and hence their independence. Questions 21 and 22 were asked to uncover, from a practical point of view, auditors' perceptions of this problem.

3.2.2.6. Benefits of the MIS audits. This area of investigation was covered in the three questionnaires and tackled from different angles. First, the respondents were asked to rate on a Likert-type seven point scale the benefits of an MIS audit in relation to its costs. The scale ranged from 1 where the benefits greatly outweigh the costs, 4 where they are equal, to 7 where they are much less than the costs. Two questions - 5 and 6 - were used for internal auditors, each relating to a type of audit (operational-compliance), while for managers and MIS managers one question only was asked - 4 and 2 respectively - as no distinction was made between these

two types of audits. Second, respondents were asked to rank the benefits of MIS audits which included several benefits uncovered in a previous study(1) and an open option response allowing candid answers from the respondents. As with the previous case, questions 13 and 14 were asked of internal auditors in relation to operational and compliance audits respectively, while one question combining the benefits of the two types of audits, question 6 for managers and question 3 for MIS managers, was asked in this respect. Respondents were asked an open question to elicit whether they perceived any additional benefits accruing if the audit approach was modified or expanded: questions 15, 7, and 4 for internal auditors, managers, and MIS managers respectively.

Finally, respondents were asked to rate on a Likert-type seven point scale the after-effects of the MIS audits in terms of managers' quality of decisions, and confidence in the reports they receive, and whether MIS has improved because of past audits. The scales used ranged from 1 (No . . .) to 7 (Much more . . .) with 4(somewhat . . .). The questions were 24 and 25 for internal auditors, 12, 13, and 14 for managers, and 11 and 12 for MIS managers.

3.2.2.7. Ideal MIS audits. A question was posed in each questionnaire asking the participants about their perceptions of an ideal operational audit of the MIS. This was changed to 'developing a guideline for evaluating MIS' in the managers' and MIS managers' questionnaires in

order to avoid terminology problems. A Likert-type seven point scale ascending from 1 (None), 4 (some) to 7 (a great deal), was used by the respondents in rating the different MIS components grouped into main categories and items under each category, a repetition of question 12 asked to internal auditors in order to describe the MIS audit scope.

3.2.3. Managers' satisfaction with MIS. A question was asked in the managers' (Q3) and MIS managers' questionnaires(Q14) for the participants to rate on a Likert-type seven point scale, their degree of satisfaction with the MIS now in operation in their company. The range of the scale was as before. MIS managers were asked to complete an open question if their ratings uncovered dissatisfaction, and to indicate the areas where improvements were needed. Data provided by this question will be used in testing hypotheses.

3.2.4. Manager-Auditor working relationship. This area concerns the internal auditors' and the managers' perceptions of the closeness of their relationship and how the latter perceive the role played by the internal auditor in conducting their audits. Questions 16 and 17 asked the internal auditors to rate on a Likert-type seven point scale ranging from 1 (not at all), 4 (moderately close), to 7 (closely enough) the extent to which they perceived the closeness with which they worked with the managers (users of management reports) and MIS personnel when conducting their audit. The same question was

repeated, asking for managers' and MIS managers' perceptions in this respect - questions 8 and 5 respectively.

Question 5 in the managers' questionnaire asks respondents to rate on a Likert-type seven point scale how well they think they understand what auditors do when reviewing MIS, while question 9 asks how they feel about being an auditee. The question included different alternatives to describe their feelings in this context, based partially on the results of a previous study (2) and also on an open option response in order to avoid making the question a leading one. This latter question was asked of MIS managers also in question 6.

3.2.5. Internal auditors' evaluation. Questions 27 asks the internal auditors about the method (approach) used in the evaluation of the internal audit function in their companies. A partial set of structured responses based on the results of a previous study (3) and an open option response were provided as guidelines for candid asnwers by the respondents.

Data provided by the answers to this question will be used in testing hypotheses

3.3. Population

The survey presented in this part of the study concerns the audit of MIS. This means there is a need to have the population consisting of companies or organisations with an internal audit function within the hierarchy. The researcher was faced with a choice between two options in locating companies satisfying this condition. The first

option was (i) to decide upon a certain population without prior knowledge of the existence of the named department, (ii) draw up a random sample, (iii) locate companies with an internal audit department by sending a letter with a follow-up letter to non-respondents asking for this information) and (iv) finally, send the questionnaires to those satisfying the above condition. A second option was to choose the population from those companies or organisations affiliated to the Institute of Internal Auditors-UK Chapter, as this proves the existence of the department concerned. While the second option has the disadvantage of excluding companies with an internal audit function but not affiliated to the UK Chapter of the Institute, it has the advantage of satisfying the limitations of time and cost which impose constraints on every research. For these reasons the second option was chosen.

The population was limited to companies working in the UK (either foreign or local), the reason being that MIS and its audits represent a new type of activity or trend in the domain of internal auditing, which can be expected to be firstly introduced into companies, and hence, by this limitation, the chances of getting the required replies for the survey are enhanced.

The total number of companies satisfying this second limitation and who are also members of the Institute of Internal Auditors - UK Chapter at the 30th November 1977 (using their 1977-1978 Handbook and the membership reports

from the 1st June 1977 to the 30th November 1978) was 396 companies.

3.3.1. Sample Plan. It was decided that a sample consisting of 100 companies representing 25%(approx.) of the population is sufficient to provide a representative sample. The sample was randomly selected using tables of random numbers. (4)

The internal auditors to whom the questionnaire was to be addressed were found in the Handbook of the Institute of Internal Auditors - UK Chapter and the membership reports. If more than one auditor and members of the Institute worked in a company chosen in the sample, then random tables (5) were used to choose the person to whom the questionnaire was to be sent.

As to managers and MIS managers participating in the research, two options were available in this context. The first option was to send a letter to the company in the sample asking for the name of a line manager who has experienced a recent audit, and the name of the MIS manager. A second option was where the internal auditor participating in the survey was asked to pass the two questionnaires to a manager and an MIS manager satisfying the conditions mentioned above. The second option was chosen by the researcher for its practicality and because previous research showed that using the first option does not yield the maximum replies to the questionnaires since companies do not choose to reveal their managers' names (6), and also the second option was shown to be satisfactory in another study.(7).

3.4. Procedure .

This section presents the steps taken in pilot testing the questionnaires, administering the final or revised version of the questionnaires and finally the tabulation of the responses.

3.4.1. Pilot study Ten internal auditors were selected from the random sample by the supervisor for the pilot-testing of the questionnaires. They answered the questionnaire and passed on the other questionnaires to managers and MIS managers. This selection was based on personal contact enabling a full response and ensuring the questionnaires received the thorough review required to uncover any problems of semantics, terminology and format.

By mid-December 1977, a formal letter, covering note and questionnaires were sent to the ten internal auditors who had said they would help in this exercise. A copy of the letter and the covering note are presented in Appendix (A).

The number of replies received by the end of January 1978 were as follows: seven internal auditor questionnaires, two manager questionnaires, and three MIS manager questionnaires. By this date a follow-up letter was sent to the non-respondent internal auditors. Two types are presented in Appendix (A). This resulted in the receipt of another three internal auditors' questionnaires, three managers' questionnaires, and one MIS manager's questionnaire. No major problems

were uncovered through the pilot testing of the questionnaires, but nonetheless several improvements did result leading to the questionnaires' final version, a copy of which is presented in Appendix (A).

The modifications made were as follows:

Internal Auditors' questionnaire

(1) Company's name was asked as part of question 1 in order to enable the collection of published data (financial and non-financial) used in testing hypotheses.

(2) A sentence was added after question 6, whereby respondents working in companies which do not audit MIS, will skip and answer the questions (starting from question 26) which can be answered irrespective of the existence of this audit.

The reason for not including this sentence in the pilot-testing was the assumption by the researcher that this type of audit exists in one form or another in any company - an assumption which was proved wrong by one respondent in the pilot test.

(3) Sentences in question 12 were underlined as the analysis of the pilot test replies showed that respondents omitted the ranking - in terms of importance - of the major categories representing the audit of MIS while ranking the items included in each category.

(4) The same as (3) was repeated for question 26 with underlining to emphasise that the aim of the question was the ranking of the ideal operational audit, categories and items inside each category, and hence this question differed from question 12 which asked for the ranking to be done in terms of the audit as practised now.

Managers' questionnaire

(1) The company's name was requested for the same reason as above.

(2) In question 3 the sentence was modified by including (would) so as to be answerable even if the respondent worked in a company which did not audit MIS. A new question, question 4, was added asking whether the MIS was audited either directly or indirectly, followed by a new sentence asking the respondent to skip to question 15 if the answer was No.

(3) Question 15 was modified to make it clearer to the respondent that the ranking was needed for main categories as well as for items inside the categories.

MIS managers' questionnaire

The same three points discussed with the previous questionnaire applied here. Questions 1, 2 and 13 were altered.

The changes made to the questionnaires as a result of the pilot-test were minor, hence, the respondents taking part in this pre-test were not re-surveyed, and their trial run questionnaires were included with those received in the main study.

3.4.2. Administration of the Questionnaires.

By the beginning of March 1978, ninety of each of the questionnaires were sent to the remaining internal auditors in the sample for them to answer, and to pass to managers and MIS managers. The set of three questionnaires were accompanied by a letter, a copy of which is presented in Appendix (A). Each questionnaire was

accompanied by a covering note, a copy of which is also presented in Appendix (A). The letter explained to the internal auditors the aim of the survey and asked for his help in this matter; the covering note indicated the type of questionnaire enclosed, the time needed to answer the questionnaire, ensured confidentiality, and asked whether the respondent would like to be informed of the results of the study. By mid-May 1978 the responses received were as follows: twenty-eight internal auditors' questionnaires, twenty-three managers' questionnaires, and nineteen MIS managers' questionnaires.

A follow-up letter was sent to the internal auditors taking part in this exercise - a copy of which is in Appendix (A) - asking for their help and the need for more respondents especially managers and MIS managers. A copy of each questionnaire not answered by the participants and a covering sheet were sent with a follow-up letter. By the end of June 1978, the following questionnaires were received: seventeen from internal auditors, eleven from managers, and thirteen from MIS managers.

3.4.3. Tabulating responses. From the beginning of July 1978, the deadline set for questionnaires to be included in the analysis, the researcher started the process of coding the data and entering the data on coding sheets from which Hollerith cards were then punched, and later used for computer analysis of the data using the SPSS (Statistical Package for the Social Sciences). Each answer on the questionnaire(s) was quantifiable either

directly or indirectly through a code,with a few exceptions, these being in the case of the open questions. These were only coded as yes or no answers. One hundred and seventy-five data elements (variables) were required to encode the data collected through the questionnaires, and through the companies' published annual report (used to collect financial and non-financial data). Seven Hollerith cards were required for coding the data elements (variables) for each respondent. These data elements and their coding are presented in Appendix (B).

Incomplete and unacceptable answers, a common phenomenon in descriptive survey questionnaires were coped with by using the following set of rules:

(1) Blanks were interpreted in the absence of any evidence for deducing an answer as a "no answer".

(2) Unaccaptable or invalid answers were interpreted in the absence of any clear evidence for deducing a valid answer as a "no answer".

In the coding process, "no answer" (missing value) was coded as -1, or -.1, or -10 depending on the type of data element (variable) coded. This is shown in the data elements sheets presented in Appendix (B).

REFERENCES

(1) Schwarzbach, H.R., Auditing management information systems: an empirical investigation on the impact of management information system's audits, Unpublished DBA dissertation, The University of Colorado, 1976, pp.260-264.

(2) Ibid, p.279.

(3) Ibid, p.227.

(4) Yamane, T., Statistics: an Introductory Analysis, Harper & Row Publishers, Inc., N.Y., Third Edition, 1973, pp.1110-1111.

(5) Ibid.

(6) Schwarzbach, H.R., op.cit., p. 195.

(7) Shahine, I.O., The impact of internal audit on middle managers' personal bias in the budgeting system, Unpublished Ph.D. dissertation, University of Sheffield, 1976.

(8) Oppenheim, A.N., Questionnaire design and attitude measurement, Heinemann, London, First Edition, 1970, p.34.

CHAPTER 4

EMPIRICAL FINDINGS RELATING TO MIS AUDIT

4.1. Introduction

4.2. Response analysis

- 4.2.1. Survey response
- 4.2.2. Survey bias
- 4.2.3. Statistics used to analyse data

4.3. Number of auditing staff

4.4. The audit of MIS

- 4.4.1. Companies auditing MIS and the type of audit performed
- 4.4.2. Audit plans
- 4.4.3. Characteristics of MIS auditors
- 4.4.4. Audit scope
  - 4.4.4.1. Audit scope in general terms
  - 4.4.4.2. Review of internally generated reports
  - 4.4.4.3. Review of the overall efficiency and effectiveness of MIS
- 4.4.5. Auditors' recommendations
- 4.4.6. Benefits of the MIS audits
  - 4.4.6.1. Rating of the benefits in comparison with the cost.
  - 4.4.6.2. Responses and rankings of the benefits of the audits
  - 4.4.6.3. The influences of the audits
- 4.4.7. Ideal MIS audits

4.5. Managers' satisfaction with the MIS

4.6. Manager-Auditor working relationship

- 4.6.1. MIS Manager-Auditor working relationship
- 4.6.2. Manager-Auditor working relationship

4.7. Internal Auditors' evaluation

4.8. Companies' published data

4.9. Summary and conclusions

CHAPTER 4

EMPIRICAL FINDINGS RELATING TO MIS AUDIT

4.1. Introduction

Descriptive statistics are utilised in this chapter to present a preliminary analysis of the responses to the questionnaires used in the survey of internal auditors, managers, and MIS managers to determine their attitudes and perceptions of the audit of MIS, and their working relationships.

Supplementary data concerning the number of auditing staff, managers' satisfaction with MIS, and the method(s) used in evaluating the audit function in the different companies represented in the survey were also collected through the questionnaires and analysed using descriptive statistics, and are presented in this chapter together with results from statistics relevant for describing the financial and non-financial data concerning the companies taking part in the survey, (data collected through their published annual reports).

Results from this chapter will be used in the following chapter to test hypotheses relating to the impact and the different factors affecting the audit of MIS.

4.2. Response analysis

This section presents the number of respondents to the questionnaires, the test results for non response bias, and the statistics used in the analysis of the data presented in this chapter.

4.2.1. Survey response. The number of respondents to the questionnaires, including those participating in the pilot testing are as follows:

Table 4.1

Analysis of Response Rates to the Questionnaires

	Internal auditor's questionnaire	Manager's questionnaire	MIS manager's questionnaire
Pilot testing	10	5	4
Final draft -			
First mailing	28	23	19
Second mailing	17	11	13
	55	39	36
Percentage of sample (100)	55%	39%	36%

The above figures show that the response rates range between 36% to 55%, which can be considered acceptable and expected from a mail survey as argued by some writers and authors on the subject of surveys (1). Nonetheless, every effort was spent in trying to increase these rates, by enclosing a stamped addressed envelope, and by enclosing questionnaires with the second mailing, or by appealing to the internal auditors for their help in this matter. The only explanation which can be offered for the low rates of response, especially if we compare it with the rate achieved with the questionnaire used in the second part of the thesis (which was 89%) is that the non respondents were working in companies which do not audit MIS, and hence they felt that any answers to the questionnaire(s) would not help, and may indeed mislead. This point was made in different letters of reply received from internal auditors who declined to participate in the study. No explanation can be offered

for the discrepancies between the rates achieved for the different questionnaires but to say that in a few cases, the third questionnaire which required answers by an MIS manager was returned because of the unavailability of a respondent with that title or performing the duties of that manager in companies taking part in the survey.

4.2.2. Survey bias. In mail questionnaires, non-response represents a source of bias, because " . . . invariably the returns are not representative of the original sample drawn; non response is not a random process; it has its own determinants, which vary from survey to survey". (2)

To check for the introduction of bias, two methods proposed by Oppenheim were used(3). A comparison was made between respondents and non-respondents in terms of geographical location; first letter of family name; and type of industry or service of the company where they work. The comparison revealed that non-respondents were distributed throughout the country; their companies were distributed throughout the type of industry or service; and that they were not confined to specific first letter(s). Next, statistical tests were performed to test for the difference, and its statistical significance, between respondents to the first mailing and respondents to the second mailing, in their answers to a selection of questions in the questionnaires. The tests used were the T-test for data measured at the interval level, and both the median test and the Fisher exact probability test for data measured at the ordinal level; the latter test was used when $N < 30$, and/or when the expected frequency in one of the

cells was less than one or zero(4). The tables from 4.2. to 4.10. present the results of these tests, and they clearly show that for any group of respondents, all differences were not significant at the .05 level of significance (2-tail test) and hence, it can be assumed that non-response bias does not exist in the data as a result of the mailing.

Table 4.2

T-test for non-response bias in the internal auditors' questionnaire

Description	First respondents		Second respondents		Test results		
	$\overline{X}$	N	$\overline{X}$	N	computed T-value	ϕ	2-tail prob.
Number of auditing staff	13.7778	27	12.7353	17	.19	42	.851*
Proportion of the department's time spent in auditing MIS	28.3810	21	36.7857	14	-.92	33	.366*
Number of auditors involved in MIS audit	7.9130	23	3.6667	15	1.22	25.10	.233**
Size of the company measured by the turnover as published in their last annual report	£1000,016,528	20	£425,016,826	16	1.20	21.30	.244**
Size of the company measured by the number of employees as published in their last annual report	24419	25	18,993	16	.53	36.61	.600**

* Using the pooled variance technique

** Using the separate variance technique

Table 4.3

Median test for non-response bias in the internal auditors' questionnaire

Description	X^2	2-tail prob.
The audit of MIS as a specific assignment(s)	1.1384	.2860
The audit of MIS performed as part of the audit of specific functions/departments	.7804	.3770
Operational audit outweighing the costs	.3482	.5551
Compliance " " " "	.6825	.4087
Drawing on personnel from outside the audit department to help in the audit of MIS	.1735	.6770
Audit scope:		
a - Data collection	1.5865	.2078
b - Data processing and storage	.1564	.6925
c - Reporting	.3106	.5773
d - Communication	.3706	.5427
e - Decision-making	.1564	.6925
f - MIS design	.1215	.7274
Benefits of the operational audit of MIS:		
a - Increases MIS efficiency	0	1.000
b - Increases manager's understanding and utilization of MIS which leads to improved decision making	1.5615	.2115
c - Improves timeliness, accuracy and formats of management reports	.0121	.9125
Benefits of the compliance audit of MIS:		
a - Improvesinternal controls	.8578	.3544
b - Uncoversand eliminatesactions which do not conform with corporate policies and procedures	.0111	.9160
Internal auditors working closely enough with managers	.0664	.7966
" " " " " " MIS personnel	.0664	.7966

Table 4.3 (continued)

Median test for non-response bias in the internal auditors' questionnaire

Description	χ^2	2-tail prob.
Audit induced change in manager's confidence in the reports (data)	1.1245	.2890
Audit " " " the quality of manager's decisions	.4982	.4803
" " " " MIS improvements	1.0164	.3134
Ideal audit scope:		
a - Data collection	.0389	.8437
b - Data processing and storage	.0752	.7839
c - Reporting	.0001	.9925
d - Communication	.0166	.8976
e - Decision making	.0941	.7590
f - MIS design	.0030	.9563

Table 4.4

Fisher exact probability test for non-response bias in the internal auditors' questionnaire

Description	2-tail prob.
Internal auditors reviewing internal reports to determine whether they meet the needs of management	1.000
Internal auditors' satisfaction with the method used in determining the data needed by managers	.2184
Auditors pointing out weaknesses in the current MIS	1.0000

Table 4.5

T-test for non-response bias in the managers' questionnaire

Decription	First respondents		Second respondents		Test results *		
	$\overline{X}$	N	$\overline{X}$	N	Computed T-value	ϕ	2-tail prob.
Size of the company measured by the turnover as published in their last annual report	£679,892,160	16	£260,759,494	10	1.64	19.47	.117
Size of the company measured by the number of employees as published in their last annual report	23668	20	13661	10	.83	27.06	.413

* Using the separate variance technique

Table 4.6

Median test for non-response bias in the managers' questionnaire

Description	X^2	2-tail prob.
Satisfaction with MIS	.0565	.8122
Audit benefits outweighting costs	.2282	.6328
Ideal audit scope:		
a - Data collection	.0492	.8244
b - Data processing and storage	2.1502	.1426
c - Communication	.0454	.8314
d - Decision making	0	1.0000
e - MIS design	.0170	.8961

Table 4.7

Fisher exact probability test for non-response bias in the managers' questionnaire

Description	2-tail prob.
Internal auditors reviewing MIS	1.0000
Managers' level of understanding of MIS audits	.7014
Benefits of MIS audits:	
a - Increases MIS efficiency	.8012
b - Increases manager's understanding and utilization of MIS which leads to improved decision making	.1419
c - Improves timeliness, accuracy and formats of management reports	.3334
d - Insuresand improvesinternal controls	.7072
e - Uncoversand eliminatesactions which do not conform with corporate policies and procedures	.9476
Internal auditors working closely enough with managers	.6036
Internal auditors reviewing internal reports to determine whether they meet managements' needs	.6036
Satisfaction with the method used by internal auditors in determining the needed data	.2028
Audit induced change in manager's confidence in the reports (data)	.4733
Audit induced change in the quality of manager's decisions	.4455
Audit induced change in MIS improvements	.1392
Ideal audit scope:	
a - Reporting	1.0000

Table 4.8

T-test for non-response bias in the MIS managers' questionnaire

Description	First respondents		Second respondents		Test results *		
	$\bar{X}$	N	$\bar{X}$	N	Computed T-value	ϕ	2-tail prob.
Size of the company measured by the turnover as published in their last annual report	£517,997,255	14	£479,554,106	12	.13	20.58	.898
Size of the company measured by the number of employees as published in their last annual report	20714	18	21717	12	-.08	25.93	.941

* Using the separate variance technique

Table 4.9

Median test for non-response bias in the MIS managers' questionnaire

Description	X^2	2-tail prob.
Satisfaction with MIS	.8568	.3546
Audit benefits outweighting costs	1.9151	.1664
Ideal audit scope:		
a - Data processing and storage	.0348	.8521

Table 4.10

Fisher exact probability test for non-response bias in the MIS managers' questionnaire

Description	2-tail prob.
Internal auditors reviewing MIS	1.0000
Benefits of MIS audits:	
a - Increases MIS efficiency	.5504
b - Increases manager's understanding and utilization of MIS which leads to improved decision making	.6254
c - Improves timeliness, accuracy and formats of management reports	.1192
d - Insuresand improvesinternal controls	.5232
e - Uncoversand eliminatesactions which do not conform with corporate policies and procedures	.6393
Internal auditors working closely with MIS personnel	.2507
Internal auditors reviewing internal reports to determine whether they meet management's needs	1.0000
Satisfaction with the method used by Internal auditors in determining managers' needed data	.3776
Audit induced change in manager's confidence in the reports (data)	.6938
Audit induced change in the quality of manager's decisions .	.3631
Audit induced change in MIS improvements	.5963
Ideal audit scope:	
a - Data collection	1.0000
b - Reporting	.5000
c - Communication	.7027
d - Decision making	1.0000
e - MIS design	.3632

4.2.3. Statistics used to analyse data. Data collected through the three questionnaires and from the companies' published reports comprises three levels of measurements:

a) Data measured at the nominal level, for example answers to the questions asking "Who are the auditors of the MIS"?, or answers to the question asking for the method(s) used in the evaluation of the internal audit department.

b) Data measured at the ordinal level, for example, answers to the question about the importance auditors attach to the main categories and items inside each category in their MIS audit at present; by the answers also to the degree of satisfaction with the methods used by auditors in reviewing that internally generated reports meet managers' needs.

c) Data measured at the interval level, for example, financial data collected through published annual reports, and by the answers to the question seeking to establish the number of professional audit staff in the companies participating in the research.

To describe the data, frequency tables were used for measurements at the nominal level, while descriptive statistics such as means, standard deviations, medians, and range were used for the data measured at the ordinal and interval level, as they are useful in characterising the data for the reader.

However, when inferential tests were performed (presented in the following chapter) non-parametric statistics like X^2 test, median test and the like were used for the first two levels of measurement, while parametric tests like T-test, F-test, were used for the interval data.

4.3. Number of auditing staff

The number of auditing staff working in UK offices of the companies in this survey (N=54) ranged from one auditor to seventy four auditors),with the average=13, the standard deviation=17, and the median of 6. Using the sample mean, the mean number of auditors working in the population of companies in this survey range (with 95% confidence) from 9 to 18 auditors.

The frequency distribution of the number of auditors working in the different companies in the sample (presented in the following table) shows that about two-thirds of the companies employ ten or less internal auditors, a result which confirms that this distribution is skewed to the left as most cases fall left of the mean. This can be the reason for the difference between the mean and the median, since the first statistic is influenced by extreme cases. These results will be used to test whether a relationship exists between the number of internal auditors working in the companies and the intensity, frequency, and the number of internal auditors involved in the audit of MIS presented in the following chapter.

TABLE 4.11

Number of auditing staff employed by companies

Number of auditing staff	Number of companies	Percentages %	95% confidence interval for population proportion
1 to ≤ 5	22	40.7%	27.6% to 53.8%
> 5 to ≤ 10	15	27.8%	15.9% to 39.7%
> 10 to ≤ 20	8	14.8%	5.4% to 24.2%
> 20 to ≤ 40	5	9.3%	1.6% to 17.0%
> 40 and over	4	7.4%	0.5% to 14.3%
Total	54	100.0%	

4.4. The audit of MIS

This section presents the statistical results to questions concerning the audit of MIS in the following areas: type of audits performed, audit plans and scope, qualifications and experience of the auditors performing the MIS audit, audit recommendations, benefits of the MIS audits, and finally the ideal MIS audit scope.

The results presented in the following sub-sections serve two purposes:

(i) To describe the "state of the art" in connection with the audit of MIS, and

(ii) To present data which in some cases will be used later to test the hypotheses related to this part of the study.

4.4.1. Companies auditing MIS and the type of audit performed.

All internal auditors participating in the survey answered the two questions posed in the questionnaire about the performance of the audit, and its type. In devising the two questions (questions 3 and 4), great care was exercised in order to avoid semantic problems, or different interpretations affecting respondents' answers, which may accompany a new application in a new discipline (.i.e. audit of MIS). This was accomplished firstly by providing a definition of MIS in the introduction to the questionnaire, and secondly by accepting the fact uncovered in a previous research (5) that while some companies do not audit MIS as a special assignment (either because they do not have a department by this name, or they have it in a decentralised state), they do audit activities related to MIS when auditing other functions or departments. Descriptive statistics associated with the answers to the two questions concerning the audit of MIS and its type are presented in the following table.

Table 4.12

Companies auditing MIS and the type of audit performed

Description	Number of companies	% of sample	95% confidence interval for population proportion
Companies auditing their MIS as a specific assignment(s)	22	40%	27.1% to 52.9%
Companies auditing activities related to MIS when auditing specific functions/departments	27	49%	35.8% to 62.2%
(Sub-total) Number of companies auditing MIS either directly or indirectly	49	89%	80.8% to 97.2%
Companies not auditing the MIS	6	11%	2.8% to 19.2%
Total number of companies answering the questions	55	100%	
Companies performing only a compliance audit	5	10.2%	1.8% to 18.6%
Companies performing only an operational audit	-	-	- -
Companies performing both compliance and operational audits	44	89.8%	81.4% to 98.2%
Total number of companies auditing their MIS (directly or indirectly)	49	100%	

The above figures show that forty per cent of companies in the sample audit MIS as a specific assignment(s), forty nine per cent of the sample audit MIS indirectly when auditing other functions/departments, and the remaining eleven per cent do not audit MIS. As to the type of audit performed, about ninety per cent of the companies which audit MIS perform both compliance and operational audit, while the remaining ten per cent only perform compliance audit.

These figures have to be taken with caution since they represent results associated with those answering the questionnaire, and a few who declined to participate mentioned they do not audit MIS. This puts some limitation on these results, but nonetheless, they do reveal that a majority of companies with an internal audit function do audit MIS.

The figures concerning the type of audit performed reveal a shift of emphasis by internal auditors from a compliance audit alone to a type of audit which combines compliance and operational simultaneously, i.e. audit and review to ascertain that procedures are being followed and that reports are not erroneous (compliance) together with an evaluation of the effectiveness and efficiency of MIS (operational). These results are in accord with other research findings (6).

4.4.2. Audit plans. Four questions were included in the internal auditors' questionnaire pertaining to this aspect of the audit of MIS. Question 7 asked about the audit frequency, the results are presented in the following table.

Table 4.13

Frequency of MIS audit

Description	Number of companies	Percentage	95% confidence interval
Continuously	26	53.1%	39.2% to 67.0%
At least once a year	11	22.4%	10.8% to 34.0%
Every 1-2 years	8	16.3%	6.0% to 26.6%
Other (when need arises and more than 2 years)	4	8.2%	0.6% to 15.8%
Total	49	100.0%	

The results show that a continuous audit of MIS is practised in more than half the companies in the sample, while the other types of audit frequencies share the remaining percentage. The existence, or otherwise, of a relationship between the audit frequency and the way MIS audit is performed, i.e. direct or indirect, is a point which will be investigated in the next chapter.

Audit intensity as a second aspect of the audit plans was investigated using two questions. Question 8 asked for the estimated percentage of the audit department's total available time spent on auditing MIS. Forty five respondents answered this question, giving a mean of 30.8%, a standard deviation of 26.9%, a median of 20%, with the answers ranging from 3% to 100%. Using the sample mean, it can be said that, with 95% confidence, in this population the estimated time spent by the internal audit departments auditing MIS lies

between 22.7% to 38.9% of their available time (noting that the number of auditors in a department will have an influence on this figure).

To give a clearer view of the respondents' estimates, the following table presents the frequency distribution.

TABLE 4.14

Proportion of the internal audit department's time spent in MIS audit

Proportion of time	Number of companies	Percentage
1% to < 5%	6	13.3%
> 5% to < 10%	10	22.2%
> 10% to < 20%	8	17.7%
> 20% to < 40%	8	17.7%
> 40% to < 60%	6	13.3%
60% and over	7	15.8%
	45	100.0%

Question 9 (also to investigate audit intensity), asked for the number of auditors involved in the audit of MIS. Forty eight respondents answered the question, the average number of auditors involved in such audits was 5 auditors, with standard deviation 11 auditors and median equalling two auditors. The answers ranged from one auditor to fifty nine auditors. Using the sample mean, the number of auditors involved in the MIS audit in the population can be said to range, with 95% confidence, between 2 auditors to 8 auditors.

As with the answers to the previous question, a frequency distribution table is presented to provide a clearer view of the respondents' answers.

TABLE 4.15

Number of auditors involved in an MIS audit

Number of auditors	Number of companies	Percentage
1	10	20.8%
2	18	37.5%
3	4	8.3%
4	5	10.4%
5 and over	11	23.0%
	48	100.0%

The size of the MIS department, the complexity of its operations, the audit scope, and the size of the company can be considered factors affecting audit intensity as discussed above. Hence, they will represent avenues for exploration in the next chapter. Moreover, the relationship between audit intensity and the manner in which MIS audit is performed, i.e. direct or indirect, and between audit intensity and the type of audit performed will be investigated in the next chapter.

The final dimension of audit plans explored in this survey concerns the use of personnel from outside the internal audit department to work on the audit of MIS. Question 10 asked about this use, with forty two respondents replying "No" to this question, and seven replying in the affirmative. A second part of this question asking the respondent to state the identity of these personnel resulted in the following:

TABLE 4.16

Personnel from outside the internal audit department working in the audit of MIS

Types of personnel from outside the audit dept.	Number of companies using them	Percentage (N=7)*
Computer programmers	4	57.1%
Computer analysts	2	28.5%
User department(s)	2	28.5%
System designer	1	14.3%
External auditor	1	14.3%
Manufacturers	1	14.3%
District manager	1	14.3%

* The percentage sums to more than 100 because some companies use more than one type of additional personnel

While the number of respondents who replied "Yes" to the use of outside personnel was very small, the analysis gives an indication of which personnel are utilised, and the distribution of their use in this context.

4.4.3. Characteristics of MIS auditors. Question 11 asked internal auditors to state the backgrounds, in terms of education and experience, of those involved in the audit of MIS. Only forty respondents answered the question, revealing that a degree in accounting or experience in accounting were the qualifications required by companies in the sample in the employment of internal auditors to audit MIS (70%); this was followed by experience in EDP and experience in managerial positions as the second qualification used by companies in this context (32.5%). The following table presents a summary of results.

TABLE 4.17

Education and Experience of MIS Auditors

Background	Companies listing the specific background (N=40)	
	Numbers	Percentages*
Auditors who are accountants or have experience in accountancy	28	70.0%
Auditors who have experience in EDP	13	32.5%
Auditors who have managerial experience	13	32.5%
Auditors who are graduates	11	27.5%
Auditors who have auditing experience	5	12.5%
School leavers with "A" levels	2	5.0%
School leavers with "O" levels	1	2.5%

* The percentage sums to more than 100 because some auditors stated more than one background.

The above results present the qualifications of those employed in this area of auditing. The two qualifications sharing second place in the table are a confirmation of the trend suggested as desirable by writers and practitioners in internal auditing concerning the need to have multi-discipline teams working in internal auditing instead of the traditional reliance on accountants. This move is needed in view of the expansion of auditing into non-financial areas, and the shift of emphasis to include operational audits besides compliance audits, as types of audits performed.

4.4.4. Audit Scope. This aspect of the MIS audit covers three areas of interest: first, audit scope in general terms, measured by the relative importance attached by internal auditors to main categories and items inside each category as to where audit attention is directed in the practice of this type of audit; second, a review of the internally generated reports in order to determine whether they meet management needs; third, a review of the overall efficiency and effectiveness of the MIS. The results pertaining to each of these areas are presented below.

4.4.4.1. Audit scope in general terms. Question 12 asked internal auditors to rank in terms of importance categories and items inside each category as practised in their MIS audit at present. Scoring of the respondents' answers to the main categories was achieved by assigning 6 points to the category ranked first, five points to the category assigned second, and so forth to the last category which was assigned one. The same process was used in coding the ranking of the items inside each category. The following table presents the results of the ranking process.

Table 4.18

Auditors' ranking of the categories and items inside each category representing the elements of audit of MIS

2nd I. Data collection

- 8th (a) overcollection of data
- 5th (b) undercollection of data
- 1st (c) accuracy of data
- 4th (d) coding of data
- 3rd (e) errors in data entry
- 2nd (f) efficiency of data collection and entry
- 7th (g) evaluation of data collection and entry personnel
- 6th (h) evaluation of data collection and entry management
- 9th (i) other

4th II. Data processing and storage

- 1st (a) security
- 8th (b) storage of unneeded data
- 4th (c) destruction of needed data
- 2nd (d) computer programs
- 3rd (e) evaluation of data processing organization
- 6th (f) evaluation of data processing personnel
- 5th (g) efficiency of storage methods
- 7th (h) evaluation of data processing management
- 9th (i) other

1st III. Reporting

- 6th (a) cost efficiency
- 4th (b) timeliness
- 7th (c) format
- 5th (d) understandability
- 2nd (e) relevance to manager's needs
- 1st (f) accuracy
- 8th (g) unbiased data
- 3rd (h) completeness
- 9th (i) other

6th IV. Communication

- 1st (a) relations between managers and data processing
- 3rd (b) relations between accounting and data processing
- 4th (c) semantic problems in reports
- 2nd (d) managers' opinions of the MIS
- 5th (e) other

Table 4.18 continued

Auditors' ranking of the categories and items inside each category representing the elements of audit of MIS

5th V. Decision-making

2nd (a) whether the reports generated lead to good decisions on the part of managers

4th (b) whether managers get too much data

3rd (c) whether managers get all the data they need

1st (d) whether managers use the data they receive

5th (e) other

3rd VI. MIS design

2nd (a) whether new systems are efficiently designed

5th (b) whether the purchase, hire, or lease of new EDP equipment is cost justified

1st (c) whether the new systems are designed with the user in mind

4th (d) whether the new systems are adequately explained to the users

3rd (e) whether the operation of new systems meets original specifications

6th (f) other

The above results show reporting to be the most important category where the audit attention is directed, followed by data collection as the second in importance, while communication was the last. Within the reporting category, the items in order of importance were accuracy, followed by relevance to managers' needs, completeness, timeliness, etc. These results clearly indicate an inclination by the auditors to take a management perspective in the audit of MIS, while still maintaining a bias toward internal controls. This inclination toward a management perspective is consistent with the general nature of operational auditing, in the sense that it is used for management control and not for detailed operational control.

4.4.4.2. Review of internally generated reports. Two questions were asked in each questionnaire about the review of the internal reports to determine whether they meet managers' needs. The first question asked the respondents whether or not this review was performed by internal auditors; what method(s) are used, and the degree of satisfaction with these method(s). In view of the fact that the same question was asked of the three types of respondents, the following table presents only the answers given by internal auditors (as the other answers correspond).

Table 4.19

Internal auditors reviewing reports to determine whether they meet managers' needs and the methods used

Description	Number of companies	% of sample
Companies with internal auditors reviewing internally generated reports	39	81.3%
Companies with internal auditors not reviewing internally generated reports	9	18.7%
	48	100%
Where the review (audit) of the reports is performed?		
- At the department issuing the reports	4	10.5%
- At the department receiving the reports	26	68.4%
- Both departments	8	21.1%
	38	100%
Method(s) used by internal auditors in determining the data needed by managers*:	(N=37)	
a - Questionnaire	22	59.4%
b - Mathematical models	2	5.4%
c - Other: - Discussion (either through a committee or a group / project study, or informally with the users)	16	43.3%
- Flow charts	1	2.7%

* Percentages do not add up to 100% because some companies use more than one method.

The above results reveal that the audit and review of the internally generated reports performed by internal auditors in order to determine whether these reports meet managers' needs is practised in the majority of companies in the sample (81.3%), and that this review and audit of the usefulness of the reports is carried out in two thirds of the companies in the department receiving the reports.

As to the methods used by internal auditors in this context, the figures show that the use of a questionnaire, a tool normally used by auditors in the conduct of their audit, was practised by over half the companies (59.4%); this was followed by discussion with the users, either through a committee, or informally, with a percentage of 43.3%. The use of discussion as a means of determining whether the reports contain the required data indicates that some auditors still prefer the informal approach to the review or audit of some aspects of a department's activity (i.e. MIS here). Mathematical models were only used in two companies, (which can be attributed to internal auditors being non mathematically oriented).

These results support and sustain the earlier findings in relation to the audit scope of MIS, which indicated that reporting is the most important category where the audit attention is directed, and that the internal auditors are inclined to take a management perspective in their audit of the MIS.

Finally, the respondents were asked to use a seven point scale to describe their satisfaction with the method used in the audit and review of the reports. The ratings analysed using descriptive statistics are presented in the following table.

TABLE 4.20

Respondents' satisfaction with the method(s) used by internal auditors in reviewing internally generated reports

Statistics \ Respondents	Internal auditors (N=37)	Managers (N=17)	MIS managers (N=17)
Mean	4.270	4.176	3.647
Standard deviation	1.305	.951	1.320
Median	4	4	3
Range	1 to 7	3 to 7	2 to 7

These statistics show that for the internal auditors and the managers the mean and the median of their scores indicate that they are merely satisfied with the method(s) used, as they are around the (4) point of the scale which was labelled satisfied, while those for the MIS managers reflected a lesser degree of satisfaction.

The second question asked the internal auditor and the manager whether any other department in the company reviews the reports to determine whether they meet managers' needs, with a similar version put to the MIS managers, (different in the sense that it asked whether his department performed this review). As the figures from the answers to the MIS manager questionnaire tally with those from the auditors, and the managers - taking into consideration the number of respondents in each category - the internal auditors' answers only will be presented. The following tables present the findings of which

departments - other than the internal audit - are required to perform this review or audit, and the methods used in this process.

Table 4.21

Other departments reviewing reports to determine whether they meet managers' needs

Description	Number of companies	% of sample
Companies requiring other departments to review reports	32	66.7%
Companies not requiring other departments to review reports	16	33.7%
	48	100%
Names of other departments:-		
a - MIS department with its different sections	22 *	68.7%
b - management services	3	9.4%
c - Corporate planning/various sub-committees reporting to directors	2	6.2%
d - Users	2	6.2%
e - O & M department (section)	2	6.2%
f - Various departments at the Head Office	1	3.3%
	32	100%

* 21 respondents to MIS-manager questionnaire out of 26 who answered this question answered yes to their department reviewing internal reports. (This represents 80.8% of the sample.)

TABLE 4.22

Method(s) used by the other departments in reviewing internal reports to determine whether they meet managers' needs

Methods	Number of companies (N=31)	Percentage of sample*
a - Questionnaire	11	35.4%
b - Mathematical models	4	13.0%
c - Other - Discussion (either through a committee, or a group/project study, or informally with the users)	20	64.5%

* Percentages do not add to 100% because some companies use more than one method.

The figures in the above tables can be summarised as follows:

1) Two thirds of the companies in the sample of internal auditors require their MIS department or other department(s) to review the reports to determine their relevance to managers' needs.
2) In those companies requiring the review of the reports, around two thirds also rely on the MIS department and its different sections to perform it.
3) The methods used in this process are discussion, either informally or formally through a committee which was used in 64.5% of the sample, and/or the use of questionnaire (35.4%). In comparison with the results uncovered by the first question in this context of reviewing reports, the order is reversed. This may be because the regular contact between MIS personnel and the users of their output makes the use of a questionnaire secondary to

the informal discussion and discussion through a committee.

The respondents, excluding internal auditors, were asked to use a seven point scale to rate their satisfaction with the method(s) used in this context. The exclusion of the internal auditors was justified on the grounds that they are not directly involved in this process.

TABLE 4.23

Respondents' satisfaction with the method(s) used by the other departments in reviewing internally generated reports

Statistics \ Respondents	Managers (N=22)	MIS managers (N=21)
Mean	4.091	4.524
Standard deviation	1.231	1.123
Median	4	4
Range	1 to 7	3 to 7

The figures show that on average the respondents were "just satisfied" with the method(s) used. This satisfaction was higher in the case of the MIS managers, which can be attributed to either a reflection of a genuine satisfaction, or to their bias. The addition of "just" to describe their satisfaction is due to the fact that in the seven point scale used, (4) was labelled satisfied, and (7) highly satisfied, and the mean and the median are around this (4) figure.

In conclusion it appears that the results presenting the practitioners' point of view confirm the points made in section 2.4.4. concerning the need to develop tools for use

by internal auditors and others in the audit and review of internally generated MIS reports. This confirmation is reflected from the data relating to tools already in use and the low degree of satisfaction with these methods.

4.4.4.3. Review of the overall efficiency and effectiveness of MIS. Internal auditors and MIS managers were asked whether a review concerning the overall efficiency and effectiveness of the MIS was performed by internal auditors; the sources of the criteria used in the evaluation; the methods used in the process; and finally the degree of satisfaction with method(s) used. As the answers to the internal auditors' questionnaire encompass those of the MIS managers, the results presented in the following two tables will be those of the auditors.

Table 4.24

Internal auditors reviewing and reporting on the overall efficiency and effectiveness of the MIS

Description	Number of companies	% of sample
Companies requiring I.A. to review and report on the overall efficiency and effectiveness of MIS	26	54.2%
Companies not requiring I.A. to review and report on the overall efficiency and effectiveness of MIS	22	45.8%
	48	100%
Sources of criteria used in the evaluation:	(N=24)*	
a - Users' satisfaction	11	45.8%
b - Auditors' experience	11	45.8%
c - M.I.S.	8	33.3%
d - Results of other companies	2	8.3%
e - Original feasibility studies and needs analysis	1	4.1%
f - Others (special committee/parent company)	2	8.3%
Method(s) used by internal auditors in reviewing and auditing MIS for their overall efficiency and effectiveness:-	(N=20)*	
a - Questionnaire	3	15%
b - Audit programs	7	35%
c - Adherence to pre-determined standards and general procedures	5	25%
d - Discussion	9	45%

* Percentages do not add to 100 because some companies use more than one criteria source and method.

TABLE 4.25

Respondents' satisfaction with the method(s) used by internal auditors in reviewing MIS for their overall efficiency and effectiveness

Statistics \ Respondents	Internal auditors (N=24)	MIS managers (N=13)
Mean	4.333	4.077
Standard deviation	1.007	1.441
Median	4	4
Range	3 - 7	2 - 7

The results presented in the previous tables can be summarised as follows:

1) Only 26 companies (54%) in the sample expect their internal auditors to review (audit) and report on the overall efficiency and effectiveness of their MIS. While this may seem contradictory to the figure of 44 companies with internal auditors mentioning that they perform an operational audit of the MIS, (defined in the questionnaire as the evaluation of the efficiency and effectiveness of the MIS), this can be accepted because some respondents in the latter category mentioned that the company has only just started this type of audit, and while they are performing it on an experimental basis, they are not required to report on the overall efficiency and effectiveness of the MIS. A second explanation can be that some of the auditors perform a limited, non-comprehensive operational audit and hence

they are unable to make a full report in this context.

The reasons for the moderate number of companies who require their internal auditors to review and report on the overall efficiency and effectiveness of the MIS can be attributed to either the difficulty, in some instances, in establishing the criteria to be used in this process, or to the recent installation of the internal audit department in the company, with the consequences being that their resources are directed toward more traditional areas leaving these new areas to future applications.

2) The sources of the criteria used by internal auditors in the evaluation of MIS were clustered around either the user of MIS services, the MIS itself, or the auditors' experience. Other sources presented in the table were less frequently used.

3) The two methods most widely used by internal auditors in the process of evaluating MIS were discussion, used in 9 companies representing 45% of the companies answering the question. Audit programs containing specific steps for use in this process are used in 7 companies (35%).

These results show an inclination by auditors to use informal procedures in preference to formal ones with the implication being a difficulty in justifying any audit findings or recommendations.

4) The last results concern the degree of satisfaction of internal auditors and MIS managers with the method(s) used. The statistics show that the average and the median were around 4 labelled "satisfied" in the scale.

Thus, again, there is evidence that the practitioner encounters problems - in this case, in the audit of MIS efficiency and effectiveness and hence there exists a need for new improved techniques in this context.

The same respondents were asked a second question in relation to the same area of inquiry. The question asked whether any other department in the company reviews MIS for efficiency and effectiveness. The results summarised in the following table show that:

1) Thirty five companies representing 72.9% of the sample require other department(s) to perform this review. If we compare this percentage with the percentage of the companies requiring the audit department to perform this review, it can be seen that some companies who review their MIS and evaluate its performance achieve this through other department(s) and not the internal audit department. This means that the internal audit department has to convince management of the benefits of using their services in the performance of this review, either in conjunction or in addition to the use of other department(s).
2) The MIS department represented by the group department or by the senior manager to whom this department reports were the most widely used in the process of reviewing MIS for efficiency and effectiveness.

Table 4.26

Other departments reviewing and reporting on the overall efficiency and effectiveness of the MIS

Description	Number of companies	% of sample
Companies requiring other departments to review and report on the overall efficiency and effectiveness of MIS	35	72.9%
Companies not requiring other departments to review and report on the overall efficiency and effectiveness of MIS	13	27.1%
	48	100%
Names of other departments:-	(N=34) *	
a - MIS	26	76.4%
b - Users of MIS services	9	26.4%
c - Management services	3	8.8%
d - O & M dept (section)	3	8.8%
e - H.Q. depts.	2	5.8%
f - Group planning dept.	1	2.9%

* Percentages do not add to 100 because some companies use more than one (other) department.

4.4.5. Auditors' recommendations

Forty seven of the forty eight respondents who answered the question about whether the audit report points out weaknesses in the current MIS replied "yes", and of this forty seven, forty six stated they make recommendations for correcting weaknesses. Thus, the audit acts not only as a tool for directing attention, but also as a change agent. Some argue that such a role may weaken the independence and objectivity of the auditors in future audits. To explore the present state of the art in relation to this point, a question was asked about the policy used to avoid this problem. Thirty four of the respondents making recommendations answered this question. Their answers can be grouped into two groups:

Group One. Those auditors who think that the problem posed in the question does not exist in reality. Reasons mentioned in their answers were either:

a - The question is based on a wrong premise, or

b - Making recommendations is distinct from taking decisions. Decisions are taken by management, hence no conflict exists.

c - Because recommendations are based on management policies, company law, or standard business practice, independence or objectivity in future audits will not be impaired.

Group Two: Those auditors who accept that there is a problem, and that there exists a need for a policy to avoid it. The policy being either:

a - Conducting each audit as a separate issue changing staff frequently.

b - Being prepared to revise recommendations if considered necesaary, i.e. acceptance by the auditor of the need to amend his thoughts in the light of changing circumstances, an "openness" to modification.

The following quotation from an internal auditor summarises the point: "Generally by getting the auditee to himself initiate change. I do not feel that the making of a recommendation impairs future objectivity/independence. However, should I feel then that they are threatened, another team would subsequently review the area". No explanation can be offered for these different views concerning this problem but to say that this area would profit from further study, especially by field studies which afford opportunity for the situational influences to be investigated.

4.4.6. Benefits of the MIS audits

The benefits of the MIS audits were investigated in the survey using a mixture of different questions. The first set asked the respondents to rate on a seven point scale these benefits in comparison with the costs of such audits. The second set asked for the ranking of the different benefits envisaged to result from such audits. Finally, a seven point scale was used by the respondents to rate the influences and effects of the audits on managers' decisions, managers' confidence in the data they receive, and improvements implemented in the MIS because of past audits. The following sub-sections present a detailed analysis of each area investigated.

4.4.6.1. Rating of the benefits in comparison with the cost

A question was included in the auditor's questionnaire asking them to rate on a seven point scale the benefits of an operational audit of MIS compared with its costs. The same question was repeated for a compliance audit. For managers and MIS managers, the two questions were substituted by one which asked for the comparison to be made concerning the internal audit of MIS (without differentiating between operational and compliance audits, in order to avoid terminology and semantic problems).

Descriptive statistics associated with the responses to the above questions are presented in the following two tables:

TABLE 4.27

Internal auditors' rating of audit benefits compared with costs

Statistics \ Type of audit	Operational audit (N=49)	Compliance audit (N=49)
Mean	4.653	4.082
Standard deviation	1.562	1.484
Median	5	4
Range	1 to 7	1 to 6

TABLE 4.28

Managers' and MIS managers' rating of audit benefits compared with costs

Statistics \ Respondents	Managers (N=39)	MIS managers (N=34)
Mean	4.077	4.441
Standard deviation	1.511	1.655
Median	4	5
Range	1 to 7	2 to 7

Since different questions were asked, internal auditors' answers cannot be compared with those of other departmental personnel. Within this limitation, study of the above figures shows that:

a - Internal auditors perceive the performance of both audits as beneficial, with operational audits rated higher on the scale than compliance audits. This is an expected result because the type of services provided by internal auditors with their performance of operational audits in the different departments of the company in general, and in the MIS in particular, are greatly valued in view of their relevance to management's needs, and are greatly in demand because of the need by auditees for opinions of an outside discipline concerning the state of their department(s).

b - A comparison between the answers as revealed by the mean and the median of managers and MIS managers ratings on the scale show that MIS managers perceive more benefits resulting from auditing their departments, possibly because the results of previous audits had had effects which were only confined to the department concerned, and so managers (users of MIS services) were not affected (e.g. reasons of time lag) and did not appreciate these influences and so gave different ratings.

4.4.6.2. Responses and Rankings of the benefits of the audits.

Two questions were posed in the internal auditors' questionnaire concerning the benefits of past MIS audits, these being both operational and compliance. Respondents were asked

to rank these benefits in order of their importance. The results are presented in the following two tables. The first table concerning the benefits of operational audits shows that the first and second most important benefits achieved through past audits, namely increased internal control system reliability, and increased MIS efficiency by uncovering weaknesses and suggesting improvements are consistent with corporate goals and relevant to the purpose of operational audit. The second table concerning the benefits of compliance audits reveals that improvement in internal control is the most important of these benefits. The study of these two sets of results reveals that:

a - The audit acting as a communication device, via the audit criteria, was not considered to be of direct benefit. Nonetheless, items 3, 4, and 6 of the table of operational audit benefits, and number 6 of the compliance audit benefits can be considered to be indirectly related to this notion.

b - Although one major contribution of an audit is that of prevention, not one auditor made explicit mention of this benefit.

Table 4.29

Auditors' ranking of benefits from past operational audits

Item number	Description	Number of auditors and ranks							N	Overall rank
		1st	2nd	3rd	4th	5th	6th	7th		
1	Increase internal control system reliability	13	7	6	7	5	3	-	41	First
2	Increase MIS efficiency (uncover weaknesses and suggests improvements)	9	13	5	6	3	5	-	41	Second
3	Increase manager's understanding and utilization of MIS which leads to improved decision making	9	5	6	9	8	3	-	40	Third *
4	Improve timeliness, accuracy, and formats of management reports	4	11	6	10	7	2	-	40	Third *
5	Improve new systems design (especially control features)	4	2	8	8	7	11	-	40	Fifth
6	Improve MIS/user interface	1	2	9	10	6	10	-	38	Sixth
7	Other:									
	Cost effectiveness	-	-	-	-	-	-	1	1	Seventh

* Tie

Table 4.30

Auditors' ranking of benefits from past compliance audits

Item number	Description	Number of auditors and ranks						N	Overall rank
		1st	2nd	3rd	4th	5th	6th		
1	Improve internal controls	13	12	9	6	3	2	45	First
2	Confirm compliance with internal controls	12	10	12	5	5	2	46	Second
3	Improve accuracy and reliability of the data	9	11	10	12	2	3	47	Third
4	Uncover and eliminate actions which do not conform with corporate policies and procedures	8	8	8	16	2	2	44	Fourth
5	Improve management's utilization of the MIS	1	1	4	10	15	10	41	Fifth
6	Increase knowledge of MIS management (act as a communication link between managers and MIS management)	1	2	2	4	13	18	40	Sixth

Managers and MIS managers were also asked to rank the benefits of MIS audits, but to avoid problems of terminology and semantics, they were only asked one question with no distinction being made between operational and compliance audits. The results presented in the following two tables reveal the following:

a - The benefits accruing from compliance audits were perceived by respondents as more important than those resulting from operational audits (occupying first and second positions in the tables). An explanation which can be offered for this result, is the newness of performing operational audit in MIS, hence its second place, since some benefits take time to accrue, and to be perceived by auditees as benefits with some or great importance. A second explanation can be that respondents answered the question with a model of a prototype internal auditor whose main aim would be compliance audits, hence resultant perceived benefits registered as high in importance.

b - The audit can act indirectly as a communicating device as represented by items 4,5 in Table 4.31, and items 5,6 in Table 4.32.

Table 4.31

Managers' ranking of benefits from past audits of MIS

Item number	Description	Number of managers and ranks							N	Overall rank
		1st	2nd	3rd	4th	5th	6th	7th		
1	Insure and improve internal controls	5	11	6	2	2	6	-	32	First
2	Uncover and eliminate actions which do not conform with corporate policies and procedures	10	1	9	4	2	6	-	32	Second
3	Increase MIS efficiency (uncover weaknesses and suggests improvements)	7	-	5	9	5	4	-	30	Third
4	Increase understanding and utilization of MIS which leads to improved decision-making	6	4	-	9	4	5	1	29	Fourth *
5	Improve timeliness, formats and accuracy of management reports	-	9	6	4	5	5	-	29	Fourth *
6	Increase management control of the MIS	2	5	4	3	9	6	-	29	Sixth
7	Other: Ensure that agreed control procedures are operated	1	-	-	-	-	-	-	1	Seventh

* Tie

Table 4.32

MIS Managers' ranking of benefits from past audits of MIS

Item number	Description	Number of MIS managers and ranks							N	Overall rank
		1st	2nd	3rd	4th	5th	6th	7th		
1	Uncover and eliminate actions which do not conform with corporate policies and procedures	11	7	4	3	-	1	-	26	First
2	Insure and improve internal controls	7	10	3	2	1	3	-	26	Second
3	Increase MIS efficiency (uncover weaknesses and suggest improvements)	4	3	12	5	-	2	-	26	Third
4	Increase management control of the MIS	1	1	6	9	4	3	-	24	Fourth
5	Increase understanding and utilization of MIS which leads to improved decision-making	1	2	-	2	12	5	1	23	Fifth
6	Improve timeliness, formats and accuracy of management reports	-	1	-	6	7	9	-	23	Sixth
7	Other: - Provide an external discipline to ensure that current best practices are in fact used		1						1	Seventh
8	- Increase confidence in MIS output when audit is seen to support MIS decision and views				1				1	Eighth

Participants were also asked an open-ended question about whether additional benefits could be gained if the MIS audit approach were modified or expanded. This question was answered by only a few respondents, the details of which are presented below.

Internal auditors: Eight out of forty nine respondents answered this question, representing about 17% of the sample. Their responses covered four areas of interest as the following quotations reveal:

a- Extending the MIS audit coverage - "We should be branching out more into spheres other than accounting/ finance. Production control and work load in factories should be more integrated into the MIS area."

b - Participation in MIS design - "MIS audit approach needs involvement during all stages of system design . . ." ". . . greater audit and user involvement at design stage should lead to improved MIS."

c - MIS audit being conducted as a specific audit - "As indicated we have scheduled a 'specific' MIS audit for 1978; we feel this is important to achieve total coverage . ."

d - The audit acting as a communication device - "An expansion of the audit activity in this area should lead line management into a great awareness of the implications of MIS and help bridge the communication gap . . ."

Managers: Six out of thirty three respondents answered this question representing 18% of the sample. Their responses were not directly related to the question, as half discussed the internal audit function in general, and the other half presented

their perceptions of the MIS department and their views about its future development.

MIS managers: Seven MIS managers out of twenty seven respondents, representing 26% of the sample, answered the question. Four of these respondents answered the question in general terms; they discussed and presented their perceptions of the auditors' role in this audit, and perceived limitations. The remaining answers covered two areas, as the following quotations reveal:

a - The worth of the information requested: ". . . more effort should be spent questioning the value of management information requested." ". . . measuring the costs of the MIS against the benefits."

b - Participating in MIS design: "Audit department should be involved at systems design stage in order to contribute to sensitive areas."

No generalisations can be made concerning the respondents' views of the additional benefits accruing from the modification or expansion of the MIS audit approach because of the small number of respondents. However, the areas covered indicate an awareness of the benefits which may result from auditor's participation in the design stage; from conducting the audit as a special assignment; by recognising the role which the auditor can play in bridging the communications gap between management and MIS; and finally by suggesting the role auditors can play in evaluating needed information.

4.4.6.3. The influences of the audits. Three questions were included in the questionnaires asking the respondents to rate on a seven point scale their perceptions of the audits' influences, as manifested by managers' confidence in the data they receive; by the quality of managers' decisions; and by implemented improvements in MIS being induced by past audits.

Descriptive statistics associated with the results of the three questions are presented in the following tables:

TABLE 4.33

Respondents' perceptions of the effects of MIS audits on managers' confidence in the data they receive

Statistics \ Respondents	Internal Auditors (N=42)	Managers (N=33)	MIS managers (N=25)
Mean	3.810	4.727	3.840
Standard deviation	1.452	1.039	1.625
Median	4	5	3
Range	1 to 7	1 to 6	2 to 7

TABLE 4.34

Respondents' perceptions of MIS audits effects on management decisions

Statistics \ Respondents	Internal Auditors (N=42)	Managers (N=32)	MIS managers (N=27)
Mean	3.643	3.428	3.480
Standard deviation	1.411	1.831	1.828
Median	3.5	3	3
Range	1 to 7	1 to 7	1 to 7

TABLE 4.35

Respondents' perceptions of MIS improving because of past audits

Statistics \ Respondents	Internal Auditors (N=42)	Managers (N=32)	MIS Managers (N=27)
Mean	4.429	3.656	3.556
Standard deviation	1.382	1.473	1.553
Median	4	4	4
Range	1 to 7	1 to 6	1 to 7

Analysis of the above results reveal the following:

a - Managers perceived the MIS audit as having a positive influence on their confidence in the data they receive. Their mean and median rating was higher than those of internal auditors and MIS managers. The relatively low positive rating given by the two latter respondents may be attributed to the fact they are not directly affected by the audits and hence opted for caution in answering the question.

b - All three groups of respondents perceived the MIS audits as having a positive effect on management decisions, i.e. managers take better decisions. This moderate effect (as reflected by the mean and the median) may be due to the difficulty of quantification since decisions are effected by numerous other factors. Another reason may be the newness of MIS audit and hence the limited recognition by auditees (managers) of its effects on their decisions.

c - The mean and the median of the respondents' ratings concerning the induced improvements in MIS were positive, reflecting a general satisfaction with the performance of the audits and their effects. Internal auditors scored marginally higher in comparison with managers and MIS managers.

4.4.7. Ideal MIS audits

The three types of respondents were asked to rate, using a seven point scale, the degree of attention they would devote to various components and problems if they were designing an ideal operational audit of their company's MIS. The format of the question was similar to the one used by auditors to rank their present audit scope*, the difference being the use of the rating scale instead of asking the respondents to rank the items. The question posed to internal auditors differed from that posed to managers and MIS managers. Internal auditors were asked to rate these various MIS components and problems in relation to their development of an ideal operational audit. The other two types of respondents were asked to do the rating as if they were developing guidelines for evaluating the MIS. The reason for the different versions is the lack of common vocabulary across the groups of respondents, however since operational audit is in fact evaluation, no problem with semantics should arise.

---

* Please see Appendix A.

The answers to the question using descriptive statistics are presented in the following table:

Table 4.36

Respondents' perceptions of the scope of the ideal MIS operational audits

Description	Respondents	N	Statistics				
			Mean	Standard deviation	Median	Range	95% confidence interval for population mean
1 - Data Collection	A	51	5.5	1.2	6	1-7	5.2-5.9
	B	39	6.0	.9	6	4-7	5.7-6.3
	C	36	5.9	1.6	7	1-7	5.4-6.4
(a) Over collection of data	A	49	4.3	1.7	4	1-7	3.8-4.8
	B	39	5.1	1.6	5	2-7	4.6-5.6
	C	36	4.7	1.9	5	1-7	4.1-5.3
(b) Under collection of data	A	49	4.8	1.6	5	1-7	4.3-5.2
	B	39	5.3	1.5	6	1-7	4.9-5.8
	C	33	5.6	1.5	6	2-7	5.1-6.2
(c) Accuracy of data	A	51	6.2	.9	6	4-7	5.9-6.4
	B	39	6.3	1.0	7	3-7	5.9-6.6
	C	36	6.1	.9	6	4-7	5.8-6.5
(d) Coding of data	A	51	5.2	1.3	6	2-7	4.9-5.6
	B	39	5.5	1.7	6	1-7	5.0-6.1
	C	36	5.5	1.5	6	1-7	5.0-6.0

A = Internal auditors
B = Managers
C = MIS-managers

Table 4.36 (continued)

Respondents' perceptions of the scope of the ideal MIS operational audits

Description	Respondents	N	Statistics				
			Mean	Standard deviation	Median	Range	95% confidence interval for population mean
(e) Errors in data entry	A	50	5.4	1.1	5.5	3-7	5.1-5.7
	B	39	5.4	1.2	6	3-7	5.0-5.8
	C	36	5.3	1.4	5.5	1-7	4.8-5.8
(f) Efficiency of data collection and entry	A	51	5.5	1.0	5	3-7	5.2-5.7
	B	39	5.6	1.1	6	3-7	5.2-5.9
	C	36	5.3	1.0	5	3-7	4.9-5.6
(g) Evaluation of data collection and entry personnel	A	50	4.1	1.3	4	1-7	3.8-4.5
	B	39	4.6	1.4	4	2-7	4.1-5.1
	C	33	4.5	1.5	4	1-7	3.9-5.0
(h) Evaluation of data collection and entry management	A	50	4.2	1.2	4	1-7	3.8-4.6
	B	39	5.2	1.5	5	2-7	4.7-5.7
	C	33	5.1	1.6	5	1-7	4.5-5.7
2 - Data processing and storage	A	50	5.7	1.3	6	3-7	5.3-6.0
	B	39	5.6	1.2	6	4-7	5.2-6.0
	C	35	5.7	1.3	6	3-7	5.2-6.1

A = Internal Auditors
B = Managers
C = MIS-managers

Table 4.36 (continued)

Respondents' perceptions of the scope of the ideal MIS operational audits

Description	Respondents	N	Statistics				
			Mean	Standard deviation	Median	Range	95% confidence interval for population mean
(a) Security	A	50	5.7	1.5	6	1-7	5.3-6.1
	B	39	5.7	1.4	6	2-7	5.2-6.1
	C	35	5.3	1.4	6	2-7	4.9-5.8
(b) Storage of unneeded data	A	49	3.8	1.6	4	1-7	3.4-4.3
	B	39	4.1	1.6	4	1-7	3.6-4.6
	C	35	4.0	1.4	4	2-7	3.5-4.5
(c) Destruction of needed data	A	50	5.5	1.5	6	2-7	5.0-5.9
	B	39	5.3	1.5	6	1-7	4.8-5.8
	C	35	5.8	1.2	6	3-7	5.4-6.2
(d) Computer programs	A	50	5.5	1.2	6	2-7	5.1-5.9
	B	39	5.3	1.6	6	1-7	4.8-5.9
	C	33	6.1	1.1	6	4-7	5.7-6.5

A = Internal auditors
B = Managers
C = MIS-managers

Table 4.36 (continued)

Respondents' perceptions of the scope of the ideal MIS operational audits

Description	Respondents	N	Statistics				
			Mean	Standard deviation	Median	Range	95% confidence interval for population mean
(e) Evaluation of data processing organization	A	49	4.8	1.2	5	2-7	4.5-5.2
	B	39	4.8	1.5	5	1-7	4.3-5.3
	C	33	4.9	1.3	5	2-7	4.5-5.4
(f) Evaluation of data processing personnel	A	49	4.1	1.2	4	1-7	3.8-4.5
	B	39	4.3	1.5	4	1-7	3.9-4.8
	C	33	4.7	1.5	5	1-7	4.2-5.3
(g) Efficiency of storage methods	A	50	4.7	1.4	5	1-7	4.3-5.1
	B	39	4.4	1.5	4	1-7	3.9-4.9
	C	33	4.6	1.3	5	2-7	4.2-5.1
(h) Evaluation of data processing management	A	49	4.4	1.5	4	1-7	3.9-4.8
	B	39	5.0	1.8	5	1-7	4.4-5.6
	C	33	5.1	1.8	6	1-7	4.5-5.8

A = Internal auditors
B = Managers
C = MIS-managers

Table 4.36 (continued)

Respondents' perceptions of the scope of the ideal MIS operational audits

Description	Respondents	N	Statistics				
			Mean	Standard deviation	Median	Range	95% confidence interval for population mean
(i) Other: interface with manual procedures	A	1	5	—	5	-	-
	B	-	-	-	-	-	-
	C	-	-	-	-	-	-
3 - Reporting	A	51	5.7	1.1	6	2-7	5.4-6.1
	B	39	6.4	.8	7	4-7	6.2-6.7
	C	34	6.0	1.5	7	2-7	5.4-6.5
(a) Cost efficiency	A	50	4.7	1.5	5	1-7	4.3-5.1
	B	39	5.6	1.4	6	2-7	5.1-6.0
	C	36	5.2	1.4	5	1-7	4.7-5.7
(b) Timeliness	A	50	5.4	1.1	6	3-7	5.1-5.8
	B	39	6.3	.9	7	4-7	6.0-6.6
	C	34	5.9	1.2	6	3-7	5.4-6.3

A = Internal auditors
B = Managers
C = MIS-managers

Table 4.36 (continued)

Respondents' perceptions of the scope of the ideal MIS operational audits

Description	Respondents	N	Statistics				
			Mean	Standard deviation	Median	Range	95% confidence interval for population mean
(c) Format	A	50	4.6	1.1	5	2-7	4.3-5.0
	B	39	6.0	1.2	6	3-7	5.6-6.4
	C	34	5.4	1.4	6	1-7	4.9-5.9
(d) Understandability	A	50	5.3	1.1	5	3-7	5.0-5.7
	B	39	6.4	.8	7	5-7	6.1-6.6
	C	36	6.1	1.0	7	4-7	5.8-6.5
(e) Relevance to managers' needs	A	51	5.9	1.1	6	3-7	5.6-6.2
	B	39	6.3	1.1	7	4-7	6.0-6.7
	C	34	6.2	1.4	7	2-7	5.7-6.7
(f) Accuracy	A	51	6.1	1.1	6	2-7	5.8-6.4
	B	39	6.2	.9	6	4-7	5.9-6.5
	C	36	5.9	1.0	6	3-7	5.6-6.3

A = Internal auditors
B = Managers
C = MIS-managers

Table 4.36 (continued)

Respondents' perceptions of the scope of the ideal MIS operational audits

Description	Respondents	N	Statistics				
			Mean	Standard deviation	Median	Range	95% confidence interval for population mean
(g) Unbiased data	A	50	4.9	1.6	5	1-7	4.5-5.4
	B	39	5.9	1.0	6	4-7	5.6-6.3
	C	34	5.6	1.4	6	2-7	5.1-6.1
(h) Completeness	A	50	5.6	1.4	6	2-7	5.2-5.9
	B	39	5.8	1.2	6	3-7	5.4-6.2
	C	36	5.5	1.3	5.5	3-7	5.0-5.9
4 - Communication	A	51	5.1	1.1	5	3-7	4.8-5.4
	B	39	5.7	1.2	6	3-7	5.3-6.1
	C	33	5.9	1.2	6	2-7	5.5-6.4
(a) Relations between managers and D.P.	A	51	4.8	1.3	5	2-7	4.5-5.2
	B	39	5.0	1.5	5	1-7	4.5-5.5
	C	34	5.1	1.5	5	2-7	4.6-5.6

A = Internal auditors
B = Managers
C = MIS-managers

Table 4.36 (continued)

Respondents' perceptions of the scope of the ideal MIS operational audits

Description	Respondents	N	Statistics				
			Mean	Standard deviation	Median	Range	95% confidence interval for population mean
(b) Relations between accounting and D.P.	A	50	4.8	1.4	5	2-7	4.5-5.2
	B	39	5.4	1.3	5	3-7	5.0-5.9
	C	34	5.5	1.4	6	2-7	5.0-6.0
(c) Semantic problems in reports	A	50	4.3	1.4	4	2-7	3.9-4.7
	B	39	4.6	1.6	5	2-7	4.1-5.1
	C	36	5.2	1.3	5	1-7	4.7-5.6
(d) Managers' opinions of the MIS	A	50	4.5	1.5	4	1-7	4.1-4.9
	B	39	6.1	1.0	6	3-7	5.8-6.4
	C	34	5.8	1.2	6	2-7	5.4-6.2
5 - Decision-making	A	51	5.2	1.4	6	1-7	4.8-5.6
	B	39	6.1	1.1	7	4-7	5.8-6.5
	C	33	5.8	1.6	7	2-7	5.2-6.4

A = Internal auditors
B = Managers
C = MIS-managers

Table 4.36 (continued)

Respondents' perceptions of the scope of the ideal MIS operational audits

Description	Respondents	N	Statistics				
			Mean	Standard deviation	Median	Range	95% confidence interval for population mean
(a) Whether the reports generated lead to good decisions on the part of managers	A	50	5.2	1.4	5	1-7	4.7-5.6
	B	39	5.8	1.5	6	1-7	5.3-6.3
	C	34	5.7	1.8	7	1-7	5.1-6.4
(b) Whether managers get too much data	A	50	4.6	1.2	5	2-7	4.3-5.0
	B	39	5.5	1.2	6	3-7	5.1-5.9
	C	36	5.3	1.4	6	2-7	4.8-5.8
(c) Whether managers get all the data they need	A	50	5.6	.9	6	4-7	5.3-5.8
	B	39	5.8	1.2	6	4-7	5.4-6.2
	C	36	5.7	1.3	6	2-7	5.2-6.2
(d) Whether managers use the data they receive	A	49	5.3	1.3	6	2-7	4.9-5.7
	B	39	5.8	1.3	6	3-7	5.4-6.2
	C	36	5.3	1.8	5	1-7	4.6-5.9

A = Internal auditors
B = Managers
C = MIS-managers

Table 4.36 (continued)

Respondents' perceptions of the scope of the ideal MIS operational audits

Description	Respondents	N	Statistics				
			Mean	Standard deviation	Median	Range	95% confidence interval for population mean
6 - MIS design	A	51	5.5	1.1	6	3-7	5.2-5.8
	B	38	6.0	1.0	6	4-7	5.7-6.3
	C	31	5.9	1.0	6	4-7	5.6-6.3
(a) Whether new systems are efficiently designed	A	50	5.3	1.4	5	1-7	5.0-5.7
	B	38	5.7	1.0	6	4-7	5.4-6.0
	C	33	5.6	1.1	6	3-7	5.2-6.0
(b) Whether the purchase, hire or lease of new EDP equipment is cost justified	A	50	4.5	1.5	5	1-7	4.1-4.9
	B	38	5.4	1.3	5	3-7	5.0-5.8
	C	33	5.2	1.6	5	1-7	4.7-5.8

A = Internal auditors
B = Managers
C = MIS-managers

Table 4.36 (continued)

Respondents' perceptions of the scope of the ideal MIS operational audits

Description	Respondents	N	Statistics				
			Mean	Standard deviation	Median	Range	95% confidence interval for population mean
(c) Whether the new systems are designed with the user in mind	A	51	5.8	1.1	6	4-7	5.5-6.1
	B	38	6.1	.8	6	4-7	5.9-6.4
	C	33	6.1	1.1	6	4-7	5.7-6.4
(d) Whether the new systems are adequately explained to the users	A	50	5.5	1.0	6	4-7	5.3-5.8
	B	38	6.2	.8	6	4-7	5.9-6.5
	C	33	6.1	1.1	6	4-7	5.7-6.5
(e) Whether the operation of new systems meets original specifications	A	51	5.3	1.2	6	2-7	5.0-5.7
	B	38	5.6	1.0	6	4-7	5.2-5.9
	C	33	5.5	1.1	5	3-7	5.1-5.9

A = Internal auditors
B = Managers
C = MIS-managers

A lot of information is presented in this table, and any attempt to summarise it will be misleading and incomprehensive. Hence, discussion of the highest and lowest mean ratings for the main categories and the items inside each category seems to be the best solution in this context. The means and medians of all items and categories were around point (4) and over, indicating that the respondents felt that MIS components and problems presented in the question deserve some attention in some cases and a great deal of attention in others, but none scored very low in the scale as requiring little attention.

(a) Categories: The highest of the categories in terms of requiring most attention as perceived by the three types of respondents is "Reporting" with mean ratings 5.7 by internal auditors, 6.4 by managers, and 6.0 by MIS managers. It is worth noting also that internal auditors rated "Data processing and storage" at the same level as "Reporting". The category requiring the lowest amount of attention (in relative terms) was communication for internal auditors with mean rating of 5.1, while the other two types of respondents agreed on it being data processing and storage with means 5.6 and 5.7 respectively.

(b) Items inside each category:

- Data collection: The three types of respondents agreed that the "Accuracy of data" and the "Evaluation of data collection and entry personnel" were the highest and lowest respectively in terms of degree of devoted attention required.

- Data processing and storage: The mean ratings of "Security" given by internal auditors and managers were the highest, while MIS managers perceived "Computer programs" as the highest in this context. Meanwhile, they all agreed on "Storage of unneeded data" as being the lowest in terms of attention to be devoted to these items.

- Reporting: "Accuracy" was rated by internal auditors as the highest in terms of required attention, while "Format" was rated lowest in this context. For Managers, "Understandability" was highest with "Cost efficiency" lowest. Finally, MIS managers rated "Relevance to managers' needs" as highest, with "Cost efficiency" similar to the managers as lowest.

- Communication: Internal auditors' mean ratings for the items inside this category revealed that "Relations between D.P. and managers" and "Relations between D.P. and accounting" were rated highest in comparison with the other items, while "Semantic problems in reports" were rated lowest. Managers and MIS managers agreed on rating "Managers' opinions of the MIS" as the highest, but they differed with the lowest, as the former perceived it to be "Semantic problems in reports", while the latter perceived it to be "Relations between managers and D.P."

- Decision-making: All three types of respondents rated the item "Whether managers get all the data they need" as highest by comparison with managers rating another two items at the same level "Whether the reports generated lead to good

decisions on the part of managers" and "Whether managers use the data they receive", with MIS managers rating the former item at the same level of attention.

As to the item requiring lowest attention, all three types of respondents chose the item "Whether managers get too much data" as the lowest, with MIS managers rating the item "Whether managers use the data they receive" at the same level.

- MIS design: Internal auditors' mean ratings showed that the item "Whether the new systems are designed with the user in mind" is the highest in terms of attention required. Managers' mean ratings showed that the item "Whether the new systems are adequately explained to the users" gained the highest rating. The MIS managers also rated highest in terms of attention the two items previously mentioned attributing to them the same level of attention.

Lowest in this context, with concensus by the three types of respondents, was the item "Whether the purchase, hire or lease of new EDP equipment is cost justified".

4.5. Managers' satisfaction with the MIS

Managers and MIS managers were asked to describe their satisfaction with the MIS in their company, with the latter being asked an additional question about the areas where improvements are needed if they are not satisfied with the system. The following table presents descriptive statistics associated with their answers:

TABLE 4.37

Respondents' satisfaction with the MIS in their company

Statistics \ Respondents	Managers (N=39)	MIS managers (N=36)
Mean	4.154	4.611
Standard deviation	1.204	1.400
Median	4	5
Range	1 to 6	1 to 7
95% confidence interval for population mean	3.764-4.544	4.138-5.085

The above statistics show that the respondents were in general satisfied with the systems in operation, with the MIS managers scoring higher than the managers, which may be attributed to the "Black box" concept repeatedly used by some MIS managers in justifying the lack of communications between them and the managers.

The question asked of the unsatisfied MIS managers, (those scoring less than (4)), resulted in merely ten replies which can be classified into two groups. The following are representative quotations of these two groups:

Group One - Managers dissatisfied with the basic components of the system.

"1 - Integration of information. 2 - Decisions of what information is needed and what is also important. 3 - Timeliness." MIS manager

"Most information requires considerable manual work to compile, and is thus more likely to suffer from delay, inaccuracy and subjectivity . . ." MIS manager

The above two quotations reveal shortcomings in the systems with no clear indication of any attempt to correct this situation. This contrasts with the following quotation where steps have been taken to improve the system.

> "Unfortunately our computer system does not allow regular reports,and is not always in the format that is required. Having said this, work has already commenced on an on-line system which is being designed to overcome these problems and to provide for more useful data". MIS manager

Group Two - Managers seeking improved MIS

This second group represents managers who are satisfied with the system and its basic (essential) components, but who are seeking improved MIS, either through new applications to be added to its capabilities, or through its permanent evaluation in order to maintain its viability and value. This was expressed by respondents as follows:

> "MIS is currently geared to meeting continuing requirements in a relatively stable environment. More attention should be given to meeting ad hoc requirements and providing facilities for statistical manipulation of data". MIS manager
>
> ". . .while our MIS is quite satisfactory, it should still be looked at with a view to increasing its effectiveness and reducing the chance of the system stagnating with 'old age'." MIS manager

4.6. Manager-Auditor Working Relationship

This section investigates the working relationship between internal auditors and auditees, the auditees being managers of the MIS or any other department. The analysis and discussion presented in this section will be divided into two sub-sections, the first dealing with MIS manager-auditor working relationship, and the second dealing with manager-auditor working relations.

4.6.1. MIS manager-Auditor working relationship.

Two questions were included in the MIS manager's questionnaire exploring this area. The first question asked respondents to rate on a seven point scale how they perceive the closeness of the working relationship with internal auditors, while the second question asked the respondents to describe (using an open ended question) how they feel about being audited. As to internal auditors, a similar version of the first question was asked to elicit how they perceive the closeness of their working relationship with MIS personnel.

The descriptive statistics summarising the respondents answers to the above questions are presented in the following two tables:

Table 4.38

Internal auditors' and MIS managers' perceptions of their working relationship

Statistics \ Respondents	Internal Auditors (N = 48)	MIS-managers (N = 26)
Mean	4.854	4.769
Standard deviation	1.544	.951
Median	5	5
Range	1-7	2-7
95% confidence interval for population mean	4.406-5.302	4.403-5.135

Table 4.39

MIS-managers' opinions about being audited

Opinions	Respondents stating the opinion(s) (N=27)	% of sample (Sums to more than 100)
- The audit is helpful to the auditee. It is a positive management tool that aids in directing attention	8	30%
- Audits are accepted, because they are a necessary management practice	7	26%
- Audits are accepted, conditional upon the auditor acting in a professional manner	6	22%
- Audits are necessary because objective opinions are needed	5	19%
- Internal auditors are very helpful; they always provide the auditees with useful advice and information	4	15%
- Other(s)	4	15%

The above results reveal the following:

a) Respondents perceive their working relationship as moderately close as the means and medians are around point '5' in the scale.

b) MIS managers expressing their opinions of being audited and their work reviewed by internal auditors, revealed a positive attitude in this context and a great appreciation of the work performed by auditors. The six respondents who accepted the audits conditional upon the auditor acting in a professional manner can still be considered as holding a positive attitude, as the condition does not imply any rejection or hostile attitude. Four respondents who stated other opinions were also positive, and the following is a quotation representative of their answers.

> "The audit tends to highlight areas which may have come to be accepted as standard through years of operation, but which are now either outdated or in some cases even erroneous". - MIS manager

While the above results can be considered to be satisfactory to auditors, they still show that there is room for improvement in establishing better working relationships with MIS managers.

4.6.2. Manager-Auditor working relationship

A question was asked of managers and internal auditors about their perceptions of the closeness of their relationship. The latter group was also asked another two questions pertaining to this area of investigation, the first question asked them to rate on a seven point scale their perception of their level

of understanding MIS audits, which was assumed to be affected by their answers to the previous question, while the second asked whether they were auditees, and if yes, their opinions relating to it.

The results of the above described questions are presented using descriptive statistics in the following tables:

TABLE 4.40

Internal auditors' and managers' perceptions of their working relationships

Statistics \ Respondents	Internal Auditors (N=48)	Managers (N=33).
Mean	4.750	4.697
Standard deviation	1.537	1.403
Median	5	5
Range	2 to 7	2 to 7
95% confidence interval for population mean	4.304-5.196	4.218-5.175

Table 4.41

Managers' opinions about being audited

Opinions	Respondents stating the opinion (s) (N=30)	% of sample (Sums to more than 100)
- The audit is helpful to the auditee. It is a positive management tool that aids in directing attention	17	57%
- Audits are accepted, conditional upon the auditor acting in a professional manner	14	47%
- Audits are necessary because objective opinions are needed	11	37%
- Audits are accepted because they are a necessary management practice	7	23%
- Internal auditors are very helpful; they always provide the auditees with helpful advice and information	4	13%
- Other(s)	5	17%

TABLE 4.42

Managers' perceptions of their level of understanding MIS audits (N=33)

Mean	5.364
Standard deviation	.962
Median	5
Range	3 - 7
95% confidence interval for population mean	5.022-5.705

The results presented in the previous tables uncover the same moderate closeness of a working relationship and the same positive attitude and opinions held by auditees toward the internal auditors reviewing and auditing their work. In addition, only one of the five respondents included in the other(s) category did qualify his opinion of the auditor, as the following quotation shows: "Audits could be more acceptable, if the recommendations were practical ones and not consistently utopian." Manager

What is worth mentioning too in relation to this other(s) category is that one respondent stated that the usefulness of the audits lies in the fact that control procedures are reviewed by auditees and are kept into line as a result of audit anticipation.

The last of the tables presented concerns managers' perceptions of their level of understanding MIS audits. The mean and the median of their answers reflect a moderate and fair level.

While the above results can be considered quite satisfactory, they also show that there is room for improvement. Closer relations between managers and internal auditors accompanied by a publicity effort on the part of the latter could benefit their working relationship.

4.7. Internal auditors' evaluation

A question was posed to internal auditors asking for the method(s) used in the evaluation of the department. Forty seven respondents answered the question, a frequency distribution of the methods used in the different companies in the sample, as revealed by their answers, are presented in the following table.

TABLE 4.43

Method(s) of evaluating the internal audit department

Methods	No. of companies using the method	Percentages* (N=47)
Attainment of pre-established objectives	29	61%
Top management opinions	28	59%
Uncovering problem areas (cost savings and fraud detected)	27	57%
Auditees action on auditor findings	26	55%
Opinions of the company's external auditors	19	40%
Number of audits	15	31%
Opinions of the parent company's audit department	2	4%
No formal evaluation	3	6%

* Percentages do not sum to 100 because some companies use more than one method.

The above results show that objective methods are used by a great majority of companies in the sample in the evaluation of the audit department. Results also show that no formal evaluation exists in only three companies (6% of our sample), a very important result since the existence of a method of evaluation does affect the work of the department and the nature of its future role in the company.

4.8. Companies' published data

Financial and non-financial data relating to the companies in the sample were collected through the following means:

a - Published annual reports as they exist in the files maintained by Companies' House.

b - Where the data was not present in the file (especially in the case of non-financial data), a telephone call was made to the company asking for the missing data, and in all cases, they proved very helpful in providing such data.

The data collected represents two variables for use in testing some hypotheses. The first of these variables is "Profitability" as measured by the return on net assets, for which profit was arrived at, before interest and tax (7). The last four annual reports were looked at to calculate the profit and net assets for each year, for computations of the ratio with a simple average of these four years. The aim of averaging four years is to smoothe any fluctuations which may result from market conditions outside the control of the companies.

Due to time and unavailability of information, the two following assumptions were made:

a - That the companies in the sample are affected by the same market conditions and the same environmental influences (8).

b - That the accounting policies used in the companies were the same.

The second variable is "Size" and it is measured by turnover, financial data, and the average number of employees in the company, non-financial data. The last published annual report was used in collecting these two types of data. The two assumptions apply in this case as well.

The following table presents descriptive statistics computed on the collected data to measure the two variables, and for reasons of anonymity and confidentiality, means, standard deviation, and medians only are presented.

Table 4.44

Companies' financial and non-financial data

Companies' data \ Statistics		Mean	Standard deviation	Median
Profit before interest and tax:		£	£	£
First year	(N=45)	31,014,900	64,268,048	9,492,000
Second year	(N=45)	24,002,322	66,607,993	7,156,000
Third year	(N=45)	43,290,283	102,014,316	10,578,167
Fourth year	(N=45)	42,380,178	110,179,345	12,006,000
Net assets:				
First year	(N=45)	193,854,457	383,565,240	64,324,000
Second year	(N=45)	231,926,332	468,226,759	65,709,000
Third year	(N=45)	293,357,584	627,637,501	73,278,000
Fourth year	(N=45)	338,934,534	716,600,390	84,600,000
Turnover				
(Fourth year)	(N=41)	678,596,240	1,501,407,385	200,663,000
No. of employees		No.	No.	No.
(Fourth year)	(N=49)	20,078	33,937	8,146

4.9. Summary and Conclusions

This chapter investigated data relating to the practitioners' experiences concerning the audit of MIS as practised in a sample of UK companies surveyed in this study.

The salient points presented in this chapter are:

(i) Eighty nine per cent of companies in the sample audit MIS (directly or indirectly) while the remaining eleven per cent do not audit MIS.

(ii) Ninety per cent of the companies which audit MIS perform both compliance and operational audit, while the remaining ten percent perform compliance audit alone.

(iii) Over half the companies in the sample which audit MIS perform a continuous audit of the MIS.

(iv) On average, auditors spend thirty per cent of their departments' total available time in auditing MIS.

(v) Auditors ranked 'reporting' as the most important category where audit attention is directed. Within this category, the items in order of importance were accuracy; relevance to mangers' needs; completeness and timeliness.

(vi) A review to determine whether the reports meet the needs of managers is performed by internal auditors and MIS department personnel. The methods are predominantly use of questionnaires and discussion (formal or informal) with the users. Moreover, consensus of opinion among all respondents was that they were 'just satisfied' with the available tools used in this context.

(vii) A review of MIS to determine its overall efficiency and effectiveness is performed by internal auditors and other departmental personnel (including MIS department). Methods used by internal auditors are predominantly audit programmes and discussions with the users. Respondents were 'just satisfied' with the tools used in this context.

(viii) Respondents perceive that benefits do accrue from the audit of MIS by internal auditors. For example, a positive influence on their confidence in the data received; a positive effect on management decision making; and general satisfaction with improvements in MIS induced as a result of audits.

(ix) The working relationship between internal auditors and managers was perceived as being 'moderately close' with auditees expressing a positive attitude and appreciation of the work performed by internal auditors.

In conclusion, it can be said that these results show that internal auditors audit MIS in the majority of companies surveyed; few negative attitudes appear to be held by auditees, and a need exists to develop new improved tools, to determine whether the MIS reports meet managers' requirements and to audit MIS for overall efficiency and effectiveness.

REFERENCES

(1) See for example:

a - Moser, C.A., & Kalton, G., Survey Methods in Social investigation, Heinemann Educational Books, London, Second Edition, 1977, pp.262-269.

b - Oppenheim, A.N., Questionnaire design and attitude measurement , Heinemann, London, First Edition, 1970, p.34.

(2) Oppenheim, A.N., op.cit., p.34.

(3) Ibid, pp.34-35.

(4) Siegel, S., Non-parametric statistics for the Behavioural Sciences , McGraw Hill Co. Inc., N.Y., 1956, pp.96-111.

(5) Schwarzbach, H.R., Auditing management information systems: an empirical investigation on the impact of management information system's audits , Unpublished DBA dissertation, the University of Colorado,1976, p.244.

(6) See for example:

a - Rittenberg, L.E., & Davis, G.B., The roles of internal and external auditors in auditing EDP systems , The Journal of Accountancy, December, 1977, pp.51-58.

b - Rittenberg, L.E., & Purdy, C.R., The Internal Auditor's Role in MIS developments , MIS Quarterly, December 1978, pp.47-57.

(7) Batty, J., Management Accountancy , Macdonald & Evans Ltd., London, Fourth Edition, 1975, pp.420-421.

(8) For the computations of financial ratio for different types of companies, see:

Grinyer, P.H., & Norburn, D., Planning for existing markets: perceptions of executives and financial performance , Journal of the Royal Statistical Society, A., Vol.138, 1975, p.75.

CHAPTER 5

INFERENTIAL ANALYSIS OF SELECTED ASPECTS OF MIS AUDITS

5.1. Introduction

5.2. General rules applied in hypothesis testing

5.3. Analysis of hypotheses: results and comments

- 5.3.1. Hypotheses relating to the number of auditing staff
- 5.3.2. Hypotheses relating to the characteristics of the companies auditing MIS and the approach (type) used in this audit
- 5.3.3. Hypotheses relating to the audit plans
- 5.3.4. Hypotheses relating to the audit scope
- 5.3.5. Hypotheses relating to the benefits of the MIS audits
  - 5.3.5.1. Hypotheses relating to the influences of MIS audits
  - 5.3.5.2. Hypotheses relating to the benefits (as scales and ranked) of MIS audits
- 5.3.6. Hypotheses relating to the ideal MIS audits
- 5.3.7. Hypotheses relating to the manager-auditor working relationship

5.4. Summary and Conclusions

CHAPTER 5

INFERENTIAL ANALYSIS OF SELECTED ASPECTS OF MIS AUDITS

5.1. Introduction

This chapter presents the results of testing different hypotheses which explore the most possible areas of interest within the sphere of the audit of MIS by internal auditors Statistics used in this process were determined by the level of measurement attained by the data; for internal data, Pearson product moment correlations and other inferential parametric statistics are used; for ordinal data, Kendall's τ (Tau) correlation coefficients and Median test are used.

5.2. General rules applied in hypothesis testing

In the testing of the hypotheses presented in this chapter, the following rules will be applied:

(a) The minimum level of significance for the acceptance or the rejection of a hypothesis is set at the .05 level for either two-tail or one-tail test.

(b) For each hypothesis, tests will be performed in relation to each sample whenever this is relevant to the study, with generalizability of the results across the different samples where feasible.

5.3. Analysis of hypotheses: Results and Comments

This section presents the results of the hypothesis testing in the same order as in Chapter 4.

5.3.1. Hypotheses relating to the number of auditing staff

The following hypotheses were formulated to test for the existence of an association between the number of auditing staff with different aspects of the MIS audits; and with characteristics of the company. The results are presented in the following table:

TABLE 5.1

Testing of hypotheses related to the size of the audit department and company and audit variables

Hypothesis	Statistic used	Statistical results			Conclusion
			N	2-tail prob.	
H1.1. There is a relationship between the number of auditing staff and the intensity of the MIS audits as measured by the number of auditors performing the audits.	Pearson's P-M	r=.6117	47	.001	Accepted
H1.2. There is a relationship between the number of auditing staff and the intensity of the MIS audits as measured by the proportion of the department's total available time spent on these audits.	Pearson's P-M	r=-.0830	44	.592	Rejected
H1.3. There is no relationship between the number of auditing staff and the audit of MIS as a special assignment.	Kendall's Tau	τ=.0571	54	.542	Accepted
H1.4. There is no relationship between the number of auditing staff and the internal auditors reviewing internally generated reports to determine whether they meet managers' needs.	Kendall's Tau	τ=.1681	47	.096	Accepted
H1.5. There is no relationship between the number of auditing staff and the internal auditors reviewing the overall efficiency and effectiveness of MIS.	Kendall's Tau	τ=.0649	47	.520	Accepted

TABLE 5.1(continued)

Testing of hypotheses related to the size of the audit department and company and audit variable

Hypothesis	Statistic used	Statistical results			Conclusion
			N	2-tail prob.	
H1.6 There is a relationship between the number of auditing staff and the size of the company as measured by the number of employees.	Pearson's P.M.	r=.7630	48	.001	Accepted
H1.7 There is a relationship between the number of auditing staff and the size of the company as measured by its turnover.	Pearson's P.M.	r=.6445	40	.001	Accepted
H1.8 There is no relationship between the number of auditing staff and the profitability of the company as measured by the return on net assets.	Pearson's P.M.	r=-.2347	44	.125	Accepted

The results presented in the above table show:

(a) While there is a positive and statistically significant relationship between the number of auditing staff employed in the department (U.K. based only) and the intensity of the audits as measured by the number of auditors performing the audits, there is no significant relationship between number of auditing staff employed and the intensity of the audit as measured by the proportion of the department's time spent on the audit of MIS, although the sign is in the right direction.

(b) Internal auditors performing the MIS audits as a special assignment; internal auditors' review of internally generated reports to determine whether they meet managers' needs; and internal auditors' review of MIS for efficiency and effectiveness were not significantly correlated with the number of auditing staff, also confirming that there is no correlation between the time allocated to the MIS audits and the number of auditing staff.

(c) The three remaining hypotheses tested the relationships between the size of the auditing staff and companies' characteristics. The tests reveal that a positive and significant relationship exists between the number of auditing staff and the size of the company as

measured by number of employees, and by the turnover, confirming the literature (1). The hypothesis of 'no relationship' existing between the number of auditing staff and profitability was also statistically significant. The sign of the non-significant relationship is negative which, if taken literally, means that the number of auditors increases in the company with every decrease in its profitability and vice versa. This may indicate the use of audit staff in a trouble-shooting role or in a problem-solving role, a point worth further investigation in the future.

Statistical analysis was performed to test for an association between the number of auditing staff and both the frequency of the MIS audits, and the type of audit performed, using Chi square, but as the requirements for its use were not met, results could not be reported.(2)

5.3.2. Hypotheses relating to the characteristics of the companies auditing MIS and the approach(type) used in the audit

The first set seeks to examine whether there is a relationship between the audit of MIS and characteristics of the company auditing their MIS; and with respondents' perceptions of the benefits - scaled against costs - of the audit; the second set examines the relationship between

the approach used in the audit of MIS and audit and company variables; the third set tests for differences in respondents' perceptions of the audit scope (in general), the benefits of the audits, the influences of the audits and ideal MIS audits as a result of the differences in approach to the audit. The following table presents the results of testing the first set of hypotheses.

TABLE 5.2

Testing of hypotheses related to the characteristics of the companies auditing their MIS and the relationship between these audits and the respondents' perceptions of their benefits

Hypothesis	Statistic used	Statistical results			Conclusion
		τ	N	2-tail prob.	
H2.1. There is a relationship between the audit of MIS and the size of the company as measured by the number of employees.	Kendall's Tau	.1852	49	.061	Rejected
H2.2. There is a relationship between the audit of MIS and the size of the company as measured by its turnover.	Kendall's Tau	.3176	41	.004	Accepted
H2.3. There is no relationship between the audit of MIS and the profitability of the company as measured by the return on net assets.	Kendall's Tau	-.0135	45	.897	Accepted
H2.4. There is a relationship between the audit of MIS and the number of auditing staff.	Kendall's Tau	.3413	54	.001	Accepted
H2.5. There is a relationship between the audit of MIS and internal auditors' perceptions of the benefits - scaled against costs - of compliance audits.	Kendall's Tau	.1082	49	.273	Rejected
H2.6. There is a relationship between the audit of MIS and internal auditors' perceptions of the benefits - scaled against costs - of operational audits.	Kendall's Tau	.0659	49	.505	Rejected

TABLE 5.2(continued)

Testing of hypotheses related to the characteristics of the companies auditing their MIS and the relationship between these audits and the respondents' perceptions of their benefits

Hypothesis	Statistic used	Statistical results			Conclusion
		τ	N	2-tail prob.	
H2.7. There is a relationship between the audit of MIS and managers' perceptions of its benefits scaled against costs.	Kendall's Tau	.4273	39	.001	Accepted
H2.8. There is a relationship between the audit of MIS and MIS-managers' perceptions of its benefits scaled against costs.	Kendall's Tau	-.2171	34	.071	Rejected

The results reveal the following:

(a) There is a positive relationship between the audit of MIS and the size of the company. This is sustained by the acceptance of hypothesis two which tested for this relationship with size measured in terms of the company's turnover. With size measured in terms of number of employees, the results were not significant although they can be considered supportive of such a relationship.

The explanation which can be offered for such a positive relationship is that the size of the company influences the size of the MIS and its complexity. Hence the internal audit, as a management control tool, is called upon to ensure its compliance with control procedures and the efficiency and effectiveness of its operations.

(b) The hypothesis of no relationship between the audit of MIS and the profitability of the company was accepted. This is an expected result because the audit of any activity in a company is not determined by its profitability, but by a break-even analysis of the costs and benefits of auditing an activity.

(c) The hypothesis of a relationship between the audit of MIS and the number of auditing staff was tested with the result being the existence of a positive

and significant relationship. This is also an expected result since number of auditing staff determines the amount of resources available to the department to conduct their audits.

(d) The relationships between the audit of MIS and the respondents' perceptions of their benefits - scaled against costs - explored in four hypotheses yielded mixed results. For internal auditors, the hypotheses of such a relationship was rejected. This can be taken as an indication that internal auditors not performing this audit perceive the benefits at the same level as those performing it. The opposite holds true for managers, as the Kendall's τ (Tau) revealed a positive significant relationship. This positive relationship can be interpreted to mean that managers whose company perform the audit, perceive its benefits as being higher than those in companies not performing an audit. For MIS managers, the figures presented show a negative relationship which can be considered suggestive, although non-significant. This negative relationship cannot be explained and justified from the available data since other data does not reveal any negative or hostile attitude by MIS managers to the audit of MIS. Inconsistency by respondents can be the only explanation offered in this case.

To summarise the analysis concerning the characteristics of the companies auditing their MIS, it can be said that the performance of this type of audit is positively correlated with the size of the company and with the size of the internal audit department. As to the relationship between these audits and the respondents' perceptions of their benefits, only managers revealed such a positive relationship.

The results of testing for the second set of hypotheses related to the relationship between the approach used in the audit of MIS, and audit and company variables are presented in the following table.

TABLE 5.3

Testing of hypotheses related to the approach used in the audit of MIS and audit and company variables

Hypothesis	Statistic used	Statistical results			Conclusion
		τ	N	2-tail prob.	
H3.1. There is no relationship between the approach used in the audit of MIS and the size of the company as measured by the number of employees.	Kendall's Tau	.0465	43	.661	Accepted
H3.2. There is no relationship between the approach used in the audit of MIS and the size of the company as measured by its turnover.	Kendall's Tau	-.0490	36	.675	Accepted
H3.3. There is no relationship between the approach used in the audit of MIS and the profitability of the company as measured by the return on net assets.	Kendall's Tau	.1058	40	.337	Accepted
H3.4. There is a relationship between the approach used in the audit of MIS and the perceived benefits - scaled against costs - arising from compliance audits.	Kendall's Tau	.0360	44	.731	Rejected
H3.5. There is a relationship between the approach used in the audit of MIS and the perceived benefits - scaled against costs - arising from operational audits.	Kendall's Tau	.2548	44	.015	Accepted

TABLE 5.3 (continued)

Testing of hypotheses related to the approach used in the audit of MIS and audit and company variables

Hypothesis	Statistic used	Statistical results			Conclusion
		τ	N	2-tail prob.	
H3.6 There is no relationship between the approach used in the audit of MIS and the intensity of the audit as measured by the number of auditors performing the audits.	Kendall's Tau	.1045	48	.295	Accepted
H3.7 There is no relationship between the approach used in the audit of MIS and the internal auditors reviewing internally generated reports to determine whether they meet managers' needs.	Kendall's Tau	-.1205	48	.227	Accepted
H3.8 There is no relationship between the approach used in the audit of MIS and the internal auditors reviewing the overall efficiency and effectiveness of MIS.	Kendall's Tau	-.0909	48	.363	Accepted

The above results uncover the following:

(a) The "no relationship" hypothesised between company variables in terms of size and profitability and the approach used in the audit of MIS, (this being either direct or indirect) was statistically significant. If we combine these results with those found in relation to the previous set of hypotheses, it may be concluded that the size of the company is one of the factors affecting the existence of the audit of MIS but not to the approach used.

(b) The two hypotheses testing for the existence of a relationship(s) between the approach used in the audit, and the perceived benefits scaled against the costs of these audits, revealed mixed results. On one hand, a positive relationship between the approach and operational audits was statistically significant, while on the other hand, the same relationship but with compliance audits was not statistically significant. The explanation which can be offered for this finding is that the benefits of the operational audits of MIS are best perceived if these audits were conducted as special assignments and not as part of the audit of other departments or other activities, since maximum benefits may notaccrue to a company from an audit unless it is conducted as a specific assignment with well-defined plans, tools and objectives. The explanation which can be offered for the "no relationship" in the case of the compliance audits is that the majority of the companies in the sample (44 out of 49) perform both types of audit. This

means that there is no dividing line between the two audits, consequently there is a degree of difficulty in attempting to perceive or divide the different benefits against the costs of such audits. This may have affected the respondents' answers to the question. Moreover, the number of companies performing only the compliance audits is very small, hence their answers were limited in their effect on the results.

(c) The three remaining hypotheses tested for a "no relationship" between the approach used in the audit of MIS and audit variables, namely intensity of the audits, auditors reviewing the internally generated reports in order to determine whether they meet managers needs; and auditors reviewing MIS for efficiency and effectiveness. All results were statistically significant. The explanation for these results can be that the approach to the audit does not affect or influence its intensity or its coverage.

To conclude it may be said that:

- No relationship exists between
  - i) The approach used to audit MIS and company variables
  - ii) The approach used to audit MIS and audit variables.
  - iii) The approach used to audit MIS and the perceived benefits of compliance audits scaled against its costs.
- A positive relationship exists between the approach used to audit MIS and the perceived benefits of operational audits scaled against its costs.

Finally, a summary of the results concerning the testing of the third set of hypotheses presented in the following table, shows that all five hypotheses were rejected at the .05 level (2-tail test). They relate to auditors following different approaches in the performance of the MIS audits and whether their perceptions of the audit scope (in general), the ideal MIS audits (audit scope) and the influences of the audits on the decision maker (manager) in terms of the quality of the decision and confidence in the data, and the improvements of MIS are different. These results confirm the previous findings of "no relationship" between the audit approach and audit variables, and emphasise a need for further studies in this area.

Two relationships were tested relating audit approach with the frequency of the audits, and with the location where the audit of the internally generated reports was performed. Chi square was used in this process, but the requirements for the use of the statistic were not met, hence no results are available.(3)

TABLE 5.4

Testing of hypotheses related to the difference between respondents' perceptions of the audit scope (in general) the benefits and influences of the audits and the ideal MIS audits, as a result of their difference in the approach they use to perform the audit

Hypothesis	Test used	Statistical results*			Conclusion
			N	2-tail prob.	
H4.1. There is a difference between auditors following different approaches in their audit of MIS and the degree of importance they attach to the different categories and items describing their audit scope.	Median test	All results were non-significant at the .05 level			Rejected
H4.2. There is a difference between auditors following different approaches in their audit of MIS and their rankings of the benefits of the operational audits.	Median test	All results were non-significant at the .05 level			Rejected
H4.3. There is a difference between auditors following different approaches in their audit of MIS and their rankings of the benefits of the compliance audits.	Median test	All results were non-significant at the .05 level			Rejected
H4.4. There is a difference between auditors following different approaches in their audit of MIS and their perceptions of the audits' influences	Median test	All results were non-significant at the .05 level			Rejected

TABLE 5.4 (continued)

Testing of hypotheses related to the difference between respondents' perceptions of the audit scope (in general), the benefits and influences of the audits and the ideal MIS audits, as a result of their difference in the approach they use to perform the audit

Hypothesis	Test used	Statistical results *			Conclusion
			N	2-tail prob.	
H4.5. There is a difference between auditors following different approaches in their audit of MIS and the degree of importance they attach to the different categories and items describing their ideal audit scope	Median test	All results with the exception of one main item only were non-significant at the .05 level			Rejected

* For details of the statistical results, see supplement to the chapter.

5.3.3. Hypotheses relating to the audit plans

The audit plans of MIS include audit frequency and audit intensity. Audit frequency was measured on a nominal scale, which meant that in the testing of any hypotheses relating it to audit variables, company variables, and benefits and influences of the audits, the Chi square statistic was to be used. These hypotheses were tested but since the requirements of the use of the statistic were not met and any grouping of the cells would have meant loss of information and irrelevant results, no results could be reported.(4)

A second dimension of these plans concerns the intensity of the audits. Intensity was measured in two ways: firstly, the proportion of the department's total available time spent on these audits, and secondly, the number of auditors performing the audits. Correspondingly two sets of hypotheses were formulated to test the relationships between each measure of intensity and variables measuring audit scope, audit benefits and influences, and company characteristics.

The results of testing the first set of hypotheses are presented in the following table.

TABLE 5.5

Testing of hypotheses related to the intensity of MIS audits and company variables, audit variables, audit scope, and effects of the audits. (Intensity as measured by the proportion of the department's total available time spent on these audits).

Hypothesis	Statistic used	Statistical results			Conclusion
		τ	N	2-tail prob.	
H5.1. There is no relationship between the intensity of MIS audits and internal auditors reviewing the internally generated reports to determine whether they meet managers' needs.	Kendall's Tau	.0992	44	.343	Accepted
H5.2. There is no relationship between the intensity of MIS audits and internal auditors reviewing the overall efficiency and effectiveness of MIS.	Kendall's Tau	-.0388	44	.711	Accepted
H5.3. There is no relationship between the intensity of MIS audits and the degree of importance attached to the different categories and items describing audit scope.	Kendall's Tau	All results with the exception of seven items were non-significant at the .05 level.*			Accepted
H5.4. There is a relationship between the intensity of MIS audits and the perceived benefits - scaled against costs -- arising from operational audits.	Kendall's Tau	.2073	41	.057	Rejected

TABLE 5.5 (continued)

Testing of hypotheses related to the intensity of MIS audits and company variables, audit variables, audit scope, and effects of the audits. (Intensity as measured by the proportion of the department's total available time spent on these audits.)

Hypothesis	Statistic used	Statistical results			Conclusion
		τ	N	2-tail prob.	
H5.5. There is a relationship between the intensity of MIS audits and the perceived benefits - scaled against costs - arising from compliance audits.	Kendall's Tau	.2295	41	.035	Accepted
H5.6. There is a relationship between the intensity of MIS audits and internal auditors' ranking of the benefits of its operational audits.	Kendall's Tau	All correlations were non-significant at the .05 level.*			Rejected
H5.7. There is a relationship between the intensity of MIS audits and internal auditors' rankings of the benefits of its compliance audits.	Kendall's Tau	All correlations with the exception of one only were non-significant at the .05 level*			Rejected
H5.8. There is a relationship between the intensity of MIS audits and internal auditors' perceptions of its influence.	Kendall's Tau	All correlations were non-significant at the .05 level.*			Rejected
H5.9. There is a relationship between the intensity of MIS audits and internal auditors' perceptions of the closeness of their working relationships with managers.	Kendall's Tau	.2285	44	.029	Accepted

TABLE 5.5 (continued)

Testing of the hypotheses related to the intensity of MIS audits and company variables, audit variables, audit scope and effects of the audits. (Intensity as measured by the proportion of the department's total available time spent on these audits)

Hypothesis	Statistic used	Statistical results			Conclusion
		τ	N	2-tail prob.	
H5.10. There is a relationship between the intensity of MIS audits and internal auditors' perceptions of the closeness of their working relationships with MIS personnel	Kendall's Tau	.1580	44	.131	Rejected
H5.11. There is no relationship between the intensity of MIS audits and the size of the company as measured by the number of employees.	Kendall's Tau	-.0356	39	.829	Accepted
H5.12. There is no relationship between the intensity of MIS audits and the size of the company as measured by its turnover.	Kendall's Tau	-.1213	32	.509	Accepted
H5.13. There is no relationship between the intensity of MIS audits and the profitability of the company as measured by the return on net assets.	Kendall's Tau	.0769	36	.659	Accepted

* For details of the correlational results, see supplement to the chapter.

The results show the following (with intensity measured as a proportion of the total available time to the department).

a) The "no relationship" hypothesized between the intensity of MIS audits with auditors reviewing the internally generated reports to determine whether they meet managers' needs; with auditors reviewing MIS for efficiency and effectiveness ; and with the degree of importance auditors attach to the different categories and items describing the audit scope were all statistically significant. While in the last hypothesis (H5.3) seven of these items showed a positive significant relationship, this was not considered sufficient for its rejection. These results indicate that the scope of the audit, either in general or in specific terms, is not related in terms of coverage to the intensity of the audits. A tentative explanation which can be offered in this case is that while intensity may differ between companies, this may be to compensate for the complexity of the MIS in terms of the time and depth needed for its audits, and not to represent new addition to the scope of these audits. Nonetheless, further research to enable generalisations is required to try and uncover the reasons behind the "no relationships".

b) Relationships hypothesized to exist between the intensity of the audits (operational-compliance) and the auditors' perceptions of benefits scaled against the costs were

tested with a resultant positive relationship, statistically suggestive, but not significant for operational audits, while for compliance audits the results were a positive and statistically significant relationship. These mixed results require further testing.

c) Relationships hypothesized between the intensity of the audits and the benefits of operational and compliance audits ranked in terms of importance and also between audit intensity and auditors' perceptions of their effects on managers' quality of decisions; confidence in the data received, and improvements in MIS were all non-significant. These results also await further testing in order to generalize in the context of the MIS audits. Nonetheless, these results do seem to indicate that intensity is not a factor influencing perceived benefits achieved from the audits, and that other factors, e.g. quality of the audits, not studied in this research, can be the reason.

d) Relationships hypothesized to exist between audit intensity and auditors' perceptions of the degree of closeness in their working relationship with managers and MIS managers was statistically significant with the former and statistically non-significant for the latter.

e) Finally, the remaining three hypotheses postulating "no relationship" between the audit intensity and company variables in terms of size and profitability resulted in the acceptance of a "no relationship". The results

were expected because neither the size of the company nor the profitability can be hypothesized as having a relationship with the variable in question.

The results of testing the second set of hypotheses related to the same variables but with intensity measured by the number of auditors performing the audits, presented in the following table reveal that:

a) H6.1. to H6.3. reveal no relationship exists between audit intensity and audit scope (either general or specific).

b) H6.4. and H6.5. relate to the relationship between intensity and the benefits (scaled against costs) of the operational and compliance audits. They reveal that for benefits of operational audits results are suggestive for existence of this relationship. However, with benefits of compliance audits, results were neither statistically significant nor suggestive of this relationship.

c) The testing of H6.6 to H6.8. confirmed no significant relationships exist.

d) The relationshipsbetween the intensity of the audits with the auditors' perceptions of the closeness of their working relationship with managers (H6.9) and MIS managers (H6.10) were tested, with the result of rejection of the former and acceptance of the latter, although the rejected relationship was considered to be suggestive ($p = .075$).

e) The remaining three hypotheses relating audit intensity with company characteristics were tested with the acceptance of all these hypotheses. H6.11 and H6.12 resulted in a positive relationship between the size of the company as measured by the number of employees and by its turnover with the intensity of the audits. Test of H6.13 resulted in a significant "no relationship" between profitability of the company and the intensity of the audits. These results are to be expected since the overall number of auditors in a company was related to its size but not to its profitability (H1.6 to H1.8).

TABLE 5.6

Testing of hypotheses related to the intensity of MIS audits and company variables, audit variables, audit scope and effects of the audits. (Intensity as measured by the number of auditors performing the audits.)

Hypothesis	Statistic used	Statistical results			Conclusion
		τ	N	2-tail prob.	
H6.1. There is no relationship between the intensity of MIS audits and internal auditors reviewing the internally generated reports to determine whether they meet managers' needs.	Kendall's Tau	.0917	47	.364	Accepted
H6.2. There is no relationship between the intensity of MIS audits and internal auditors reviewing the overall efficiency and effectiveness of MIS.	Kendall's Tau	.0604	47	.550	Accepted
H6.3. There is no relationship between the intensity of MIS audits and the degree of importance they attach to the different categories and items describing their audit scope.	Kendall's Tau	All results with the exception of four items were non-significant at the .05 level.*			Accepted
H6.4 There is a relationship between the intensity of MIS audits and the percieved benefits - scaled against costs - arising from operational audits.	Kendall's Tau	.1915	43	.071	Rejected
H6.5. There is a relationship between the intensity of MIS audits and the perceived benefits - scaled against costs - arising from compliance audits.	Kendall's Tau	.0702	43	.507	Rejected

TABLE 5.6(continued)

Testing of hypotheses related to the intensity of MIS audits and company variables, audit variables, audit scope and effects of the audits. (Intensity as measured by the number of auditors performing the audits).

Hypothesis	Statistic used	Statistical results			Conclusion
		τ	N	2-tail prob.	
H6.6. There is a relationship between the intensity of MIS audits and internal auditors' rankings of the benefits of its operational audits.	Kendall's Tau	All correlations were non-significant at the .05 level.*			Rejected
H6.7. There is a relationship between the intensity of MIS audits and internal auditors' rankings of the benefits of its compliance audits.	Kendall's Tau	All correlations were non-significant at the .05 level.*			Rejected
H6.8. There is a relationship between the intensity of MIS audits and internal auditors' perceptions of its influences.	Kendall's Tau	All correlations were non-significant at the .05 level.*			Rejected
H6.9. There is a relationship between the intensity of MIS audits and internal auditors' perceptions of the closeness of their working relationships with managers.	Kendall's Tau	.1799	47	.075	Rejected
H6.10. There is a relationship between the intensity of MIS audits and internal auditors' perceptions of the closeness of their working relationships with MIS personnel.	Kendall's Tau	.2125	47	.036	Accepted

TABLE 5.6 (continued)

Testing of hypotheses related to the intensity of MIS audits and company variables, audit variables, audit scope and effects of the audits.(Intensity as measured by the number of auditors performing the audits).

Hypothesis	Statistic used	Statistical results			Conclusion
		τ	N	2-tail prob.	
H6.11. There is a relationship between the intensity of MIS audits and the size of the company as measured by the number of employees.	Kendall's Tau	.7785	42	.001	Accepted
H6.12. There is a relationship between the intensity of MIS audits and the size of the company as measured by its turnover.	Kendall's Tau	.8324	35	.001	Accepted
H6.13. There is no relationship between the intensity of MIS audits and the profitability of the company as measured by the return on net assets.	Kendall's Tau	-.1268	39	.442	Accepted

* For details of the correlational results, see supplement to the chapter.

5.3.4. Hypotheses relating to the audit scope

Other hypotheses beside the ones presented here were investigated in relation to the audit scope (either in general or in specific terms), these include:

- Audit scope as relating to the internal audit evaluation system.
- The relationship between the methods used by auditors in reviewing whether the reports meet managers' needs, and auditors' degree of satisfaction with them.
- The relationship between the methods used by MIS personnel and other departments in reviewing whether the reports meet managers' needs, and managers and MIS personnel degree of satisfaction with them.
- The relationship between the methods used by auditors in reviewing MIS for efficiency and effectiveness and respondents' degree of satisfaction with them.

No reporting of the results is possible because of non-satisfaction of the requirements for the use of the Chi square (5).

Two hypotheses were tested in this section, they relate to the difference between respondents in their degree of satisfaction with the methods used by internal auditors either in reviewing reports to determine whether they meet managers' needs, or in reviewing MIS for efficiency and effectiveness. The first hypotheses H7.1. states that

"There is a difference between respondents in their degree of satisfaction with the methods used by auditors in reviewing reports to determine whether they meet managers' needs." Median test between k-samples and between two-samples was used in the testing of the hypothesis.

In the testing of the difference between the three types of respondents (Internal auditors, managers, MIS managers), computed χ^2 was 1.4183 with d.f.2 with 2-tail probability of .4921 (n=71). More detailed testing was conducted between each possible pair of respondents in order to uncover any significant differences,with the following results.

TABLE 5.7.

Median test between respondents in their degree of satisfaction with the methods used by auditors in reviewing reports to determine whether they meet managers' needs

Pairs of respondents	Cases	χ^2	2-tail prob.
Internal auditors - managers	54	.1188	.7304
Internal auditors - MIS managers	54	.6393	.4240
Managers - MIS managers	54	0	1.0000

The above results lead to the rejection of the hypothesis hence it may be said that no statistically significant differences exist between respondents in this respect. This is important since the aim of the present study is the development of a new approach which embodies a test instrument for use

by auditors in the evaluation of management information generated through reports. This result indicates that no real differences exist between the three types of respondents and so there is no need for different methods to satisfy different respondents.

The second hypothesis H7.2. states that "There is a difference between respondents in their degree of satisfaction with the methods used by auditors in reviewing MIS for efficiency and effectiveness." The question yielding the data used in the testing of this hypothesis was asked to internal auditors and MIS managers only, hence a median test between two samples was used. The results were a computed χ^2 =.0885, 2-tail probability =.7661, n=37.

The above results show that no statistically significant differences exist and hence the hypothesis was rejected.

5.3.5. Hypotheses relating to the benefits of the MIS audits

Two sets of hypotheses were formulated in relation to the benefits of the MIS audits. The first set concerns the influences of the audits, which includes the effects of the audits on both the quality of the decisions taken by managers and managers' confidence in the data received, and also whether the MIS improved as a result of past audits. The second set involves managers and MIS managers' perceptions of both the benefits of the audits, as scaled against the costs, and the ranking of the different benefits seen to result from these audits.

5.3.5.1. Hypotheses relating to the influences of MIS audits

This set of hypotheses consists of twelve hypotheses; the first three test whether managers and MIS managers, as recipients of the audit services, hold favourable views of the effects of the audits. Sample statistics were used to compute the 95% confidence interval for the population statistic. The following table presents the hypotheses and the results.

TABLE 5.8.

Testing of hypotheses related to managers and MIS managers' views about the influences of the MIS audits

Hypothesis	Sample	95% confidence interval for population median	95% confidence interval for population mean
H8.1. In the opinion of managers, MIS audits cause better decisions	Managers (n=32)	2-4	2.778-4.097
H8.2. MIS audits cause managers to place more confidence in the data they receive	Managers (n=33)	4-5	4.359-5.096
H8.3. MIS audits cause improvements in MIS	Managers (n=32)	2-5	3.125-4.187
	MIS-managers (n=27)	3-4	2.941-4.170

Before discussing the results it is worth mentioning that the 95% confidence interval for the population mean is only presented to shed more light on the results. The confidence interval for the population median will only be used in the discussion and analysis. The formula for the computation of this statistic can be found in Gibbons (6).

The results of the first hypothesis show that the population median lies between 2 and 4. The 7-point scale used in the question was labelled 1 (No), 4 (Somewhat better), and 7 (much better). Thus, it can be said that managers perceive the MIS audits influence them in making slightly somewhat better decisions. This result is very realistic in that the audit of MIS may or may not result in improving the information provided to the decision maker (manager). This depends on a lot of factors outside the control of the internal auditors. A second reason may be that the quality of any decision is dependent on a lot of factors, e.g. cognitive property of the decision maker, type of decisions, external and environmental effects, which are also outside the auditors' control.

The statistics presented for the second hypothesis shows that the population median lies between 4 and 5. This can be interpreted to mean that the MIS audits cause managers to place somewhat more confidence in the data they receive. Auditors performing their audits, resulting in MIS changes or not, will affect managers' confidence in the data because of managers' prior expectancies.

With the third hypothesis, the figures presented are those of the population of managers and MIS managers using sample statistics. The figures show that moderately favourable views are held by respondents concerning the improvements effected by MIS audits. This is probably because unless the changes are needed to satisfy internal control requirements, e.g. deficiences (and hence gain priority), consideration of auditors' suggested changes is likely to be delayed.

The above results are all supportive of the notion that MIS audits improve management decision-making, that MIS audits cause managers to place more confidence in the data they receive, and that MIS audits result in improvements in MIS.

Three hypotheses were formulated to test for the statistical significance of the difference in the respondents' median related to the different influences of the MIS audits. The results are presented in the following table.

TABLE 5.9.

Median test results for H8.4 to H8.6

Hypothesis	N	d.f.	χ^2	2-tail prob.
H8.4. There is a difference between respondents in their perceptions of the influence MIS audits has on the quality of managers' decisions	99	2	.6332	.7286
H8.5. There is a difference between respondents in their perceptions of the influence MIS audits has on the managers' confidence in the data they receive.	100	2	17.1084	.0002
H8.6. There is a difference between respondents in their perceptions of the influence MIS audits has on MIS improvements	101	2	5.3764	.0680

The results of H8.4 show that the difference between respondents in the median were not statistically significant. Nonetheless, median tests between pairs of samples were performed between pairs of medians. The results of such tests are as follows:

- Between internal auditors and managers, n=74, χ^2=.0010, 2-tail prob.=.9747
- Between internal auditors and MIS managers, n=67, χ^2=.2923, 2-tail prob.=.5887
- Between managers and MIS managers, n=57, χ^2=.0625, 2-tail prob.=.8025

The above results confirm no differences exist, and the hypothesis is rejected. Hence no statistically significant differences exist in the median of the respondents' perceptions of the MIS audits' influence on the quality of managers' decisions.

The test performed in relation to H8.5 reveals that there are statistically significant differences (at and beyond the .001 level 2-tail test). Before accepting this hypothesis, the same process of testing between each pair of sample medians was performed, and the results were as follows:

- Between internal auditors and managers, n=75, χ^2=14.2647, 2-tail prob.=.0002
- Between internal auditors and MIS managers, n=67, χ^2=.3279, 2-tail prob.=.5669
- Between managers and MIS managers, n=58, χ^2=.0177, 2-tail prob.=.8941

These results show that the significant differences exist only between internal auditors and managers, and not between any other pair. Hence, acceptance of H8.5. is for a difference between medians of internal auditors and managers only, and rejection of H8.5 for the others.

The results of H8.6 show a supportive but non-statistically significant difference between respondents. The results of the median test between every possible pair of samples were as follows:

- Between internal auditors and managers, n=74, χ^2=.9620, 2-tail prob.=.3267
- Between internal auditors and MIS managers, n=69, χ^2=4.0616, 2- tail prob.=.0439
- Between managers and MIS managers, n=59, χ^2=.6705, 2-tail prob.=.4129

Hence, the hypothesis of a difference between respondents in their perceptions of the influence MIS audits has on MIS improvements, is accepted in relation to the difference between internal auditors and MIS managers, but rejected for the others.

Reasons which may lie behind the differences or the no-differences uncovered in the last three hypotheses require further study as they were not covered in this research.

The final group of hypotheses test for the existence of a relationship between the respondents' perceptions of the audit influences and the auditor-manager working relationship. The hypotheses and the results are presented in the following table.

TABLE 5.10

Testing of hypotheses related to the influences of the MIS audits and the manager-auditor working relationship

Hypothesis	Sample	Statistic used	Statistical results			Conclusion
			τ	N	2-tail prob.	
H8.7. There is a relationship between the level of understanding MIS audits and managers' perceptions of its effects on the quality of their decisions.	Managers	Kendall's Tau	.1133	32	.363	Rejected
H8.8. There is a relationship between the level of closeness between managers and internal auditors and managers' perceptions of the effects of MIS audits on the quality of their decisions.	Managers	Kendall's Tau	.1935	32	.120	Rejected
H8.9. There is a relationship between the level of understanding MIS audits and managers' perceptions of its effects on their confidence in the data received	Managers	Kendall's Tau	.0340	33	.781	Rejected
H.8.10 There is a relationship between the level of closeness between managersand internal auditors and managers' perceptions of its effects on their confidence in the data received.	Managers	Kendall's Tau	.1649	33	.178	Rejected

TABLE 5.10 (continued)

Testing of hypotheses related to the influences of the MIS audits and the manager-auditor working relationship

Hypothesis	Sample	Statistic used	Statistical results			Conclusions
			τ	N	2-tail prob.	
H8.11. There is a relationship between the level of understanding of MIS audits and managers' perceptions of its effects on the improvements in MIS.	Managers	Kendall's Tau	0	33	*	Rejected
H8.12. There is a relationship between the level of closeness between managersand internal auditors and their perceptions of its effects on the improvements in MIS.	Managers MIS managers	Kendall's Tau Kendall's Tau	.3426 .2331	32 26	.006 .096	Accepted

The above results reveal that no statistically significant relationships (with one exception only) exist between the influence of MIS audits and both managers' level of understanding MIS audits, and the closeness of the working relationship between managers and internal auditors. Hence, H8.7. to H8.11 were rejected. The exception in H8.12 is the relationship between the closeness of the working relationship and improvements in MIS because of past audits. The results were a significant relationship for the managers' sample, and a finding considered supportive of the relationship for the MIS managers' sample. Hence H8.12 was accepted.

An explanation for the rejection of H8.7. and H8.8. is that different factors play different roles in shaping and influencing the quality of managers' decisions. The MIS audits play an indirect role in this context through providing more valuable and needed information to the decision-maker. Although data led to rejecting H8.9. to H8.11, a relationship would have been expected since one would assume the level of understanding of the work of the auditor and the closeness of the working relationship between them and the managers would play a direct role in the managers' perceptions of the benefits arising from such audits.

5.3.5.2. Hypotheses relating to the benefits (as scaled and ranked) of MIS audits

Four hypotheses formulated to test for the relationship(s) between the benefits (scaled against costs) and both the manager-auditor working relationship and the managers' and

MIS managers' degree of satisfaction with their MIS were tested using the Kendall's Tau (τ) correlation coefficient. The following table which presents the results of such tests reveals that:

(a) The hypothesis postulating a relationship between these benefits and managers' level of understanding MIS was rejected, a result similar to the results relating to the influences of the audits (H8.7., H8.9., H8.11). Similarly, a relationship would also have been expected

(b) The level of closeness between internal auditor and manager was positively correlated with the managers' perceptions of the benefits (scaled against costs). Hence H9.2. was accepted. The same hypothesis but involving the internal auditor and MIS manager relationship was rejected. These mixed results are yet another indication that further studies are required before any generalisation can be made about the relationships investigated.

(c) H9.4. postulating a "no relationship" between perceived benefits and the respondents' degree of satisfaction with MIS was accepted. The independence of these two variables was expected. A point worth mentioning is the negative relationship uncovered in relation to MIS managers (suggestive but not significant) which suggests that an ascendance in perceptions of the benefits was accompanied by a descending satisfaction with MIS, or vice versa.

TABLE 5.11

Testing of hypotheses related to the benefits - scaled against costs - of MIS audits as perceived by managers and MIS managers and their working relationship with auditors; satisfaction with MIS

Hypothesis	Sample	Statistic used	Statistical results			Conclusion
			τ	N	2-tail prob.	
H9.1. There is a relationship between the benefits - scaled against costs - of MIS audits and managers' level of understanding these audits	Managers	Kendall's Tau	-.0149	33	.903	Rejected
H9.2. There is a relationship between the benefits -scaled against costs - of MIS audits and manager-auditor closeness of relationship	Managers	Kendall's Tau	.2603	33	.034	Accepted
H9.3. There is a relationship between the benefits - scaled against costs - of MIS audits and MIS manager-auditor closeness of relationship	MIS managers	Kendall's Tau	.0386	24	.792	Rejected
H9.4. There is no relationship between the benefits - scaled against costs - of MIS audits and managers and MIS managers' satisfaction with MIS	Managers MIS managers	Kendall's Tau Kendall's Tau	.1691 -.2162	39 34	.130 .073	Accepted Accepted

The fifth hypothesis (H9.5.) in this section postulates that "There is a difference between managers and MIS managers in their perceptions of the benefits - scaled against costs - of MIS audits". A median test between the two samples was performed and the result was n=73, χ^2=.7714, 2-tail probability=.3798. These results led to the rejection of the hypothesis and the acceptance of a "no difference" existing between the two types of respondents in their perceptions of the benefits of MIS audits.

The final hypothesis(H9.6) postulates a difference between managers and MIS managers in their ranking of the benefits of MIS audits; it states that "There is a difference between managers and MIS managers in their ranking of the benefits of MIS audits". The following table presents the results of the median test and reveals that there are statistically significant differences between the two types of respondents in relation to items 1, 4, and 5. Hence, it can be said that this hypothesis is accepted for these items and rejected for the remaining items. These differences confirm the results of rankings presented descriptively in the previous chapter* where managers ranked them second, fourth, and fifth respectively compared with the MIS managers' ranking of first, fifth, and sixth respectively. As these items are benefits which may arise from both compliance and operational types of audit and no

---

* Please refer to Section 4.4.6.2., pp.187

ideal ranking of these benefits do exist, it may be said that the value of these results lies in providing statistical evidence of a difference existing in this context.

TABLE 5.12

Median test between managers and MIS managers in their rankings of the benefits arising from the audit of MIS (H9.6.)

Item No:	Cases	χ^2	2-tail prob.
1. Uncovers and eliminates actions which do not conform with corporate policies and procedures.	58	5.6466	.0175*
2. Increases management control of the MIS	53	.0036	.9524
3. Increases MIS efficiency (uncovers weaknesses and suggests improvements)	56	0	1.0000
4. Increases understanding and utilisation of MIS which leads to improved decision-making	52	8.2086	.0042*
5. Improves timeliness, formats, and accuracy of management reports	52	4.9895	.0255*
6. Insures and improves internal controls	58	.5336	.4651

* Significant at and beyond the .05 level (2-tail test)

5.3.6. Hypotheses relating to the ideal MIS audits

Two hypotheses were formulated in relation to the ideal MIS operational audit. The first investigated the relationship between the degree of importance attached by auditors to the different categories and items inside each, and the internal audit evaluation system. No results are available due to non-satisfaction of the requirements for use of the Chi square statistic.(7)

The second (H.10.1) postulates that "There is a difference between respondents as to the perceived degree of importance attached to the different categories and items inside each category representing the ideal MIS operational audits". Median tests between all three samples of respondents and between each pair were performed and the results are presented in the following table. Since investigation of this hypothesis includes forty nine different categories and items, no total acceptance or rejection can be envisaged. Hence, in view of these results, the hypothesis is partially accepted, and acceptance is only for those items and categories statistically significant at the .05 level (2-tail test).

TABLE 5.13

Median test results between respondents as to their perceptions of the ideal MIS audits (H10.1)

	All respondents d.f.=2			I.A. and Managers			I.A. and MIS managers			Managers and MIS managers		
	Cases	χ^2	2-tail prob.	Cases	χ^2	2-tail prob.	Cases	χ^2	2-tail prob.	Cases	χ^2	2-tail prob.
I. Data collection	126	12.3868	.0020**	90	4.9119	.0267**	87	10.3779	.0013**	75	.6203	.4309
(a) over-collection of data	124	2.2666	.3220	88	1.5389	.2148	85	.5875	.4434	75	.0318	.8584
(b) under-collection of data	121	4.2249	.1209	88	.3271	.5674	82	3.1382	.0765*	72	.2073	.6489
(c) accuracy of data	126	.8513	.6533	90	.3072	.5794	87	.0070	.9334	75	.3627	.5470
(d) coding of data	126	5.6131	.0604*	90	3.8549	.0496**	87	2.7823	.0953*	75	.0001	.9923
(e) errors in data entry	125	.3339	.8462	89	.0739	.7857	86	.0478	.8270	75	.0300	.8624
(f) efficiency in data collection and entry	126	1.7927	.4081	90	.0581	.8095	87	.0412	.8391	75	.7812	.3768
(g) evaluation of data collection and entry personnel	122	1.0989	.5773	89	.6373	.4247	83	.2006	.6543	72	.0016	.9685
(h) evaluation of data collection and entry management	122	9.8187	.0074**	89	6.9997	.0082**	83	3.9083	.0480**	72	.0101	.9200

* Significance $>.05<.10$ (2-tail test) considered suggestive and supportive

** Significance at and beyond the.05 level (2-tail test)

TABLE 5.13 (continued)

Median test results between respondents as to their perceptions of the ideal MIS audits (H10.1) (continued)

	All respondents d.f.=2			I.A. and Managers			I.A. and MIS managers			Managers and MIS managers		
	Cases	χ^2	2-tail prob.	Cases	χ^2	2-tail prob.	Cases	χ^2	2-tail prob.	Cases	χ^2	2-tail prob.
II. Data processing and storage	124	.3073	.8576	89	.0965	.7560	85	.0099	.9207	74	.0055	.9411
(a) security	124	2.1718	.3376	89	.0452	.8316	85	.7531	.3855	74	1.4316	.2315
(b) storage of unneeded data	123	.6721	.7146	88	.0470	.8284	84	.0376	.8462	74	.3264	.5678
(c) destruction of needed data	124	.3280	.8487	89	.0237	.8776	85	.0002	.9890	74	.0978	.7545
(d) computer programs	122	3.5301	.1720	89	.0671	.7956	83	2.5517	.1102	72	1.0779	.2992
(e) evaluation of data processing organisation	121	.2798	.8694	88	.0400	.8414	82	.0461	.8300	72	.0458	.8306
(f) evaluation of data processing personnel	121	2.9243	.2317	88	.0218	.8826	82	1.8256	.1767	72	.9052	.3414
(g) efficiency of storage methods	122	.8758	.6454	89	.4784	.4892	83	.0462	.8298	72	2.0140	.1559
(h) evaluation of data processing management	121	9.8465	.0073**	88	4.5021	.0339**	82	7.5385	.0060**	72	.2238	.6362

** Significance at and beyond the .05 level (2-tail test)

TABLE 5.13 (continued)

Median test results between respondents as to their perceptions of the ideal MIS audits (H10.1) (continued)

	All respondents d.f.=2			I.A. and Managers			I.A. and MIS managers			Managers and MIS managers		
	Cases	χ^2	2-tail prob.	Cases	χ^2	2-tail prob.	Cases	χ^2	2-tail prob.	Cases	χ^2	2-tail prob.
III. Reporting	124	11.4934	.0032**	90	7.6371	.0057**	85	6.7847	.0092**	73	Exact	1.0000
(a) cost efficiency	125	10.9300	.0042**	89	9.2205	.0024**	86	.4809	.4880	75	.3806	.5373
(b) timeliness	123	11.0484	.0040**	89	9.6166	.0019**	84	2.5295	.1117	73	1.2069	.2719
(c) format	123	25.3581	.0000**	89	21.9536	.0000**	84	9.9946	.0016**	73	5.1013	.0239**
(d) understandability	125	15.0290	.0005**	89	11.0822	.0009**	86	8.6482	.0033**	75	Exact	1.0000
(e) relevance to manager's needs	124	0	1.0000	90	5.3458	.0208**	85	5.1064	.0238**	75	Exact	1.0000
(f) accuracy	126	2.3970	.3016	90	.0130	.9093	87	1.3136	.2518	75	1.3191	.2507
(g) unbiased data	123	2.1438	.3424	89	1.3963	.2373	84	2.7407	.0978*	73	.0115	.9146
(h) completeness	125	.9637	.6176	89	.0452	.8316	86	.1428	.7055	75	.5409	.4621

* Significance $>.05<.10$ (2-tail test) considered suggestive and supportive

** Significance at and beyond the .05 level (2-tail test)

TABLE 5.13 (continued)

Median test results between respondents as to their perceptions of the ideal MIS audits (H10.1) (continued)

	All respondents d.f.=2			I.A. and Managers			I.A. and MIS managers			Managers and MIS managers		
	Cases	χ^2	2-tail prob.	Cases	χ^2	2-tail prob.	Cases	χ^2	2-tail prob.	Cases	χ^2	2-tail prob.
IV. Communication	123	8.6942**	.0129**	90	3.8992	.0483**	84	6.2538	.0124**	72	.6539	.4187
(a) relations between managers and data processing	124	.9641	.6175	90	.2280	.6330	85	.4830	.4871	73	0	.9974
(b) relations between accounting and data processing	123	6.2604	.0437**	89	1.9136	.1666	84	4.9010	.0268**	73	.0095	.9225
(c) semantic problems in reports	125	6.3504	.0418**	89	1.0769	.2994	86	4.7100	.0300**	75	.0758	.7831
(d) managers' opinions of the MIS	123	23.1876	.0000**	89	20.3832	.0000**	84	7.5185	.0061**	73	.0508	.8217
V. Decision-making	123	14.5181	.0007**	90	9.9598	.0016**	84	9.2270	.0024**	72	Exact	1.0000
(a) whether the reports generated lead to good decisions on the part of managers	123	12.9036	.0016**	89	6.9394	.0084**	84	9.7830	.0018**	73	.1183	.7309
(b) whether managers get too much data	125	12.2030	.0022**	89	8.3163	.0039**	86	7.4261	.0064**	75	.1327	.7156
(c) whether managers get all the data they need	125	4.6388	.0983*	89	2.7532	.0971*	86	2.6191	.1056	75	.0601	.8063
(d) whether managers use the data they receive	124	11.0896	.0039**	88	9.3334	.0023**	85	.0160	.8993	75	.4195	.5172

* Significance $>.05<.10$ (2-tail test) considered suggestive and supportive.

** Significance at and beyond .05 level (2-tail test)

TABLE 5.13 (continued)

Median test results between respondents as to their perceptions of the ideal MIS audits (H10.1) (continued)

	All respondents d.f.=2			I.A. and Managers			I.A. and MIS managers			Managers and MIS managers		
	Cases	χ^2	2-tail prob.	Cases	χ^2	2-tail prob.	Cases	χ^2	2-tail prob.	Cases	χ^2	2-tail prob.
VI. System Design	120	2.3807	.3041	89	.7579	.3840	82	1.4755	.2245	69	.0182	.8926
(a)whether new systems are efficiently designed	121	.4765	.7880	88	.0463	.8296	83	.0080	.9289	71	.0185	.8919
(b) whether the purchase, hire, or lease of new EDP equipment is cost justified	121	6.4527	.0397**	88	3.3160	.0686*	83	4.2923	.0383**	71	.0060	.9384
(c) whether the new systems are designed with the user in mind	122	1.2640	.5315	89	.1397	.7085	84	.7872	.3750	71	.0718	.7887
(d) whether the new systems are adequately explained to the users	121	11.5288	.0031**	88	6.1605	.0131**	83	8.6869	.0032**	71	.0898	.7644
(e) whether the operation of new systems meets original specifications	122	.5888	.7450	89	.0151	.9023	84	.2950	.5870	71	.0319	.8583

* Significance $>.05$ $<.10$ (2-tail test) considered suggestive and supportive

** Significance at and beyond the .05 level (2-tail test)

A discussion of the statistically significant differences between respondents presented in the table will be conducted in relation to each category and to items inside it, utilising findings from the previous chapter (Section 4.4.7).

a) Data Collection

- "Data collection" and "Evaluation of data collection and entry management" were rated significantly differently by managers and MIS managers compared with the internal auditors. Managers and MIS managers perceived "data collection" to be more important than did internal auditors. "Evaluation of data entry management" was rated significantly lower than other items in this category by all three groups of respondents with internal auditors again showing a difference, rating it of less importance. This may be because internal auditors lowered their ratings so as not to appear to seek the audit of the personnel.
- Managers rated "coding of data" as more important than did internal auditors.
- Differences between MIS managers and internal auditors in two items "coding of data" and "undercollection of data" were not statistically significant but they were suggestive and supportive of a difference.

b) Data processing and storage

- The only item inside this category with statistically significant differences is "evaluation of data processing management". The differences are due to

managers and MIS managers rating it higher than internal auditors, possibly for reasons discussed previously.

c) Reporting

- "Reporting" as a category and the following items inside it: "Understandability", "relevance to manager's needs" were all rated by managers and MIS managers higher compared with the ratings given by internal auditors. The differences were statistically significant although this does not mean that the internal auditor perceived these items and category as not important. Merely, they were of importance but not so intensely as that perceived by the other types of respondents.
- The three types of respondents differed significantly in their ratings of "Format" with managers rating it higher than MIS managers, who in turn rated it higher than internal auditors.
- "Cost efficiency" and "Timeliness" were rated higher by managers than by internal auditors, the differences were statistically significant probably for the above mentioned reasons.

d) Communication

- "Communication" as a category and "managers' opinions of the MIS" as an item inside it, were rated differently by each type of respondent, the differences between internal auditors and managers, and between the former

and MIS managers were statistically significant. In order of importance managers followed by MIS managers rated "managers' opinions of the MIS" higher than internal auditors. An explanation which can be offered for the low rating by internal auditors to this item, is that the need for a tool to be used in this context may have been the reason for its relatively low rank with "communication"; MIS managers followed by managers rated it higher than auditors. Auditors probably do not feel so intense about "communication" although viewing it as "important".

- MIS managers and auditors differed in their ratings of "relations between accounting and data processing" and "semantic problems in reports" with the MIS managers providing a higher rating. Here also, the need for a tool to be used in this audit or review can be the reason behind these differences.

e) Decision-making

- Managers rated this category and its items higher than the ratings given by internal auditors, while MIS managers rated only the category and the first two items higher than internal auditors ratings. Differences in all cases were statistically significant at and beyond the .05 level (2-tail test). Since managers, and to some extent MIS managers, are very highly interested in receiving data which allows the

decision-maker to gain all the information he needs for his decision, it is likely that while auditors are interested, their degree of interest is lesser because such data is not of direct relevance to them.

f) System design

- "Whether the purchase, hire, or lease of new EDP equipment is cost justified" was rated higher by managers followed by MIS managers compared to the ratings of internal auditors. The differences were suggestive but not statistically significant between the first and the last type of respondents, while it was significant at the stated level between the second and last types.

  The same pattern of ratings was obtained in relation to the item "whether the new systems are adequately explained to the users" but all the differences in this case were statistically significant.

To conclude, differences uncovered in this section between internal auditors, managers, and MIS managers do not represent in themselves a cause for concern since the differences between respondents,(with each type representing a group of interests in the company with specific aims and objectives)are to be expected. Moreover, their agreement, in broad terms, of the degree of importance internal controls would receive in the ideal MIS operational audit can be taken as an indication of the

partial success auditors have achieved in communicating their objectives to the different parties in their companies. This partial success highlights those areas where divergence between respondents exists, and where more attention can fruitfully be applied to reduce differences.

5.3.7. Hypotheses relating to the manager-auditor working relationship

Three hypotheses were formulated to test for relationships and differences between respondents concerning this aspect of investigation.

The first hypothesis (H11.1) postulates that "There is no difference between auditors and auditees in their perceptions of the closeness of their working relationship". A median test was used to test for the existence of no differences. The result for the test between internal auditors and managers was n=81, χ^2=1.2980, 2-tail prob.=.2546, while the result for the test between the internal auditors and MIS managers was n=74, χ^2=3.6603, 2-tail prob.=.0557. These results reveal that while there exist differences between respondents in their perceptions, these differences are not statistically significant and hence the hypothesis is rejected. This result confirms findings presented in the previous chapter.*

---

* Please refer to section 4.6, p.216.

The second hypothesis (H11.2) postulates that "There is a relationship between managers' perceived level of understanding MIS audits and their perceptions of the closeness of their working relationship with internal auditors."

Kendall's τ (Tau) correlation coefficient was used to test for the existence of the relationship and its significance. The result was a τ=.3479, significant at the .005 level, with n=33. The statistically significant relationship leads to the acceptance of the hypothesis. This means that with every increase in effort spent by auditors in improving and enhancing the closeness of their working relationship with auditees (managers), level of understanding of auditees and by implication their acceptance of the role played by auditors in performing their MIS audits increases.

A third hypothesis (H11.3) postulating that "There is no relationship between respondents as auditees and their perceptions of the benefits -scaled against costs - of MIS audits" was formulated in order to uncover the attitude of respondents towards auditors and auditing. This could not be tested because only three respondents of the thirty-three were not auditees. Nonetheless, the data presented in the previous chapter* did reveal that respondents (auditees and non-auditees) do not appear to hold hostile or negative feelings towards auditors and auditing. On the contrary, their views appear to be positive and they are very appreciative of the role played by auditors in the performance of their duties. These same positive attitudes towards auditors are also held by MIS managers.

*Please refer to section 4.6, p. 216.

Although this hypothesis could not be accepted or rejected directly, extrapolation leads to indirectly accepting the "no relationship" between respondents auditees and the benefits perceived from the audits of MIS.

5.4. Summary and Conclusions

Results presented and analysed in this chapter can be summarised as follows:

a) Relationships between variables representing the audit of MIS, its benefits, and characteristics of companies in the sample can be said to be grouped into three clusters (A,B,C,) as the following figure shows.

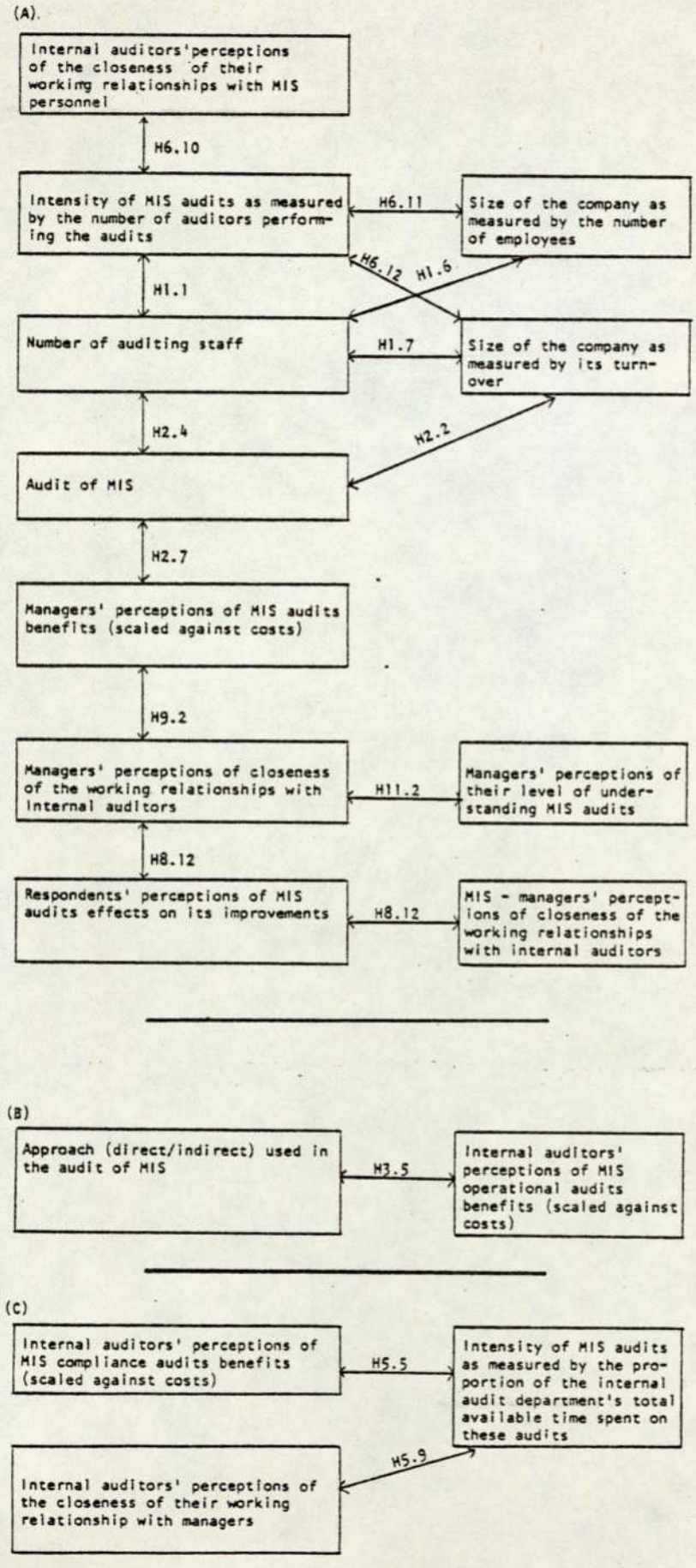
b) Statistically significant differences in the medians exist between:

- Internal auditors and managers in their perceptions of the influence that MIS audits have on the managers' confidence in the data they receive. (H8.5)
- Internal auditors and MIS managers in their perceptions of the influence MIS audits have on MIS improvements (H8.6)
- Managers and MIS managers in their rankings of three items representing benefits arising from the audits of MIS (H9.6)
- Internal auditors, managers, and MIS managers as to the perceived degree of importance they attach to some categories and items inside each category representing the ideal MIS operational audits. (H10.1)

c) The three hypotheses (H8.1 to H8.3) tested descriptively can be said to reflect positive perceptions and attitude by managers as to the effects MIS audits have on their decision-making and their confidence in the data received, and together with MIS managers, both hold positive perceptions also as to the effects these audits have on MIS improvements.

Figure 5.1

Relationships between variables representing the audit of MIS, its effects, and characteristics of companies



REFERENCES

1. Chambers, A., The structure of internal auditing, Accountancy, October 1974, pp.40-42.

2. Siegel, S., Non-parametric statistics for the behavioural sciences, McGraw-Hill Book Co., N.Y., 1956, pp.104-111.

3. Ibid.

4. Ibid.

5. Ibid.

6. Gibbons, J.D., Non-parametric methods for quantitative, analysis, Holt, Rinehart & Winston, N.Y., 1976, pp.114-118.

7. Siegel, S., op.cit., pp.104-111.

SUPPLEMENT TO THE CHAPTER

TABLE V.I.

Median test results related to H4.1

Categories and items describing MIS audit scope	Cases (N)	Exact	χ^2	2-tail prob.
I. Data collection	47		.1090	.7413
(a) overcollection of data	32		.9697	.3248
(b) undercollection of data	36		.1125	.7373
(c) accuracy of data	46	✓		1.0000
(d) coding of data	44		.8250	.3637
(e) errors in data entry	45		.0011	.9731
(f) efficiency of data collection and entry	44		.0330	.8559
(g) evaluation of data collection and entry personnel	34		.0067	.9348
(h) evaluation of data collection and entry management	36		.4026	.5257
(i) other	4	✓		.5000
II. Data processing and storage	46		.4980	.4804
(a) security	45	✓		1.0000
(b) storage of unneeded data	33		1.2375	.2660
(c) destruction of needed data	42		.1704	.6798
(d) computer programs	41		.0197	.8885
(e) evaluation of data processing organisation	42		.9844	.3211
(f) evaluation of data processing personnel	36		.0796	.7778
(g) efficiency of storage methods	40		.7204	.3960
(h) evaluation of data processing management	35		.0048	.9448
(i) other	7	✓		1.0000

TABLE V.I.(continued)

Median test results related to H4.1 (continued)

Categories and items describing MIS audit scope	Cases (N)	Exact	χ^2	2-tail prob.
III Reporting	47		.0550	.8146
(a) cost efficiency	41		.0030	.9563
(b) timeliness	43		.1665	.6832
(c) format	37		.0787	.7790
(d) understandability	43		1.5087	.2193
(e) relevance to manager's needs	47		.6891	.4065
(f) accuracy	47	✓		1.0000
(g) unbiased data	33		.0322	.8575
(h) completeness	43		.3157	.5742
(i) other	3	✓		.6667
IV Communication	46		.3505	.5538
(a) relations between managers and data processing	44		.1398	.7085
(b) relations between accounting and data processing	43		.0528	.8183
(c) semantics problems in reports	42		.2129	.6445
(d) managers' opinions of the MIS	44		.0205	.8863
(e) other	3	✓		.6667

TABLE V.I. (continued)

Median test results related to H4.1 (continued)

Categories and items describing MIS audit scope	Cases (N)	Exact	χ^2	2-tail prob.
V. Decision-making	46		.0294	.8639
(a) whether the reports generated lead to good decisions on the parts of managers	44		.1291	.7194
(b) whether managers get too much data	45		.1879	.6647
(c) whether managers get all the data they need	45		.6856	.4077
(d) whether managers use the data they receive	45		1.5469	.2136
(e) other	3	✓		.6667
VI. MIS design	45		2.2029	.0884
(a) whether new systems are efficiently designed	42		.0182	.8926
(b) whether the purchase, hire, or lease of new EDP equipment is cost justified	39		1.8662	.1719
(c) whether the new systems are designed with the user in mind	43		.0063	.9368
(d) whether the new systems are adequately explained to the users	42		.0618	.8037
(e) whether the operation of new systems meets original specifications	41		.9062	.3411
(f) other	5	✓		.6000

TABLE V.II

Median test results related to H4.2

Benefits arising from the operational audit of MIS	Cases (N)	Exact	χ^2	2-tail prob.
Increases MIS efficiency (uncovers weaknesses and suggests improvements).	41		.0069	.9340
Increases managers' understanding and utilisation of MIS which leads to improved decision-making.	40		0	1.0000
Improves timeliness, accuracy and formats of management reports.	40		.1671	.6827
Improves new systems design (especially control features).	40		.3184	.5726
Improves MIS/user interface.	38		.3251	.5685
Increases internal control system reliability.	41		.2162	.6419
Other	2	✓		1.0000

TABLE V.III

Median test results related to H4.3

Benefits arising from the compliance audits of MIS	Cases (N)	Exact	χ^2	2-tail prob.
Confirm compliance with internal controls	46		.8635	.3604
Improve internal controls	45		1.0668	.3017
Improve accuracy and reliability of the data	47		.1119	.7379
Uncover and eliminate actions which do not conform with corporate policies and procedures	44		.0073	.9318
Improve management's utilisation of the MIS	41		.0030	.9563
Increase knowledge of MIS management (act as a communication link between managers and MIS management)	40		.0291	.8645
Other	2	✓		1.0000

TABLE V.IV

Median test results related to H4.4

Influence of the audits	Cases (N)	χ^2	2-tail prob.
MIS audits cause managers to place more confidence in the data they receive	42	.1127	.7370
MIS audits cause better decisions	42	.3844	.5352
MIS audits cause improvements in MIS	42	1.7031	.1919

TABLE V.V

Median test results related to H4.5

Categories and items describing MIS audit scope	Cases (N)	Exact	χ^2	2-tail prob.
I. Data collection	45		3.3903	.0656
(a) overcollection of data	43		.0147	.9036
(b) undercollection of data	43		.4886	.4845
(c) accuracy of data	45		.4922	.4830
(d) coding of data	45		.3590	.5490
(e) errors in data entry	44		.8250	.3637
(f) efficiency of data collection and entry	45		1.9064	.1674
(g) evaluation of data collection and entry personnel	44		.0200	.8876
(h) evaluation of data collection and entry management	44		.1897	.6632
(i) other	NOT ENOUGH CASES			
II. Data processing and storage	44		7.5635	.060 (sig. at .05 level
(a) security	44		1.1539	.2827
(b) storage of unneeded data	43		.0423	.8370
(c) destruction of needed data	44		.1222	.7266
(d) computer programs	44		.4756	.4904
(e) evaluation of data processing organisation	43		.0267	.8703
(f) evaluation of data processing personnel	43		.9267	.3357
(g) efficiency of storage methods	44		1.1146	.2911
(h) evaluation of data processing management	43		1.8615	.1725
(i) other	3	✓		.6667

TABLE V.V. (continued)

Median test results related to H4.5. (continued)

Categories and items describing MIS audit scope	Cases (N)	Exact	χ^2	2-tail prob.
III Reporting	45		.0650	.7988
(a) cost efficiency	44		.0737	.7860
(b) timeliness	44		.0619	.8036
(c) format	44		.8250	.3637
(d) understandability	44		.5967	.4399
(e) relevance to managers' needs	45		.9040	.3417
(f) accuracy	45		.1468	.7016
(g) unbiased data	44		.5456	.4601
(h) completeness	44		.0917	.7621
(i) other	NOT ENOUGH CASES			
IV Communication	45		.0004	.9834
(a) relations between managers and data processing	45		.3893	.5327
(b) relations between accounting and data processing	44		.0413	.8390
(c) semantics problems in reports	44		.0413	.8390
(d) managers' opinions of the MIS	44		.2309	.6309
(e) Other	NOT ENOUGH CASES			

TABLE V.V. (continued)

Median test results related to H4.5(continued)

Categories and items describing MIS audit scope	Cases (N)	Exact	χ^2	2-tail prob.
V. Decision-making	45		.3590	.5490
(a) whether the reports generated lead to good decisions on the part of managers	44		.0619	.8036
(b) whether managers get too much data	44		.0917	.7621
(c) whether managers get all the data they need	44		.0694	.7923
(d) whether managers use the data they receive	43		.0277	.8679
(e) other	NOT ENOUGH CASES			
VI. MIS design	45		.0915	.8891
(a) whether new systems are effeciently designed	44		.7341	.3916
(b) whether the purchase, hire, or lease of new EDP equipment is cost justified	44		.0115	.9148
(c) whether the new systems are designed with the user in mind	45		1.6113	.2043
(d) whether the new systems are adequately explained to the users	44		2.2917	.1301
(e) whether the operation of new systems meets original specifications	45		.0323	.8574
(f) other	3	✓		1.0000

TABLE V.VI

Kendall's τ (Tau) correlation coefficients results between intensity of MIS audits and scope of the audit

Intensity of MIS audits / Categories and items describing MIS audit scope	Intensity as measured by the proportion of the department's total available time spent on these audits(H5.3)			Intensity as measured by the number of auditors performing these audits (H6.3)		
	τ	N	2-tail prob.	τ	N	2-tail prob.
I. Data collection	.1335	43	.208	.0036	46	.972
(a) overcollection of data	.0119	31	.926	-.1346	32	.279
(b) undercollection of data	-.0040	34	.974	.0762	35	.520
(c) accuracy of data	-.0730	42	.496	-.0972	45	.347
(d) coding of data	.0294	41	.787	.0192	44	.855
(e) errors in data entry	-.0350	42	.744	-.1917	45	.064
(f) efficiency of data collection and entry	.2125	41	.051	.2375	44	.024**
(g) evaluation of data collection and entry personnel	.2890	31	.023**	.1575	34	.191
(h) evaluation of data collection and entry management	.1953	33	.111	.0587	36	.615
(i) other	NOT ENOUGH CASES			.1826	4	.710

** Significant at the .05 level

TABLE V.VI (continued)

Kendall's τ (Tau) correlation coefficients results between intensity of MIS audits and scope of the audi

Intensity of MIS audits / Categories and items describing MIS audit scope	Intensity as measured by the proportion of the department's total available time spent on these audits (H5.3)			Intensity as measured by the number of auditors performing these audits (H6.3)		
	τ	N	2-tail prob.	τ	N	2-tail prob.
II. Data processing and storage	-.0896	42	.403	-.0199	45	.848
(a) security	.0275	41	.801	.0978	44	.350
(b) storage of unneeded data	.0259	30	.841	.0896	33	.464
(c) destruction of needed data	.1416	40	.199	.0014	42	.990
(d) computer programs	.1188	38	.294	.0625	41	.566
(e) evaluation of data processing organisation	.0513	39	.646	-.0223	42	.836
(f) evaluation of data processing personnel	.0671	33	.584	.0547	36	.639
(g) efficiency of storage methods	.1091	37	.342	.0729	40	.508
(h) evaluation of data processing management	.2424	33	.048**	.0221	35	.852
(i) other	-.0598	7	.851	.1839	7	.562

** significant at the .05 level

TABLE V.VI. (continued)

Kendall's τ (Tau) correlation coefficients results between intensity of MIS audits and scope of the audit

Intensity of MIS audits / Categories and items describing MIS audit scope	Intensity as measured by the proportion of the department's total available time spent on these audits (H5.3)			Intensity as measured by the number of auditors performing these audits (H6.3)		
	τ	N	2-tail prob.	τ	N	2-tail prob.
III. Reporting	-.0053	43	.960	-.0273	46	.789
(a) cost efficiency	-.1200	38	.289	-.0092	40	.934
(b) timeliness	.1276	40	.247	.0058	42	.957
(c) format	-.0910	33	.457	.0329	36	.778
(d) understandability	-.0536	40	.627	.2191	42	.041**
(e) relevance to managers' needs	.1109	43	.295	.1172	46	.251
(f) accuracy	.0683	43	.519	-.1167	46	.253
(g) unbiased data	.3243	30	.012**	.0183	33	.881
(h) completeness	.1092	40	.322	-.3500	42	.002**
(i) other	.3333	3	.602	1.0000	3	.118
IV. Communication	.0688	42	.521	.0025	45	.981
(a) relations between managers and data processing	.2940	41	.001**	.0100	44	.924
(b) relations between accounting and data processing	.0971	40	.378	-.1656	43	.118
(c) semantics problems in reports	.1408	38	.214	.3202	41	.004**
(d) managers' opinions of the MIS	-.2360	40	.032	-.1495	43	.158
(e) other	.3333	3	.602	1.0000	3	.118

** Significant at the .05 level

TABLE V.VI. (continued)

Kendall's τ (Tau) correlation coefficients results between intensity of MIS audits and scope of the audit

Intensity of MIS audits / Categories and items describing MIS audit scope	Intensity as measured by the proportion of the department's total available time spent on these audits (H5.3)			Intensity as measured by the number of auditors performing these audits (H6.3)		
	τ	N	2-tail prob.	τ	N	2-tail prob.
V. Decision -making	.2951	42	.006**	-.0404	45	.696
(a) whether the reports generated lead to good decisions on the part of managers	.0453	40	.681	.0105	43	.922
(b) whether managers get too much data	.0181	41	.868	.1180	44	.259
(c) whether managers get all the data they need	.2234	41	.040**	.1959	44	.061
(d) whether managers use the data they receive	-.1332	41	.220	-.1778	44	.089
(e) other	.3333	3	.602	1.0000	3	.118
VI. MIS design	.1201	42	.263	.0993	44	.342
(a) whether new systems are efficiently designed	.0859	40	.435	-.0579	42	.590
(b) whether the purchase, hire, or lease of new EDP equipment is cost justified	-.0856	37	.456	-.1747	39	.118
(c) whether the new systems are designed with the user in mind	.0811	41	.456	.1020	43	.336
(d) whether the new systems are adequately explained to the users	-.0079	40	.944	.1695	42	.114
(e) whether the operation of new systems meets original specifications	.0956	39	.392	.0976	41	.369
(f) other	.2222	5	.587	.2222	5	.587

** Significant at the .05 level

TABLE V.VII

Kendall's τ (Tau) correlation coefficients results between intensity of MIS audits and benefits of operational audits

Intensity of MIS audits / Benefits arising from the operational audit of MIS	Intensity as measured by the proportion of the department's total available time spent on these audits (H5.6)			Intensity as measured by the number of auditors performing these audits (H6.6)		
	τ	N	2-tail prob.	τ	N	2-tail prob.
Increases MIS efficiency (uncovers weaknesses and suggests improvements)	-.0655	38	.563	.0160	40	.885
Increases manager's understanding and utilisation of MIS which leads to improved decision-making	-.0873	37	.448	-.0296	39	.791
Improves timeliness, accuracy and formats of management reports	.0191	37	.868	.0847	39	.448
Improves new systems design (especially control features)	-.0602	37	.601	-.0263	39	.814
Improves MIS/user interface	.0752	35	.525	.1386	37	.228
Increases internal control system reliability	.0978	38	.388	-.1551	40	.159
Other	-1.0000	2	.318	-1.0000	2	.318

TABLE V.VIII

Kendall's τ (Tau) correlation coefficients results between intensity of MIS audits and benefits of compliance audits

Intensity of MIS audits / Benefits arising from the compliance audits of MIS	Intensity as measured by the proportion of the department's total available time spent on these audits (H5.7)			Intensity as measured by the number of auditors performing these audits (H6.7)		
	τ	N	2-tail prob.	τ	N	2-tail prob.
Confirm compliance with internal controls	-.0432	42	.687	.0500	45	.629
Improve internal controls	.1732	41	.111	.0788	44	.451
Improve accuracy and reliability of the data	-.0038	43	.971	-.1400	46	.171
Uncover and eliminate actions which do not conform with corporate policies and procedures	-.3358	41	.002**	-.1224	43	.248
Improve management's utilisation of the MIS	-.1249	38	.270	-.1088	40	.323
Increase knowledge of MIS management (act as a communication link between managers and MIS management)	.0639	37	.578	.1673	39	.134
Other	-1.0000	2	.318	-1.0000	2	.318

** significant at the .05 level

TABLE V.IX

Kendall's τ (Tau) correlation coefficients results between intensity of MIS audits and the influences of the audits

Intensity of MIS audits / Influences of the audits	Intensity as measured by the proportion of the department's total available time spent on these audits(H5.8)			Intensity as measured by the number of auditors performing these audits (H6.8)		
	τ	N	2-tail prob.	τ	N	2-tail prob.
MIS audits cause managers to place more confidence in the data they receive	.1010	39	.366	.1286	41	.237
MIS audits cause better decisions	.0298	39	.790	.1678	41	.123
MIS audits cause improvements in MIS	.1262	40	.252	.0980	42	.361

CHAPTER 6

'EVALUATION OF M.I.' QUESTIONNAIRE - METHODOLOGY AND PROCEDURE

6.1. Introduction.

6.2. Factors used to select a company as a field site.

6.3. Choosing Company XXX

- 6.3.1. Details of Company XXX
- 6.3.2. Details of reports "A" and reports "B"
  - 6.3.2.1. The "A" reports
  - 6.3.2.2. The "B" reports

6.4. Developing the questionnaire to investigate:

- 6.4.1. Details of the respondent's job
- 6.4.2. Objectives of the reports
- 6.4.3. Monetary evaluation of the reports
- 6.4.4. Semantic differential instrument
- 6.4.5. Custom tailored reports
- 6.4.6. Respondents' involvement with and attitudes towards the reports

6.5. Sample selection

- 6.5.1. Sampling plan

6.6. Procedure

- 6.6.1. Initial meeting with Company XXX's representative
- 6.6.2. Agreed timetable for pilot study and administration of the questionnaire
- 6.6.3. Pilot study
- 6.6.4. Administration of the questionnaire
- 6.6.5. Tabulating responses

CHAPTER 6

'EVALUATION OF M.I.' QUESTIONNAIRE- METHODOLOGY AND PROCEDURE

6.1. Introduction

The aims of this chapter are threefold. Firstly, to discuss the process of the selection of company XXX; secondly, to describe and give reasons for choosing the sampling process used to select the participating managers and lastly, to describe the development of the questionnaire from its inception to the tabulating of responses.

6.2. Factors used to select a company as a field site

Several factors were considered in the selection of a field site for the research. The approach used in this study is in the phase of evolution, and a lot of research is needed to improve its reliability in measuring the value and attributes of management information before any kind of recommendations and generalisations can be made about its use. This means there is a need to conduct the research at one location or in one organisation only. This factor according to Good and Scotes(1) is important, because it helps diminish the effects of varying environments biasing the data, which could lead to questionable results.

The second factor which complements the first, is that the previous research studies conducted in the U.S. using this approach were also applied in one location (2). Research conducted under the same conditions here may reveal whether this new approach can be used with the same degree of success in a British

company, and if not, the reasons behind this failure. Some may argue that replication of previous studies does not go beyond checking findings and is likely to make no contribution to new knowledge. The assertion here is that a hypothesis which has once been tested and shown to relate to the empirical data can then be regarded as true and pass directly to theory seems to contradict the scientific theory of proof. One can argue that a piece of research work should be replicated by others, because only in this way can one become sure that the relationships established are general and not idiosyncratic or unique.

Examination of previous research suggests consideration of four criteria for selecting a company as a field site for research (3). This technique is based on opinion sampling and thus the first criterion is that the size of the management group reviewing the report generated by the MIS must be large enough to avoid distortion caused by extreme views. In addition, a report with a limited distribution can easily be evaluated within the company by word of mouth. When the group receiving the report is large, evaluation by this technique proves to be possible and feasible. The problem is what is the dividing line between large and small samples? It must be said that there is no easy answer to this question, and that the best solution offered by statisticians in this matter is for the sample to be larger than 30 (4).

The second criterion is that the management group should include at least three levels of management. This restriction is not required for methodological reasons but is included to allow testing for differences among levels.

The third criterion relates to the length of time that the report(s) has been in use within the organisation. Gallagher (1971) suggests "New systems often have a break-in period during which design errors are corrected and recipients learn to use the system. Any evaluation during this period will likely be erroneous due to the inexperience of the users and the possibility of major faults in the system. While this break-in period will vary, a nominal time of one year is chosen as the study criterion"(5). This criterion was satisfied in this study for reports "A" but for the purposes of testing the influence of a 'break-in period' and its affects, if any, on the evaluation process, the second set of reports - reports "B" - did not satisfy this criterion as they had only been in use for about five months.

The fourth and final criterion is that the information system satisfy the limitations described previously*. That is, the system must have been internally requested, be used by management principally in making decisions, and have computer-generated reports on a periodic basis.

---

* Please refer to Section 1.4, p.46.

6.3. Choosing Company XXX

The selection of the company for the field site of the research presented a problem to the researcher arising from the fact that this study represents an in-depth review of particular reports in one location, through sampling the opinions of the managers receiving the reports. This meant that the company participating in the research would incur costs in terms of the time their employees will take answering the questionnaire. The solution was to find a company which would have its own reasons for intending to review reports generated by its MIS, and which at the same time would satisfy the factors guiding the selection of the field site of the research.

In October 1977, a contact was established with the XXX Company. This company met all the requirements mentioned above. A letter was sent to the company requesting their help in the study accompanied by a detailed schedule of the research steps. This was followed by a despatch of the first draft of the questionnaire. By November 1977 the company agreed to participate in the research project and different meetings were arranged to discuss in detail the different aspects of the questionnaire.

6.3.1. Details of company XXX

The XXX company is a publicly owned firm operating in the United Kingdom with over 5000 employees. The computer based MIS has been in use for a number of years, with different aspects of their activities being gradually

transferred from manual systems to the computer. This pattern is still continuing, the final aim being the possession or the creation of a "Data Base MIS".

6.3.2. Details of reports "A" and reports "B"

6.3.2.1. The "A" reports. This set of reports has been used by company managers for a number of years. The reports are produced monthly and distributed to 307 managers. Each includes two reports (or sections). The first section reports on the Expenses, and consists of detailed monthly expenditure and the year to date accumulation; both are compared with the budget. Each main item of expense is broken down into its constituent elements. The second section represents the Income and is organised on the same lines as the previous one.

6.3.2.2. The "B" reports. This second set of reports had been in use for about five months prior to the date at which the study was conducted. They are also produced monthly and distributed to the same managers - 307. "B" reports include four reports (or sections). The first report (section) includes a detailed account of all the resources available to the department for the month. The second report (section) includes a detailed account of all the advances which were made by the department during the month. The third and fourth reports (sections) represent a summary of the first and second reports (sections) respectively, with another summary showing the main items compared with the budget.

The possibility of evaluating the two sets of reports individually was considered. That is, to have six questionnaires each asking only about one sub-report. This method was rejected on the grounds that the individual managers perceived each set of reports as an entity, not as separate reports. Each manager received two monthly reports, namely "A" and "B". To inquire about only one report or section of a report would, it was felt, be confusing and misleading to the managers.

6.4. Developing the questionnaire to investigate:

The questionnaire used in this study is a descriptive survey instrument. It was designed to be self-explanatory and easily read. It uses a format which tends to diminish any potential defensive behaviour by the respondents. All necessary instructions were included in the body of the questionnaire and questions were arranged in logical order. Due to the exploratory nature of the study, and the spacing allowed for emphasis, the questionnaire totalled eight pages.

The complete questionnaire is illustrated in Appendix (C) . Each group of questions is segmented and identified with a title. This was done to enhance readability and eye appeal and to emphasize a logical order of inquiry.

6.4.1. Details of the Respondent's Job

The questions in this section were under the heading 'About your job' and ask for the respondent's job title;

length of time in present appointment; number of subordinates answerable to him; length of time as a manager; and whether the respondent has ever had any involvement in the design and development of an information system. The answers to these questions are to be used in correlation analysis with other data from the questionnaire.

6.4.2. Objectives of the Reports

This section included one question asking the respondents to rate on a seven point scale how the two main objectives, namely monitoring performance of the operations and planning future operations were met by the two sets of reports under study. The scales ranged from 1(not at all) to 7(very well) with 4 as (somewhat).

6.4.3. Monetary evaluation of the reports

This section represents one of two important sections of the questionnaire and demonstrates the evolving research methodology. It starts with a purely theoretical assumption about the future provision of the reports being subject to a contractual agreement with the management information department in the company. A parenthetical disclaimer was included to inhibit any rumours about this assumption being a prelude to a full implementation afterwards.

The section includes two questions. The first asks for the maximum amount the respondent would be ready to pay annually for each set of reports. A wide range of monetary values is offered as a framework to this question. The second question asks the respondent to

describe the factors used to establish the monetary value estimate for each set of reports. A partial set of structured responses using some previously tested by Kelly (6) in similar research, and two new ones (added to represent the particular type of operations performed in the company) were used together with an open option response. The pilot questionnaire was modified to enable respondents to make more than one response.

6.4.4. Semantic Differential Instrument

The remainder of the second and third pages were devoted to directions for answering the semantic differential questions. These directions were modelled after those of Osgood et al (7). The test instrument itself is presented on the fourth page for reports "A" and the fifth page for reports "B". Each includes thirty-four bi-polar adjective pairs and is randomised in both order and direction (favourable/unfavourable). No test for order bias is conducted in this study, since previous tests were conducted and yielded negative results (8).

The selection of the bi-polar adjective pairs were governed by the two following considerations: (1) As this study represents the third attempt to use the Semantic Differential Technique to evaluate in quantitative terms the value and attributes of MIS reports, use can be made of the results obtained in the two previous studies where applicable, in order to make comparisons where necessary, and to provide further

empirical testing of this new methodology and establishing the reliability of the scales. (2) Fundamental to the semantic differential technique is redundancy. This redundancy is necessary in order to elicit the respondents' feelings about the reports under review in this study.

These considerations resulted in the choice of twelve bi-polar adjectives to reflect the value of the MIS report; they are included without any modification or addition as they were used before in a previous research (9) and yielded a significant correlation with the monetary value estimates of the report.

The twelve bi-polar adjectives are:

1. Important - Unimportant
2. Valuable - Worthless
3. Meaningful - Meaningless
4. Material - Immaterial
5. Desirable - Undesirable
6. Effective - Ineffective
7. Applicable - Inapplicable
8. Relevant - Irrelevant
9. Informative - Uninformative
10. Necessary - Unnecessary
11. Beneficial - Non-beneficial
12. Supportive - Non-supportive

To select the bi-polar adjectives for the attributes of the MIS reports, considerable effort was expended to arrive at a comprehensive and concise list which can be used to reflect these different attributes. These efforts resulted in the following steps:

(1) A list of adjectives used by Gallagher (10) and Kelly (11) was compiled.

(2) Additional bi-polar adjectives were added from three sources:

   (a) a list of bi-polar adjectives published by Osgood et al (12) which they found useful in the semantic differential;

   (b) Roget's Thesaurus (13) was used to look for new adjectives;

   (c) A Research Fellow and five post-graduate research students in accounting were asked to add new adjectives which can be used to measure these attributes of MIS reports.

(3) The result of the above steps was a list of 53 bi-polar adjectives which was given to 34 persons (12 M.Sc. students, 6 internal auditors attending a one day conference, 16 researchers and post-graduate research students studying for their Ph.Ds) in an attempt to separate the words into two categories: (1) those directly connoting a particular attribute of the MIS report, and (2) those not relevant to the study in hand. The questionnaire

and the list used for this purpose are shown in Appendix(C)

The list of words and the survey results are shown in Table 6.1.

TABLE 6.1

Word Survey Results

Word	Attribute					N/A	No answers
	Quantity	Format	Reliability	Timeliness	Cost		
1. Enough - Not enough	27		2		5		
2. Sufficient - Insufficient	23	1	2		3	5	
3. Complete - Incomplete	20	5	3	2	2	2	
4. Adequate - Inadequate	19	1	9	1	1	3	
5. Ordered - Disordered		27	2		1	4	
6. Well-constructed - Ill-constructed	1	28	2	1	1	1	
7. Organised - Disorganised	1	26	2		5		
8. Simple - Complex	2	24		1	4	2	1
9. Detailed - General	3	19	4		6	1	1
10. Accurate - Inaccurate		1	29		3		1
11. Reliable - Unreliable	1	1	29	1	1	1	
12. Trustworthy - Untrustworthy	1		26		3	3	1
13. Correct - Incorrect	3		25		3	2	1
14. Confirmed - Unconfirmed		1	24	2	2	5	
15. Timely - Untimely				31	1	1	1
16. Current - Out-dated	1	1	1	28	2	1	
17. Well-timed - Ill-timed			1	28	2	1	2
18. Opportune - Inopportune	1			22	2	5	4
19. Productive - Unproductive	2	1	3		18	9	1
20. Efficient - Inefficient	1		10	1	15	6	1
21. Workable - Unworkable	2	3	6		15	6	2
22. Appropriate - Inappropriate	4	3	2	5	14	4	2
23. Enough - Insufficient	29	1		2	1	1	

TABLE 6.1 (cont'd)

Word Survey Results

Word	Attribute					N/A	No answers
	Quantity	Format	Reliability	Timeliness	Cost		
24. Full - Sparse	16	5			4	5	4
25. Superficial - In-depth	13	5	6		1	7	2
26. Slight - Weighty	15	3	3		3	8	2
27. Obscure - Precise	2	15	7	2	3	4	1
28. Clear - Unclear	5	16	7		2		4
29. Readable - Unreadable	3	17	1	1	4	5	3
30. Logical - Illogical		15	5		4	6	4
31. Coherent - Incoherent	3	13	6		5	4	3
32. Structured - Unstructured	1	17	4		6	3	3
33. Consistent - Inconsistent	2	5	19		4	3	1
34. Methodical - Unmethodical		16	2		4	7	5
35. Systematic - Unsystematic		16	2	1	6	4	5
36. Specific- General	6	14	6		3	4	1
37. Detailed - Sketchy	10	14	5		2	2	1
38. Lucid - Opaque	3	10	7		5	7	2
39. Fluent - Hesitant	2	7	4		3	18	
40. Descriptive - Non-descriptive	5	17	1	1	4	6	
41. Valid - Invalid	1	1	19	1	6	5	1
42. True - False	1		20		4	7	2
43. Ambiguous - Unambiguous	1	12	13	1	5	2	
44. Precise - Vague (imprecise)	4	5	16	1	6	2	
45. Authentic - Unauthentic	4	1	20	2		5	2
46. Exact - Inexact	3	1	20	1	4	4	1

TABLE 6.1 (cont'd)

Word Survey Results

Word	Attribute					N/A	No answers
	Quantity	Format	Relia-bility	Time-liness	Cost		
47. Certain - Uncertain			20	2	2	8	2
48. Right - Wrong	4	1	15		2	6	6
49. Up-to-date - Out-of-date	4		3	18	2	5	2
50. Recent - Past	2		2	17		7	6
51. New -Old	3		2	18	3	8	
52. Concise - Redundant	8	10	3	2	5	3	3
53. Concise - Rambling	6	10	3		6	8	1

The criterion employed in the choice of the bi-polar adjectives for the instrument was to choose those adjectives having the highest frequencies in relation to the respective attributes. This resulted in the choice of 22 bi-polar adjectives.* These adjectives and the attributes they principally connote are shown below:

TABLE 6.2

Attribute Scales

ATTRIBUTE	SCALE
Quantity	Enough - Not enough
	Sufficient - Insufficient
	Complete - Incomplete
	Adequate - Inadequate
Quality - Format	Ordered - Disordered
	Well-constructed - Ill-constructed
	Organised - Disorganised
	Simple - Complex
	Detailed - General

* One bi-polar adjective (i.e. Enough - Insufficient) N 23 in Table 6.1. while having a frequency of 29, and while being tested before by Gallagher (14) in his research, was not selected, as it was felt that it included a mix of two words, namely, enough and sufficient, which in our opinion does not represent a bi-polar adjective in its true sense.

TABLE 6.2 (cont'd)

Attribute Scales

ATTRIBUTE	SCALE
Quality - Reliability	Accurate - Inaccurate
	Reliable - Unreliable
	Trustworthy - Untrustworthy
	Correct - Incorrect
	Confirmed - Unconfirmed
Timeliness	Timely - Untimely
	Current - Out-dated
	Well-timed - Ill-timed
	Opportune - Inopportune
Cost	Productive - Unproductive
	Efficient - Inefficient
	Workable - Unworkable
	Appropriate - Inappropriate

While many of the above adjectives chosen to reflect the different attributes of the MIS reports have empirical support from recent studies (15), and while redundancy as a fundamental feature of the semantic differential technique was catered for in this choice, the researcher felt that there was not enough evidence to support the choice of a specific scale to reflect a specific attribute, and that a more thorough analysis was needed if these scales were to have a solid base of support. A thorough analysis suggests a factor analysis to uncover the different dimensions these adjectives are measuring and an item analysis to measure the internal consistency reliability of the scales.

Such an analysis requires the application of these scales in two field research sites. In the first field site the data would be collected and analysed in order to build the scales. The second field site would be used for applying the scales. Unfortunately, in view of the problems associated with finding a research site with the required criteria, it was deemed necessary to collect and analyse the data and present the results so that others may apply the scales in an organisation to which they have access.

In designing the format for presenting the bi-polar adjectives of the semantic differential, three approaches were used. First, the directions described in the second and third pages regarding the scaling of the adjectives were repeated in the fourth and fifth pages as header descriptions for each column. Secondly, the list of adjectives was separated into groups to provide breakpoints in the total list of thirty-four pairs. This would enable the respondent to pause while reflecting on previous responses, before proceeding with the next group. Lastly, the bi-polar adjectives were alternated in both position and polarity, in order to avoid response bias.

6.4.5. Custom-tailored reports

The sixth page of the questionnaire introduces two assumptions about the two sets of reports under review in this study. The first assumption was that the managers

could have the reports with optimal attributes; that is - their format, quantity of data, timeliness, and reliability would be tailored to meet their needs. The second assumption was a repetition of the one made before in the monetary evaluation section, i.e. the future provision of these reports being subject to a contractual agreement with the management information department in the company. These were followed by two questions: the first question asking for the amount the manager would be ready to pay for this "custom-tailored" reports on an annual subscription basis; the second presented a list of twelve bi-polar adjectives for each set of reports, concerning the value of these custom-tailored reports. Instructions for completing the semantic differential were not repeated - only a reference to previous instructions was given. The same adjectives in the two lists were varied in both order and favourableness.

The purpose of this section was to differentiate between the case of low value given to reports "A" and reports "B" because of poor attributes and the case of low value assigned to the reports because their content was of low value to the manager. In the former case, the answers to these questions will be favourable to the reports, since any attribute deficiency is assumed non-existent, whereas in the latter case the response should continue to be unfavourable because the value content of the reports has not changed.

6.4.6. Respondents' involvement with and attitudes towards the reports

The seventh and final pages of the questionnaire included seven questions to obtain supplementary data from the respondents. The first question asked whether the user was consulted in any way about the design of the two sets of reports prior to their implementation. The answers to this question will be used in correlation analysis with other data from the questionnaire. The second question was included to identify those users who were extremely dissatisfied with the two sets of reports. The following four questions were included upon the request of the company XXX in the hopes of getting more information from the managers about their use of the reports, two of these questions concern reports "A" and two concern reports "B". The questions ask the managers to rate on a seven point scale the amount of detail contained in each set of reports, which parts in the report they regularly review and any changes they would like to see to these reports. One additional sub-question was included for reports "A". This asked if the managers would like to receive a summary of controllable expenses instead of the reports "A" in its actual format. The last question is an open-ended question and gives the respondent complete flexibility of reply. Such a question was deemed necessary to provide the respondent with an opportunity to emphasize any aspects of the reports he feels do not meet his requirements and which could not be easily identified or foreseen in the original design.

6.5. Sample Selection

The population of managers receiving the two sets of reports was 307. To survey the whole population was felt to be in excess of any practical needs relating to the purpose of statistical analysis. For this reason it was decided to choose a representative sample to whom to sent the questionnaire.

6.5.1. Sampling Plan

To make the sample representative of the whole population, it was decided with the company to choose 80 managers representing about 26% of the population.

As to the sample design, it was decided that a stratified sample will offer the researcher an opportunity to select a better sample able to accommodate the special characteristic of the company. Moreover, this method of selecting the sample will increase its precision over a simple random sample which is used in virtually all sample designs.(16)

Moser describes stratification as a design which " . . . does not imply any departure from the principle of randomness. All it means is that, before any selection takes place, the population is divided into a number of strata; then a random sample is selected within each stratum". (17)

A structural factor was used to stratify the population. This means stratifying according to the position of managers in the organisational hierarchy of the company.

This resulted in five strata which are called managers of departments type "A" to type "E".

A decision has to be made between using the proportionate stratified sampling, where the sample size from each stratum is proportional to its population size, and the disproportionate stratified sampling where the use is made of variable sampling fractions. The latter plan was chosen by the researcher and the company because it offers, as was pointed out by Moser (18) "....although gain in precision is an important reason for using variable sampling fractions, it is not the only one. Results are often wanted separately for special subgroups of the population, known technically as domains of study, so that it is important to have sufficient sample numbers in each domain. It is often convenient to make the domains into separate strata, or groups of strata, and the requirement of sufficient numbers in the domains may then call for variable sampling fractions. With a uniform sampling fraction, a small stratum will give only a small proportion of the total sample, so that probably no meaningful results could be given for this stratum separately. If such results are required, a higher sampling fraction can be employed in the stratum; indeed, should the stratum be very small, the necessary sampling fraction could approach 1, in which case a complete coverage of that stratum may be appropriate."

This procedure was applied to the different strata in the population with the result of three strata populations being included entirely in the 'sample', while the remaining two strata were randomly sampled using tables of random numbers. (19) The composition of the stratified sample and the percentage of managers in each stratum in relation to its population size was as follows:

Strata	Population	Sample	%
Managers of department type "A"	3	3	100
Managers of department type "B"	17	17	100
Managers of department type "C"	10	10	100
Managers of department type "D"	23	17	74 (approx.)
Managers of department type "E"	254	33	13 (approx.)
	307	80	

6.6. Procedure

6.6.1. Initial meeting with company XXX's representative

On 8th October, 1977, Mr. Andrew Chambers, the supervisor, and the researcher met the Deputy Comptroller of the company to explain the purpose of the research and to seek help in providing entry into his company for the field site of the research. This meeting was followed by a letter requesting formally their help, accompanied by a detailed schedule of the research steps. Around mid-October the company informed the researcher of the company's readiness to help in this research. By the 24th October 1977 the draft questionnaire was despatched to the Deputy Comptroller who was designated as a liaison officer - a task he fulfilled with skill and considerable expertise.

6.6.2. Agreed timetable for the pilot study and administration of the questionnaire

During November 1977 and the beginning of December different meetings were arranged to discuss the questionnaire. One part of the questionnaire concerning the role of the internal auditors in auditing and reveiwing MIS was deleted as it was felt that in view of the "state of the art" of internal auditing in the company, the respondents' answers would not provide the researcher with the necessary data needed for this part of the research. The other part of the questionnaire was agreed upon. (One question was objected to, concerning the amount of the annual budget the manager was responsible for, as it was felt that this question might disclose commercial information. The company suggested an alternative which was to rate the different departments on a scale ranging from 1 to 6. This was agreed upon as it provided the researcher with the data needed to perform statistical analysis without disclosing commercial information) Four additional questions were requested for inclusion as described in the previous section. Several valuable suggestions were offered concerning phraseology which improved clarity of the questionnaire.

The sequence of events for the remainder of the study was discussed and agreed upon. The selection of a sample of managers would be done randomly. A pilot test of the questionnaire would be made within the company. This would be followed by a preliminary analysis of the pilot test results and modifications (if necessary). Lastly, the

final version of the questionnaire would be mailed and collected internally by the management information department. To encourage participation, the company would circulate a memorandum with both the pilot and the final test to announce and explain the aim of the study and encourage cooperation.

Background information including annual reports, the MIS description, detailed description about reports "A" and "B" and their distribution, and the organisation chart were provided by the company.

6.6.3. Pilot Study

Ten managers (1 of department type "D" and 9 of department type "E") were selected by the Deputy Comptroller for the pilot testing of the questionnaire.* This selection was based on the feeling that they would be supportive and would give the questionnaire a thorough review. The purpose of the pilot testing was explained in a memorandum enclosed with each questionnaire sent. The following resulted from the pilot test:

In the first section, About your job, question 3 was modified so that it applied only to managers of departments type "C" to "E". Other managers were excluded in view of their position in the hierarchy of the company, and the possibility of their including other departments' subordinates in their answers which would have resulted in unreliable data. Question 4 was modified to enhance clarity and prevent confusion by the inclusion of a specific

* A copy of the pilot test questionnaire is included in Appendix (C).

instruction for those managers not satisfying the requirements for answering it. In the section, About the objectives of reports "A" and reports "B", some ambiguity resulted in using the scales provided to rate the two reports in meeting the control and planning objectives, as the questionnaire provided only one scale for each set of reports. This was modified by separating the two sets of reports and providing two scales for each set, one scale for the control objective and the second for the planning objective.

As these changes were only of a minor nature, the questionnaires of the ten managers in the pilot survey were incorporated with those of the major survey and the data were analysed together.

6.6.4. Administration of the questionnaire

By late January 1978, seventy questionnaires were mailed internally by the management information department to the remaining managers in the sample. Each questionnaire was accompanied by a memorandum explaining the aim of the research and asking for help by completing the questionnaire. By February 10th more than half of those receiving the questionnaire had replied. Since time was available, the deadline for returning the questionnaires was extended to the last week of February. This extension proved useful as it resulted in the increase in the rate of response (including the pilot test responses) to about eighty nine per cent of the sample. All questionnaires returned were usable by the researcher in performing the statistical analysis.

6.6.5. Tabulating responses

After receiving the questionnaires from the management information department, the data were coded and entered onto coding sheets. Hollerith cards were then punched to record the data from those sheets. The cards were used for computer analysis of the data using the SPSS (Statistical Package for the Social Sciences). Each answer on the questionnaire was quantifiable, either directly or through a code, with the exception of section (b) questions 15 and 17, and the open question number 18, which were coded as yes or no answer to the question. One hundred and ninety two data elements were needed to encode the data collected either directly through the questionnaire or indirectly from the company to complement the data about each respondent (e.g. the rating of each manager's annual budget). The data elements for each respondent required nine Hollerith cards. The data elements and their coding are shown in Appendix (D)

To code incomplete and unacceptable answers two decision rules were applied:

(i) invalid answers are interpreted as "no answer" unless there is evidence to the contrary;

(ii) blanks are interpreted as "no answer" unless there is evidence that an answer could be deduced.

Coding of -1·00, -1, 9 was used to indicate "no answer" (as shown in the data elements sheets).

REFERENCES

(1) Good, C.V., & Scotes, D.E., Methods of Research: Educational, Psychological, and Social, Appleton-Century-Craft, Inc., N.Y., 1954, pp.456-459.

(2) See: Kelly, J.A., The analysis and measurement of value of selected non-financial project management information, Unpublished DBA dissertation, Florida State University, 1974

Gallagher, C.A., The measurement and analysis of managers' perceptions of the value of selected management information, Unpublished DBA dissertation, Florida State University, 1971

(3) Ibid, pp.54-55

(4) See for example:
Hays, W.L., Statistics for the social sciences, Holt, Rinehart & Winston, London, 1973, p.322

Yamane, T., Statistics: An introductory analysis, Harper & Row Publishers Inc., N.Y., Third Edition, 1973, p.163

(5) Gallagher, C.A., op.cit., pp.54-55

(6) Kelly, J.A., op.cit., p.140

(7) Osgood, C.E., Suci, G.J., & Tannenbaum, P.H., The Measurement of meaning, Univeristy of Illinois Press, Urbana, 1957, p.83

(8) See for example:
Gallagher, C.A., op.cit., pp.99-100

Osgood, C.E., May, W.H., & Miron, M.S., Cross-cultural universals of affective meaning, University of Illinois Press, Urbana, 1975, p.119

(9) Kelly, J.A., op.cit., p.93

(10) Gallagher, C.A., op.cit., p.66

(11) Kelly, J.A., op.cit., p.94

(12) Osgood, C.E., Suci, G.J., & Tannenbaum, P.H., op.cit., pp.53-61

(13) Roget's Thesaurus of English Words and Phrases, Penguin Books Ltd., Middlesex, England, 1977

(14) Gallagher, C.A., op.cit., p.66

(15) See:

Ibid, p.66.

Kelly, J.A., op.cit., p.94

(16) Moser, C.A., & Kalton, G., Survey methods in social investigation, Heinemann Educational Books Ltd., London, Second Edition, 1977, p.85

(17) Ibid

(18) Ibid, p.95

(19) Yamane, T., op.cit., pp.1110-1111

CHAPTER 7

EMPIRICAL FINDINGS RELATING TO THE EVALUATION OF M.I.

7.1. Introduction

7.2. Response rate

- 7.2.1. Response rate by strata
- 7.2.2. Survey bias

7.3. Statistics used to analyse data

7.4. Characteristics of the respondents

7.5. Monetary value

- 7.5.1. Introduction
- 7.5.2. Overall statistical results
- 7.5.3. Individual manager's monetary value estimates
- 7.5.4. Managers' bases for monetary value estimates
- 7.5.5. Net system value
- 7.5.6. Methodological considerations

7.6. Semantic differential

- 7.6.1. Introduction
- 7.6.2. Overall score results
- 7.6.3. Individual score results
- 7.6.4. Individual scale results

7.7. Custom Tailored (Ideal) reports

- 7.7.1. Introduction
- 7.7.2. Analysis of monetary value estimates
- 7.7.3. Analysis of Semantic Differential value scores

7.8. Degree to which reports meet control and planning needs

7.9. Parts reviewed in the reports

7.10. Summary and conclusions

CHAPTER 7

EMPIRICAL FINDINGS RELATING TO THE EVALUATION OF M.I.

7.1. Introduction

The purpose of this chapter is to present and discuss the background details of participating managers; attitudes towards reports "A" and "B" and estimates of the value of the reports as indicated by responses to the survey questionnaire.

The preliminary analysis of the background details of the participating managers includes descriptive statistics indicating the amount of supervisory experience, the number of personnel supervised; experience in information system design; and participation and involvement in the design of the two sets of reports.

The data which bears directly upon the value and attributes of the two sets of reports as perceived by the participating managers includes the monetary value estimates of the two sets of reports, attitudes and feelings toward the reports measured by the semantic differential technique, and lastly monetary estimates of the value of an "ideal" set of reports.

Finally, descriptive statistics are presented to indicate managers' degree of satisfaction with the reports in meeting their control and planning needs, and the parts they review in each sets of reports.

The questionnaire data with its associated descriptive statistics presented in this chapter is used in the next chapter in a factor analytic study of the bi-polar adjectives used in the semantic differential instrument. The data is also used in the testing of hypotheses presented in Chapter 10.

7.2. Response Rate

7.2.1. Response rate by strata

Eighty questionnaires were sent to the stratified sample of managers participating in the study. A total of seventy-one responses were returned which represents 89% of the total administered. Excluding the ten questionnaires sent in a trial run for pilot testing, sixty-one out of seventy questionnaires sent in the final run were returned, a response rate of 87%. All questionnaires returned either in the trial or the final run were usable.

The following table shows the responses by strata and their percentages.

TABLE 7.1.

Responses Received

Strata	Samole	Answered	%
Managers of department type "A"	3	3	100
Managers of department type "B"	17	13	76.5
Managers of department type "C"	10	10	100
Managers of department type "D"	17	15	88
Managers of department type "E"	33	30	91
	80	71	89%

The fact that the survey received the active support of company officials, and that the test instrument presented an opportunity for the participating managers to express their views and their subjective opinions about the two sets of reports under study, were felt to be the contributory factors toward achieving the high level of response as shown in the above figures.

7.2.2. Survey bias (Response bias)

As discussed previously in section 4.2.2., survey bias as a potential source of error exists in all questionnaire surveys (1), and this study is no exception. However, in the researcher's opinion, this bias in this part of the study may be considered small and relatively insignificant for the following two reasons:

(1) The response rate was exceptionally high, leaving only nine non-respondents representing 11% of our sample, in contrast to the average response in mail

questionnaires of between 40% to 60% and 80% being seldom exceeded (2). Hence, it should prove to be quite representative of the sample drawn.

(2) An analysis of the nine non-respondents was performed and no consistent pattern was discovered; they were distributed both horizontally and vertically throughout the company, and their geographical location was also distributed throughout the country.

7.3. Statistics Used to Analyse Data

The data collected through the questionnaire and subjected to statistical analysis with the results presented in this chapter and the next three chapters comprise two levels of measurement:

1) Data measured at the ordinal level which represents the answers to the questions included in the sections, Objectives of the "A" and "B" reports, How do you feel about the reports (which uses the semantic differential test instrument) and some questions relating to About You and the Reports.

2) Data measured at the internal level which was collected through the respondents' answers to the questions regarding About Your Job, and their monetary estimates of the reports.

Descriptive statistics, such as means, standard deviations, and medians are presented in this chapter for the ordinal data as they are helpful in characterising the data for the reader.

However, when inferential statistical tests will be performed, the appropriate statistics and tests will be used. Medians and non-parametric will be used for ordinal data, while means and T-test will be used for interval data.

7.4. Characteristics of the respondents

The managers participating in the study averaged in their current position 2.6 years in department type "A", 4.2 years in department type "B", 3.5 years in department type "C", 3.9 years in department type "D", and 5 years in department type "E". The range in these departments was from 9 months to 4 years, 4 months to 5.5 years, 8 months to 8 years, 5 months to 8 years, 5 months to 11.5 years respectively. The question asking for the number of personnel under the supervision of each manager was asked of managers in departments "C" to "E" only; they averaged 74 , 27 , 10 for each respectively, ranging from 31.5 (includes one part-time) to 140 individuals in department type "C", 9 to 53 individuals in department type "D", and 3 to 55 in department type "E". The length of supervisory experience* averaged 12.2 years for department type "B", 8.8 years for department type "C", 9.1 years for department type "D", and 8.3 years for department type "E". The range

---

* The answers from managers in department type "A" are not included because these reflect only time in positions above a certain grade and not necessarily their years of managerial experience.

was from 8 to 20 years, 2 years and 8 months to 18 years, 2 to 13 years, 2 to 13 years in each of these departments respectively. Nine managers have previous experience in designing information systems. Five managers and seven managers felt they were consulted about the design of reports "A" and "B" respectively. The respondents were located in four scalar levels in the organisation's chart.

A summary of the above descriptions is presented in Table 7.2.

TABLE 7.2.

Description of respondents' characteristics (by strata)

Description \ Strata	Department type "A"	Department type "B"	Department type "C"	Department type "D"	Department type "E"
Time in present appointment (years)					
Mean	2.6	4.2	3.5	3.9	5
Range	9/12 - 4	4/12 - 5.5	8/12 - 8	5/12 - 8	5/12 - 11.5
Number of personnel supervised					
Mean *	-	-	74	27	10
Range	-	-	31.5 - 140	9 - 53	3 - 55
Length of Managerial experience (years)					
Mean	-	12.2	8.8	9.1	8.3
Range	-	8 - 20	2 8/12 - 18	2 - 13	2 - 13
Previous experience in information system design (no. of managers)	1	3	2	1	2
Participation in reports design					
Reports "A"	1	1	1	2	-
Reports "B"	3	1	2	1	-

* Rounded to the nearest whole number

7.5. Monetary value

7.5.1. Introduction

The section of the questionnaire titled, About the Report was included in the measuring instrument to:

(1) measure the monetary value of the reports, and

(2) establish the bases for the participating managers' monetary estimates.

7.5.2. Overall statistical results

The descriptive statistics associated with responses to the monetary value question are presented in the following table.

TABLE 7.3.

Monetary Value Descriptive Statistics (by Strata)

Strata / Reports	Department type "A"	Department type "B"	Department type "C"	Department type "D"	Department type "E"
	(N=3)	(N=12)	(N=10)	(N=15)	(N=30)
Reports "A"					
Mean £	4333•333	791•667	540•000	306•667	178•667
S.D. £	5008•326	1104•296	359•629	197•183	294•487
Median £	2500	350	500	250	50
Range £	500 - 10000	50 - 4000	0 - 1000	0 - 500	0 - 1500
Reports "B"					
Mean £	4333.333	777•083	455.000	163•333	108•000
S.D. £	5008.326	1417•643	411•265	181•725	208•097
Median £	2500	125	350	100	50
Range £	500 - 10000	50 - 5000	0 - 1000	0 - 500	0 - 1000

If we combine the strata to form the following two groups:

Group 1: comprising managers of departments type "A" and "B" whose activities are mainly concerned with the supervision of the managers of other departments.

Group 2: comprising managers of departments type "C", "D", and "E" whose activities are mainly to deal with customers, we obtain the following results:

TABLE 7.4.

Monetary Value Descriptive Statistics (by Groups)

		Group 1 (N=15)	Group 2 (N=55)
Reports "A"			
Grand Mean	£	1500.00	279•273
S.D.	£	2586•849	310•852
Median	£	500	200
Range	£	50 - 10000	0 - 1500
Reports "B"			
Grand Mean	£	1488•333	186•182
S.D.	£	2707•478	277•364
Median	£	350	50
Range	£	50 - 10000	0 - 1000

The above results, especially for the average of the managers' monetary value estimates, reflect for both sets of reports a decreasing trend as we move from department type "A" to department type "E", a trend sustained by the grand average of the groups.

7.5.3. Individual manager's monetary value estimates

The individual responses to monetary value estimates are presented by categories in Table 7.5. for reports "A", and Table 7.6. for reports "B". (A more detailed presentation of the responses is included in Tables VII.I and VII.II of the supplement to the Chapter).

The distribution of the individual manager's estimates presented in Tables 7.5. and 7.6. shows in more detail the statistical results presented previously. It can be seen that most of the estimates of managers in department type "A" are in the £2500 and over category, while in the case of the managers in departments type "D" and "E" the majority of estimates are in the first three categories (which extend from £0 to less than £150) with most clustering in the £50 to £99 category.

TABLE 7.5.

Individual Manager's Monetary Value Estimates for Reports "A"

Categories of value estimates (pounds) / Strata	Department type "A"	Department type "B"	Department type "C"	Department type "D"	Department type "E"	Total number of managers in each category
0 to 49			1	1	2	4
50 to 99		1		1	16	18
100 to 149				2	4	6
150 to 199		1				1
200 to 249		4	2	3	2	11
250 to 499				1	1	2
500 to 999	1	2	4	7	4	18
1000 to 1499		2	3			5
1500 to 2499		1			1	2
2500 and over	2	1				3
Total number of managers in each stratum	3	12	10	15	30	70

TABLE 7.6.

Individual Manager's Monetary Value Estimates for Reports "B"

Categories of value estimates (pounds) \ Strata	Department type "A"	Department type "B"	Department type "C"	Department type "D"	Department type "E"	Total number of managers in each category
0 to 49			1	2	9	12
50 to 99		3	1	4	14	22
100 to 149		3	1	4	3	11
150 to 199		1		1		2
200 to 499		1	2	1	1	5
500 to 999	1		2	3	2	8
1000 to 1499		2	3		1	6
1500 to 2499		1				1
2500 and over	2	1				3
Total number of managers in each stratum	3	12	10	15	30	70

7.5.4. Managers' bases for monetary value estimates

An item was included in the questionnaire to elicit the managers' bases for their monetary value estimates: it contained a combination of structured responses and an open response. The structured responses were based on (a) the cost of receiving the information from alternative methods, (b) the value of time saved toward preparedness for taking and implementing decisions, (c) a percentage of the gross revenue of the department, (d) a percentage of the gross costs of the department, (e) the opportunity cost associated with the lack of preparedness, (f) a percentage of the respondent's salary, and the open response (g) requiring managers to list any other related factors.

The answers to this item are presented as relating to each set of reports under investigation in the study.

Reports "A"

Sixty-eight managers out of the sample of seventy-one managers (96%) answered this question. The answers are presented in the following table.

TABLE 7.7.

Managers' bases for Monetary Value Estimates for Reports "A"*

Bases \ Strata	Department type "A"	Department type "B"	Department type "C"	Department type "D"	Department type "E"	Total number of managers in each basis
a) Based on the cost of adding personnel to your department to collect and compile the data in report form for your use:	3	9	7	9	13	41
b) Based on the value of time saved towards preparedness for taking decisions and implementing them:	2	6	4	12	20	44
c) Based on a percentage of the gross revenue of your department (including interest):	-	2	1	-	3	6
d) Based on a percentage of the gross costs of your department (including interest):	-	2	-	1	4	7
e) Based on the cost of lack of preparedness or poor performance of your operations:	-	5	2	1	1	9
f) Based on a percentage of your annual salary (i.e. the monetary value of your organisational position). Implied is that current information assists you in maintaining or improving your organisational position:	-	6	1	3	2	6
g) Based on other factors:	-	1	1	2	3	7

* The total of each stratum does not add up to the number of managers who answered the question as managers were allowed to choose more than one basis for their monetary value estimates.

The last basis was left open for managers to include any additional factors that formed the basis for their estimates of the monetary values of reports "A". Seven managers only added their own factors, represented as follows:

Other factors	Number of respondents and their stratum
A percentage of department contribution.	One manager in a department type "B".
Information available in other forms and from other sources.	One manager in a department type "C", and one manager in a department type "D".
Estimated cost of producing the reports in the Comptroller division.	One manager in a department type "D", and one manager in a department type "E".
Extent of usage and usefulness of the reports.	Two managers in a department type "E".

One of the managers (in a department type "C") gave a value of zero to the reports, and based his estimate on the fact that data contained in the reports are available from other sources and in other forms. The other managers gave monetary estimates of more than zero to the reports

As a final comment on the above figures it can be said that the cost of receiving the information contained in the reports from alternative methods (i.e. adding personnel to produce the reports) was the first choice for managers in departments type "A", "B", and "C", and the second choice for managers in departments type "D" and "E". The value of time saved toward preparedness for

taking decisions and implementing them was the second choice for the former managers and the first choice for the latter managers.

Reports "B"

Sixty-seven managers out of our sample of seventy-one managers (94%) answered this question, and their answers are presented in the following table.

TABLE 7.8.

Managers' Bases for Monetary Value Estimates for Reports "B"*

Bases \ Strata	Department type "A"	Department type "B"	Department type "C"	Department type "D"	Department type "E"	Total number of managers in each basis
a)Based on the cost of adding personnel in your department to collect and compile the data in report form for your use:	3	7	5	7	13	35
b) Based on the value of time saved toward preparedness for taking decisions and implementing them:	2	5	4	8	17	36
c) Based on a percentage of the gross revenue of your branch (including interest):	-	2	1	1	3	7
d) Based on a percentage of the gross costs of your branch (including interest):	-	2	-	-	2	4
e) Based on the cost of lack of preparedness or poor performance of your operations:	-	4	2	-	1	7
f) Based on a percentage of your annual salary (i.e. the monetary value of your organisational position). Implied is that current information assists you in maintaining or improving your organisational position:	-	1	-	3	2	6
g) Based on other factors:	-	2	1	4	5	12

* The total of each stratum does not add up to the number represented in our sample as managers were allowed to choose more than one basis for their monetary value estimates.

Twelve managers, as shown in the table, added their own bases for estimating the monetary value of the reports, these additional bases and the distribution among the strata of managers choosing them is as follows:

Other factors	Number of respondents and their stratum
Extent of usage and usefulness of the reports.	One manager in a department type "B", one manager in a department type "D", and four managers in departments type "E".
A percentage of department contribution.	One manager in a department type "B".
Information available in other forms and from other sources.	One manager in a department type "C", and one manager in a department type "D".
Potential for error spotting.	One manager in a department type "D".
Estimated cost of producing the reports in the Comptroller department.	One manager in a department type "D".
No other source to provide the same information.	One manager in a department type "E".

A review of the monetary value of the reports estimated by those managers who added these additional bases shows that:

(i) Managers who chose the extent of usage and usefulness of the reports as their basis gave a low monetary estimate in their respective strata, with two of the managers in departments type "E" giving an estimate of zero to the reports, and one in the same stratum giving £10 as his estimate.

(ii) The manager who gave the potential for error spotting as his basis gave one of the low estimates in his stratum (department type "D").

(iii) The manager who mentioned that no other source is available to provide the same information contained in the reports, gave one of the high monetary estimates in his stratum (department type "E").

To conclude our discussion of the bases chosen by managers for their estimations of the monetary value of the reports, it can be said that basis (a) "the cost of adding personnel in your department to collect and compile the data in report form for your use" and basis (b) "the value of time saved towards preparedness for taking decisions and implementing them" were chosen as the bases by most managers in all strata as the figures in the above table show (they represent together 66% of all bases chosen).

7.5.5. Net system value

The aim of the question relating to perceived monetary value was to obtain an estimate of the total monetary value of the two sets of reports to the company. As an example for reports "A" using the sample mean and a 95% confidence limit, the estimated mean for the population of each stratum is presented in the following table:

TABLE 7.9.

Estimated mean of the population for reports "A" (by strata)*

Strata \ Reports	Reports "A"
Department type "A"	£4333.33
Department type "B"	£90.03 to £1493.30
Department type "C"	£540
Department type "D"	£197.47 to £415.86
Department type "E"	£68.70 to £288.63

* The figures presented for departments type "A" and "C" are not estimates, as these two strata included the total population which means that the sample mean = the population mean.

Furthermore, using the figures presented in the above table, the total monetary value for reports "A" with a 95% confidence limit is presented for each stratum in the following table.

TABLE 7.10.

Estimated total monetary value for reports "A" (by strata)*

Strata \ Reports	Reports "A"
Department type "A"	£13.000
Department type "B"	£1530.53 to £25386.15
Department type "C"	£5400
Department type "D"	£4541.83 to £9564.85
Department type "E"	£17450.87 to £73312.02

* The figures for the two departments "A" and "C" represent the total value of the reports.

If the above figures can be accepted as a total value for a set of reports on an annual basis, then it can be compared with the costs of the reports to determine net value. While making comparisons is not part of the study, a discussion of the determination of these costs is relevant.

For consistency with decision-making practices, only variable costs should be considered. Fixed costs such as those for existing computer installations, initial development and programming, will have already been expended, and no need exists for their inclusion in the comparison.

Variable costs include such items as wages, maintenance, materials required to assimilate the input data and also publish and distribute the output report, and other costs such as power, stand-by, etc.(3) The variable costs for each set of reports are not available to the researcher, hence no statement can be made about their net value.

7.5.6. Methodological considerations

Seventy out of seventy-one respondents answered the question about the monetary value of the two sets of reports, and thus the feasibility of the question was satisfactorily demonstrated. Even the three respondents who gave a value of zero to reports "A", and the nine respondents who gave a value of zero to reports "B" demonstrated a valid understanding of this question as shown in the bases for their estimates given in answer to question 8.

A review of the questionnaire revealed that the different bases offered in answer to the open-ended question 8 which included some bases tested in a previous research (4) and two new bases representing the particular type of operations performed in the company, proved to be quite successful in eliciting managers' candid answers to their monetary value estimates, and proved that a similar question may be tailored to meet the particular characteristics of any environment when investigating the value of MIS reports.

It will not be argued here that the monetary value estimates given in answer to the hypothetical question will be identical to those obtained in an actual situation. It is felt, however, that by using a large sample and verifying high and low estimates, a real and valid amount will be obtained for a total monetary value of a report.

7.6. Semantic Differential

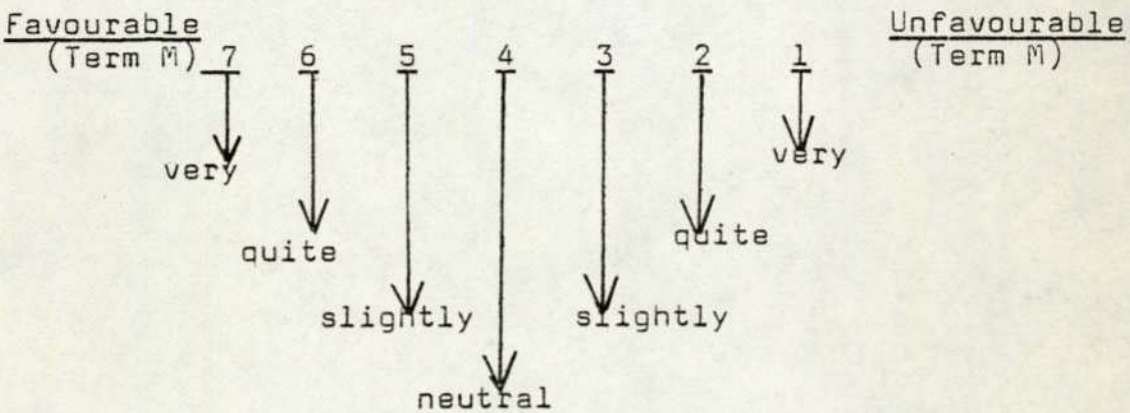
7.6.1. Introduction

The semantic differential (S.D.) technique was included in the questionnaire to measure the perceptions of the users of the two sets of reports, it was included in the section titled: How you feel about reports . . .? and consisted of thirty-four bi-polar adjectives that examined both the value and attributes of the reports. The S.D. used in the section: About custom-tailored reports, consisted of twelve bi-polar

adjectives that were purported to measure the value of custom-tailored reports having optimal attributes.

In scoring the semantic differential, the following scale assignments were utilised(5):

Semantic differential scoring



7.6.2. Overall score results

The descriptive statistics of the semantic differential questions related to each set of reports are presented in the following tables:

TABLE 7.11.

S.D. - Overall Statistical Results (by strata)

Reports \ Strata	Department type "A"	Department type "B"	Department type "C"	Department type "D"	Department type "E"
	(N=3)	(N=13)	(N=10)	(N=15)	(N=30)
Reports "A"					
Grand Mean	6·010	6·034	6·219	6·133	5·989
Standard Deviation	·114	·657	·350	·425	·463
Median	6·000	6·000	6·500	6·000	6·000
Range of averages	5.88 to 6·09	4·88 to 6·88	5·53 to 6·65	5·18 to 6·88	5·12 to 6·82
Reports "B"					
Grand Mean	5·940	5·555	5·438	5·452	5·161
Standard Deviation	·603	·680	1·049	·678	·855
Median	6·000	6·000	6·000	6·000	5·000
Range of averages	5·26 to 6·41	4·56 to 6·91	3·62 to 6·59	4·47 to 6·26	3·12 to 6·32

If we combine the strata into the two groups defined earlier, we get the following results:

TABLE 7.12.

S.D. - Overall Statistical Results (by groups)

	Group 1 (N=16)	Group 2 (N=55)
Reports "A"		
Grand Mean	6·029	6·070
Standard Deviation	·589	·437
Median	6·000	6·000
Range of averages	4·88 to 6·88	5·12 to 6·88
Reports "B"		
Grand Mean	5·627	5·291
Standard Deviation	·665	·846
Median	6·000	5·75
Range of averages	4·56 to 6·910	3·12 to 6·59

The above figures, while they are overall statistics, do show in general that in relation to reports "A" in all strata and groups managers perceive these reports as valuable and possessing favourable attributes since the grand mean lies in the quite favourable rating.

As to reports "B", the managers perceive these reports as between slightly favourable and quite favourable. In the meantime, the range of averages shows that in departments type "C" and "E", some managers' scores were between slightly unfavourable and neutral.

7.6.3. Individual score results

The mean, standard deviation, and the median for each respondent in each stratum and for each set of reports are presented in the tables 7.13 to 7.18. These figures present in detail the total range of averages for each stratum and also indicate that all respondents rated reports "A" favourably. As to reports "B", all respondents with the exception of two managers in each of the departments type "C" and "E" rated them between highly favourable and neutral.

TABLE 7.13.

Semantic differential score for each respondent in department type "A"

Statistics / Reports	Mean	Standard Deviation	Median
Reports "A"	6·09	·668	6·00
	6·06	1·300	6·00
	5·88	·879	6·00
Reports "B"	6·41	·657	6·00
	6·15	1·258	6·50
	5·26	1·162	5·00

TABLE 7.14.

Semantic Differential score for each respondent in department type "B"

Statistics / Reports	Mean	Standard Deviation	Median
Reports "A"	6·88	0·327	7·00
	6·85	0·359	7·00
	6·76	0·606	7·00
	6·38	0·853	7·00
	6·38	0·493	6·00
	6·24	0·430	6·00
	6·24	1·017	6·00
	6·18	0·716	6·00
	5·59	1·048	6·00
	5·50	1·619	6·00
	5·38	1·843	6·00
	5·21	1·871	6·00
	4·88	1·629	5·50
Reports "B"	6·91	0·288	7·00
	6·56	1·211	7·00
	5·79	1·200	6·00
	5·76	1·182	6·00
	5·74	0·618	6·00
	5·74	1·188	6·00
	5·62	1·015	6·00
	5·41	1·459	6·00
	5·41	1·209	6·00
	5·32	0·589	5·00
	4·74	2·050	5·50
	4·68	1·342	5·00
	4·56	1·501	5·00

TABLE 7.15.

Semantic differential score for each respondent in department type "C"

Reports \ Statistics	Mean	Standard Deviation	Median
Reports "A"	6.65	0·646	7·00
	6.50	0·788	7·00
	6·47	1·161	7·00
	6·44	1·021	7·00
	6·35	1·152	7·00
	6·27	0·864	6·00
	6·24	0·987	6·00
	5·91	1·264	6·00
	5·85	0·702	6·00
	5·53	1·134	6·00
Reports "B"	6·59	0·499	7·00
	6·29	1·382	7·00
	6·26	1·814	7·00
	6·00	1·255	6·00
	5·82	0·903	6·00
	5·65	1·152	6·00
	5·47	1·237	6·00
	5·03	0·870	5·00
	3·65	1·739	4·00
	3·62	1·045	3·50

TABLE 7.16.

Semantic differential score for each respondent in department type "D"

Statistics / Reports	Mean	Standard Deviation	Median
Reports "A"	6.88	0·537	7.00
	6·82	0·387	7·00
	6·50	0·663	7·00
	6·47	0·825	7·00
	6·21	0·914	6·00
	6·15	0·989	6·00
	6·12	1·493	7·00
	6·12	1·122	6·00
	6·06	1·301	6·00
	5·97	0·300	6·00
	5·97	0·969	6·00
	5·94	1·153	6·00
	5.91	0·379	6·00
	5·71	0·836	6·00
	5·18	1·403	6·00
Reports "B"	6·26	1·024	6·00
	6·26	0·710	6·00
	6·18	1·029	6·00
	6·18	0·758	6·00
	6·00	0·853	6·00
	5·91	1·311	6·00
	5·53	1·107	6·00
	5·47	0·706	5·50
	5·41	0·657	5·00
	5·41	0·821	6·00
	5·06	0·886	5·00
	4·62	2·132	5·00
	4·53	1·285	5·00
	4·50	2·149	4·50
	4·47	1·022	4·00

TABLE 7.17.

Semantic differential score for each respondent in department type "E" for reports "A"

Mean	Standard Deviation	Median
6·82	0·716	7·00
6·68	0·475	7·00
6·68	0·878	7·00
6·59	0·783	7·00
6·56	0·660	7·00
6·32	0·475	6·00
6·32	0·535	6·00
6·32	1·065	7·00
6·32	0·535	6·00
6·29	0·462	6·00
6·26	1·109	7·00
6·26	0·751	6·00
6·12	1·472	7·00
6·06	0·776	6·00
6·03	1·058	6·00
6·03	0·300	6·00
5·97	1·029	6·00
5·91	1·357	7·00
5·82	0·576	6·00
5·71	0·760	6·00
5·68	1·646	6·00
5·65	1·070	6·00
5·59	1·019	6·00
5·56	1·460	6·00
5·47	0·706	6·00
5·44	1·133	6·00
5·44	1·284	6·00
5·44	1·106	6·00
5·24	1·156	6·00
5·12	0·913	5·00

TABLE 7.18.

Semantic differential score for each respondent in department type "E" for reports "B"

Mean	Standard Deviation	Median
6·32	0·638	6·00
6·26	1·286	7·00
6·26	1·163	7·00
6·24	1·046	7·00
6·21	0·410	6·00
6·03	1·243	6·00
6·03	0·870	6·00
6·00	1·279	7·00
5·94	1·071	6·00
5·68	1·571	6·00
5·68	1·093	6·00
5·47	0·788	5·50
5·41	1·351	6·00
5·29	0·970	5·00
5·21	1·250	5·00
5·12	1·038	5·50
4·94	1·613	4·00
4·88	1·387	5·00
4·76	1·046	5·00
4·76	1·156	5·00
4·71	0·938	5·00
4·68	0·684	5·00
4·63	1·505	3·00
4·62	0·697	4·50
4·59	1·708	5·00
4·41	1·987	4·00
4·06	1·153	4·00
4·06	0·983	4·00
3·50	2·219	4·00
3·12	1·225	3·00

7.6.4. Individual scale results

The results of the semantic differential used in the questionnaire to measure the managers' perceptions of the reports, are presented for ALL respondents grouped together in table 7.19 for reports "A" and table 7.20 for reports "B". A more detailed analysis of the results by strata and groups, for each set of reports, is included in the supplement to the chapter in tables VII.III to VII.XVI.

No attempt was made to divide the bi-polar adjectives into those measuring the VALUE of the reports, and those measuring the different ATTRIBUTES of the reports (i.e., quantity, format, reliability, timelines, cost) in the presentation of the results, the reason being that the data collected through these questions were factor analysed and the results subjected to a test of internal-consistency reliability (coefficient Alpha) in order to arrive statistically at the best clustering of these adjectives in relation to the measurement of the different aspects of the reports. Any presentation of the results with an intuitive division at this stage would have been in the researcher's opinion misleading and contradictory to the final results of the research.

The figures presented in the table show that for reports "A" all adjectives were rated favourably as reflected by the means and the medians, and that the majority of these adjectives (22) were rated as between quite favourable and very favourable. The bi-polar adjective rated least favourable by the respondents was confirmed - unconfirmed with its mean 4.97 and its median 4.

As to reports "B", the figures show that in comparison with reports "A" it was rated less favourably. However, all adjectives with the exception of simple - complex were rated favourably, with the latter being rated as between slightly unfavourable and neutral.

TABLE 7.19

S.D. Scale Results for Reports "A" - ALL respondents

Pair of adjectives \ Statistics	Mean	Standard Deviation	Median
Correct - Incorrect	6.53	·753	7.00
Informative - Uninformative	6.52	·753	7.00
Accurate - Inaccurate	6.49	1·145	7·00
Relevant - Irrelevant	6·42	·710	7·00
Reliable - Unreliable	6·42	·856	7·00
Important - Unimportant	6·38	·684	6·00
Material - Immaterial	6·37	·741	6·00
Necessary - Unnecessary	6·32	·807	6·00
Meaningful - Meaningless	6·31	·767	6·00
Beneficial - Non-beneficial	6·30	·744	6·00
Valuable - Worthless	6·24	·597	6·00
Current - Outdated	6·20	·965	6·00
Adequate - Inadequate	6·18	·883	6·00
Desirable - Undesirable	6·15	1·359	6·00
Trustworthy - Untrustworthy	6·15	1·261	6·00
Ordered - Disordered	6·14	1·004	6·00
Organised - Disorganised	6·14	·915	6·00
Efficient - Inefficient	6·14	1·018	6·00
Effective - Ineffective	6·13	·893	6·00
Appropriate - Inappropriate	6·13	·909	6·00
Workable - Unworkable	6.13	·755	6·00
Well-timed - Ill-timed	6·06	1·027	6·00
Applicable - Inapplicable	5·96	1·314	6·00
Detailed - General	5·96	1·259	6·00
Sufficient - Insufficient	5·94	1·157	6·00
Well-constructed - Ill-constructed	5·93	·961	6·00
Complete - Incomplete	5·90	1·300	6·00
Timely - Untimely	5·76	1·259	6·00
Enough - Not enough	5·75	1·431	6·00
Productive - Unproductive	5·75	·982	6·00
Supportive - Non-supportive	5·59	1·103	6·00
Opportune - Inopportune	5·48	1·194	6·00
Simple - Complex	5·27	1·673	6·00
Confirmed - Unconfirmed	4·97	1·230	4·00

TABLE 7.20

S.D. Scale Results for Reports "B" - ALL respondents

Pair of adjectives \ Statistics	Mean	Standard Deviation	Median
Accurate - Inaccurate	6.01	1·248	6·00
Correct - Incorrect	6·00	1·095	6·00
Current - Outdated	6·00	1·134	6·00
Detailed - General	5·97	1·454	6·00
Sufficient - Insufficient	5·96	1·237	6·00
Complete - Incomplete	5·82	1·280	6·00
Reliable - Unreliable	5·80	1·460	6·00
Informative - Uninformative	5·77	1·136	6·00
Trustworthy - Untrustworthy	5·76	1·270	6·00
Adequate - Inadequate	5·61	1·127	6·00
Timely - Untimely	5·55	1·285	6·00
Desirable - Undesirable	5·46	1·169	6·00
Ordered - Disordered	5·46	1·566	6·00
Well-timed - Ill-timed	5·46	1·318	6·00
Relevant - Irrelevant	5·45	1·538	6·00
Meaningful - Meaningless	5·44	1·339	6·00
Organised - Disorganised	5·44	1·461	6·00
Efficient - Inefficient	5·39	1·357	6·00
Enough - Not enough	5·34	1·638	6·00
Applicable - Inapplicable	5.32	1·500	6·00
Valuable - Worthless	5·31	1·249	5·00
Appropriate - Inappropriate	5·25	1·574	6·00
Workable - Unworkable	5·15	1·316	6·00
Well-constructed - Ill-constructed	5·13	1·473	6·00
Beneficial - Non-beneficial	5·08	1·556	5·00
Material - Immaterial	5·07	1·598	6·00
Important - Unimportant	5·06	1·567	5·00
Necessary - Unnecessary	5·06	1·548	5·00
Opportune - Inopportune	5·06	1·275	5·00
Effective - Ineffective	5·00	1·531	5·00
Confirmed - Unconfirmed	4·84	1·203	4·00
Supportive - Non-supportive	4·83	1·276	5·00
Productive - Non-productive	4·68	1·556	5·00
Simple - Complex	3·82	1·922	3·00

7.7. Custom-tailored (Ideal) reports

7.7.1. Introduction

As was mentioned earlier regarding the methodology applied in the study, a section was included in the questionnaire titled, "About custom-tailored reports" to repeat the analysis of the monetary and semantic differential value estimates for reports tailored to managers' needs, i.e. having optimal attributes. The aim of this section was to gather data for the case where the value measures of the existing report(s) indicated a low value. Under this condition, the value estimates would not reveal whether the low value was the result of poor implementation of the MIS or to inherently low valued information.

Such a measure would have enabled the researcher to discern between these alternatives. But, in view of the users' perceptions that the existing reports are valuable, this section will only be used to study:

(1) whether the users are ready to pay more for an improved version of the reports;

(2) to what extent the users will pay more, and whether this is statistically significant;

(3) whether the assumption of a report with ideal attributes has any effect on the value - in non-monetary terms - of the reports, and whether this effect is statistically significant.

7.7.2. Analysis of monetary value estimates

A review of the monetary value estimates for hypothetical reports with ideal attributes revealed results as shown in the following tables:

TABLE 7.21

Monetary Value Descriptive Statistics for Custom-tailored Reports (by strata)

Reports \ Strata	Department type "A"	Department type "B"	Department type "C"	Department type "D"	Department type "E"
Reports "A"	(N=3)	(N=12)	(N=10)	(N=15)	(N=30)
Mean £	9333•333	1135•417	625	313•333	185•333
S.D. £	13604•534	1896•422	470•962	192•230	285•702
Range £	500-25000	125-7000	0-1500	0-500	10-1500
Reports "B"					
Mean £	7666•667	1087•500	595	166•667	108•667
S.D. £	10727•690	2509•448	602•979	179•947	159•471
Range £	500-20000	50-9000	0-2000	0-500	0-500

TABLE 7.22

Monetary Value Descriptive Statistics for Custom-tailored Reports (by groups)

		Group 1 (N=15)	Group 2 (N=55)
Reports "A"			
Grand mean	£	2775•000	300•182
S.D.	£	6386•488	342•488
Range	£	125-25000	0-1500
Reports "B"			
Grand mean	£	2403•333	212•909
S.D.	£	5367•377	341•052
Range	£	50-20000	0-2000

In comparing the above figures with the averages presented earlier for the actual reports, we find that:

1. For reports "A", the comparison shows an increase of about 115% in the case of department type "A". This is attributable to the fact that one respondent gave £25000 as an estimated value of the hypothetical reports compared with only "£10000 +" (which was recorded in the analysis as only £10000)for the existing ones. The other two respondents gave the same monetary values to the existing reports as to the hypothetical ones. For department type "B", the increase was 43% on their estimates for the existing reports, for department type "C" the increase was 15%, for department type "D" the increase was only 2%, and finally for department type "E" the increase was 3%.

2. For reports "B", the comparison shows that the managers in department type "A" were willing to pay 71% more for these hypothetical reports, this increase is in fact (as with reports "A") attributable to one manager who gave £20000 as his estimate of the monetary value of these reports, while his estimate of the existing reports was "£10000 +" (which was recorded as £10000 only in our analysis). For departments type "B" and "C" the increases were by average 40% and 31% respectively. As to departments type "D" and "E" their estimates for these hypothetical reports with ideal attributes compared with the existing reports showed an increase by average of 2.5% and 1% respectively.

The decrease in the monetary value estimates as we move from department type "A" to department type "E", which is clearly obvious when we look at the averages of the two groups, supports the previous trend obtained in the analysis of the managers' estimates of the existing reports.

To test for the statistical significance of the difference between the monetary value estimates for the existing and the ideal (custom-tailored) reports, a "t" rest for paired observations was used (6). This test was used because the two estimates were dependent observations made by each participating manager.

The results of the paired difference test are presented in the following tables for each stratum and group, and for each set of reports.

TABLE 7.23

T-TEST Results for Monetary Values Estimates of Actual versus Hypothetical Reports (by strata)

Strata and Statistics / Monetary estimates	Dept. type "A" (N=3)			Dept. type "B" (N=13)			Dept. type "C" (N=10)			Dept. type "D" (N=15)			Dept. type "E" (N=30)		
	Computed t-value	ϕ	1-tail prob.	Computed t-value	ϕ	1-tail prob.	Computed t-value	ϕ	1-tail prob.	Computed t-value	ϕ	1-tail prob.	Computed t-value	ϕ	1-tail prob.
Monetary estimates for actual reports "A" vs. monetary estimates for hypothetical reports "A".	-1·00	2	·212	-1·40	11	·095*	-1·68	9	·064*	-1·47	14	·082*	-·58	29	·282
Monetary estimates for actual reports "B" vs. monetary estimates for hypothetical reports "B".	-1·00	2	·212	-·89	11	·196	-1·44	9	·092*	-1·00	14	·167	-·03	29	·487

* Significance $>$·05 $<$·10 (1-tail test) considered suggestive and supportive.

TABLE 7.24

T-TEST Results for Monetary Value Estimates of Actual versus Hypothetical Reports (by groups)

Groups and Statistics / Monetary estimates	Group 1 (N=15)			Group 2 (N=55)		
	Computed t-value	ϕ	1-tail prob.	Computed t-value	ϕ	1-tail prob.
Monetary estimates for actual reports "A" vs. Monetary estimates for hypothetical reports "A".	-1·27	14	·112	-1·81	54	·039*
Monetary estimates for actual reports "B" vs. monetary estimates for hypothetical reports "B".	-1·30	14	·108	-1·25	54	·109

* Significant at the ·05 level (1-tail test)

The above results show that the difference between the two monetary value estimates was statistically significant at the .05 level of significance (one-tailed test) only for reports "A", and only for group 2. As to the other strata and groups, while some of them for either reports were significant at the .10 level of significance (one-tailed test), this was considered to be well above $\alpha = .05$, a limit considered by the researcher as acceptable.

As a concluding comment, it may be said that the difference between the monetary value estimates of the existing and ideal (custom-tailored) reports were not significant, in a statistical framework, at the .05 level (using a one-tailed test). However, the figures presented earlier imply a willingness by the respondents especially in the case of departments "A", "B", and "C" to pay more for these hypothetical reports, an indication of the merits of any possible improvement in the satisfaction of the users of these reports with their attributes.

7.7.3. Analysis of semantic differential value scores

The aim of the analysis in this section is to find an answer to the question posed earlier - "whether the assumption of a report with ideal attributes has any effect on the value - in non-monetary terms - of the reports i.e. the semantic differential value scales, and is this effect statistically significant?" Before proceeding with the analysis, a word of caution seems necessary.

As was mentioned previously, the bi-polar adjectives used in the test instrument were factor analysed (the subject of the next chapter) in order to study their clustering, and hence build scales statistically sound to measure the value and the attributesof the reports. For this reason, the researcher presented in the section dealing with the semantic differential, overall results only, in order to avoid confusing and contradicting in some cases the results of this section with that of the next chapter. If this section were to include detailed analysis of the bi-polar adjectives scores in relation to the different aspects of the reports (value-attributes) as classified intuitively, confusion would result. Because of the above remark, the analysis in this section of the bi-polar adjectives which were assumed intuitively in the formulation of the questionnaire to reflect the value in non-monetary terms, and the test for any significant differences between their scores for the existing and hypothetical reports, are merely a tentative step to discern whether there is any differences, and their significance from a statistical point of view. A step deemed necessary in order to sustain the aim of these questions as part of the methodology applied in the research.

To test for the statistical significance of the difference between the scores of the 12 bi-polar adjectives which reflect value , the scores of all these adjectives were summed for the existing reports, and for the ideal hypothetical reports, then as the data were measured at

the ordinal level, the Wilcoxon matched-pairs signed ranks test (7) was used for the statistical significance of these differences, as these two scores were dependent observations made by each respondent. The results of the test are presented in the following tables for strata and groups and for both sets of reports.

TABLE 7.25

Wilcoxon Matched Pairs Signed Ranks Test for S.D. Value Scores of Actual versus Hypotherical Reports (by strata)

Strata and Statistics / SD "VALUE" scores	Dept. type "A" (N=3)		Dept. type "B" (N=13)		Dept.type "C" (N=10)		Dept. type "D" (N=15)		Dept. type "E" (N=30)	
	Z	1-tail prob.	Z	1-tail prob.	Z	1-tail prob.	Z	1-tail prob.	Z	1-tail prob.
S.D. "VALUE" scores for actual vs. hypothetical reports "A".	-1·6036	.0544*	-2·5205	·0059***	-2·2404	·0121**	-1·7821	·0374**	-·3920	.3476
S.D. "VALUE" scores for actual vs. hypothetical reports "B".	-1·6036	·0544*	-1·8227	·0342**	-2·6656	·0039***	-2·4422	·0073***	-3·3995	·0004***

* Significance > ·05 < ·10 level (1-tail test) considered suggestive and supportive.

** Significant at the ·05 level (1-tail test).

*** Significant at and beyond the ·01 level (1-tail test).

TABLE 7.26

Wilcoxon Matched Pairs Signed Ranks Test for S.D. Value Scores of Actual versus Hypotehtical Reports (by groups)

Groups and Statistics / SD "VALUE" scores	Group 1 (N=16)		Group 2 (N=55)	
	Z	1-tail prob.	Z	1-tail prob.
S.D. "VALUE" scores for actual vs. hypothetical reports "A".	-2·9341	·0017**	-1·6587	·0486*
S.D. "VALUE" scores for actual vs. hypothetical reports "B".	-2·4483	·0072**	-5·3810	·0000**

* Significant at the ·05 level (1-tail test)

** Significant at and beyond the ·01 level (1-tail test)

The results presented in the previous tables show that the difference in the scores of the bi-polar adjectives reflecting "Value" in non-monetary terms were statistically significant at the .05 level of significance (one-tailed test) and far beyond that in some cases, for all strata and groups with both reports, with the exception of department type "A" in both reports, and department type "E" in reports "A" only. In a statistical framework, while some of the results were not significant, we can still say that the assumption of optimal attributes did result in an increase statistically significant on the S.D. "Value" scores, an indication that:

1. From a practical point of view, any improvement in the attributes of the existing reports will have an effect on the users' satisfaction and greatly enhance the value of the reports.
2. From a methodological point of view, the inclusion of these questions in the test instrument to gather data for the case where the measures indicate a low value, and there is a need to differentiate between low value as a result of either a poor implementation of the MIS or as a result of low valued information is justified. The significant relationship between the assumption of optimal attributes and the value scores in non-monetary terms proves statistically that the aim of the questions was achieved, and that their use will furnish the people using it with the data needed for this purpose.

7.8. Degree to which reports meet control and planning needs.

Managers were asked to rate on a seven point scale how well the two sets of reports meet each of two original objectives, namely, to provide information to monitor performance, and to provide information for planning future operations. Descriptive statistics related to managers' answers are presented in the following two tables:

TABLE 7.27

How Well Reports "A" and Reports "B" provide information to Monitor Performance

Reports and Respondents / Statistics	Reports	Groups		Departments				
		Group 1 (N=16)	Group 2 (N=55)	Type "A" (N=3)	Type "B" (N=13)	Type "C" (N=10)	Type "D" (N=15)	Type "E" (N=30)
Mean (Grand)	A	6·06	5·91	6·00	6·08	6.40	6·27	5·57
Standard Deviation		·573	1·080	0	·641	·699	·799	1·194
Median		6·00	6·00	6·00	6·00	6·50	6·00	6·00
Range		5.00-7.00	2.00-7.00	-	5.00-7.00	5.00-7.00	5.00-7.00	2.00-7.00
Mean (Grand)	B	5·19	4·85	5·33	5·15	5·20	5·60	4·37
Standard Deviation		1·420	1·610	1·155	1·519	1·476	1·121	1·732
Median		5·00	5·00	6·00	5·00	5·00	6·00	4·00
Range		3.00-7.00	1·00-7·00	4·00-6·00	3·00-7·00	2·00-7·00	4·00-7·00	1·00-7·00

TABLE 7.28

How Well Reports "A" and Reports "B" Provide Information for Planning Future Operations

Reports and Respondents / Statistics	Reports	Groups		Departments				
		Group 1 (N=16)	Group 2 (N=55)	Type "A" (N=3)	Type "B" (N=13)	Type "C" (N=10)	Type "D" (N=15)	Type "E" (N=30)
Mean (Grand)	A	5·06	5·36	5·00	5·08	5·40	5·80	5·13
Standard Deviation		1·611	1·440	1·00	1·754	1·838	1·014	1·479
Median		5.00	6·00	5·00	5·00	6·00	6·00	6·00
Range		1·00-7·00	1·00-7·00	4·00-6·00	1·00-7·00	2·00-7·00	3·00-7·00	1·00-7·00
Mean (Grand)	B	4.25	3·94	3·67	4·38	4·30	4·13	3·73
Standard Deviation		1·880	1·660	1·155	2·022	1·829	1·685	1·617
Median		3·50	4·00	3·00	4·00	5·00	4·00	3·50
Range		1.00-7·00	1·00-7·00	3·00-5·00	1·00-7·00	1·00-7·00	1·00-7·00	1·00-7·00

The previous results can be summarised as follows:

a) Managers in all departments or groups perceived reports "A" as providing more information needed for the control and planning of their operations than those provided by reports "B".

b) In terms of each set of reports, managers perceived control needs as more satisfied than planning needs.

c) While managers' ratings for reports "A" for both needs and for reports "B" in relation to control needs only were either slightly well or quite well as the figures show, they rated reports "B" in how well they provide them with information for planning their future operations around (4) which was labelled "somewhat", an indication of a general need by managers for more information in this context.

The data provided by this question will be used later in testing hypotheses about the relationship between managers' degree of satisfaction with the reports providing them with information for the controlling and planning of their operations, and both their monetary value estimates of these reports and their scores on the S.D. scales; their level in the organisational hierarchy; the amount of budget they are responsible for; the number of parts they review in each set of reports, which will be presented in a later chapter in this part of the study.

7.9. Parts reviewed in the reports

Two questions were included in the questionnaire upon the request of the company. These asked managers about the parts they review regularly in the two sets of reports under investigation. Tabulating the responses was achieved with the help of company officials, and are presented in the following two tables:

TABLE 7.29

Parts Reviewed Regularly in Reports "A"

Respondents / Parts reviewed	Departments					Total number of managers reviewing the part(s)
	Type "A"	Type "B"	Type "C"	Type "D"	Type "E"	
A. All income and expenses.	3	9	4	13	15	44
B. All expenses or all commissions and fees.	-	-	1	1	1	3
C. Significant items (from management point of view) of Income and Expenses.	-	4	4	1	13	22
D. A specific item of expense .	-	-	1	-	-	1
E. None.	-	-	-	-	1	1
Total number of respondents (managers) in each department.	3	13	10	15	30	71

TABLE 7.30

Parts Reviewed Regularly in Reports "B"

Respondents / Parts reviewed	Departments					Total number managers reviewing the part(s)
	Type "A"	Type "B"	Type "C"	Type "D"	Type "E"	
A. All resources and advances.	3	8	5	8	14	38
B. All advances.	-	-	-	3	6	9
C. All except budget rate and budget resources.	-	1	-	-	-	1
D. Significant items (from management point of view) of Resources and Advances.	-	4	4	2	7	17
E. None.	-	-	-	2	2	4
Total number of respondents (managers) in each department.	3	13	9	15	29	69

The previous results can be summarised as follows:

(i) Reports "A", 62% of all managers in the sample regularly review the reports in all their parts and sections, 31% review only the significant items of Income and Expenses, with the remainder 7% reviewing only All expenses, All commissions and fees, a specific item of expense, or not reviewing any parts of the reports.

(ii) Reports "B", 55% of the managers reviewed the reports in all their parts, 24.5% reviewed significant items of Resources and Advances, and 13% reviewed All advances statements. The remainder of managers, 7.5% either reviewed all the parts except for the budget rate and budget resources, or did not review any of the parts.

In general it can be said that the majority of the respondents see these reports, as reflected by the number of parts they regularly review in the reports, as important for the performance of their duties.

Before concluding this discussion, it is worth mentioning that managers' answers to these two questions were ranked from 4 to 0 to represent in descending order the number of parts reviewed in the reports, corresponding to A through E as presented in the tables, the aim being their use in testing hypotheses about the relationship between the number of parts managers review in the reports and both their monetary value and their scores on the S.D. scales; their level in the organisational hierarchy; the amount of budget they are responsible for; and finally, their degree of satisfaction with the reports meeting their control and planning needs, which will be presented in a later chapter in this part of the study.

7.10. Summary and Conclusions

This chapter has presented preliminary results of the questionnaire survey used to collect the data required in the development of a tool for use in the evaluation of management information. A summary of the results related to each set of reports investigated and its associated descriptive statistics are presented below:

(i) The managers were willing to pay annually for reports "A" the following amounts (in averages - rounded to the nearest £): £4334 (Department type "A"); £792 (Department type "B"); £540 (Department type "C"); £307 (Department type "D"); and £179 (Department type "E"). They were willing to pay the following amounts for reports "B" (in averages - rounded to the nearest £): £4334 (Department type "A"); £777 (Department type "B"); £455 (Department type "C"); £163 (Department type "D"); and £108 (Department type "E").

(ii) The cost of receiving the information contained in both sets of reports from alternative methods (i.e. additional personnel to produce the reports) was the first choice as a basis for estimating the monetary value of the reports for managers in departments type "A", "B", and "C".

The value of time saved towards preparedness for taking decisions and implementing them was the first choice as a basis for estimating the monetary value of the reports for managers in departments type "D" and "E".

(iii) From an overall point of view, the managers rated reports "A" on the SD scales as between quite favourable and very favourable, and they rated reports "B" as between slightly favourable and quite favourable.

(iv) Managers were ready to pay more for an improved version of the reports. As to the statistical significance of the differences between the two estimates, the study revealed that this was significant for one of the two groups studied and in relation to one of the two sets of reports only at the .05 level (one tail test) and for some of the strata at the .10.level (one tail test).

(v) The assumption that perceived ideal attributes have an effect on the value - (as measured by the SD scales) - of the resports was found to be valid. The effect was found to be positive. The difference between the two scores was significant at the .05 level and far beyond (one tail test) for all strata and most groups with both sets of reports.

(vi) Managers perceive reports "A" as meeting the controlling objective "quite well" and the planning objective is met "slightly" to "quite well". As to reports "B", managers in departments type "A" to "D" rated the reports as meeting the controlling objective between "slightly well" and "quite well", while the ratings of managers of department type "E" was around the "slightly well". The ratings of all strata for the reports meeting the planning objective was around the (4) mark labelled "somewhat" in the questionnaire.

(vii) Forty-four managers representing 62% of all managers in the sample stated they reviewed ALL parts of reports "A"; only one manager said that he did not review any parts of the reports. As to reports "B", thirty-eight managers (55% of the sample) reviewed ALL parts of the reports. Four managers only (6% of the sample) did not review any of the parts of the reports.

(viii) Five and seven managers felt they were consulted about reports "A" and reports "B" respectively prior to implementation.

To conclude, it is worth discussing the 'break-in period' mentioned earlier.* One criterion suggested for application when selecting a company as a field site for research is that a report should have been used within an organisation for one year or more. Reports "B" have only been in use for five months. In spite of this, the results above indicate that perceptions of the value and attributes of these reports did not appear to be influenced unduly by this time factor. Hence, as far as this report was concerned, the users' experience was sufficient to make these judgements; indicating greater flexibility is possible in relation to this criterion in future research.

Moreover, the results presented in this chapter indicate that the measure of monetary value and the measures of maximum value proposed for use in the evaluation of management information performed successfully:

---

* Please refer to section 6.2, p.310

(i) The feasibility of the question relating to the monetary value of the reports was satisfactorily demonstrated. This claim can be substantiated by the fact that seventy out of the seventy-one respondents answered the question about the monetary value of the two sets of reports. Even the respondents who gave a value of zero to a set of reports demonstrated a valid understanding of this question as shown in the bases they gave for their estimates.

A review of the results concerning the different bases offered for these monetary estimates uncovered the success achieved in eliciting managers' candid answers in this respect, and proved that a similar question may be tailored to meet the particular characteristics of any environment when investigating the value of management information generated through MIS reports.

(ii) The results relating to measures of maximum report value to a manager reveal that the aim of including the questions in the test instrument to gather data to differentiate between low value as a result of either a poor implementation of the MIS or low value as a result of low valued information was met. The questions proved quite feasible and will provide the data needed to resolve this issue.

REFERENCES

1. Oppenheim, A.N., Questionnaire design and attitude measurement, Heinemann Educational Books Ltd., London, 1973, p.34.

2. Ibid

3. McRae, T.W., Computers and Accounting, John Wiley & Sons Ltd., London, 1976, pp.149-151.

4. Kelly, J.A., The Analysis and Measurement of Value of selected non-financial project management information, Unpublished DBA dissertation, Florida State University, 1971, p.140.

5. Messick, S.J., Metric Properties of the Semantic Differential, in Snider, J.G., & Osgood, C.E., (eds.), Semantic Differential Technique: A Sourcebook, Aldine Publishing Co., Chicago, 1969, pp.161-167.

6. Hays, W.L., Statistics for the Social Sciences, Holt, Rinehart & Winston, London, Second Edition, 1973, pp.424-427.

7. Siegel, S., Non-parametric Statistics: for the behavioural sciences, McGraw-Hill Co. Inc., N.Y., 1956, pp.75-83.

SUPPLEMENT TO CHAPTER 7

TABLE VII.I

Annual Monetary Value Estimates of the Managers' Willingness to Pay for the Reports "A" - Ranked

Department type "A"	Department type "B"	Department type "C"	Department type "D"	Department type "E"
10000	4000	1000	500	1500
2500	1500	1000	500	500
500	1000	1000	500	500
	1000	500	500	500
	500	500	500	500
	500	500	500	250
	200	500	500	200
	200	200	250	200
	200	200	200	100
	200	0	200	100
	150		200	100
	50		100	100
			100	50
			50	50
			0	50
				50
				50
				50
				50
				50
				50
				50
				50
				50
				50
				50
				50
				50
				10
				0

TABLE VII.II

Annual Monetary Value Estimates of the Managers' Willingness to Pay for Reports "B" - Ranked

Department type "A"	Department type "B"	Department type "C"	Department type "D"	Department type "E"
10000	5000	1000	500	1000
2500	1500	1000	500	500
500	1000	1000	500	500
	1000	500	200	200
	200	500	150	100
	150	200	100	100
	100	200	100	100
	100	100	100	50
	100	50	100	50
	75	0	50	50
	50		50	50
	50		50	50
			50	50
			0	50
			0	50
				50
				50
				50
				50
				50
				50
				25
				10
				5
				0
				0
				0
				0
				0
				0

TABLE VII.III

S.D. Scale Results for Reports "A" - Departments Type "A"

Statistics / Pair of adjectives	Mean	Standard Deviation	Median
Desirable - Undesirable	6.66	.577	7.00
Detailed - General	6.66	.577	7.00
Accurate - Inaccurate	6.66	.577	7.00
Correct - Incorrect	6.66	.577	7.00
Current - Outdated	6.66	.577	7.00
Well-timed - Ill-timed	6.66	.577	7.00
Timely - Untimely	6.66	.577	7.00
Important - Unimportant	6.33	.577	6.00
Valuable - Worthless	6.33	.577	6.00
Relevant - Irrelevant	6.33	.577	6.00
Informative - Uninformative	6.33	.577	6.00
Necessary - Unnecessary	6.33	1.155	7.00
Beneficial - Non-beneficial	6.33	1.155	7.00
Complete - Incomplete	6.33	.577	6.00
Sufficient - Insufficient	6.33	.577	6.00
Enough - Not enough	6.33	.577	6.00
Reliable - Unreliable	6.33	.577	6.00
Trustworthy - Untrustworthy	6.33	.577	6.00
Appropriate - Inappropriate	6.33	.577	6.00
Meaningful - Meaningless	6.00	0.000	6.00
Material - Immaterial	6.00	0.000	6.00
Effective - Ineffective	6.00	0.000	6.00
Applicable - Inapplicable	6.00	0.000	6.00
Adequate - Inadequate	6.00	0.000	6.00
Ordered - Disordered	6.00	0.000	6.00
Organised - Disorganised	6.00	0.000	6.00
Well-constructed - Ill-constructed	5.66	.577	6.00
Opportune - Inopportune	5.66	1.528	6.00
Workable - Unworkable	5.66	.577	6.00
Efficient - Inefficient	5.33	1.155	6.00
Productive - Unproductive	5.33	.577	5.00
Supportive - Non-supportive	4.66	1.155	4.00
Confirmed - Unconfirmed	4.00	0.000	4.00
Simple - Complex	3.33	2.517	3.00

TABLE VII.IV

S.D. Scale Results for Reports "A" - Departments type "B"

Statistics / Pair of Adjectives	Mean	Standard Deviation	Median
Accurate - Inaccurate	6.92	.277	7.00
Informative - Uninformative	6.69	.480	7.00
Adequate - Inadequate	6.53	.519	7.00
Material - Immaterial	6.46	1.127	7.00
Correct - Incorrect	6.46	.967	7.00
Necessary - Unnecessary	6.38	1.121	7.00
Ordered - Disordered	6.38	.650	6.00
Reliable - Unreliable	6.38	1.325	7.00
Important - Unimportant	6.30	.855	6.00
Valuable - Worthless	6.30	.480	6.00
Relevant - Irrelevant	6.30	1.109	7.00
Efficient - Inefficient	6.30	1.109	7.00
Beneficial - Non-beneficial	6.23	.927	6.00
Detailed - General	6.23	.439	6.00
Meaningful - Meaningless	6.15	1.345	6.00
Organised - Disorganised	6.15	1.068	6.00
Complete - Incomplete	6.07	1.320	6.00
Well-constructed -Ill-constructed	6.07	1.038	6.00
Workable - Unworkable	6.07	1.115	6.00
Trustworthy - Untrustworthy	6.00	1.080	6.00
Well-timed - Ill-timed	6.00	1.080	6.00
Appropriate - Inappropriate	5.92	1.256	6.00
Supportive - Non-supportive	5.84	.987	6.00
Current - Out-dated	5.84	1.214	6.00
Sufficient - Insufficient	5.76	1.536	6.00
Productive - Unproductive	5.76	.832	6.00
Opportune - Inopportune	5.69	1.032	6.00
Effective - Ineffective	5.53	1.613	6.00
Applicable - Inapplicable	5.53	1.898	6.00
Simple - Complex	5.53	1.761	6.00
Enough - Not enough	5.46	2.222	6.00
Desirable - Undesirable	5.38	2.364	6.00
Timely - Untimely	5.30	1.548	5.00
Confirmed - Unconfirmed	5.15	1.519	4.00

TABLE VII.V

S.D. Scale Results for Reports "A" - Departments Type "C"

Pair of Adjectives \ Statistics	Mean	Standard Deviation	Median
Relevant - Irrelevant	6.70	.483	7.00
Informative - Uninformative	6.70	.483	7.00
Accurate - Inaccurate	6.70	.483	7.00
Meaningful - Meaningless	6.60	.516	7.00
Material - Immaterial	6.60	.516	7.00
Necessary - Unnecessary	6.60	.699	7.00
Adequate - Inadequate	6.60	.516	7.00
Important - Unimportant	6.50	.527	6.50
Beneficial - Non-beneficial	6.50	.707	7.00
Current - Outdated	6.50	.707	7.00
Appropriate - Inappropriate	6.50	.527	6.50
Valuable - Worthless	6.40	.516	6.00
Effective - Ineffective	6.40	.516	6.00
Complete - Incomplete	6.40	.699	6.50
Reliable - Unreliable	6.40	.516	6.00
Well-timed - Ill-timed	6.40	.699	6.50
Applicalbe - Inapplicable	6.30	1.567	7.00
Sufficient - Insufficient	6.30	.483	6.00
Workable - Unworkable	6.30	.483	6.00
Supportive - Non-supportive	6.20	.919	6.00
Enough - Not enough	6.20	.632	6.00
Correct - Incorrect	6.20	.919	6.00
Timely - Untimely	6.20	.919	6.00
Efficient - Inefficient	6.20	.919	6.00
Desirable - Undesirable	6.10	1.853	7.00
Trustworthy - Untrustworthy	6.10	1.524	6.50
Ordered - Disordered	6.00	1.155	6.00
Well-constructed - Ill-constructed	6.00	1.414	6.50
Detailed - General	5.90	1.663	6.50
Productive - Unproductive	5.90	.876	6.00
Organised - Disorganised	5.80	1.317	6.00
Confirmed - Unconfirmed	5.20	1.317	5.00
Opportune - Inopportune	5.20	1.317	5.00
Simple - Complex	4.90	1.912	5.00

TABLE VII.VI

S.D. Scale Results for Reports "A" - Departments Type "D"

Statistics / Pair of Adjectives	Mean	Standard Deviation	Median
Accurate - Inaccurate	6.73	.458	7.00
Correct - Incorrect	6.60	.507	7.00
Important - Unimportant	6.53	.516	7.00
Reliable - Unreliable	6.53	.516	7.00
Material - Immaterial	6.46	.516	6.00
Desirable - Undesirable	6.46	.516	6.00
Organised - Disorganised	6.46	.516	6.00
Trustworthy - Untrustworthy	6.46	.640	7.00
Meaningful - Meaningless	6.40	.507	6.00
Relevant - Irrelevant	6.40	.632	6.00
Beneficial - Non-beneficial	6.40	.507	6.00
Ordered - Disordered	6.40	.632	6.00
Informative - Uninformative	6.33	1.291	7.00
Necessary - Unnecessary	6.33	.488	6.00
Valuable - Worthless	6.26	.458	7.00
Current - Outdated	6.26	.799	6.00
Efficient - Inefficient	6.26	1.280	7.00
Appropriate - Inappropriate	6.26	.458	6.00
Workable - Unworkable	6.26	.458	6.00
Effective - Ineffective	6.20	.107	6.00
Applicable - Inapplicable	6.20	.414	6.00
Detailed - General	6.20	1.320	7.00
Well-timed - Ill-timed	6.13	1.125	6.00
Opportune - Inopportune	5.93	1.100	6.00
Adequate - Inadequate	5.86	1.125	6.00
Timely - Untimely	5.86	1.302	6.00
Productive - Unproductive	5.86	.834	6.00
Complete - Incomplete	5.80	1.612	6.00
Sufficient - Insufficient	5.80	1.521	6.00
Well-constructed - Ill-constructed	5.73	1.163	6.00
Enough - Not enough	5.60	1.805	6.00
Supportive - Non-supportive	5.40	1.404	6.00
Simple - Complex	5.40	1.682	6.00
Confirmed - Unconfirmed	4.66	1.113	4.00

TABLE VII.VII

S.D. Scale Results for Reports "A" - Departments Type "E"

Pair of adjectives \ Statistics	Mean	Standard Deviation	Median
Correct - Incorrect	6.63	.718	7.00
Informative - Uninformative	6.50	.572	7.00
Relevant - Irrelevant	6.40	.621	6.00
Reliable - Unreliable	6.40	.894	7.00
Important - Unimportant	6.30	.750	6.00
Desirable - Undesirable	6.30	.750	6.00
Meaningful - Meaningless	6.26	.640	6.00
Effective - Ineffective	6.26	.691	6.00
Material - Immaterial	6.23	.728	6.00
Necessary - Unnecessary	6.20	.805	6.00
Beneficial - Non-beneficial	6.20	.761	6.00
Current - Out-dated	6.16	1.020	6.00
Valuable - Worthless	6.13	.730	6.00
Organisied - Disorganised	6.10	.885	6.00
Accurate - Inaccurate	6.10	1.626	7.00
Adequate - Inadequate	6.06	.944	6.00
Trustworthy - Untrustworthy	6.06	1.337	6.00
Efficient - Inefficient	6.06	.868	6.00
Workable - Unworkable	6.06	.785	6.00
Appropriate - Inappropriate	6.00	1.017	6.00
Ordered - Disordered	5.96	1.245	6.00
Well-constructed - Ill-constructed	5.96	.669	6.00
Sufficient - Insufficient	5.93	.980	6.00
Applicable - Inapplicable	5.90	1.296	6.00
Well-timed - Ill-timed	5.86	1.074	6.00
Enough - Not enough	5.73	1.015	6.00
Complete - Incomplete	5.66	1.322	6.00
Detailed - General	5.66	1.348	6.00
Timely - Untimely	5.66	1.213	6.00
Productive - Unproductive	5.66	1.184	6.00
Supportive - Non-supportive	5.46	.973	6.00
Simple - Complex	5.40	1.429	6.00
Opportune - Inopportune	5.23	1.223	6.00
Confirmed - Unconfirmed	5.06	1.172	4.50

TABLE VII.VIII

S.D. Scale Results for Reports "A" - Group 1

Pair of adjectives \ Statistics	Mean	Standard Deviation	Median
Accurate - Inaccurate	6.87	.342	7.00
Informative - Uninformative	6.62	.500	7.00
Correct - Incorrect	6.50	.894	7.00
Adequate - Inadequate	6.44	.512	6.00
Necessary - Unnecessary	6.38	1.088	7.00
Reliable - Unreliable	6.38	1.204	7.00
Material - Immaterial	6.38	1.025	6.00
Detailed - General	6.31	.479	6.00
Important - Unimportant	6.31	.793	6.00
Valuable - Worthless	6.31	.479	6.00
Relevant - Irrelevant	6.31	1.014	6.00
Ordered - Disordered	6.31	.602	6.00
Beneficial - Non-beneficial	6.25	.931	7.00
Well-timed - Ill-timed	6.13	1.025	6.00
Complete - Incomplete	6.13	1.204	6.00
Meaningful - Meaningless	6.13	1.204	6.00
Organised - Disorganised	6.13	.957	6.00
Efficient - Inefficient	6.13	1.147	6.00
Trustworthy - Untrustworthy	6.06	1.436	6.00
Current - Outdated	6.00	1.155	6.00
Appropriate - Inappropriate	6.00	1.155	6.00
Well-constructed - Ill-constructed	6.00	.966	6.00
Workable - Unworkable	6.00	1.033	6.00
Sufficient - Insufficient	5.88	1.408	6.00
Opportune - Inopportune	5.69	1.078	6.00
Productive - Unproductive	5.69	.793	6.00
Desirable - Undesirable	5.63	2.187	7.00
Effective - Ineffective	5.63	1.455	6.00
Enough - Not enough	5.63	2.029	6.00
Applicable - Inapplicable	5.63	1.708	6.00
Supportive - Non-supportive	5.62	1.088	6.00
Timely - Untimely	5.56	1.504	6.00
Simple - Complex	5.13	2.029	6.00
Confirmed - Unconfirmed	4.94	1.436	4.00

TABLE VII.IX

S.D. Scale Results for Reports "A" - Group 2

Pair of adjectives \ Statistics	Mean	Standard Deviation	Median
Correct - Incorrect	6.55	.715	7.00
Informative - Uninformative	6.49	.814	7.00
Relevant - Irrelevant	6.46	.603	7.00
Reliable - Unreliable	6.44	.739	7.00
Important - Unimportant	6.40	.655	6.00
Accurate - Inaccurate	6.38	1.269	7.00
Meaningful - Meaningless	6.36	.589	6.00
Material - Immaterial	6.36	.649	6.00
Necessary - Unnecessary	6.31	.717	6.00
Beneficial - Non-beneficial	6.31	.690	6.00
Desirable - Undesirable	6.31	.979	6.00
Effective - Ineffective	6.27	.592	6.00
Current - Outdated	6.26	.907	6.00
Valuable - Worthless	6.22	.629	6.00
Trustworthy - Untrustworthy	6.18	1.219	6.00
Appropriate - Inappropriate	6.16	.834	6.00
Workable - Unworkable	6.16	.660	6.00
Efficient - Inefficient	6.15	.989	6.00
Organised - Disorganised	6.15	.911	6.00
Adequate - Inadequate	6.11	.956	6.00
Ordered - Disordered	6.09	1.093	6.00
Applicable - Inapplicable	6.05	1.177	6.00
Well-timed - Ill-timed	6.04	1.036	6.00
Sufficient - Insufficient	5.96	1.088	6.00
Well-constructed - Ill-constructed	5.91	.967	6.00
Detailed - General	5.86	1.393	6.00
Complete - Incomplete	5.84	1.330	6.00
Timely - Untimely	5.82	1.188	6.00
Enough - Not enough	5.78	1.228	6.00
Productive - Unproductive	5.76	1.036	6.00
Supportive - Non-supportive	5.58	1.117	6.00
Opportune - Inopportune	5.42	1.228	6.00
Simple - Complex	5.31	1.574	6.00
Confirmed - Unconfirmed	4.98	1.178	4.00

TABLE VII.X

S.D.Scale Results for Reports "B" - Departments Type "A"

Pair of adjectives \ Statistics	Mean	Standard Deviation	Median
Enough - Not enough	7.00	0.000	7.00
Detailed - General	7.00	0.000	7.00
Desirable - Undesirable	6.66	.577	7.00
Informative - Uninformative	6.66	.577	7.00
Complete - Incomplete	6.66	.577	7.00
Sufficient - Insufficient	6.66	.577	7.00
Adequate - Inadequate	6.66	.577	7.00
Current - Outdated	6.66	.577	7.00
Timely - Untimely	6.66	.577	7.00
Meaningful - Meaningless	6.33	.577	6.00
Necessary - Unnecessary	6.33	1.155	7.00
Ordered - Disordered	6.33	.577	6.00
Well-timed - Ill-timed	6.33	.577	6.00
Important - Unimportant	6.00	1.000	6.00
Valuable - Worthless	6.00	1.000	6.00
Material - Immaterial	6.00	1.000	6.00
Relevant - Irrelevant	6.00	1.000	6.00
Well-constructed - Ill-constructed	6.00	0.000	6.00
Accurate - Inaccurate	6.00	1.000	6.00
Correct - Incorrect	6.00	1.000	6.00
Opportune - Inopportune	6.00	1.732	7.00
Appropriate - Inappropriate	6.00	1.000	6.00
Effective - Ineffective	5.66	.577	6.00
Applicable - Inapplicable	5.66	.577	6.00
Beneficial - Non-beneficial	5.66	2.309	7.00
Organised - Disorganised	5.66	.577	6.00
Reliable - Unreliable	5.33	2.082	6.00
Trustworthy - Untrustworthy	5.33	2.082	6.00
Efficient - Inefficient	5.33	.577	5.00
Productive - Unproductive	5.33	.577	5.00
Workable - Unworkable	5.33	.577	5.00
Supportive - Non-supportive	4.66	1.155	4.00
Confirmed - Unconfirmed	4.66	1.155	4.00
Simple - Complex	3.33	2.517	3.00

TABLE VII.XI

S.D. Scale Results for Reports "B" - Departments Type "B"

Statistics / Pair of adjectives	Mean	Standard Deviation	Median
Detailed - General	6.30	.855	6.00
Informative - Uninformative	6.23	.599	6.00
Correct - Incorrect	6.15	1.144	6.00
Sufficient - Insufficient	6.00	1.000	6.00
Trustworthy - Untrustworthy	6.00	1.291	6.00
Adequate - Inadequate	5.96	.751	6.00
Meaningful - Meaningless	5.92	.760	6.00
Relevant - Irrelevant	5.92	1.188	6.00
Valuable - Worthless	5.84	.689	6.00
Applicable - Inapplicable	5.84	1.144	6.00
Complete - Incomplete	5.84	.801	6.00
Current - Outdated	5.76	1.589	6.00
Desirable - Undesirable	5.69	1.251	6.00
Workable - Unworkable	5.69	1.032	6.00
Supportive - Non-supportive	5.53	.877	5.00
Enough - Not enough	5.53	1.613	6.00
Ordered - Disordered	5.53	1.664	6.00
Reliable - Unreliable	5.53	1.941	6.00
Material - Immaterial	5.46	1.664	6.00
Effective - Ineffective	5.46	1.266	6.00
Beneficial - Non-beneficial	5.46	1.330	6.00
Organised - Disorganised	5.46	1.450	6.00
Well-timed - Ill-timed	5.46	1.391	6.00
Timely - Untimely	5.46	1.450	6.00
Appropriate - Inappropriate	5.46	1.391	6.00
Important - Unimportant	5.38	1.325	6.00
Accurate - Inaccurate	5.38	1.981	6.00
Opportune - Inopportune	5.38	1.325	6.00
Necessary - Unnecessary	5.23	1.363	5.00
Well-constructed - Ill-constructed	5.23	1.589	6.00
Confirmed - Unconfirmed	5.23	1.301	5.00
Efficient - Inefficient	5.15	1.725	6.00
Productive - Unproductive	4.84	1.281	5.00
Simple - Complex	3.76	2.088	3.00

TABLE VII.XII

S.D. Scale Results for Reports "B" - Departments Type "C"

Pair of Adjectives \ Statistics	Mean	Standard Deviation	Median
Desirable - Undesirable	6.30	.675	6.00
Current - Outdated	6.10	.994	6.00
Relevant - Irrelevant	6.00	1.155	6.00
Beneficial - Non-beneficial	6.00	1.155	6.00
Detailed - General	6.00	1.826	6.50
Valuable - Worthless	5.90	.738	6.00
Informative - Uninformative	5.90	1.287	6.00
Accurate - Inaccurate	5.90	.994	6.00
Correct - Incorrect	5.90	1.101	6.00
Applicable - Inapplicable	5.70	1.567	6.00
Complete - Incomplete	5.70	1.636	6.00
Sufficient - Insufficient	5.70	1.636	6.00
Trustworthy - Untrustworthy	5.70	1.252	6.00
Appropriate - Inappropriate	5.70	1.567	6.00
Enough - Not enough	5.60	2.011	6.50
Organised - Disorganised	5.50	1.581	6.00
Well-constructed - Ill-constructed	5.50	1.509	6.00
Timely - Untimely	5.50	1.434	6.00
Necessary - Unnecessary	5.40	1.647	6.00
Reliable - Unreliable	5.40	1.776	6.00
Well-timed - Ill-timed	5.40	1.350	6.00
Meaningful- Meaningless	5.30	1.829	6.00
Effective - Ineffective	5.30	1.703	6.00
Adequate - Inadequate	5.20	1.619	5.50
Opportune - Inopportune	5.20	1.317	5.00
Efficient - Inefficient	5.20	1.476	6.00
Important - Unimportant	5.10	1.912	6.00
Productive - Unproductive	5.10	1.969	5.50
Workable - Unworkable	5.10	1.853	6.00
Ordered - Disordered	5.00	1.944	5.50
Material - Immaterial	4.90	2.079	6.00
Confirmed - Unconfirmed	4.70	.949	4.00
Supportive - Non-supportive	4.30	1.889	4.00
Simple - Complex	3.70	2.406	3.50

TABLE VII.XIII

S.D. Scale Results for Reports "B" - Departments Type "D"

Statistics / Pair of Adjectives	Mean	Standard Deviation	Median
Current - Outdated	6.26	.704	6.00
Timely - Untimely	6.20	.862	6.00
Accurate - Inaccurate	6.13	1.246	7.00
Well-timed - Ill-timed	6.13	.990	6.00
Correct - Incorrect	6.06	.961	6.00
Detailed - General	6.00	1.512	6.00
Trustworthy - Untrustworthy	6.00	.926	6.00
Efficient - Inefficient	5.93	.458	6.00
Adequate - Inadequate	5.86	.915	6.00
Organised - Disorganised	5.86	1.302	6.00
Informative - Uninformative	5.80	1.014	6.00
Reliable - Unreliable	5.80	1.373	6.00
Sufficient - Insufficient	5.73	1.280	6.00
Ordered - Disordered	5.73	1.486	6.00
Complete - Incomplete	5.60	1.404	6.00
Enough - Not enough	5.46	1.506	6.00
Material - Immaterial	5.40	.828	6.00
Meaningful - Meaningless	5.33	1.113	6.00
Opportune - Inopportune	5.33	1.047	5.00
Appropriate - Inappropriate	5.26	1.223	6.00
Important - Unimportant	5.20	1.612	6.00
Relevant - Irrelevant	5.20	1.521	6.00
Necessary - Unnecessary	5.20	1.207	5.00
Workable - Unworkable	5.20	1.320	6.00
Desirable - Undesirable	5.13	.915	5.00
Valuable - Worthless	5.06	1.486	5.00
Effective - Ineffective	5.06	1.624	6.00
Applicable - Inapplicable	5.06	1.223	5.00
Beneficial - Non-beneficial	5.00	1.414	5.00
Supportive - Non-supportive	5.00	1.309	6.00
Well-constructed - Ill-constructed	5.00	1.558	5.00
Productive - Unproductive	5.00	1.464	5.00
Confirmed - Unconfirmed	4.86	1.407	5.00
Simple - Complex	3.46	1.727	3.00

TABLE VII.XIV

S.D. Scale Results for Reports "B" - Departments Type "E"

Pair of adjectives \ Statistics	Mean	Standard Deviation	Median
Accurate - Inaccurate	6.26	.868	6.00
Reliable - Unreliable	6.10	1.094	6.50
Correct - Incorrect	5.93	1.202	6.00
Complete - Incomplete	5.86	1.332	6.00
Correct - Outdated	5.86	1.167	6.00
Detailed - General	5.70	1.557	6.00
Trustworthy - Untrustworthy	5.60	1.380	6.00
Adequate - Inadequate	5.46	1.167	6.00
Informative - Uninformative	5.43	1.278	6.00
Sufficient - Insufficient	5.43	1.194	6.00
Ordered - Disordered	5.36	1.520	6.00
Efficient - Inefficient	5.30	1.489	6.00
Meaningful - Meaningless	5.23	1.478	5.50
Organised - Disorganised	5.16	1.577	6.00
Timely - Untimely	5.16	1.262	6.00
Desirable - Undesirable	5.13	1.224	5.00
Relevant - Irrelevant	5.13	1.776	6.00
Applicable - Inapplicable	5.06	1.760	5.50
Well-timed - Ill-timed	5.06	1.363	5.00
Valuable - Worthless	4.93	1.337	5.00
Enough - Not enough	4.93	1.596	4.50
Well-constructed - Ill-constructed	4.93	1.461	5.00
Appropriate - Inappropriate	4.93	1.837	5.00
Workable - Unworkable	4.90	1.269	5.00
Important - Unimportant	4.73	1.574	5.00
Confirmed - Unconfirmed	4.73	1.172	4.00
Material - Immaterial	4.70	1.705	5.00
Necessary - Unnecessary	4.66	1.729	5.00
Supportive - Non-supportive	4.63	1.098	4.50
Opportune - Inopportune	4.63	1.245	4.50
Effective - Ineffective	4.60	1.567	5.00
Beneficial - Non-beneficial	4.60	1.653	5.00
Productive - Non-productive	4.23	1.519	4.50
Simple - Complex	4.10	1.807	3.50

TABLE VII.XV

S.D. Scale Results for Reports "B" - Group 1

Pair of adjectives \ Statistics	Mean	Standard Deviation	Median
Detailed - General	6.44	.814	7.00
Informative - Uninformative	6.31	.602	6.00
Sufficient - Insufficient	6.13	.957	6.00
Correct - Incorrect	6.13	1.088	6.00
Complete - Incomplete	6.00	.816	6.00
Meaningful - Meaningless	6.00	.730	6.00
Current - Outdated	5.94	1.482	7.00
Relevant - Irrelevant	5.94	1.124	6.00
Adequate - Inadequate	5.88	.806	6.00
Desirable - Undesirable	5.88	1.204	6.00
Valuable - Worthless	5.88	.719	6.00
Trustworthy - Untrustworthy	5.88	1.408	6.00
Enough - Not enough	5.81	1.559	7.00
Applicable - Inapplicable	5.81	1.047	6.00
Timely - Untimely	5.69	1.401	6.00
Ordered - Disordered	5.69	1.537	6.00
Well-timed - Ill-timed	5.63	1.310	6.00
Workable - Unworkable	5.63	.957	6.00
Material - Immaterial	5.56	1.548	6.00
Appropriate - Inappropriate	5.56	1.315	6.00
Important - Unimportant	5.50	1.265	6.00
Accurate - Inaccurate	5.50	1.826	6.00
Opportune - Inopportune	5.50	1.366	6.00
Effective - Ineffective	5.50	1.155	6.00
Beneficial - Non-beneficial	5.50	1.461	6.00
Organised - Disorganised	5.50	1.317	6.00
Reliable - Unreliable	5.50	1.897	6.00
Necessary - Unnecessary	5.44	1.365	6.00
Well-constructed - Ill-constructed	5.38	1.455	6.00
Supportive - Non-supportive	5.38	.957	5.00
Efficient - Inefficient	5.19	1.559	5.00
Confirmed - Unconfirmed	5.13	1.258	5.00
Productive - Unproductive	4.94	1.181	5.00
Simple - Complex	3.69	2.089	3.00

TABLE VII.XVI

S.D. Scale Results for Reports "B" - Group 2

Pair of adjectives \ Statistics	Mean	Standard Deviation	Median
Accurate - Inaccurate	6.16	.996	6.00
Current - Outdated	6.02	1.027	6.00
Correct - Incorrect	5.96	1.105	6.00
Reliable - Unreliable	5.89	1.315	6.00
Detailed - General	5.84	1.572	6.00
Complete - Incomplete	5.76	1.387	6.00
Trustowrthy - Untrustworthy	5.73	1.239	6.00
Informative - Uninformative	5.62	1.209	6.00
Sufficient - Insufficient	5.56	1.288	6.00
Adequate - Inadequate	5.53	1.200	6.00
Timely - Untimely	5.51	1.260	6.00
Efficient - Inefficient	5.46	1.303	6.00
Organised - Disorganised	5.42	1.512	6.00
Well-timed - Ill-timed	5.42	1.329	6.00
Ordered - Disordered	5.40	1.582	6.00
Desirable - Undesirable	5.35	1.142	6.00
Relevant - Irrelevant	5.31	1.620	6.00
Meaningful - Meaningless	5.27	1.433	6.00
Enough - Not enough	5.20	1.649	6.00
Applicable - Inapplicable	5.18	1.588	6.00
Appropriate - Inappropriate	5.16	1.642	6.00
Valuable - Worthless	5.15	1.325	5.00
Well-constructed - Ill-constructed	5.06	1.483	5.00
Workable - Unworkable	5.02	1.381	6.00
Beneficial - Non-beneficial	4.96	1.575	5.00
Necessary - Unnecessary	4.95	1.592	5.00
Important - Unimportant	4.93	1.631	5.00
Opportune - Inopportune	4.93	1.230	5.00
Material - Immaterial	4.93	1.597	6.00
Effective - Ineffective	4.86	1.603	5.00
Confirmed - Unconfirmed	4.76	1.186	4.00
Supportive - Non-supportive	4.67	1.320	5.00
Productive - Unproductive	4.60	1.651	5.00
Simple - Complex	3.86	1.890	3.00

CHAPTER 8

FACTOR ANALYSIS OF SD SCALES

8.1. Introduction

8.2. Factor analytic procedures: the problemsof choice

- 8.2.1. Introduction
- 8.2.2. The preparation of the correlation matrix
  - 8.2.2.1. Parametric or Non-parametric measures of association?
  - 8.2.2.2. Spearman's (R_s) or Kendall's τ(Tau)?
- 8.2.3. The extraction of initial factors
- 8.2.4. Factors for rotation
- 8.2.5. Rotation of factors
- 8.2.6. Factor scores
- 8.2.7. Summary

8.3. Factor analysis results

- 8.3.1. Treatment of data
- 8.3.2. Constructing a matrix to be used as input data
- 8.3.3. Results for Reports "A"
  - 8.3.3.1. Final solution
  - 8.3.3.2. Factor pattern correlations
- 8.3.4. Results for Reports "B"
  - 8.3.4.1. Final solution
  - 8.3.4.2. Factor pattern correlations
- 8.3.5. Results for the two sets of reports combined
  - 8.3.5.1. Final solution
  - 8.3.5.2. Factor pattern correlations
- 8.3.6. Summary and Conclusions

CHAPTER 8

FACTOR ANALYSIS OF SD SCALES

8.1. Introduction

Since the publication of the work by Osgood, Suci, and Tannenbaum in 1957 on the theory and measurement of meaning (1), the SD technique has been extensively used in the fields of psychology, linguistics, marketing, and many other disciplines including speech communication from whence the technique originated. Accompanying this use were extensive factor-analytic studies of SD scales, which were summarised by Osgood in a paper published in 1962 (2). In this paper the author states that the problem ". . . concerns the generality of this semantic factor system, both across the people doing the judging and across the concepts being judged" (3). As to the first part of this problem, the author states that "The evidence to date, then, indicates considerable generality in semantic space across people, both within and between language-culture groups."(4). This was further elucidated in a recent publication by the author and others in 1975 (5). The answer to the second part of the problem, i.e. the generality of the semantic factor system across the concepts being judged, did not prove to be the same as across people, in the words of Osgood "this instability of scale relations and factors across concepts contrasts sharply with the stability we have found across people" (6). He then concluded his point by saying:

"The preceeding evidence as a whole forces us to the conclusion that there is a significant interaction between concepts and scales in the process of sematic judgement. What are the implications of this? From the standpoint of the practice of semantic measurement, this means that there is no such entity as 'The Semantic Differential' with a rigidly defined set of factors - except perhaps in the sense of a common denominator from which more specific instruments are to be derived. For significant concept classes we will therefore want to develop specific instruments, and for the important class of personality concepts we have already done some work" (7). In the words of another author(8), "One caution in employing semantic-differential scales is that the meanings of scales sometimes depend on the concept being rated . . . Many other examples could be given in which the meanings of scales differ with the concepts being studied and in which the size and directions of correlations between scales differ with the types of concepts.

The interaction of scales with concepts places a limit on the extent to which individual scales can be interpreted in the same way when applied to different concepts, and it also places a limit on the extent to which factors in semantic differential scales can be employed as general yardsticks (e.g. to measure evaluation) regardless of the concepts in a particular study".

The implication of the above comments for the use of SD scales as a tool to test users' perceptions of MIS reports are as follows.

In order to claim the scales used in this study have successfully measured perceptions relating to different aspects of the reports (namely the value and attributes, with the latter aspect being subdivided into different components, i.e. quantity of data, format of the report, accuracy or reliability of the data, timeliness, and non-economic cost), it is necessary to subject the data to factor analysis to explore how the scales interact, what factors will result and to what extent these factors tap the different aspects of the reports.

A need to factor analyse the data results from the fact that SD has been used in three previous studies (two similar to this study(9) and a third comparing decision analysis and data analysis methods for determining management's information needs (10)). In all three studies the scales were grouped intuitively, factor analysis was not performed and thus they were used to reflect different aspects of management information reports without any statistical evidence of their validity and reliability.

This chapter presents the procedure of factor analysing the data together with the results.

To conclude this introduction, it is worth quoting Osgood et al's(11) perception of an ideal semantic measuring instrument as best summarising the aims of this chapter. "For an ideal semantic measuring instrument we would like to select a small set of scales having the following properties:

(a) high loading on the factor they represent, (b) high correlation with the other scales representing the same factor, (c) low correlation with scales representing other factors (and hence low loading on other factors), and (d) a high degree of stability across the various concepts judged."

8.2. Factor analytic procedures: the problems of choice

8.2.1. Introduction

The aim of this section is not to present a mathematical and statistical overview of factor analysis, but rather a brief introduction which will enable the author to present the decisions involved in choosing a method of analysis.

Factor analysis as a general scientific method for analysing data may be defined as ". . . a means by which the regularity and order in phenomena can be discerned."(12) What factor analysis does is this:"It takes thousands and potentially millions of measurements and qualitative observations and resolves them into distinct patterns of occurrence. It makes explicit and more precise the building of fact-linkages going on continuously in the human mind."(13) Factor analysis is achieved by firstly preparing a correlation matrix, secondly extracting the initial factors with the consequent search of reducing the data and thirdly rotating to a terminal solution resulting in simple and interpretable factors. Following on from these three steps composite scores as factor scores can be obtained for each respondent. These represent the theoretical dimensions associated with each factor.

8.2.2. The preparation of correlation matrix

In the preparation of a correlation matrix, the first decision is to choose either parametric or non-parametric measures of association for the set of variables* under study to build the correlation matrix The product-moment correlation coefficients as a parametric statistic represents the type most widely used by researchers in their factor analytic studies. Pearson's r, phi coefficient, tetrachoric are examples of such correlation coefficients. Non-parametric measures of association are the rank correlation coefficients represented by Spearman's r_s, and Kendall's τ (Tau).

The following quotation describes the problem of selecting an appropriate correlation coefficient:

"The large number of coefficients available for the matrix transformation may cause confusion and despair, leading perhaps to the use in all cases of the most familiar and most often employed product-moment".(14). Then the author continues by warning that "the general application of the product-moment (or any of the coefficients discussed above) may lead to spurious or misleading factors if certain requirements of the data are not satisfied."(15)

---

* Variable and bi-polar adjective are used interchangeably.

Of all the correlation coefficients available for use in this first step, the researcher opted for Kendall's τ (Tau) as the appropriate measure of association, for the following reasons.

8.2.2.1. Parametric or non-parametric measures of association? The decision to use a parametric or non-parametric measure of association for the variables under study rested on the type of data and to what extent it satisfied the requirements of each of these measures.

While the level of measurement of the SD scales were ordinal, and the choice of a non-parametric measure would have been the normal one, the researcher preferred to analyse the data and take the decision after this analysis, especially as some writers (16) argue for the use of parametric statistics with ordinal data; Labovitz as an example argues that "although some small error may accompany the treatment of ordinal variables as interval, this is offset by the use of more powerful, more sensitive, better developed, and more clearly interpretable statistics with known sampling error." (17)

To accomplish this aim the skewness (third moment) and kurtosis (fourth moment) were computed to describe and examine whether the data approached a normal distribution (normal curve). Skewness has a value of zero with a completely symmetric bell-shaped curve; a positive value indicates clustering of cases to the left of the mean, and a negative value indicates clustering of cases to the right of the mean. The kurtosis describes the relative

peakness or flatness of the curve. A zero value indicates a normal distribution of cases, a positive value indicates a peaked distribution and a negative value indicates a curve flatter than normal.

The following table presents skewness and kurtosis computed for the SD scales in relation to each set of reports.

TABLE 8.1.

Skewness and Kurtosis for SD scales (All respondents)

Statistics / Scales	Reports "A"		Reports "B"	
	Skewness	Kurtosis	Skewness	Kurtosis
Important-Unimportant	-1.181	2.105	-1.037	-0.386
Valuable-Worthless	-0.534	1.540	-1.445	2.830
Meaningful-Meaningless	-2.499	12.103	-1.195	1.244
Material-Immaterial	-1.757	5.279	-1.068	0.219
Desirable-Undesirable	-2.724	7.443	-1.184	2.308
Effective-Ineffective	-2.066	6.728	-0.939	0.062
Applicable-Inapplicable	-2.090	4.250	-1.102	0.513
Relevant-Irrelevant	-1.771	5.791	-1.212	0.604
Informative-Uninformative	-3.203	16.235	-1.432	2.479
Necessary-Unnecessary	-1.471	3.060	-0.816	-0.134
Beneficial-Non-benefical	-0.951	.791	-0.829	-0.222
Supportive-Non-supportive	-0.877	.369	-0.595	-0.167
Complete-Incomplete	-1.741	2.576	-1.096	0.313
Sufficient-Insufficient	-1.672	2.455	-0.989	0.252
Adequate-Inadequate	-1.742	3.831	-0.868	0.436
Enough-Not enough	-1.784	2.920	-0.750	-0.457
Ordered-Disordered	-1.648	3.282	-0.935	-0.299
Organised-Disorganised	-1.521	2.762	-0.981	-0.092
Simple-Complex	-0.706	-0.798	0.287	-1.267
Well-constructed - Ill-constructed	-1.902	4.645	-0.760	-0.094
Detailed-General	-1.739	2.666	-2.170	4.432
Accurate-Inaccurate	-3.463	13.087	-1.671	2.963
Reliable-Unreliable	-1.889	3.848	-1.373	1.216
Correct-Incorrect	-1.841	3.266	-0.985	-0.102
Confirmed-Unconfirmed	0.471	-1.302	-0.196	0.167
Trustworthy-Untrustworthy	-2.576	7.291	-0.849	-0.472

TABLE 8.1. (continued)

Skewness and Kurtosis for SD Scales (All respondents)

Statistics / Scales	Reports "A"		Reports "B"	
	Skewness	Kurtosis	Skewness	Kurtosis
Current-Out-dated	-1.553	2.360	-1.303	1.365
Well-timed-Ill-timed	-1.070	0.375	-0.526	-0.756
Opportune-Inopportune	-0.534	-0.688	-0.314	-0.422
Timely-Untimely	-0.839	-0.154	-0.537	-0.962
Efficient-Inefficient	-1.837	3.916	-1.087	0.603
Appropriate-Inappropriate	-1.400	1.973	-0.867	-0.136
Productive-Unproductive	-1.758	6.188	-0.732	-0.241
Workable-Unworkable	-1.416	3.908	-0.780	0.137

The above results show that the distribution of the cases does depart from normality which suggests the need to use a non-parametric measure of association instead of a parametric one, especially since in this case no assumption about the underlying distribution is made. This choice is sustained by Rummel (18) when he says: "In factor designs that will use the results descriptively rather than inferentially, the characteristics of the distributions are still important. Variables with tied values and disparate marginal distributions will restrict the range of the product moment. Moreover, the product moment will be unequally weighted by skewed distributions with extreme values. Accordingly, if the distributions in the data depart from normality and cannot be transformed to normality . . ., then a correlation matrix transformation not dependent on normality should be used." He continues his argument by saying that, "the non-parametric correlation coefficients may be employed if the data distributions are largely non-normal. The nature of the distribution and existence of outliers* will not affect the Spearman or Kendall rank correlation coefficients, and, if many tied values (causing tied ranks) exist, there are correction formulas."(19)

---

* Outliers were discussed by Rummel (18) in a previous chapter to the one included in the quotations, and includes extreme frequencies, restriction of range, and their effects on the product-moment correlation especially when the data are ordinal or nominal.

In conclusion, the author explored the possibility of transforming the data to normality. Different methods(20) were tried on the data with the result that normality was attained with the cost that the intervals within the scales became non-equal. This meant that the different points of the scale ranging from 1 (very unfavourable) to 7 (very favourable) passing through the midpoint of 4 (neutral) would be invalid. Consequently the researcher rejected this option.

8.2.2.2. Spearman's (R_s) or Kendall's τ (Tau)?

"The Spearman rank correlation is the traditional way to treat the problem of association between ranks. However, there is reason to believe that the τ coefficient may be superior for many purposes".(21) This is how an author started a comparison between the two non-parametric measures of association. The superiority of the τ coefficient may be ascribed to different reasons, but one of the most important of these is that in the testing of the hypothesis of independence, the τ converges more rapidly to normality as opposed to the somewhat slower convergence of the R_s. Thus, in samples of moderate size, where the exact tables of sampling distribution cannot be used, the τ coefficient provides a better test of the hypothesis of no association than does the R_s(22). For the above reason, the researcher opted for the use of Kendall's τ (Tau) as the measure of association used in constructing the correlation matrix.

8.2.3. The extraction of initial factors

The next step in factor analysis involves the search for ways of reducing the data by constructing new variables from characteristic interrelations present in the data.

The choice here is principally between using one method called principal-component analysis yielding new variables (factors) which may be defined as exact mathematical transformations of the data, where no assumption is made about the data having common or unique variances, and where the correlation matrix is factored with unities in the diagonal (23), or a second group of methods which includes principal-factor analysis (or common factor analysis), image factor analysis, canonical factor analysis, and ALPHA factor analysis, where the basic assumption around which these factor models are built is that the variable's variance can be divided into common and unique parts. This means that the factors extracted will define the common variance among the variables, and in contrast with the first method where unities are inserted in the diagonal, a communilaty of estimates will be inserted in the diagonal. A discussion contrasting the different methods comprising the second group of methods and their differences in estimating the communilaty and the different uses of their results is out of the main stream of this research, and hence will not be mentioned here.

The decision was made to use the principal-component analysis with unities in the diagonal as the main method

of factor analysing the data and the results presented later in the chapter are all based on this method. Other results of employing some of the second group of methods are also presented. The rationale for this is basically one of confirmation. In constructing scales it is important to produce as much confirmatory evidence as possible, especially when using factor analysis. When the same results are forthcoming from a number of different factoring methods it is possible to be more certain that the results are valid and repeatable, and are not an outcome of the factoring method used.

8.2.4. Factors for rotation

The criterion to decide the number of factors to be retained for rotation is a problem well-presented by this quotation: "The number-of-factors problem has no general solution. Specific solutions, dependent on the choice of factor model, such as ALPHA factor analysis, however, do exist . . . Moreover, from the practical experience of such factor analysts as Raymond Cattell and Henry Kaiser, a number of rules of thumb have developed that are a general aid to the researcher."(24) And it was one of these rules of thumb, namely that factors with Eigenvalues greater than or equal to one (25) are to be retained for the final rotated solution, that was decided by the researcher.

8.2.5. Rotation of Factors

The second step of the analysis results in unstated factors which are usually uninterpretable. This is because the first factor in the matrix tends to be a general factor and has high loadings for most variables. This factor delimits the most comprehensive classification. The first factor is fitted to the data so that it accounts for the maximum variance with each successive factor maximally fitted to the residual variance. Such a procedure often locates the first factor between independent clusters of interrelated variables which cannot be distinguished in this factor. Moreover, the different clusters will have loadings different in sign on the subsequent factors thus producing bi-polar factors (26).

Thus the next step consists of rotation to terminal factors. The criteria for rotating factors are: simple structure (or multiple factor solution), parsimony, factorial invariance, hypothetical structure, partialling, and causal exploration (27); of these different criteria, the simple structure was employed in the research as it is "employed in almost all factor rotations currently being published."(28) The aim of the simple structure as stated by Cattell is: "One view of this ideal of 'simplest explanation' as it affects the present aim of explaining a configuration of variables is that it is reached when each factor affects only a few variables, i.e. it loads or correlates with the smallest possible number. In common sense terms we may say that given a

wide sample of variables we should expect any true natural influence to affect only a few of them rather than all indiscriminately" (29). This aim is obtained by emphasising those factors portraying exclusive groups of highly intercorrelated variables.

The next decision involves the options of two types of rotation, orthogonal and oblique. Orthogonal rotation involves moving the whole factor structure around the origin in a rigid frame until the best fit is obtained, the result of which will be final factors that are uncorrelated. In oblique rotation, the factors are allowed to become correlated, which is achieved by individually rotating the factors until - in the simple structure case - each factor delineates a distinct cluster of variables (30). The choice of one of these two types seems quite an easy process as the balance weighs heavily in favour of the oblique solution, a view which is shared by most writers on this subject and best presented by the following quotation: "If we want to deal in factor analysis not merely with artificial, mathematical factors of arbitrary constitution and peculiar to one matrix but with factors recognisably identical as concepts across experiments and factor analyses, we must allow them to follow simple structure to whatever obliqueness is indicated (this is quite compatible, however, with orthogonality appearing as a special case)". (31)
The most important reason for advocating the use of oblique rotation solution is that "it is argued that the world cannot be realistically treated as though basic

functional unities represented by the factors are uncorrelated. Phenomena, whether singly or in clusters, are interrelated, and the factors themselves must reflect this reality. Oblique rotation allows this reality to be represented by the factor correlations."(32)

Summarising the two types of rotation, it can be said that "orthogonal rotation is a subset of oblique rotations. If the clusters of variables are uncorrelated, then the oblique rotation will result in orthogonal factors. The difference between the two modes of rotation, therefore, is not in defining uncorrelated or correlated factors, since the factors of oblique rotation can also be uncorrelated, but in whether this lack of correlation is empirical or imposed on the data by the model".(33) For the reasons mentioned above the data was subjected to both types of rotation, but the emphasis in the presentation and interpretation of the results is on the oblique solution.

One last word about rotation concerns the technique(s) used in this process. For orthogonal rotation, from the different techniques available for use, the researcher opted for the <u>varimax</u> technique (or criterion) as it comes closer than other techniques to satisfying the simple structure criterion (34). As to the oblique rotation, the package used by the researcher (i.e. SPSS) in the analysis of the data uses the <u>direct oblimin technique</u> (criterion), so there was no choice. This technique (criterion) offers an opportunity to alter the parameter δ

(which we shall call DELTA as used in the SPSS package) which results in the final solution being less or more oblique depending on the parameter δ chosen. The researcher subjected his data to different δ starting with $\delta = 0$ and ascending till $\delta = .4$ (or in some cases .3) which in other words meant an ascendance from a fairly oblique solution to more extreme obliqueness for the final solution, all this in order to test the effect of the parameter δ on the factor structure and the correlations between factors.

8.2.6. Factor scores

The final step in factor analysis involves the computations of factor scores for each respondent in the sample. The aim is to create new variables (representing the respondents' perceptions of the different aspects of the MIS reports) for use in testing the different hypotheses formulated in this research.

Different approaches may be used in this process; exact factor scores if the principal component analysis model is applied to the data; regression estimates if principal factor analysis model (or common factor analysis model) is used; composite estimates, which involves the selection of a group of salient variables to represent the factor; and finally the basic variable estimates which, as the name implies, involves the choice of one well-known variable for the computations of the factor scores for each case. (35)

The approach chosen for computing factor scores is the composite estimates approach which is highly recommended by Cattell (36). Three different methods can be used in this context: unmodified addition of salients, standard score additions of salients, true weighting of salients.

Of these three methods, the unmodified addition of salient variables was chosen as the method for computing factor scores. This meant that the factor scores for each respondent were computed by simply adding his scores on the set of variables originally picked out as highly loaded on the factor (37). Two approximations or assumptions have to be made in using this method(38): (i) that among the salient variables representing the factor, the differences in loading are negligible or insignificant, (ii) that among these salient variables, measured with the same range of possible points, the differences in standard deviation are negligible.

Results of the factor analysis which are presented later in this chapter show that the first assumption is met to some extent, and that on the whole the differences in factor loading can be considered negligible.

Tables 7.19 and 7.20 and their supplements (Tables VII. III to VII. XVI) presented in the previous chapter, show that the second assumption is also met.

The attraction of this method lies in its simplicity and practicality. No weighting is required, and no standard scores are needed as with the other two methods.

Since the aim of the research is to provide scales for use by internal auditors and others to evaluate MIS reports, the characteristics of this chosen method viz. simplicity and practicality are ideal.

8.2.7. Summary

A brief summary of the section seems necessary in order to highlight the major issues and areas of factor analysis relevant to this investigation:

1. In preparing the correlation matrix, Kendall's τ(Tau) was used as a measure of association for the variables under study.
2. In the extraction of the initial factor, the principal-component analysis was used as the main method of factor analysing the data, although the results using the other methods available in this context are presented.
3. Factors with eigenvalues greater than or equal to one were retained for rotation.
4. Simple structure (or multiple factor solution) was the criterion chosen for rotating factors.
5. Oblique rotation was chosen as the main type of rotation (the results using orthogonal rotation are also presented).
6. For the oblique rotation, the direct oblimin technique (criterion) was used. As to orthogonal rotation, the VARIMAX technqiue (criteria) was used.
7. Factor scores were computed for each respondent by adding without any modifications his scores on the set of variables picked out as highly loaded on the factor.

8.3. Factor Analysis Results

8.3.1. Treatment of data

The matrix of data, namely 71 (respondents) by 34 (bi-polar adjectives) x 2 (sets of reports) was treated in two ways.

The first factor analysis conducted on the data dealt with each set of reports separately. Thus a 34 x 34 matrix of correlations was obtained by correlating each bi-polar adjective with every other bi-polar adjective. This matrix was then subjected to the procedures described earlier, with summation being taken over subjects. This treatment enables the study of clustering of bi-polar adjectives in each case and indicates whether or not they occupy the same dimensions in factor space. If not, it enables the researcher to discover why they differ and the implications of this for building scales to evaluate MIS reports.

The second analysis conducted on the data dealt with both sets of reports, this summation occurred over subjects and reports generating a 34 x 34 intercorrelation matrix as above. This treatment enables a 'conceptual' study of the different dimensions (factors) in the factor space (reports); it indicates how the bi-polar adjectives cluster in these dimensions; it allows comparison between the results of the two analyses to show agreements and differences in results and can indicate reasons for these.

8.3.2. Constructing a matrix to be used as input data

Factor analysis of the data was performed using SPSS (Statistical Package for the Social Sciences). However, the standard procedure of this package needed to be modified. Using raw data as the input the package uses Pearson's r in constructing the correlation matrix. However, as indicated, Kendall's Tau was chosen as the preferred measure of association. Hence, the modification involved:

i) running a program to compute Kendall's τ to obtain all possible correlation coefficients from the bi-polar adjectives;

ii) a 34 x 34 matrix of Kendall's τ correlations was built and entered on coding sheets;

iii) Hollerith cards were punched to record the data from the sheets (5 cards for correlating each bi-polar adjective with the remaining adjectives); and

iv) running a programme with the matrix as the input data, which is an option in SPSS.

8.3.3. Results for Reports "A"

Factor analysis performed on SD data collected with relation to Reports "A" included the use of

i) principal-component analysis

ii) principal (common) factor analysis

iii) RAO's canonical factor analysis

iv) ALPHA factor analysis.

Two types of rotation were applied: oblique rotation with different δ (delta) was used in conjunction with the first two methods of factoring mentioned above. The last two methods were used with oblique rotation and $\delta = 0$.

Excluding principal component analysis, there is a problem of estimating the common variance as each method provides a different estimation.

Whilst recognising RAO's canonical factor analysis is of use to make statistical inference on the population of common factors from the common factors of a sample of cases, and ALPHA factor analysis is of use to make statistical inference concerning the universe of variables from a sample of variables, the main aim of applying the different forms of factor analytic procedures was to discover whether the pattern of the clusters of variables was stable regardless of procedure. A total of 16 factor analytic results was obtained from using the above methods and rotations. This was considered to be sufficient to indicate the stability (or otherwise) of the clusters of variables.

The following nine tables, from Table 8.2. to 8.10, present the original factor analysis results for each individual factor obtained by the different factoring methods and different types of rotation. The following points are made concerning the tables:

i) In orthogonal rotation, the highest factor loading was chosen for each variable to delineate to which factor the variable belongs.

ii) In oblique rotation, the highest pattern loading was chosen for each variable.

iii) As a consequence of (i) and (ii), no one variable appears on more than one factor.

iv) The ascendance of the DELTA in the oblique rotation with the principal-component analysis, and the principal

(common) factor analysis was stopped when the pattern loadings of any variable (bi-polar adjective) exceeded 1.00

v) The factor number does not represent the order in which factors appeared in the results. It is only used as a temporary name for the factor. In a discussion of the results following changes described later names are given to the factors corresponding to the different aspects and attributes of management reports.

vi) The loadings of the variables on the factors presented in the tables are significant at and beyond the .01 level of significance (2-tail test) (with the exception of a few variables, their level of significance is shown in the tables). The formula used to compute the significance levels of factor loadings was: (39)

$$\text{Standard error of a loading} = \text{Standard error of a correlation} \left(\sqrt{\frac{n}{n+1-r}} \right)$$

where n=the number of variables in the analysis, and
r=the factor number, that is the position of the factor during extraction.

vii) For oblique rotation, the figures presented in parentheses are the pattern loadings, and the figures presented outside the parentheses are the structure loadings.

TABLE 8.2.

Reports "A" -Factor 1 (N-71)

Methods of factoring with different rotation and different DELTA / Variables (bi-polar adjectives)	Principal Component Analysis						Principal (common) factor analysis						RAO's Canonical factor analysis		ALPHA factor analysis	
	ORTHOGONAL ROTATION (VARIMAX)	Oblique Rotation					ORTHOGONAL ROTATION (VARIMAX)	Oblique Rotation					ORTHOGONAL ROTATION (VARIMAX)	OBLIQUE ROTATION δ=0	ORTHOGONAL ROTATION (VARIMAX)	OBLIQUE ROTATION δ=0
		δ=0	δ=.1	δ=.2	δ=.3	δ=.4		δ=0	δ=.1	δ=.2	δ=.3	δ=.4				
Applicable-Inapplicable	.77	.82(.72)	.82(.73)	.83(.75)	.83(.77)	.84(.81)	.74	.81(.71)	.81(.73)	.82(.76)	.82(.80)	.82(.90)	.72	.79(.69)	.74	.81(.71)
Effective-Ineffective	.76	.81(.75)	.81(.75)	.81(.76)	.80(.77)	.80(.81)	.69	.75(.67)	.75(.68)	.75(.70)	.75(.72)	.74(.80)	.69	.74(.66)	.70	.76(.68)
Relevant-Irrelevant	.65	.73(.59)	.74(.60)	.75(.61)	.76(.62)	.78(.65)	.61	.69(.52)	.70(.54)	.72(.57)	.74(.60)	.75(.67)	.63	.71(.55)	.57	.66(.48)
Meaningful-Meaningless	.54	.64(.43)	.65(.44)	.66(.45)	.68(.47)	.70(.49)	.51	.61(.36)	.63(.39)	.66(.41)	.68(.44)	.71(.48)	.53	.63(.39)	.48	-
Appropriate-Inappropriate	.59	.63(.49)	.64(.50)	.65(.51)	.66(.53)	.68(.55)	.53	.60(.44)	.62(.46)	.64(.48)	.65(.51)	.67(.56)	.54	.62(.46)	.52	.60(.43)
Workable-Unworkable	.44	.56(.34)	.56(.34)	.57(.34)	.59(.34)	.62(.35)	.41	.53(.30)	.54(.30)	.56(.31)	.58(.32)	.62(.34)	.42	.54(.30)	.39	.51(.28)
Confirmed-Unconfirmed	.44	-	-	.46(.45)	.48(.48)	.49(.54)	.34	.38(.32)	.39(.34)	.40(.37)	.41(.40)	.43(.49)	.33	.38(.33)	.34	.38(.32)

TABLE 8.3.

Reports "A" - Factor 2 (N=71)

Methods of factoring with different rotation and different DELTA / Variables (bi-polar adjectives)	Principal Component Analysis						Principal (common) factor analysis						RAO's canonical factor analysis		ALPHA factor analysis	
	ORTHOGONAL ROTATION (VARIMAX)	Oblique Rotation					ORTHOGONAL ROTATION (VARIMAX)	Oblique rotation					ORTHOGONAL ROTATION (VARIMAX)	Oblique rotation δ=0	ORTHOGONAL ROTATION (VARIMAX)	Oblique rotation δ=0
		δ=0	δ=.1	δ=.2	δ=.3	δ=.4		δ=0	δ=.1	δ=.2	δ=.3	δ=.4				
Necessary - Unnecessary	.83	-.85(-.83)	-.85(-.84)	-.85(-.84)	-.85(-.86)	-.84(-.89)	.79	-.81(-.78)	-.81(-.79)	-.81(-.80)	-.81(-.81)	-.81(-.85)	.79	-.81(-.79)	.79	.81(.78)
Important - Unimportant	.82	-.82(-.85)	-.82(-.86)	-.82(-.87)	-.81(-.89)	-.80(-.93)	.79	-.80(-.82)	-.80(-.83)	-.79(-.85)	-.79(-.87)	-.77(-.93)	.79	-.80(-.82)	.77	.78(.79)
Beneficial - Non-beneficial	.80	-.82(-.78)	-.83(-.79)	-.83(-.80)	-.83(-.81)	-.84(-.83)	.77	-.79(-.75)	-.80(-.75)	-.80(-.76)	-.80(-.77)	-.81(-.80)	.76	-.79(-.75)	.77	.80(.75)
Valuable - Worthless	.80	-.82(-.82)	-.82(-.82)	-.82(-.83)	-.81(-.84)	-.80(-.89)	.75	-.77(-.76)	-.77(-.77)	-.77(-.78)	-.77(-.79)	-.76(-.85)	.75	-.77(-.77)	.76	.78(.77)
Desirable - Undesirable	.64	-.67(-.60)	-.68(-.60)	-.68(-.60)	-.68(-.60)	-.69(-.60)	.60	-.64(-.55)	-.64(-.54)	-.64(-.54)	-.65(-.53)	-.65(-.51)	.60	-.64(-.55)	.61	.64(.55)
Material - Immaterial	.58	-.64(-.54)	-.65(-.55)	-.66(-.56)	-.66(-.57)	-.68(-.60)	.55	-.63(-.53)	-.64(-.54)	-.65(-.55)	-.66(-.57)	-.68(-.62)	.55	-.62(-.52)	.56	.63(.53)

TABLE 8.4.

Reports "A" - Factor 3 (N=71)

Methods of factoring with different rotation and different DELTA / Variables (bi-polar adjectives)	Principal Component Analysis						Principal (common) factor analysis						RAO's canonical factor analysis		ALPHA factor analysis	
	ORTHOGONAL ROTATION (VARIMAX)	Oblique Rotation					ORTHOGONAL ROTATION (VARIMAX)	Oblique rotation					ORTHOGONAL ROTATION (VARIMAX)	Oblique rotation Δ=0	ORTHOGONAL ROTATION (VARIMAX)	Oblique rotation Δ=0
		Δ=0	Δ=.1	Δ=.2	Δ=.3	Δ=.4		Δ=0	Δ=.1	Δ=.2	Δ=.3	Δ=.4				
Sufficient - Insufficient	.76	.79(.76)	.79(.76)	.79(.77)	.79(.78)	.80(.80)	.73	.76(.73)	.76(.73)	.76(.74)	.77(.75)	.77(.78)	.73	.76(.72)	.74	.77(.73)
Adequate - Inadequate	.71	.75(.75)	.75(.75)	.75(.76)	.75(.77)	.75(.81)	.67	.71(.70)	.71(.71)	.71(.72)	.72(.74)	.72(.81)	.64	.68(.66)	.68	.72(.72)
Enough - Not enough	.68	.69(.70)	.69(.70)	.69(.71)	.69(.71)	.68(.73)	.58	.58(.57)	.58(.58)	.58(.58)	.58(.59)	.57(.61)	.59	.61(.61)	.56	.57(.56)
Informative - Uninformative	.59	.66(.58)	.66(.58)	.66(.58)	.67(.58)	.68(.59)	.53	.60(.50)	.60(.50)	.61(.50)	.61(.51)	.63(.53)	.55	.62(.53)	.53	.60(.50)
Detailed - General	.65	.62(.60)	.63(.61)	.63(.62)	.64(.63)	.63(.63)	.57	.56(.56)	.56(.56)	.56(.57)	.56(.58)	.56(.60)	.57	.56(.55)	.55	.55(.53)
Complete - Incomplete	.52	.55(.47)	.56(.47)	.56(.48)	.57(.49)	.57(.50)	.47	.51(.42)	.51(.42)	.52(.43)	.53(.43)	.53(.44)	.47	.51(.41)	.47	.51(.42)
Current - Out-dated	-	-	-	-	-	-	.32	-	-	-	-	-	.31	-	.31*	-

* Significant at the .05 level of significance (2-tail test)

TABLE 8.5.

Reports "A" - Factors (N=71)

Methods of factoring with different rotation and different DELTA / Variables (bi-polar adjectives)	Principal component analysis						Principal (common) factor analysis						RAO's canonical factor analysis		ALPHA factor analysis	
	ORTHOGONAL ROTATION (VARIMAX)	Oblique Rotation					ORTHOGONAL ROTATION (VARIMAX)	Oblique rotation					ORTHOGONAL ROTATION (VARIMAX)	Oblique rotation Δ=0	ORTHOGONAL ROTATION (VARIMAX)	Oblique rotation Δ=0
		Δ=0	Δ=.1	Δ=.2	Δ=.3	Δ=.4		Δ=0	Δ=.1	Δ=.2	Δ=.3	Δ=.4				
Ordered - Disordered	.81	.84(.81)	.84(.81)	.84(.81)	.84(.81)	.84(.82)	.76	.79(.74)	.80(.74)	.80(.75)	.80(.75)	.79(.76)	.74	.77(.71)	.75	.79(.73)
Organized - Disorganized	.76	.80(.72)	.81(.72)	.81(.73)	.81(.73)	.81(.74)	.69	.76(.65)	.76(.65)	.76(.65)	.76(.65)	.75(.66)	.70	.74(.62)	.71	.77(.67)
Productive - Unproductive*	-	-.30(-.47)	-.30(-.47)	-.30(-.47)	-.30(-.48)	-.29(-.52)	-	-	-	-.28(-.43)	-.29(-.45)	-.31(-.50)	-	-.29(-.42)	-	-

* All loadings for the Productive-Unproductive variable are significant at the .05 level of significance (2-tail test).

TABLE 8.6

Reports "A" -Factor 5 (N=71)

Methods of factoring with different rotation and different DELTA / Variables (bi-polar adjectives)	Principal component analysis						Principal (common) factor analysis						RAO's canonical factor analysis		ALPHA factor analysis	
	ORTHOGONAL ROTATION (VARIMAX)	Oblique rotation					ORTHOGONAL ROTATION (VARIMAX)	Oblique rotation					ORTHOGONAL ROTATION (VARIMAX)	Oblique rotation Δ=0	ORTHOGONAL ROTATION (VARIMAX)	Oblique rotation Δ=0
		Δ=0	Δ=.1	Δ=.2	Δ=.3	Δ=.4		Δ=0	Δ=.1	Δ=.2	Δ=.3	Δ=.4				
Reliable - Unreliable	.83	-.84(-.87)	-.84(-.88)	-.84(-.89)	-.85(-.91)	-.84(-.95)	.79	.81(.83)	.81(.84)	.82(.86)	.82(.88)	.81(.95)	.75	.76(.78)	.80	-.81(-.83)
Trustworthy - Untrustworthy	.73	-.81(-.75)	-.81(-.75)	-.81(-.76)	-.81(-.76)	-.81(-.79)	.63	.72(.63)	.72(.64)	.72(.64)	.73(.65)	.73(.68)	.66	.74(.67)	.64	-.72(-.64)
Correct - Incorrect	.70	-.76(-.72)	-.75(-.72)	-.75(-.72)	-.74(-.72)	-.73(-.75)	.64	.70(.66)	.70(.66)	.69(.66)	.69(.66)	.68(.69)	.64	.70(.66)	.63	-.69(-.65)

TABLE 8.7.

Reports "A"- Factor 6 (N=71)

Methods of factoring with different rotation and different DELTA / Variables (bi-polar adjectives)	Principal component analysis						Principal (common) factor analysis						RAO's canonical factor analysis		ALPHA factor analysis	
	ORTHOGONAL ROTATION (VARIMAX)	Oblique rotation					ORTHOGONAL ROTATION (VARIMAX)	Oblique rotation					ORTHOGONAL ROTATION (VARIMAX)	Oblique rotation δ=0	ORTHOGONAL ROTATION (VARIMAX)	Oblique rotation δ=0
		δ=0	δ=.1	δ=.2	δ=.3	δ=.4		δ=0	δ=.1	δ=.2	δ=.3	δ=.4				
Timely - Untimely	.81	.87(.82)	.87(.82)	.87(.83)	-.88(-.84)	-.88(-.87)	.78	-.85(-.80)	-.85(-.81)	-.85(-.82)	-.85(-.84)	-.85(-.91)	.76	-.83(-.77)	.78	.85(.80)
Well-timed - Ill-timed	.75	.82(.76)	.81(.76)	.81(.76)	-.81(-.76)	-.81(-.79)	.74	-.82(-.77)	-.82(-.77)	-.81(-.77)	-.81(-.79)	-.81(-.86)	.69	-.77(-.70)	.75	.83(.78)
Opportune - Inopportune	.70	.71(.70)	.73(.72)	.73(.74)	-.74(-.77)	-.74(-.81)	.57	-.61(-.57)	-.62(-.59)	-.63(-.61)	-.63(-.64)	-.63(-.71)	.60	-.64(-.61)	.57	.61(.58)
Current - Outdated	-	-	-	-	-	-	-	-.36(-.25)	-.36(-.24)	-.36(-.23)	-.35(-.22)	-	-	-.36(-.26)	-	-.37(-.26)

TABLE A.8.

Reports "A"- Factor 7. (N-71)

Methods of factoring with different rotation and different DELTA / Variables (bi-polar adjectives)	Principal component analysis						Principal (common) factor analysis						RAO's canonical factor analysis		ALPHA factor analysis	
	ORTHOGONAL ROTATION (VARIMAX)	Oblique rotation					ORTHOGONAL ROTATION (VARIMAX)	Oblique rotation					ORTHOGONAL ROTATION (VARIMAX)	Oblique rotation δ=0	ORTHOGONAL ROTATION (VARIMAX)	Oblique rotation δ=0
		δ=0	δ=-.1	δ=.2	δ=.3	δ=.4		δ=0	δ=-.1	δ=-.2	δ=.3	δ=-.4				
Simple - Complex	.83	.84(.84)	.84(.84)	.84(.84)	.83(.83)	.82(.82)	.64	.66(.65)	.66(.65)	.66(.64)	.66(.63)	.64(.62)	.61	.65(.64)	.68	.70(.69)
Well-constructed - Ill-constructed	.48	.55(.44)	.55(.43)	.54(.43)	.52(.42)	.49(.41)	.42	.51(.38)	.50(.37)	.48(.36)	.46(.35)	.40(.33)	.42	.54(.40)	.40	.49(.36)

TABLE 8.9.

Reports "A" - Factor 8 (N=71)

Methods of factoring with different rotation and different DELTA / Variables (bi-polar adjectives)	Principal component analysis						Principal (common) factor analysis						RAO's canonical factor analysis		ALPHA factor analysis	
	ORTHOGONAL ROTATION (VARIMAX)	Oblique rotation					ORTHOGONAL ROTATION (VARIMAX)	Oblique rotation					ORTHOGONAL ROTATION (VARIMAX)	Oblique rotation Δ=0	ORTHOGONAL ROTATION (VARIMAX)	Oblique rotation Δ=0
		Δ=0	Δ=-.1	Δ=-.2	Δ=-.3	Δ=-.4		Δ=0	Δ=-.1	Δ=-.2	Δ=-.3	Δ=-.4				
Accurate - Inaccurate	.59	.56(.53)	.57(.53)	.56(.54)	.56(.54)	.54(.55)	.49	.54(.47)	.53(.46)	.51(.46)	.50(.45)	.46(.45)	.48	-.53(-.47)	.48	.53(.46)
Efficient - Inefficient	.45	.49(.41)	.46(.39)	.45(.38)	.41(.36)	.38(.35)	.40	.49(.36)	.46(.35)	.44(.34)	.41(.33)	.39(.33)	.38	-.46(-.35)	.43	.51(.38)
Confirmed - Unconfirmed	-	-.35(-.43)	-.37(-.44)	-	-	-	-	-	-	-	-	-	-	-	-	-
Meaningful - Meaningless	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	.48(.35)

TABLE 8.10

Reports "A" - Factor 9 (N=71)

Methods of factoring with different rotation and different DELTA / Variables (bi-polar adjectives)	Principal component analysis						Principal (common) factor analysis						PAO's canonical factor analysis		ALPHA factor analysis	
	ORTHOGONAL ROTATION (VARIMAX)	Oblique rotation					ORTHOGONAL ROTATION (VARIMAX)	Oblique rotation					ORTHOGONAL ROTATION (VARIMAX)	Oblique rotation Δ=0	ORTHOGONAL ROTATION (VARIMAX)	Oblique rotation Δ=0
		Δ=0	Δ=.1	Δ=.2	Δ=.3	Δ=.4		Δ=0	Δ=.1	Δ=.2	Δ=.3	Δ=.4				
Supportive - Non-supportive	.66	.73(.68)	.70(.65)	.68(.64)	.64(.62)	.62(.61)	.54	.63(.55)	.59(.53)	.56(.50)	.52(.49)	.48(.48)	.52	.61(.54)	.55	.64(.56)
Productive - Unproductive	.48	-	-	-	-	-	.47	.59(.45)	.55(.42)	-	-	-	.43	-	.45	.57(.43)
Current - Out-dated	-.40	-.28(-.39)*	-.33(-.42)*	-.36(-.43)*	-.40(-.46)	-.42(-.48)	-	-	-	-	-	-.22(-.20)**	-	-	-	-

* Significant at the .05 level of significance (2-tail test)

** Significant at the .10 level of significance (2-tail test)

The results presented in the previous tables show that out of the thirty-four bi-polar adjectives, thirty adjectives were stable throughout the sixteen different factor analysis methods, and the different types of rotation. The thirty bi-polar adjectives had their highest loadings on the same factor irrespective of the factor analysis method used and the type of rotation performed. Four bi-polar adjectives only were unstable to a certain degree, and these adjectives and the factors on which they had their highest loadings, are presented in the following summary table, extracted from the previous nine tables.

TABLE 8.11

The four unstable bi-polar adjectives and the factors on which they had their highest loadings, shown with different factor analysis methods and different types of rotation

Methods of factor analysis with different rotation and different DELTA / Variables (Bi-polar adjectives)	Result No.	Current - Outdated	Productive - Unproductive	Confirmed - Unconfirmed	Meaningful - Meaningless
PCA -Orthogonal Rotation-(VARIMAX)	1	Factor 9	Factor 9	Factor 1	Factor 1
" -Oblique rotation - δ=0	2	"	Factor 4	Factor 8	"
" " " - δ=.1	3	"	"	"	"
" - " " - δ=.2	4	"	"	Factor 1	"
" - " " - δ=.3	5	"	"	"	"
" - " " - δ=.4	6	"	"	"	"
PFA -Orthogonal rotation-(VARIMAX)	7	Factor 3	Factor 9	"	"
" -Oblique rotation - δ=0	8	Factor 6	"	"	"
" - " " - δ=.1	9	"	"	"	"
" - " " - δ=.2	10	"	Factor 4	"	"
" - " " - δ=.3	11	"	"	"	"
" - " " - δ=.4	12	Factor 9	"	"	"
RAO -Orthogonal rotation-(VARIMAX)	13	Factor 3	Factor 9	"	"
" -Oblique rotation - δ=0	14	Factor 6	Factor 4	"	"
ALPHA -Orthogonal rotation-(VARIMAX)	15	Factor 3	Factor 9	"	"
" -Oblique rotation - δ=0	16	Factor 6	"	"	Factor 8

Although the results indicate stability in the pattern of the clusters of variables, a decision has to be made as to whether these clusters can be used for the purpose of building scales instrumental for evaluating MIS reports. The author suggests a qualified 'yes'. Qualified for the following reasons:

i) A decision has to be made concerning on which factor each of the 4 unstable bi-polar adjectives is acceptable.

ii) A decision has to be made regarding the two bi-polar adjectives which had their highest loading consistently on factor 8. These represent a distinct cluster, meaningful in semantic terms, i.e. an accurate and efficient report, but not in the building of these scales.

The author chose four criteria on which to make a decision as to which factor each bi-polar adjective belonged (these are not presented in any order of importance).

A. Objective criteria

1. A comparison of the sign of the factor loading of the unstable bi-polar adjective with the signs of the other adjectives sited on the factor.

2. A comparison of factor structure loadings of the unstable bi-polar adjective on factors with the highest and next highest factor pattern loadings for that bi-polar adjective. Structure loadings are the product-moment correlations of the variable with the factor which measures the variance* (structure loading squared) of each variable jointly accounted for by

---

* For P.F.A., RAO and ALPHA methods of factoring, the variance is common variance only.

a particular factor and the interaction effects of that factor with the other factors (40).

3. A comparison of the Kendall's τ (Tau) correlation coefficient of the unstable bi-polar adjective with the other bi-polar adjectives loading on the factor.

B. Subjective criterion

4. The relevance of the inclusion of the unstable bi-polar adjective with the cluster of stable adjectives.

Examining the four unstable bi-polar adjectives in the light of these four criteria, we find the following:

Productive-Unproductive: highest loading on Factor 4 in nine cases; highest loading on factor 9 in seven cases.

1. Sign of factor loadings. The bi-polar adjectives on factor 4 (ordered-disordered, organised-disorganised) had positive loadings. This variable had a negative loading on this factor. This means that when a report is ordered and organised it is unproductive. This is counter-intuitive since it would be difficult to envisage an ordered and organised report as being unproductive since the user can extract needed information from such a report.

Loadings on factor 9 are positive corresponding to the sign of the other bi-polar adjective (supportive-non-supportive).

2. Factor structure loadings. Table 8.12. shows the structure loadings of this variable on factors 4 and 9.

TABLE 8.12

Productive-Unproductive loadings on factor 4 and factor 9

Factors \ Results No.	(2)	(3)	(4)	(5)	(6)	(10)	(11)	(12)	(14)
Factor 4 **	-.30 *(-.47)	-.30 (-.47)	-.30 (-.47)	-.30 (-.48)	-.29 (-.52)	-.28 (-.43)	-.29 (-.45)	-.31 (-.50)	-.29 (-.42)
Factor 9 ***	.55 * (.45)	.51 (.42)	.49 (.40)	.45 (.38)	.42 (.36)	.50 (.39)	.45 (.36)	.39 (.34)	.54 (.41)

* Pattern loadings are presented in parentheses.

** All loadings on this factor are significant at the .05 level (2-tail test).

*** All loadings on this factor are significant at and beyond the .01 level (2-tail test).

Both pattern and structure loadings are presented to indicate the effect of the interaction of the factor with the other factors on the variance of the bi-polar adjective in question. For Factor 4 the indirect contribution was negative in all cases while it was positive in all cases for Factor 9. Moreover, the variance of the variable explained by factor 9 is nearly twice as large as that explained by Factor 4.

3. Kendall's Tau correlation coefficients The correlation coefficient of this variable with the other variables on Factor 4 (shown in table 8.13) were low and statistically non-significant, whereas the correlation with the bi-polar adjective having its highest loading on Factor 9 (supportive- non-supportive) was .5209 which is significant beyond .001 (2-tail test).

TABLE 8.13

Kendall's τ (Tau) correlation coefficients for the bi-polar adjectives having their highest pattern loadings on Factor 4

Bi-polar adjectives	Ordered-Disordered	Organised-Disorganised	Productive-Unproductive
Ordered-Disordered	-		
Organised-Disorganised	.6147(.001)	-	
Productive-Unproductive	-.1257(.121)	.0872(.283)	-

( )Significance levels are presented in parentheses (2-tail test)

4. Subjective criterion - relevance

Inclusion of this variable with the other two variables on Factor 4 (organised, ordered) does not result in a scale measuring a definite aspect of the report.

The author decided to accept the loading of this variable 'productive-unproductive' on Factor 9.

Current-Outdated: Highest loading on Factor 9 in seven cases; on Factor 6 in six cases; and on Factor 3 in three cases.

1. Sign of factor loadings. In all the cases in which this variable had its highest pattern loadings on Factor 9, the sign was negative compared with the positive sign of the other two bi-polar adjectives.* This means that while a report is supportive and productive, it is outdated. This does not make intuitive sense because an outdated report is unlikely to be supportive or productive to the user. On the contrary the report must provide current information to be supportive and productive.

A comparison of the loadings of this variable with the loadings of the other variables having their highest loadings on Factor 3 and Factor 6 show they are compatible, all being negative.

---

* For productive-unproductive, the complement of its loadings on factor 9 were presented in Table 8.12.

2. Structure loadings. Table 8.14 shows the structure loadings of the variable on factor 9 where the variable had the highest pattern loading and factor 6 where it had the next highest pattern loading.

The loadings of the variable in four out of the six results presented in the table are higher for the variable on factor 6 than on factor 9. The significance levels for the loadings on factor 6 are higher than for the loadings on factor 9.

TABLE 8.14

Current-Outdated loadings on factor 9 and factor 6

Results No. / Factors	(2)	(3)	(4)	(5)	(6)	(12)
Factor 9	**-.28 *(-.39)	**-.33 (-.42)	-.36 (-.43)	-.40 (-.46)	-.42 (-.48)	+-.22 (-.28)
Factor 6	.43 *(.34)	.41 (.32)	.41 (.31)	-.40 (-.29)	-.42 (-.28)	-.40 (-.22)

* The pattern loadings are presented in parentheses

\+ Significant at the .10 level of significance (2-tail test)

** Significant at the .05 level of significance (2-tail test)

All other loadings are significant beyond the .01 level of significance (2-tail test).

3. Kendall's Tau Correlation coefficients The following three tables present the correlation coefficients of the variable with the other bi-polar adjectives loading on factors 3, 6 and 9.

It can be seen that the variable was significantly correlated with bi-polar adjectives having their highest pattern loadings on factors 3 and 6, while it was not significantly correlated with those on factor 9, and the correlation size was much lower in this case.

Hence, examination of the variable using these three objective criteria suggests the variable cannot be accepted as part of the cluster of bi-polar adjectives delineated by factor 9. The decision is whether to accept this variable as part of the clusters delineated by factor 3 or factor 6.

No marked differences were found in criteria 1, 2 or 3.

TABLE 8.15

Kendall's τ (Tau) correlation coefficients for the bi-polar adjectives having their highest pattern loadings on factor 3

Bi-polar adjectives	Current - Out-dated	Informative - Uninformative	Complete - Incomplete	Sufficient - Insufficient	Adequate - Inadequate	Enough - Not enough	Detailed - General
Current - Out-dated	-						
Informative Uninformative	.2496(.003)	-					
Complete - Incomplete	.2432(.003)	.1901(.020)	-				
Sufficient - Insufficient	.4095(.001)	.5233(.001)	.4015(.001)	-			
Adequate - Inadequate	.2286(.005)	.4560(.001)	.4144(.001)	.5045(.001)			
Enough - Not enough	.1983(.015)	.3749(.001)	.3115(.001)	.4654(.001)	.3717(.001)	-	
Detailed - General	.2453(.003)	.3100(.001)	.3153(.001)	.3854(.001)	.3819(.001)	.2210(.007)	-

() Significance levels are presented in parentheses (2-tail test)

TABLE 8.16

Kendall's τ (Tau) correlation coefficients for the bi-polar adjectives having their highest pattern loadings on factor 6

Bi-polar Adjectives	Current-Out-dated	Well-timed-Ill-timed	Opportune-Inopportune	Timely-Untimely
Current-Outdated	-			
Well-timed-Ill-timed	.3519(.001)	-		
Opportune-Inopportune	.2182(.008)	.3946(.001)	-	
Timely-Untimely	.2926(.001)	.6957(.001)	.5416(.001)	-

() Significance levels are presented in parentheses (2-tail test)

TABLE 8.17

Kendall's τ (Tau) correlation coefficients for the bi-polar adjectives having their highest pattern loadings on factor 9

Bi-polar Adjectives	Current-Out-dated	Supportive-Non-supportive	Productive-Unproductive
Current-Outdated	-		
Supportive-Non-supportive	.1563(.054)	-	
Productive-Unproductive	.1062(.191)	.5209(.001)	-

() Significance levels are presented in parentheses(2-tail test)

4. Subjective criterion-relevance. It appears relevant to include the variable current-outdated with the cluster of variables loading highly on factor 6, namely well-timed, opportune and timely, as this cluster can be used as a scale to measure the 'timeliness' aspect of the reports.

In contrast, the inclusion of this bi-polar adjective with the second cluster of variables which comprises Informative, complete, sufficient, adequate, enough and detailed, will result in a mixed scale, all variables with the exception of the added variable seemingly measuring one aspect of the report, i.e. quantity of the data, while the added one appears to measure timeliness. For this reason, the loadings of the bi-polar adjective current-outdated will be accepted in the final solution, which will be presented and discussed later in this section, on factor 6 rather than factor 3.

Confirmed-Unconfirmed. Highest loading on factor 1 in 14 cases and factor 8 in 2 cases. The highest loading being on factor 8 occurred when the method of factoring was the principal-component analysis and the rotation was oblique. The main focus in a detailed analysis of the factoring results will be on this method of factoring and this type of rotation. Hence, it seems in order to apply the criteria in this case.

1. Sign of factor loadings. The bi-polar adjectives on factor 8 (accurate-inaccurate, efficient-inefficient) had positive loadings. This variable had a negative loading on this factor. It is counter-intuitive to conceive ofa

report as being accurate and efficient and in the meantime unconfirmed.

(2) Structure loadings.

Table 8.18 indicates the structure loadings of this variable on factors 8 and 1.

The amount of variance explained by factor 1 is greater than that explained by factor 8.

Table 8.18.

Confirmed-Unconfirmed loadings on factor 8 and factor 1

Results No. / Factors	(2)	(3)
Factor 8	-.35 (-.43)	-.37 (-.44)
Factor 1	.44 (.40)	.45 (.43)

() Pattern loadings are presented in parentheses
All loadings are significant at and beyond the .01 level (2-tail test)

(3) Kendall's Tau correlation coefficients

Tables 8.19 and 8.20 show the correlation coefficient of this variable with the other bi-polar adjectives having their highest loadings on factors 1 and 8.

It can be seen that this variable is highly correlated with the bi-polar adjectives loading on factor 1 and these correlation coefficients are highly significant, unlike those correlations (low and non-significant) obtained with bi-polar adjectives loading on factor 8.

There apoears to be no need to use the subjective criterion since the objective criteria give overwhelming evidence to accept the loadings of this variable 'confirmed-unconfirmed' on factor 1 rather than on factor 8.

TABLE 8.19.

Kendall's τ (Tau) correlation coefficients for the bi-polar adjectives having their highest pattern loadings on factor 1

Bi-polar Adjectives	Confirmed-Unconfirmed	Meaningful-Meaningless	Effective-Ineffective	Applicable-Inapplicable	Relevant-Irrelavant	Appropriate-Inappropriate	Workable-Unworkable
Confirmed-Unconfirmed	-						
Meaningful-Meaningless	.2118 (.009)	-					
Effective-Ineffective	.2937 (.001)	.5032 (.001)	-				
Applicable-Inapplicable	.3756 (.001)	.5597 (.001)	.5696 (.001)	-			
Relevant-Irrelevant	.2674 (.001)	.5775 (.001)	.5112 (.001)	.6047 (.001)	-		
Appropriate-Inappropriate	.2510 (.002)	.4939 (.001)	.5136 (.001)	.5986 (.001)	.5076 (.001)	-	
Workable-Unworkable	.2366 (.004)	.4354 (.001)	.4450 (.001)	.4801 (.001)	.4940 (.001)	.3699 (.001)	-

() Significance levels are presented in parentheses (2-tail test)

TABLE 8.20

Kendall's τ (Tau) correlation coefficients for the bi-polar adjectives having their highest pattern loadings on factor 8

Bi-polar Adjectives	Confirmed-Unconfirmed	Accurate-Inaccurate	Efficient-Inefficient
Confirmed-Unconfirmed	-		
Accurate-Inaccurate	.0965(.235)	-	
Efficient-Inefficient	.2288(.005)	.3121(.001)	-

() Significant levels are presented in parentheses (2-tail test)

Meaningful-Meaningless

Highest loading on factor 1 in fifteen cases and on factor 8 in one case.

(1) Sign of factor loadings

The sign of the loading of this variable was compatible with the signs of the other variables' loadings on the two factors.

(2) Structure loadings

Comparisons of the structure loadings of the unstable bi-polar adjective on factors 1 and 8 reveal .58(pattern .33) on factor 1 and .48 (pattern .35) on factor 8*, thus more variance is explained by factor 1.

(3) Kendall's Tau correlation coefficients

Correlations of variables having their highest loadings on factor 1 are shown in table 8.19 (p.463) and correlation of this variable with those on factor 8 are presented in the table overleaf.

---

* Both loadings are significant at and beyond the .01 level (2-tail test)

TABLE 8.21.

Kendall's τ (Tau) correlation coefficients for the bi-polar adjectives having their highest pattern loadings on factor 8

Bi-polar Adjectives	Meaningful-Meaningless	Accurate-Inaccurate	Efficient-Inefficient
Meaningful-Meaningless	-		
Accurate-Inaccurate	.4048(.001)	-	
Efficient-Inefficient	.4666(.001)	.3121(.001)	-

() Significance levels are presented in parentheses (2-tail test)

There is no difference in the significance of the two sets of correlation coefficients but the size of the correlations differ. The highest correlations are obtained between variables with their highest pattern loadings on factor 1.

Hence it appears suitable for this variable to be accepted on factor 1.

Accurate-Inaccurate and Efficient-Inefficient

These two bi-polar adjectives had their highest loadings on factor 8 in all sixteen different cases. This meant that they were stable and represent a distinct cluster of variables meaningful in semantic terms, viz an accurate and efficient report, but this is considered irrelevant since it does not isolate an attribute. A decision has to be made regarding an alternative factor(s) for the final solution. This was made by accepting the next highest loadings of the variables, provided the loadings were consistent on one factor, that Kendall's τ (Tau) are

high and significant, and that the new cluster of variables loading on the factor was relevant.

The loadings of the variables on the different factors are presented in the following tables, ordered according to size (in the oblique rotation cases these are the pattern loadings).

Table 8.22

The loadings of the bi-polar adjectives Accurate-Inaccurate on the different factors

Methods of factoring with different rotation and different DELTA \ Factors & Loadings	Highest loadings		Second highest loadings		Third highest loadings		Fourth highest loadings	
	Factor's Number	Loadings	Factor's Number	Loadings	Factor's Number	Loadings	Factor's Number	Loadings
P.C.A. - Orthogonal rotation (VARIMAX)	8	.59	5	.36	4	.28*	3	.25*
" - Oblique " (δ= 0)	8	.56(.53)	5	.49(-.32)	-	-	-	-
" - " " (δ=.1)	8	.57(.53)	5	-.49(-.31)	4	.39(.26)	-	-
" - " " (δ=.2)	8	.56(.54)	5	-.49(-.31)	4	.39(.26)	-	-
" - " " (δ=.3)	8	.56(.54)	5	-.50(-.31)	4	.39(.26)	-	-
" - " " (δ=.4)	8	.54(.55)	5	-.51(-.31)	4	.39(.26)	-	-
P.F.A. - Orthogonal " (VARIMAX)	8	.49	5	.37	3	.25**	-	-
" - Oblique " (δ= 0)	8	.54(.47)	5	.49(.31)	-	-	-	-
" - " " (δ =.1)	8	.53(.46)	5	.49(.31)	-	-	-	-
" - " " (δ =.2)	8	.51(.46)	5	.50(.31)	-	-	-	-
" - " " (δ =.3)	8	.50(.45)	5	.50(.31)	-	-	-	-
" - " " (δ =.4)	8	.46(.45)	5	.52(.32)	-	-	-	-
R A O - Orthogonal " (VARIMAX)	8	.48	5	.39	4	.26*	3	.25*
" - Oblique " (δ= 0)	8	-.53(-.47)	5	.50(.33)	-	-	-	-
ALPHA - Orthogonal " (VARIMAX)	8	.48	5	.36	3	.26*	4	.25*
" - Oblique " (δ= 0)	8	.53(.46)	5	-.48(-.29)	-	-	-	-

() Pattern loadings are presented in parenthesis.

* Significant at the .05 level of significance (2-tail test)

** All other loadings are significant at and beyond the .01 level (2-tail test)

Table. 8.23

The loadings of the bi-polar adjectives Efficient-Inefficient on the different factors

Methods of factoring with different rotation and different DELTA \ Factors & Loadings	Highest loadings		Second highest loadings		Third highest loadings		Fourth highest loadings	
	Factor's Number	Loadings	Factor's Number	Loadings	Factor's Number	Loadings	Factor's Number	Loadings
P.C.A. - Orthogonal rotation (VARIMAX)	8	.45	7	.37	6	.34*	4	.28*
" - Oblique " (δ=0)	8	.49(.41)	7	.47(.32)	6	.42(.28)	-	-
" - " " (δ=-.1)	8	.46(.39)	7	.47(.31)	6	.44(.30)	-	-
" - " " (δ=-.2)	8	.45(.38)	6	.45(.31)	7	.46(.31)	-	-
" - " " (δ=-.3)	8	.41(.36)	6	-.48(-.33)	7	.45(.30)	-	-
" - " " (δ=-.4)	8	.38(.35)	6	-.50(-.35)	7	.42(.29)	-	-
P.F.A. - Orthogonal " (VARIMAX)	8	.40	7	.35	6	.30*	-	-
" - Oblique " (δ=0)	8	.49(.36)	7	.45(.28)	6	-.41(-.25)	-	-
" - " " (δ=-.1)	8	.46(.35)	7	.45(.27)	6	-.43(-.26)	-	-
" - " " (δ=-.2)	8	.44(.34)	6	-.45(-.28)	7	.44(.27)	-	-
" - " " (δ=-.3)	8	.41(.33)	6	-.47(-.30)	7	.42(.26)	-	-
" - " " (δ=-.4)	8	.39(.33)	6	-.50(-.33)	7	.37(.24)	-	-
R A O - Orthogonal " (VARIMAX)	8	.38	7	.34	6	.32*	4	.31*
" - Oblique " (δ=0)	8	-.46(-.35)	7	.48(.30)	6	-.43(-.26)	-	-
ALPHA - Orthogonal " (VARIMAX)	8	.43	7	.33*	6	.29*	-	-
" - Oblique " (δ=0)	8	.51(.38)	7	.51(.27)	-	-	-	-

() Pattern loadings are presented in parenthesis.

* Significant at the .05 level of significance (2-tail test)

** All other loadings are significant at and beyond the .01 level (2-tail test)

The figures presented in Table 8.22 show that the next highest loadings of the variable (Accurate-Inaccurate) were on factor 5 in all different cases. The Kendall's τ(Tau) between this variable and the other variables having their loadings on factor 5 are presented in the following table:

TABLE 8.24.

Kendall's τ(Tau) correlation coefficients of the bi-polar adjective Accurate-Inaccurate with the other bi-polar adjectives having their highest loadings on factor 5

Bi-polar Adjectives	Accurate-Inaccurate	Reliable-Unreliable	Correct-Inaccurate	Trustworthy-Untrustworthy
Accurate-Inaccurate	-			
Reliable-Unreliable	.3417(.001)	-		
Correct-Incorrect	.4257(.001)	.4799(.001)	-	
Trustworthy-Untrustworthy	.3836(.001)	.5526(.001)	.5448(.001)	-

() Significance levels are presented in parentheses (2-tail test)

The figures presented in the above table show that the correlation coefficients between the variable in question and the other variables having their highest loadings on factor 5 are high and significant.

Another criterion for accepting the bi-polar adjective Accurate-Inaccurate as part of the cluster of bi-polar adjectives delineated by factor 5, namely its relevance for the purpose of the study, seems to be highly satisfied in view of the fact that this cluster which comprises Accurate-Inaccurate, Reliable-Unreliable, Correct-Incorrect

and Trustworthy-Untrustworthy, are all bi-polar adjectives which can be used to measure the accuracy or reliability of the data provided in MIS reports.

Hence, the criteria for accepting the loadings of the variable on an alternative factor, namely factor 5, are satisfied.

For the bi-polar adjective Efficient-Inefficient, the decision for accepting its loading on an alternative factor was not clear-cut. The figures presented in table 8.23 show that the next highest loadings were in fact on factor 7 in ten different cases, and on factor 6 in six different cases.

The Kendall's τ (Tau) of the variable in question and the other variables loading on factors 6 and 7 are presented in the following tables:

TABLE 8.25

Kendall's τ (Tau) correlation coefficients of the bi-polar adjective Efficient-Inefficient with the other bi-polar adjectives having their highest loadings on factor 6

Bi-polar adjectives	Current-Out-dated	Well-timed-Ill-timed	Opportune-Inopportune	Timely-Untimely	Efficient-Inefficient
Current-Outdated	-				
Well-timed-Ill-timed	.3519(.001)	-			
Opportune-Inopportune	.2182(.001)	.3946(.001)	-		
Timely-Untimely	.2926(.001)	.6957(.001)	.5416(.001)	-	
Efficient-Inefficient	.1155(.155)	.3309(.001)	.3796(.001)	.3540(.001)	-

() Significance levels are presented in parentheses (2-tail test)

TABLE 8.26

Kendall's τ (Tau) correlation coefficients of the bi-polar adjective Efficient-Inefficient with the other bi-polar adjectives having their highest loadings on factor 7

Bi-polar Adjectives	Simple-Complex	Well-constructed Ill-constructed	Efficient Inefficient
Simple-Complex	-		
Well-constructed-Ill-constructed	.3531(.001)	-	
Efficient-Inefficient	.3157(.001)	.3397(.001)	-

() Significance levels are presented in parentheses (2-tail test)

The figures presented above show that (with the exception of the correlation between the variable in question and the variable current-outdated - part of the first cluster of variables) all correlations for both clusters are high and significant. The decision rested on a comparison of the relevance of the variable with either cluster. Is a report efficient because it is a timely report, or because it is a well-designed report? 'Efficient' can be looked at as the outcome of an attribute or aspect of a report, i.e. timeliness or format. In this context, a report can be timely but very badly designed, and hence it is inefficient because of the time and effort needed by the user to extract the needed information, whereas a well designed report is an efficient report. Similarly, if it is argued that a report is efficient because it is timely, and enables decisions to be taken quickly, this cannot be true because the timeliness of the report is

is only one facet of many different facets affecting the outcome of any decision.

The above mentioned reasons inclines the researcher to accept the loadings of this variable on factor 7 rather than on factor 6.

8.3.3.1. Final solution. Factor analysis results of SD data are presented in the following table as the final solution for discussion and analysis and are based on the principal-component analysis model, and the oblique type of rotation with DELTA=0. These results include all the modifications discussed previously concerning the acceptance of the loadings of some variables on some factors. One other change was also made concerning the signs of factors 2 and 5; these were changed from negative to positive for ease of presentation and interpretation especially in relation to the factor pattern correlations which are discussed later.

TABLE 8.27.

Principal component analysis of SD data of reports "A" (Oblique rotation δ=0, N=71)

Factor 1 (Value-applicability)	
Applicable-Inapplicable	.82(.72)
Effective-Ineffective	.81(.75)
Relevant-Irrelevant	.73(.59)
Meaningful-Meaningless	.64(.43)
Appropriate-Inappropriate	.63(.49)
Workable-Unworkable	.56(.34)
Confirmed-Unconfirmed	.44(.40)
Factor 2 (Value-need)	
Necessary-Unnecessary	.85(.83)
Important-Unimportant	.82(.85)
Beneficial-Non-beneficial	.82(.78)
Valuable-Worthless	.82(.82)
Desirable-Undesirable	.67(.59)
Material-Immaterial	.64(.54)
Factor 3 (Quantity)	
Sufficient-Insufficient	.79(.76)
Adequate-Inadequate	.75(.75)
Enough-Not enough	.69(.70)
Informative-Uninformative	.66(.58)
Detailed-General	.62(.60)
Complete-Incomplete	.55(.47)
Factor 4 (Format-logical presentation)	
Ordered-Disordered	.84(.81)
Organised-Disorganised	.80(.72)
Factor 5 (Reliability)	
Reliable-Unreliable	.84(.87)
Trustworthy-Untrustworthy	.81(.75)
Correct-Incorrect	.76(.72)
Accurate-Inaccurate	.49(.32)
Factor 6 (Timeliness)	
Timely Untimely	.87(.82)
Well-timed-Ill-timed	.82(.76)
Opportune-Inopportune	.71(.70)
Current-Outdated	.43(.34)
Factor 7 (Format-physical construction)	
Simple-Complex	.84(.84)
Well-constructed-Ill-constructed	.55(.44)
Efficient-Inefficient	.47(.32)
Factor 8 (Cost?)	
Supportive-Non-supportive	.73(.67)
Productive-Unproductive	.55(.45)

( ) Pattern loadings are presented in parentheses.

All the loadings are significant at and beyond the .01 level of significance (2-tail test)

The first factor has the following bi-polar adjectives: Applicable-Inapplicable, Effective-Ineffective, Relevant-Irrelevant, Meaningful-Meaningless, Appropriate-Inappropriate, Workable-Unworkable, Confirmed-Unconfirmed. A study of this cluster of variables reveal that they are bi-polar adjectives which reflect the value attached by the user to the reports generated by the MIS, and that this value is looked at from a practical point of view, e.g. applicable report, effective report, relevant report, etc. The dominant variable in this cluster of variables is "applicable", hence this factor will be named VALUE-applicability.

The bi-polar adjectives loading on factor 2 were: Necessary-Unnecessary, Important-Unimportant, Beneficial-Non-beneficial, Valuable-Worthless, Desirable-Undesirable, Material-Immaterial. These bi-polar adjectives reflect value as was the case with the first factor, but looked at from the point of view of whether the report fulfills the needs - in general terms - of the users, e.g. necessary report, important report, beneficial report, etc. . .
A second consideration - which also applies equally to the variables loading on factor 1 - for viewing this cluster of variables as reflecting value and not attribute of a report, is that these bi-polar adjectives represent the result of a report having good attributes, i.e. right amount of data, presented in a good format, accurate, timely, and easy to read, understand, and comprehend. As a result of the above discussion, this factor is named VALUE-need.

The third factor has the following bi-polar adjectives loading on it: Sufficient-Insufficient, Adequate-Inadequate, Enough-Not enough, Informative-Uninformative, Detailed-General, and Complete-Incomplete. The study of this cluster of variables reveals quite clearly that they all measure the amount of data presented in a report. The factor is named Quantity.

The fourth factor has two bi-polar adjectives loading on it: Ordered-Disordered, and Organised-Disorganised. These two variables measure the degree of satisfaction of the user with the presentation of the data in the report, hence this factor is named FORMAT - logical presentation.

The fifth factor can be clearly and without doubt called Reliability or Accuracy, due to the fact that all the bi-polar adjectives loading on it measure this attribute of a report: they are Reliable-Unreliable, Trustworthy-Untrustworthy, Correct-Incorrect, and Accurate-Inaccurate.

The sixth factor has the following bi-polar adjectives loading on it: Timely-Untimely, Well-timed-Ill-timed, Opportune-Inopportune, and Current-Outdated. The variables loading on this factor clearly relate to and measure the timeliness attribute of a report. This factor is called Timeliness and is a distinct factor like the previous one.

The seventh factor has the bi-polar adjectives Simple-Complex, Well-constructed-Ill-constructed, Efficient-Inefficient, loading on it. These variables clearly measure another aspect of the format attribute, namely the physical construction of the report, as contrasted with the factor presented earlier which measured Format-logical presentation. This factor is called FORMAT-physical construction.

The eighth and last factor has Supportive-Non-supportive Productive-Unproductive loading on it. The name to be given to this factor is based on the meaning of the two variables as defined by the Oxford Dictionary. Supportive is defined as "Having the quality of supporting; sustaining"(41) while Productive was defined as "1 - having the quality of producing or bringing forth; tending to produce; creative, generative . . . 4 - that produces abundantly; prolific, fertile."(42) The meaning of the two variables may be interpreted to reflect the non-economic COST of the report, defined previously in Section 2.6 as the time and effort spent by the user to extract the needed information from a report. The researcher recognises that some may argue for a different interpretation of these meanings which would result in different names to the factor, and that in contrast to the previous factors which were to a great extent clear cut, this factor may not be measuring the satisfaction of the user with this attribute, i.e. a debatable result. For the above reason the researcher will call this factor COST? as an acceptance - at this stage of the research - of this point of argument.

To conclude the discussion about these results a comparison with the initial classification of the bi-polar adjectives and what they were supposed to measure of the different attributes and values of MIS reports seems in order. * The following table presents this comparison.

---

* The initial classification of the bi-polar adjectives was presented earlier in Section 6.4.4.

TABLE 8.28.

Comparison of the initial classification of bi-polar adjectives with the factor analysis results of Reports "A"

Bi-polar adjectives	Initial Classification	Factor analysis results
Important-Unimportant	VALUE	VALUE - need
Valuable-Worthless	"	" "
Meaningful-Meaningless	"	VALUE - applicability
Material-Immaterial	"	" - need
Desirable-Undesirable	"	" - "
Effective-Ineffective	"	" - applicability
Applicable-Inapplicable	"	" - "
Relevant-Irrelevant	"	" - "
Informative-Uninformative	"	QUANTITY
Necessary-Unnecessary	"	VALUE - need
Beneficial-Non-beneficial	"	" - "
Supportive-Non-supportive	"	COST?
Enough-Not enough	QUANTITY	QUANTITY
Sufficient-Insufficient	"	"
Complete-Incomplete	"	"
Adequate-Inadequate	"	"
Ordered-Disordered	FORMAT	FORMAT-logical presentation
Well-constructed-Ill-constructed	"	FORMAT physical construction
Organised-Disorganised	"	FORMAT-logical presentation
Simple-Complex	"	FORMAT-physical construction
Detailed-General	"	QUANTITY
Accurate-Inaccurate	ACCURACY or RELIABILITY	ACCURACY or RELIABILITY
Reliable-Unreliable	" "	" "
Trustworthy-Untrustworthy	" "	" "
Correct-Incorrect	" "	" "
Confirmed-Unconfirmed	" "	VALUE - applicability
Timely-Untimely	TIMELINESS	TIMELINESS
Current-Outdated	"	"
Well-timed-Ill-timed	"	"
Opportune-Inopportune	"	"
Productive-Unproductive	COST	COST?
Efficient-Inefficient	"	FORMAT - physical construction
Workable-Unworkable	"	VALUE - applicability
Appropriate-Inappropriate	"	" - "

As to the major groupings or classification of the bi-polar adjectives, the above table shows that instead of having one group of bi-polar adjectives reflecting the VALUE aspect of MIS reports, the factor analytic study resulted in two groups of bi-polar adjectives, each reflecting one side of this VALUE: named, need and applicability. The same resulted with the FORMAT attribute of the reports, the bi-polar adjectives were grouped into two, the first reflecting the logical presentation, and the second reflecting the physical construction of the report. The remainder of the groupings were the same between the initial classification and the factor analytic derived classification.

At the bi-polar adjective level, if we accept the fact that the division of the VALUE and FORMAT aspects of the reports does not represent a major change in the initial classification but rather a refinement of it, then it can be said that the overlap at this bi-polar adjective level between the initial and the factor analytic derived classification is considerable. About eighty per cent of these bi-polar adjectives (twenty-seven) remained within their initial groupings, and only about twenty per cent (seven) changed groups. An in-depth analysis of the reasons for these changes will be presented later.

8.3.3.2. Factor pattern correlations. The factor pattern correlations of the final solution - Principal component analysis, oblique rotation with DELTA=0 - is presented in the following table.

TABLE 8.29.

Factor pattern correlations - final solution Reports ("A")

Factors	Value-applicability	Value - need	Quantity	Format-logical presentation	Reliability	Timeliness	Format-physical construction	Cost?
Value- applicability	-							
Value - need	.27179 (.05)	-						
Quantity	.27061 (.05)	NS	-					
Format-logical presentation	NS	NS	NS	-				
Reliability	.25055 (.05)	NS	.23807 (.05)	.24084 (.05)	-			
Timeliness	.28870 (.02)	.25546 (.05)	NS	NS	NS	-		
Format-physical construction	NS	NS	NS	NS	NS	NS	-	
Cost?	NS	NS	NS	NS	NS	NS	NS	-

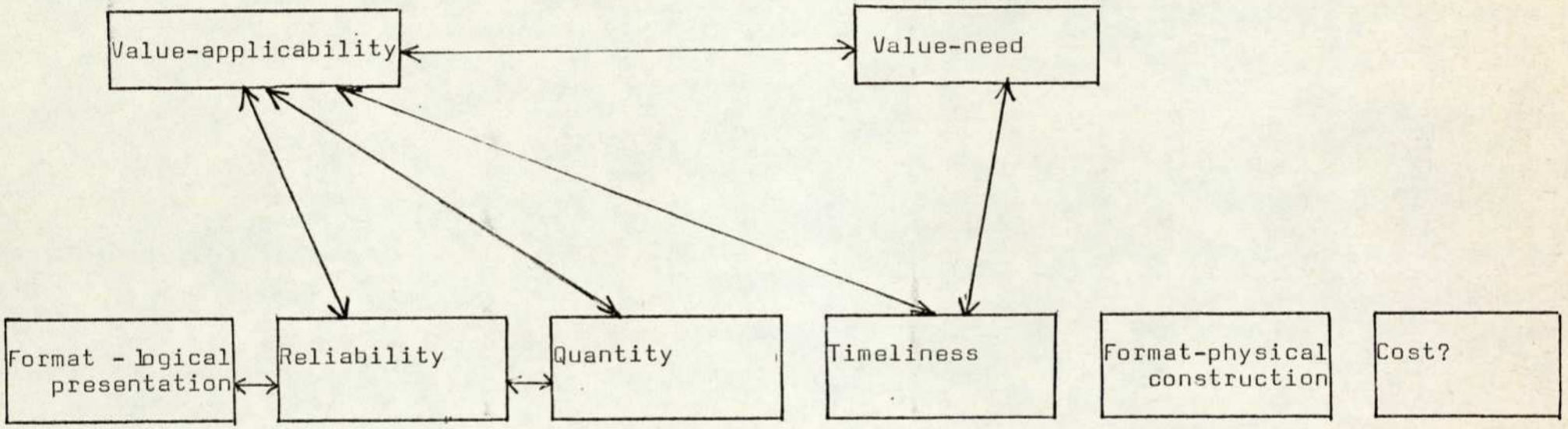
NS= Not significant at the .05 level of significance (2-tail test)

() Levels of significance are presented in parentheses (2-tail test)

For ease of interpretation, the above significant correlations are presented in the following figure.

FIGURE 8.1.

Intercorrelations between factors representing different aspects of MIS reports (Reports "A")



Before discussing these intercorrelations, two points are worth making. (i) The aim of presenting these results is only to shed some light on the interrelationships uncovered. The primary purpose of factor analysing the data was the building of scales to measure the different aspects and attributes of MIS reports, and so any generalisation about these results must await further testing with a different sample of respondents, different types of reports, and maybe a modified version of the bi-polar adjectives used in the test instrument. (ii) These results must be treated with caution since these correlations are computed (using the SPSS package) using factor scores calculated - for each respondent on each factor - as a weighted summation of the standardised variables, of all the variables on the model. (i.e. all thirty-four variables, and not only the variables chosen in the final solution to represent a factor, and hence an aspect and attribute of the report). This may result in a significant correlation or a non-significant correlation between the different factors due solely to the method of calculating factor scores.

The figures presented in Table 8.29, and the visual presentation of the intercorrelations between the factors suggest the following (within the restrictions mentioned).

First - correlated factors and their significance

1. The two factors representing the value aspect of MIS reports are significantly correlated (.05 level). This is an expected result as the two factors represent the degree of satisfaction of the user with the report in question, that is, his satisfaction with the extent to which

the report meets his needs for information, and his satisfaction too with its application.

2. The Value-applicability and the Value-need factors are significantly correlated (.02 and .05 level respectively) with the Timeliness factor. An indication of the effect the timeliness attribute of a report has on its value, and another confirmation of this relationship as uncovered by Mock (43) and Haseley (44).

3. The Value-applicability factor is correlated significantly (.05 level) with the Quantity and the Reliability factors. This can be considered a confirmation of what intuitively we may expect in relation to these two attributes of a report.

4. Format-logical presentation is significantly correlated (.05 level) with Reliability; this result can be looked at from two points of view:

(a) To accept this relationship on the ground that in the users' minds an ordered and organised report enhances the reliability of the data presented. This may be accepted if Reliability is looked as being the reliable use of the data, the ease by which this can be achieved, more than a report free of mistakes and errors.

(b) That this correlation is the result of the basis upon which the factor scores were calculated. Examination of the figures in Table VIII.I (in the supplement to this chapter) presenting the whole matrix of factor analysis results for the final solution, show that for the Format-logical presentation, and the Reliability factors, other variables - beside the ones

chosen to represent these attributes of a report - do have some loadings on the factors and it may be the effect of their inclusion in the calculation of factor scores which resulted in this statistically significant correlation.

5. The Reliability factor is also significantly correlated (.05 level) with the Quantity factor. Two explanations can be suggested in this context:

(a) That Reliability was looked at in a wider context to mean more than the freedom from errors and mistakes, and that Reliability is conceptualised as the reliable use of data. If this interpretation is accepted then a relationship may be assumed between the amount of data presented in a report and its reliability, as this means more opportunities are offered to the user to gain needed information.

(b) that this is an artifact of the method (used for calculating) factor scores.

Second - Non-correlated factors and their significance

6. The Format-logical presentation factor, the Format-physical construction factor, and the COST? factor had a positive relationship with the Value-applicability factor*, but this relationship was not significant at the .05 level. The non-significant correlations between the Format factors and the Value-applicability factor is counter intuitive and contradicts previous results by Haseley(45) discussed earlier in Chapter 2, in which a relationship did exist

* Table VIII.II in the supplement to this chapter presents the whole matrix of the factor pattern correlations for the final solution.

between this attribute and the value of a report. The non-significant correlation between the debatable COST? factor and this value factor is also counter intuitive and unexpected. Two explanations can be offered for these results:

(a) In relation to the COST? factor, this non-significant correlation may be due to the inefficiency and incompleteness of the bi-polar adjectives representing this attribute in capturing its whole sphere.

(b) As before, possibly a result of calculating factor scores.

Further analysis of these non-significant results will be offered later in the study with the presentation of the correlation analysis between the different attributes and aspects of MIS reports based on factor scores calculated as a summation without weighting of the variables representing the attribute or aspect only.

7. Non-statistically significant correlations exist between all the factors representing the different attributes of a report - with the exception of Timeliness - and the Value-need factor. This is unexpected and counter intuitive especially for the Quantity, Reliability and COST? factors, while expected for the Format factors as this attribute may be assumed to have no effect on the Value-need for a report. The non-significant correlations in the first case can be explained using the same two arguments discussed before in point 6, with no need to repeat them here.

8. The non-significant correlations between the COST? factor and the other factors representing the remaining attributes of a report is unexpected and counter intuitive

especially in view of the definition given to this debatable factor. The same arguments presented in point 6 apply here too.

9. As expected there was no significant correlation between: the Quantity factor and the Format-logical presentation, the Timeliness, the Format-physical construction factors; the Format-logical presentation factor, the Reliability factor, and the Timeliness, the Format-physical construction factors; the Timeliness factor and the Format-physical construction factor. This expected result may be due to the possibility that the presence of any attribute in a report may not affect the presence of another attribute, and what they share in common is that they all may have an effect on the value of the report as perceived by the user.

8.3.4. Results for Reports "B"

The semantic differential data collected in relation to reports "B" were factor analysed using different methods of analysis with different types of rotation, for the same reasons as discussed before in relation to the previous set of reports.* The results of these analyses are presented in the following eight tables, from table 8.30 to 8.37, which indicate the original factor analysis results for each factor separately through these different methods of analysis and rotation. The selection of the

* Please refer to Section 8.3.3, p. 437

variables loading on the factors was accomplished using procedures 1 to 6 applied in relation to the first set of reports.* All the loadings of the variables on the different factors are significant at and beyond the .01 level of significance (2-tail test), (with the exception of some loadings and their level of significance is mentioned in the tables). For oblique rotation, the figures presented in parentheses are the pattern loadings, and the figures presented outside the parentheses are the structure loadings.

---

* Please refer to Section 8.3.3, p. 437

TABLE 8.30

Reports "B"- Factor 1 (N-71)

Methods of factoring with different rotation and different DELTA / Variables (Bi-polar adjectives)	Principal-component analysis						Principal (common) factor analysis			RAO's Canonical factor analysis		ALPHA factor analysis	
	ORTHOGONAL ROTATION (VARIMAX)	Oblique rotation				ORTHOGONAL ROTATION (VARIMAX)	Oblique rotation			ORTHO-GONAL ROTATION (VARIMAX)	OBLIQUE ROTATION δ=0	ORTHO-GONAL ROTATION (VARIMAX)	OBLIQUE ROTATION δ=0
		δ=0	δ=.1	δ=.2	δ=.3		δ=0	δ=.1	δ=.2	δ=.3				
Valuable-Worthless	.84	.88(.77)	.88(.79)	.89(.81)	.89(.85)	.83	.84(.63)	.86(.67)	.87(.73)	.88(.81)	.83	.85(.67)	.83	.86(.69)
Relevant-Irrelevant	.80	.84(.85)	.84(.87)	.84(.89)	.84(.93)	.78	.83(.79)	.83(.82)	.83(.86)	.82(.92)	.77	.82(.80)	.78	.82(.80)
Desirable-Undesirable	.80	.82(.84)	.81(.86)	.81(.88)	.80(.92)	.77	.77(.71)	.78(.75)	.78(.80)	.77(.86)	.78	.78(.76)	.76	.78(.74)
Necessary-Unnecessary	.77	.80(.71)	.80(.72)	.80(.74)	.81(.76)	.74	.76(.60)	.77(.64)	.78(.68)	.79(.74)	.75	.78(.67)	.74	.77(.62)
Beneficial-Non-beneficial	.77	.79(.74)	.79(.75)	.79(.77)	.80(.80)	.74	.75(.64)	.78(.67)	.77(.67)	.77(.71)	.74	.77(.69)	.73	.76(.65)
Effective-Ineffective	.71	.78(.54)	.79(.56)	.81(.58)	.82(.61)	.70	-	.75(.41)	.78(.47)	.81(.54)	.72	.75(.44)	.70	.75(.42)
Appropriate-Inappropriate	.65	.75(.57)	.76(.58)	.78(.60)	.79(.63)	.64	.75(.54)	.77(.56)	.78(.60)	.80(.63)	.64	.75(.55)	.64	.74(.53)
Meaningful-Meaningless	.66	.72(.70)	.73(.72)	.73(.74)	.73(.78)	.62	.69(.60)	.69(.63)	.70(.67)	.70(.72)	.62	.69(.62)	.63	.70(.65)
Important-Unimportant	.72	.71(.53)	.71(.54)	.72(.57)	.72(.60)	.70	-	-	-	-	.72	-	.70	-
Applicable-Inapplicable	.53	.65(.47)	.66(.48)	.67(.49)	.69(.51)	.51	.64(.43)	.65(.45)	.67(.47)	.69(.49)	.52	.65(.43)	-	.63(.43)
Productive-Unproductive	.62	-	-	-	.67(.44)	.60	-	-	-	-	.63	-	.61	-
Material-Immaterial	.59	.63(.51)	.63(.52)	.64(.54)	.64(.55)	.54	.57(.39)	.58(.41)	.60(.45)	.61(.49)	.55	.59(.44)	.56	.59(.43)
Informative-Uninformative	.54	.60(.42)	.61(.43)	.62(.44)	.63(.45)	.51	-	-	.58(.35)	.61(.39)	.53	-	.50	-

TABLE A.31

Reports "B" - Factor 2 (N=71)

Methods of factoring with different rotation and different DELTA / Variables (bi-polar adjectives)	Principal component analysis					Principal (common) factor analysis					RAO's canonical factor analysis		ALPHA factor analysis	
	ORTHOGONAL ROTATION (VARIMAX)	Oblique rotation				ORTHOGONAL ROTATION (VARIMAX)	Oblique rotation				Orthogonal rotation (VARIMAX)	Oblique rotation δ=0	Orthogonal rotation (VARIMAX)	Oblique rotation δ=0
		δ=0	δ=.1	δ=.2	δ=.3		δ=0	δ=.1	δ=.2	δ=.3				
Correct - Incorrect	.81	.86(.81)	.87(.82)	.87(.84)	.87(.87)	.76	.83(.78)	.83(.79)	.83(.81)	.83(.85)	.76	.82(.76)	.76	.83(.78)
Reliable - Unreliable	.81	.86(.80)	.86(.81)	.86(.83)	.86(.86)	.80	.86(.81)	.86(.83)	.86(.85)	.85(.90)	.78	.84(.79)	.79	.85(.80)
Trustworthy-Untrustworthy	.83	.86(.90)	.86(.91)	.85(.93)	.85(.96)	.79	.81(.88)	.81(.90)	.81(.93)	.80(.99)	.78	.81(.86)	.79	.81(.88)
Accurate - Inaccurate	.75	.80(.76)	.80(.77)	.80(.79)	.80(.83)	.69	.74(.70)	.74(.72)	.74(.74)	.74(.78)	.71	.76(.73)	.69	.73(.70)
Current - Out-dated	.46	-	-	-	-	.40	.50(.31)	.50(.31)	.51(.31)	.52(.31)	.40	.49(.30)	.42	.51(.33)

TABLE 5.32

Reports "B" - Factor 3 (N-71)

Methods of factoring with different rotation and different DELTA / Variables (bi-polar adjectives)	Principal component analysis					Principal (common) factor analysis					RAO's canonical factor analysis		ALPHA factor analysis	
	Orthogonal rotation (VARIMAX)	Oblique rotation				Orthogonal rotation (VARIMAX)	Oblique rotation				Orthogonal rotation (VARIMAX)	Oblique rotation δ=0	Orthogonal rotation (VARIMAX)	Oblique rotation δ=0
		δ=0	δ=.1	δ=.2	δ=.3		δ=0	δ=.1	δ=.2	δ=.3				
Enough - Not enough	.76	.77(.79)	.77(.79)	.77(.80)	.77(.82)	.65	.67(.67)	.67(.68)	.67(.69)	.67(.73)	.65	.67(.66)	.66	-.67(-.67)
Complete - Incomplete	.73	.76(.72)	.77(.72)	.77(.73)	.77(.75)	.67	.72(.66)	.72(.67)	.72(.68)	.72(.71)	.67	.72(.66)	.68	-.72(-.67)
Sufficient - Insufficient	.67	.73(.64)	.74(.64)	.74(.64)	.75(.66)	.61	.67(.58)	.68(.59)	.69(.59)	.70(.62)	.59	.66(.57)	.62	-.69(-.59)
Detailed - General	.72	.71(.69)	.71(.69)	.71(.70)	.71(.72)	.72	.72(.70)	.72(.70)	.72(.71)	.71(.74)	.72	.73(.71)	.71	-.70(-.68)
Adequate - Inadequate	.55	.62(.49)	.62(.49)	.63(.49)	.64(.50)	.52	.59(.46)	.60(.47)	.61(.47)	.63(.49)	.51	.60(.48)	.51	-.59(-.45)
Informative - Uninformative	-	-	-	-	-	-	.52(.34)	.53(.34)	-	-	-	.53(.36)	-	-.52(-.34)

TABLE 0.33

Reports "B" - Factor 4 (N-71)

Methods of factoring with different rotation and different DELTA / Variables (bi-polar adjectives)	Principal component analysis					Principal (common) factor analysis					RAO's canonical factor analysis		ALPHA factor analysis	
	Orthogonal Rotation (VARIMAX)	Oblique rotation				Orthogonal Rotation (VARIMAX)	Oblique rotation				Orthogonal Rotation (VARIMAX)	Oblique rotation δ=0	Orthogonal Rotation (VARIMAX)	Oblique rotation δ=0
		δ=0	δ=.1	δ=.2	δ=.3		δ=0	δ=.1	δ=.2	δ=.3				
Simple - Complex	.74	.76(.73)	.76(.73)	.75(.73)	.76(.73)	-	-	-	-	-	-	-	-	-.61(-.59)
Well-constructed - Ill-constructed	.40	.40(.30)	.39(.30)	.39(.30)	.39(.30)	-	-	-	-	-	-	-	-	-.44(-.31)
Efficient - Inefficient	-	-	-	-	-	-	-	-	-	-	-	-	-	-.44(-.28)

TABLE n.34

Reports "B" - Factor 5 (N=71)

Methods of factoring with different rotation and different DELTA / Variables (bi-polar adjectives)	Principal component analysis					Principal (common) factor analysis					RAO's canonical factor analysis		ALPHA factor analysis	
	ORTHOGONAL ROTATION (VARIMAX)	Oblique rotation				ORTHOGONAL ROTATION (VARIMAX)	Oblique rotation				ORTHOGONAL ROTATION (VARIMAX)	Oblique Rotation δ=0	ORTHOGONAL ROTATION (VARIMAX)	Oblique rotation δ=0
		δ=0	δ=.1	δ=.2	δ=.3		δ=0	δ=.1	δ=.2	δ=.3				
Ordered - disordered	.73	.83(.78)	.82(.77)	.83(.77)	.82(.75)	.62	.66(.57)	.66(.56)	.66(.58)	.68(.61)	.65	.71(.65)	.59	.63(.54)
Organised - disorganised	.57	.72(.56)	.72(.56)	.72(.55)	.70(.54)	.55	.62(.45)	.61(.45)	.62(.46)	.63(.47)	.57	.67(.52)	.51	.57(.37)
Efficient - Inefficient	.49	.61(.48)	.61(.48)	.61(.48)	.59(.47)	.43	.50(.35)	.50(.35)	.50(.36)	.51(.37)	.45	.55(.40)	.41	-
Productive - Unproductive	-	.59(.45)	.59(.44)	.57(.42)	-	-	-	-	-	-	-	-	-	.71(.57)
Simple - Complex	-	-	-	-	-	.54	.56(.55)	.57(.55)	.57(.55)	.56(.54)	.51	.54(.52)	.56	-
Well-constructed - Ill-constructed	-	-	-	-	-	.43	.49(.34)	.49(.34)	.49(.34)	.50(.33)	.43	.53(.37)	.41	-
Important - Unimportant	-	-	-	-	-	-	-	-	-	-	-	-	-	.79(.65)
Applicable - Inapplicable	-	-	-	-	-	-	-	-	-	-	-	-	.52	-

TABLE 8.35

Reports "0" - Factor 6 (N-71)

Methods of factoring with different rotation and different DELTA / Variables (bi-polar adjectives)	Principal component analysis					Principal (common) factor analysis					RAO's canonical factor analysis		ALPHA factor analysis	
	ORTHOGONAL ROTATION (VARIMAX)	Oblique rotation				ORTHOGONAL ROTATION (VARIMAX)	Oblique rotation				Orthogonal Rotation (VARIMAX)	Oblique rotation δ=0	Orthogonal Rotation (VARIMAX)	Oblique rotation δ=0
		δ=0	δ=.1	δ=.2	δ=.3		δ=0	δ=.1	δ=.2	δ=.3				
Well-timed - Ill-timed	.83	-.92(-.90)	-.92(-.90)	.92(.92)	.92(.95)	.83	.93(.92)	.93(.94)	.93(.95)	.92(1.00)	.76	.85(.83)	.86	.96(.97)
Timely - Untimely	.79	-.86(-.85)	-.86(-.86)	.86(.87)	.85(.91)	.67	.78(.74)	.78(.75)	.78(.77)	.78(.81)	.71	.79(.78)	.66	.77(.73)
Opportune - Inopportune	.56	-.69(-.60)	-.70(-.60)	.70(.62)	.71(.65)	.45	.62(.48)	.62(.49)	.63(.50)	.64(.53)	.51	.66(.54)	.43	.60(.45)

TABLE 8.36

Reports "B" - Factor 7 (N=71)

Methods of factoring with different rotation and different DELTA / Variables (bi-polar adjectives)	Principal component analysis					Principal (common) factor analysis					RAO's canonical factor analysis		ALPHA factor analysis	
	ORTHOGONAL ROTATION (VARIMAX)	Oblique rotation				ORTHOGONAL ROTATION (VARIMAX)	Oblique rotation				ORTHOGONAL ROTATION (VARIMAX)	OBLIQUE ROTATION δ=0	ORTHOGONAL ROTATION (VARIMAX)	OBLIQUE ROTATION δ=0
		δ=0	δ=.1	δ=.2	δ=.3		δ=0	δ=.1	δ=.2	δ=.3				
Confirmed - Unconfirmed	.66	.71(.67)	.70(.66)	.70(.66)	.69(.65)	.43	.49(.41)	.48(.41)	.47(.40)	.46(.40)	40	.40(.32)	.45	-.52(-.45)
Supportive - Non-supportive	.64	.70(.60)	.70(.59)	.68(.57)	.68(.57)	.57	.65(.57)	.64(.54)	.63(.53)	.61(.52)	56	.60(.53)	.58	-.67(-.57)
Workable - Unworkable	.49	.55(.44)	.54(.44)	.53(.43)	.52(.43)	.52	.60(.49)	.57(.48)	.56(.47)	.54(.46)	53	.55(.47)	.48	-.54(-.43)
Current - Outdated	-	-.22(-.36)**	-.23(-.36)**	-.26(-.37)*	-.27(-.38)*	-	-	-	-	-	-	-	-	-

* Significant at the .05 level of significance (2-tail test)

** Significant at the .10 level of significance (2-tail test)

TABLE 8.37

Reports "B" - The NewFactor 7 (N-71)

Methods of factoring with different rotation and different DELTA / Variables (bi-polar adjectives)	Principal component analysis					Principal (common) factor analysis					RAO's canonical factor analysis		ALPHA factor analysis	
	ORTHOGONAL ROTATION (VARIMAX)	Oblique rotation				ORTHOGONAL ROTATION (VARIMAX)	Oblique rotation				ORTHOGONAL ROTATION (VARIMAX)	OBLIQUE ROTATION δ=0	ORTHOGONAL ROTATION (VARIMAX)	OBLIQUE ROTATION
		δ=0	δ=-.1	δ=-.2	δ=-.3		δ=0	δ=-.1	δ=-.2	δ=-.3				
Important - Unimportant	-	-	-	-	-	-	.86(.75)	.85(.72)	.83(.67)	.79(.61)	-	-.78(-.59)	-	-
Productive - Unproductive	-	-	-	-	-	-	.74(.60)	.73(.58)	.70(.54)	.65(.48)	-	-.70(-.53)	-	-
Effective - Ineffective	-	-	-	-	-	-	.71(.42)	.71(.42)	-	-	-	-	-	-

The results presented in the previous tables clearly show that out of the thirty-four bi-polar adjectives used to elicit the managers' perceptions of the value and the different attributes of reports "B", twenty-five bi-polar adjectives had their highest loadings on the same factors irrespective of the factor method and the type of rotation used. Only nine bi-polar adjectives were unstable to varying degrees, with their highest loadings changing from one factor to another with some methods and some types of rotation. The following table extracted from the previous eight tables summarises the situation for these unstable bi-polar adjectives and presents the different factors on which they had their highest loadings throughout the analysis.

TABLE 8.38

The nine bi-polar adjectives and the factors on which they had their highest loadings, with different factor analysis methods, and different types of rotation

Variables (bi-polar adjectives) / Methods of analysis with different rotation and different DELTA	Effective - Ineffective	Important - Unimportant	Productive - Unproductive	Applicable - Inapplicable	Informative - Uninformative	Current - Out-dated	Simple - Complex	Well-constructed - Ill-constructed	Efficient - Inefficient
P.C.A. - Orthogonal rotation - (VARIMAX)	Factor 1	Factor 1	Factor 1	Factor 1	Factor 1	Factor 2	Factor 4	Factor 4	Factor 5
P.C.A. - Oblique rotation - δ=0	"	"	Factor 5	"	"	Factor 7	"	"	"
P.C.A. - " " - δ=.1	"	"	"	"	"	"	"	"	"
P.C.A. - " " - δ=.2	"	"	"	"	"	"	"	"	"
P.C.A. - " " - δ=.3	"	"	Factor 1	"	"	"	"	"	"
P.F.A. - Orthogonal rotation - (VARIMAX)	"	"	"	"	"	Factor 2	Factor 5	Factor 5	"
P.F.A. - Oblique rotation - δ=0	The new factor 7	The new factor 7	The new factor 7	"	Factor 3	"	"	"	"
P.F.A. - " " - δ=.1	Factor 1	"	"	"	"	"	"	"	"
P.F.A. - " " - δ=.2	"	"	"	"	Factor 1	"	"	"	"
P.F.A. - " " - δ=.3	"	"	"	"	"	"	"	"	"
RAO - Orthogonal rotation - (VARIMAX)	"	Factor 1	Factor 1	"	"	"	"	"	"
RAO - Oblique rotation - δ=0	"	The new factor 7	The new factor 7	"	Factor 3	"	"	"	"
ALPHA - Orthogonal rotation - (VARIMAX)	"	Factor 1	Factor 1	Factor 5	Factor 1	"	"	"	"
ALPHA - Oblique rotation - δ=0	"	Factor 5	Factor 5	Factor 1	Factor 3	"	Factor 4	Factor 4	Factor 4

The majority (i.e. about 74 per cent) of the bi-polar adjectives are stable, and consequently can be used for the purpose of building scales.

The following detailed analysis and discussion will present the decisions, regarding the nine unstable adjectives, made using the four criteria as before.

Effective-Ineffective

(i) A comparison of the figures shown in tables 8.30 and 8.37 indicates that the size of the loadings of this unstable adjective pair was comparable with those of other adjectives loading on the two factors so no decisions can be reached using this criterion.

(ii) The highest pattern loading of this variable is to be found on the new factor 7 and the next highest pattern loading is on factor 1. Structure loadings are .71 and .73 respectively. Hence factor 1 explains fractionally more of the variance of the variable.

(iii) Tables 8.39 and 8.40 show Kendall's τ (Tau) correlation coefficients for the unstable variable and the adjectives having their highest loadings on the new factor 7 and factor 1. No major differences are to be found.

(iv) The subjective criterion concerns the relevance of the bi-polar adjective to the factors. Unstable factor 7, which does not measure a distinct dimension of the MIS reports, includes Important, Productive, and Effective and hence appears to measure the user's satisfaction with the different attributes of the report. Similarly Factor 1 also measures user's general satisfaction concerning data

required, logical presentation, good design, free from errors and presented in time for the user to act effectively and efficiently when performing his duties. In contrast Factor 1 is stable and hence it appears more relevant to accept the loadings of the variable effective-ineffective with the cluster of variables loading on factor 1.

TABLE 8.39

Kendall's τ (Tau) correlation coefficients for the bi-polar adjectives having their highest pattern loadings on the new factor 7.

Bi-polar Adjectives	Important-Unimportant	Productive-Unproductive	Effective Ineffective
Important-Unimportant	-		
Productive-Unproductive	.7024	-	
Effective Ineffective	.7106	.6657	-

All correlation coefficients are significant beyond the .001 level (2-tail test).

TABLE 8.40

Kendall's τ (Tau) correlation coefficients for the bi-polar adjectives having their highest pattern loadings on factor 1*

Bi-polar adjectives	Valuable-Worthless	Relevant-Irrelevant	Desirable Undesirable	Necessary-Unnecessary	Beneficial-Non-beneficial	Appropriate-Inappropriate	Meaningful-Meaningless	Material-Immaterial	Effective-Ineffective
Valuable-Worthless	-								
Relevant-Irrelevant	.6917	-							
Desirable-Undesirable	.7503	.5941	-						
Necessary-Unnecessary	.6868	.6437	.6938	-					
Beneficial-Non-beneficial	.7006	.6566	.5867	.6184	-				
Appropriate-Inappropriate	.6375	.6821	.5534	.6115	.5746	-			
Meaningful-Meaningless	.5854	.5572	.5359	.5311	.4089	.6000	-		
Material-Immaterial	.4363	.4590	.4378	.5006	.4944	.5031	.5430	-	
Effective-Ineffective	.7990	.6279	.5800	.6038	.5921	.7047	.5969	.4895	-

* Excluding the unstable bi-polar adjectives

All correlation coefficients are significant beyond the .001 level (2-tail test)

Important-Unimportant

(i) Tables 8.30, 8.34 and 8.37 show that the factor loadings of this variable were comparable with the loadings of the other variables delineated by factors 1, 7 and 5.

(ii) The structure loadings were contrasted and it was found that factor 5 and factor 7 explained slightly more of the variance of this variable than factor 1.

(iii) The correlation coefficients for this variable with the other variables loading highly on factors 1 and 5 are presented in the following two tables, table 8.41 and table 8.42. Examination of these and table 8.39 indicate that this bi-polar adjective is very highly correlated with the bi-polar adjectives loading on factor 1 and the new factor 7, and only moderately correlated with the bi-polar adjectives loading on factor 5 (especially the two stable ones).

(iv) Inclusion of this variable with the variables ordered organised and productive does not result in a coherent cluster as the first two variables reflect the user's perceptions of the format of the report, and no place exists in this context for important - unimportant, as it has no direct relationship with the former attribute.

Rather than include it in the unstable and indistinct factor 7, it seems appropriate to accept its loading on factor 1.

TABLE 8.41

Kendall's τ (Tau) correlation coefficients for the bi-polar adjectives having their highest pattern loadings on factor 5

Bi-polar Adjectives	Ordered-Disordered	Organised-Disorganised	Productive-Unproductive	Important-Unimportant
Ordered-Disordered	-			
Organised-Disorganised	.6280	-		
Productive-Unproductive	.3723	.3564	-	
Important-Unimportant	.3820	.3685	.7024	-

All correlation coefficients are significant beyond the .001 level (2-tail test).

TABLE 8.42

Kendall's τ (Tau) correlation coefficients for the bi-polar adjectives having their highest pattern loadings on factor 1*

Bi-polar adjectives	Valuable-Worthless	Relevant-Irrelevant	Desirable Undesirable	Necessary-Unnecessary	Beneficial-Non-beneficial	Appropriate-Inappropriate	Meaningful-Meaningless	Material-Immaterial	Effective-Ineffective	Important-Unimportant
Valuable-Worthless	-									
Relevant-Irrelevant	.6917	-								
Desirable-Undesirable	.7503	.5941	-							
Necessary-Unnecessary	.6868	.6437	.6938	-						
Beneficial-Non-beneficial	.7006	.6566	.5867	.6184	-					
Appropriate-Inappropriate	.6375	.6821	.5534	.6115	.5746	-				
Meaningful-Meaningless	.5854	.5572	.5359	.5311	.4089	.6000	-			
Material-Immaterial	.4363	.4590	.4378	.5006	.4944	.5031	.5430	-		
Effective-Ineffective	.7990	.6279	.5800	.6038	.5921	.7047	.5969	.4895	-	
Important-Unimportant	.7332	.5237	.5437	.5479	.5462	.4819	.4424	.4688	.7106	-

* Excluding the unstable bi-polar adjectives

All correlation coefficients are significant beyond the .001 level (2-tail test)

Productive-Unproductive

(i) A comparison of the loadings of this variable on the different factors indicate that it is compatible and consistent with other variables in its sign on all factors.

(ii) Tables 8.43 and 8.44 indicate the structure loadings of this variable on factors 5, 1 and new factor 7. It can be seen that the highest pattern loadings on factor 5 were not accompanied by the highest structure loadings. For the other factors this was not the case.

(iii) Table 8.39 presented previously on p.499 indicates the variables loading on the new factor 7, and the comments made previously concerning variables loading on this factor are equally applicable here. Table 8.41, p. 502 indicates one result, and for the remaining results the correlations on factor 5 are presented in table 8.45. Table 8.46 presents the correlation coefficients of the variable with the other variables loading on factor 1. From all this information we can conclude that it is more appropriate and relevant to consider this variable as either clustering on factor 1 or new factor 7.

(iv) This variable would not be relevant to include on factor 7 for reasons described previously. Inclusion with variables on factor 5 would result in a coherent cluster measuring the format attribute of a report. Similarly, inclusion with variables delineated by factor 1 produces a coherent cluster reflecting a general satisfaction

with the overall attributes of the reports.

Thus the decision is made to accept this bi-polar adjective 'productive-unproductive' as part of the cluster of variables delineated by factor 1 namely for these reasons:

(i) In 75 per cent of cases when this variable has its highest pattern loadings on factor 5, the variance explained by factor 1 was more than that explained by factor 5.

(ii) The correlation coefficients of this variable with the other variables loading on factor 1 are higher overall than those of the variable with factor 5 variables.

TABLE 8.43

Productive-Unproductive loadings on factor 5 and factor 1

Results No. / Factors	(2)	(3)	(4)	(14)
Factor 5	.59(.45)	.59(.44)	.57(.42)	.71(.57)
Factor 1	.64(.38)	.65(.39)	.66(.41)	.60(.24)

() Pattern loadings are presented in parentheses. All loadings are significant at and beyond the .01 level (2-tail test).

TABLE 8.44.

Productive-Unproductive loadings on the new factor 7 and factor 1

Results No. / Factors	(7)	(8)	(9)	(10)	(12)
New factor 7	.74(.60)	.73(.58)	.70(.54)	.65(.48)	-.70(-.53)
Factor 1	.57(.18)	.59(.22)	.62(.28)	.65(.36)	.60(.28)

() Pattern loadings are presented in parentheses.

All loadings are significant at and beyond the .01 level (2-tail test).

TABLE 8.45.

Kendall's τ (Tau) correlation coefficients for the bi-polar adjectives having their highest pattern loadings on factor 5

Bi-polar Adjectives	Ordered-Disordered	Organised-Disorganised	Efficient-Inefficient	Productive-Unproductive
Ordered-Disordered	-			
Organised-Disorganised	.6280	-		
Efficient-Inefficient	.4997	.5430	-	
Productive-Unproductive	.3723	.3564	.3122	-

All correlation coefficients are significant beyond the .001 level (2-tail test).

TABLE 8.46

Kendall's τ (Tau) correlation coefficients for the bi-polar adjectives having their highest pattern loadings on factor 1*

Bi-polar adjectives	Valuable-Worthless	Relevant-Irrelevant	Desirable Undesirable	Necessary-Unnecessary	Beneficial-Non-beneficial	Appropriate-Inappropriate	Meaningful-Meaningless	Material-Immaterial	Effective-Ineffective	Important-Unimportant	Productive-Unproductive
Valuable-Worthless	-										
Relevant-Irrelevant	.6917	-									
Desirable-Undesirable	.7503	.5941	-								
Necessary-Unnecessary	.6868	.6437	.6938	-							
Beneficial-Non-beneficial	.7006	.6566	.5867	.6184	-						
Appropriate-Inappropriate	.6375	.6821	.5534	.6115	.5746	-					
Meaningful-Meaningless	.5854	.5572	.5359	.5311	.4089	.6000	-				
Material-Immaterial	.4363	.4590	.4378	.5006	.4944	.5031	.5430	-			
Effective-Ineffective	.7990	.6279	.5800	.6038	.5921	.7047	.5969	.4895	-		
Important-Unimportant	.7332	.5237	.5437	.5479	.5462	.4819	.4424	.4688	.7106	-	
Productive-Unproductive	.6332	.4826	.4519	.5737	.5448	.5347	.4423	.4741	.6657	.7024	-

* Excluding the unstable bi-polar adjectives

All correlation coefficients are significant beyond the .001 level (2-tail test)

Applicable-Inapplicable

(i) The loadings of this variable with the other variables' loadings were compatible and consistent.

(ii) This criterion can not be used as the method of factor analysis when the variable highly loaded on factor 5 was alpha and the rotation was orthogonal.

(iii) Tables 8.47 and 8.48 indicate the Kendall's τ (Tau) correlation coefficients for the bi-polar adjectives having their highest pattern loadings on factor 5 (1 case) and factor 1 (13 cases). Examination of these two tables indicates that this variable is more related to the cluster of variables delineated by factor 1.

(iv) This unstable bi-polar adjective is relevant for inclusion with both factors 5 and 1 since on the former it indicates the user's general satisfaction with one attribute, namely format.

Examining the third and fourth criteria the decision is to accept the loadings of this bi-polar adjective on factor 1.

TABLE 8.47.

Kendall's τ (Tau) correlation coefficients for the bi-polar adjectives having their highest pattern loadings on factor 5

Bi-polar Adjectives	Ordered-Disordered	Organised-Disorganised	Efficient-Inefficient	Simple-Complex	Well-constructed-Ill-constructed	Applicable-Inapplicable
Ordered-Disordered	-					
Organised-Disorganised	.6280	-				
Efficient-Inefficient	.4997	.5430	-			
Simple-Complex	.2939	.2542*	.2697	-		
Well-constructed-Ill-constructed	.4423	.5026	.3186	.2505*	-	
Applicable-Inapplicable	.4515	.5535	.4261	.3882	.4182	-

* Significant at the .003 level (2-tail test)

All other correlation coefficients are significant beyond the .001 level (2-tail test).

TABLE 8.48.

Kendall's τ (Tau) correlation coefficients for the bi-polar adjectives having their highest pattern loadings on factor 1*

Bi-polar adjectives	Valuable-Worthless	Relevant-Irrelevant	Desirable-Undesirable	Necessary-Unnecessary	Beneficial-Non-beneficial	Appropriate-Inappropriate	Meaningful-Meaningless	Material-Immaterial	Effective-Ineffective	Important-Unimportant	Productive-Unproductive	Applicable-Inapplicable
Valuable-Worthless	-											
Relevant-Irrelevant	.6917	-										
Desirable-Undesirable	.7503	.5941	-									
Necessary-Unnecessary	.6868	.6437	.6938	-								
Beneficial-Non-beneficial	.7006	.6566	.5867	.6184	-							
Appropriate-Inappropriate	.6375	.6821	.5534	.6115	.5746	-						
Meaningful-Meaningless	.5854	.5572	.5359	.5311	.4089	.6000	-					
Material-Immaterial	.4363	.4590	.4378	.5006	.4944	.5031	.5430	-				
Effective-Ineffective	.7990	.6279	.5800	.6038	.5921	.7047	.5969	.4895	-			
Important-Unimportant	.7332	.5237	.5437	.5479	.5462	.4819	.4424	.4688	.7106	-		
Productive-Unproductive	.6332	.4826	.4519	.5737	.5448	.5347	.4423	.4741	.6657	.7024	-	
Applicable-Inapplicable	.6228	.6041	.4236	.4486	.5263	.6704	.5445	.4553	.6440	.4082	.4301	-

* Excluding the unstable and undecided-upon bi-polar adjectives

All correlation coefficients are significant beyond the .001 level (2-tail test).

Informative-Uninformative

(i) The loadings of this variable on both factors 1 and 3 were consistent and compatible.

(ii) Table 8.49 presents the structure loadings of this variable on the factors where it has the highest and next highest pattern loadings. It can be seen that factor 1 explains, overall, more of the variance than does factor 5.

(iii) Tables 8.50 and 8.51 show clearly that while this variable is related to either cluster of variables, this relationship is stronger with factor 1.

(iv) Although related to both clusters of variables, it is more relevant to include this variable with variables of factor 1 to reflect the user's general satisfaction with the MIS reports.

Thus, to conclude, the decision was taken to accept this variable as loading on factor 1 since factor 1 explains more of the variable's variance and the variable is more strongly related to the cluster of variables delineated by factor 1.

TABLE 8.49

Informative-Uninformative loadings on factor 3 and factor 1

Results / No. / Factors	(7)	(8)	(12)	(14)
Factor 3	.52(.34)	.53(.34)	.53(.36)	-.62(-.34)
Factor 1	.54(.29)	.56(.32)	.56(.33)	.56(.33)

() Pattern loadings are presented in parentheses.
All loadings are significant at and beyond the.01 level (2-tail test).

TABLE 8.50.

Kendall's τ (Tau) correlation coefficients for the bi-polar adjectives having their highest pattern loadings on factor 3

Bi-polar Adjectives	Enough-Not enough	Complete-Incomplete	Sufficient-Insufficient	Detailed-General	Adequate-Inadequate	Informative-Uninformative
Enough-Not enough	-					
Complete-Incomplete	.4758	-				
Sufficient-Insufficient	.5044	.4987	-			
Detailed-General	.4188	.5061	.4220	-		
Adequate-Inadequate	.3565	.4767	.5146	.4319	-	
Informative-Uninformative	.3270	.4010	.3519	.4571	.4350	-

All correlation coefficients are significant beyond the .001 level (2-tail test)

TABLE 8.51

Kendall's τ (Tau) correlation coefficients for the bi-polar adjectives having their highest pattern loadings on factor 1

Bi-polar adjectives	Valuable-Worthless	Relevant-Irrelevant	Desirable-Undesirable	Necessary-Unnecessary	Beneficial-Non-beneficial	Appropriate Inappropriate	Meaningful-Meaningless	Material-Immaterial	Effective-Ineffective	Important-Unimportant	Productive-Unproductive	Applicable-Inapplicable	Informative-Uninformative
Valuable-Worthless	-												
Relevant-Irrelevant	.6917	-											
Desirable-Undesirable	.7503	.5941	-										
Necessary-Unnecessary	.6868	.6437	.6938	-									
Beneficial-Non-beneficial	.7006	.6566	.5867	.6184	-								
Appropriate-Inappropriate	.6375	.6821	.5534	.6115	.5746	-							
Meaningful-Meaningless	.5854	.5572	.5359	.5311	.4089	.6000	-						
Material-Immaterial	.4363	.4590	.4378	.5006	.4944	.5031	.5430	-					
Effective-Ineffective	.7990	.6279	.5800	.6038	.5921	.7047	.5969	.4895	-				
Important-Unimportant	.7332	.5237	.5437	.5479	.5462	.4819	.4424	.4688	.7106	-			
Productive-Unproductive	.6332	.4826	.4519	.5737	.5448	.5347	.4423	.4741	.6657	.7024	-		
Applicable-Inapplicable	.6288	.6041	.4236	.4486	.5263	.6704	.5445	.4553	.6440	.4082	.4301	-	
Informative-Uninformative	.6221	.4893	.4471	.4607	.4833	.4525	.3409	.3388	.6119	.5462	.4322	.4511	-

All correlation coefficients are significant beyond the .001 level (2-tail test)

Current-Outdated

(i) Study of the loadings of this variable in relation with the variables loading on factor 7 show that the former was negative in sign, whilst the latter were positive, whereas in loading on factor 2 the signs were compatible.

(ii) Table 8.52 shows clearly that the structure loadings are almost twice as great on factor 2 as on factor 7.

(iii) Tables 8.53 and 8.54 reveal that this bi-polar adjective is related more to the cluster of bi-polar adjectives delineated by factor 2, all being highly and significantly related.

Thus it appears conclusive to include this bi-polar adjective with those adjectives clustering on factor 2.

TABLE 8.52.

Current-Outdated loadings on factor 7 and factor 1

Results No. / Factors	(2)	(3)	(4)	(5)
Factor 7	-.22 (-.36)**	-.23 (-.36)**	-.26 (-.37)*	-.27 (-.38)*
Factor 2	.54 (.36)	.54 (.36)	.55 (.35)	.56 (.35)

() Pattern loadings are presented in parentheses.

* Significant at the .05 level of significance.

** Significant at the .10 level of significance.

All other loadings are significant at and beyond the .01 level of significance.

TABLE 8.53.

Kendall's τ (Tau) correlation coefficients for the bi-polar adjectives having their highest pattern loadings of factor 7

Bi-polar Adjectives	Confirmed-Unconfirmed	Supportive-Non-supportive	Workable-Unworkable	Current-Outdated
Confirmed-Unconfirmed	-			
Supportive-Non-supportive	.3969(.001)	-		
Workable-Unworkable	.4122(.001)	.4467(.001)	-	
Current-Outdated	.1686(.038)	.0785(.334)	.2726(.001)	-

() Significant levels are presented in parentheses (2-tail test).

TABLE 8.54.

Kendall's τ (Tau) correlation coefficients for the bi-polar adjectives having their highest pattern loadings on factor 2

Bi-polar Adjectives	Accurate-Inaccurate	Reliable-Unreliable	Correct-Incorrect	Trustworthy-Untrustworthy	Current Outdated
Accurate-Inaccurate	-				
Reliable-Unreliable	.6593	-			
Correct-Incorrect	.6173	.7195	-		
Trustowrthy-Untrustworthy	.5739	.6879	.6707	-	
Current-Outdated	.3541	.4209	.4212	.3756	-

All correlation coefficients are significant at the .001 level (2-tail test)

Efficient-Inefficient

(i) Consistent loadings on both factors 4 and 5.

(ii) There was no difference in the variance of the variable explained by either factor, namely -.44 on factor 5 and .45 on factor 4.

(iii) Tables 8.55 and 8.56 clearly indicate that the variable is more related to the cluster of variables loading highly on Factor 5 since the magnitude of its correlation is nearly twice as great.

(iv) This variable would be relevant for inclusion with either cluster for the purpose of the study, the only difference being what this 'efficiency' reflects in connection with the other variables.

In view of the results of criterion (iii) it was decided to accept this variable on factor 5.

TABLE 8.55.

Kendall's τ (Tau) correlation coefficients for the bi-polar adjectives having their highest pattern loadings on factor 5*

Bi-polar Adjectives	Ordered-Disordered	Organised-Disorganised	Efficient-Inefficient
Ordered-Disordered	-		
Organised-Disorganised	.6280	-	
Efficient-Inefficient	.4997	.5430	-

* Excluding the variables decided upon the acceptance of their loadings on other factors.

All correlation coefficients are significant at the .001 level (2-tail test)

TABLE 8.56

Kendall's τ (Tau) correlation coefficients for the bi-polar adjectives having their highest pattern loadings on factor 4

Bi-polar Adjectives	Simple-Complex	Well-constructed-Ill-constructed	Efficient-Inefficient
Simple-Complex	-		
Well-constructed-Ill-constructed	.2505(.003)	-	
Efficient-Inefficient	.2697(.001)	.3186(.001)	-

() Significance levels are presented in parentheses (2-tail test)

Simple-Complex/Well-constructed-Ill-constructed

Both of these variables have their highest pattern loadings on a distinct factor, namely factor 4 when the method of analysis was principal-component analysis (with both orthogonal and oblique method of rotation and different δ DELTA in the oblique case). In all other methods of analysis with different rotations and different delta values they loaded highly on factor 5 (except ALPHA, oblique rotation, δ=0).

Hence, using the first factor model, two clusters of variables reflecting the user's perceptions of 'Format-physical construction and Format-logical presentation' were obtained. With the majority of the other models, one cluster reflecting the 'Format' attribute of the report was obtained.

To make a decision, the following guideline was chosen:

(i) That the results be consistent, by using the principal-component model with oblique rotation and different Delta. The final solution uses results obtained from this model and type of rotation - as happened with the first set of reports.

Since the aim of the study is the building of scales, correspondence between results, if achieved, will help the generalizability of these scales.

This guideline was followed for the two variables in question, with the result being a final acceptance of these two variables as a distinct cluster delineated by factor 4 and not as part of factor 5, since this resulted when the model used was the principal-component (and the rotation performed was oblique with different DELTA (δ) and also orthogonal) with the correspondence to a great extent between this result and the factor analytic result of the first set of reports.

8.3.4.1. Final Solution

The final solution for reports "B" presented in this section is based on the Principal-component model, with oblique rotation (DELTA=0) as was the case with the first set of reports. All the decisions concerning the acceptance of the loadings of some variables on certain factors as discussed in the previous section were incorporated in this solution. The sign of the loadings on factor 6 were changed from negative to positive for ease of discussion and interpretation. The naming of the factors will be the same (where appropriate) as those given to the factors resulting from the analysis of the first set of reports.

TABLE 8.57

Principal component analysis of SD data of reports "B" (Oblique rotation δ=0, N=71)

Factor 1 (Value)	
Valuable-Worthless	.88(.77)
Relevant-Irrelevant	.84(.85)
Desirable-Undesirable	.82(.84)
Necessary-Unnecessary	.80(.71)
Beneficial-Non-beneficial	.79(.74)
Effective-Ineffective	.78(.54)
Appropriate-Inappropriate	.75(.57)
Meaningful-Meaningless	.72(.70)
Important-Unimportant	.71(.53)
Applicable-Inapplicable	.65(.47)
Productive-Unproductive	.64(.38)
Material-Immaterial	.63(.51)
Informative-Uninformative	.60(.42)
Factor 2 (Reliability)	
Correct-Incorrect	.86(.81)
Reliable-Unreliable	.86(.80)
Trustworthy-Untrustworthy	.86(.90)
Accurate-Inaccurate	.80(.76)
Current-Outdated	.54(.36)
Factor 3 (Quantity)	
Enough-Not enough	.77(.79)
Complete-Incomplete	.76(.72)
Sufficient-Insufficient	.73(.64)
Detailed-General	.71(.69)
Adequate-Inadequate	.62(.49)
Factor 4 (Format-physical construction)	
Simple-Complex	.76(.73)
Well-constructed-Ill constructed	.40(.30)
Factor 5 (Format-logical presentation)	
Ordered-Disordered	.83(.78)
Organised-Disorganised	.72(.56)
Efficient-Inefficient	.61(.48)
Factor 6 (Timeliness)	
Well-timed-Ill-timed	.92(.90)
Timely-Untimely	.86(.85)
Opportune-Inopportune	.69(.60)
Factor 7 (Cost?)	
Confirmed-Unconfirmed	.71(.67)
Supportive-Non-supportive	.70(.60)
Workable-Unworkable	.55(.44)

( ) Pattern loadings are presented in parentheses.

All the loadings are significant at and beyond the .01 level of significance (2-tail test).

Factor 1

13 bi-polar adjectives

Loadings ranged from .88(.77) valuable-worthless
to .60(.42) informative-uninformative.

The majority of variables appear to indicate the general satisfaction of the user with this set of reports reflected through its different attributes.

Name of factor 1: VALUE.

Factor 2

5 bi-polar adjectives

Loadings ranged from .86(.81) 3 variables
to .54(.36) current-outdated.

With the exception of current-outdated, the variables reflect the reliability or accuracy attribute of the data.

Name of factor 2: RELIABILITY or ACCURACY.

Current-outdated was accepted as part of the cluster of variables delineated by this factor although it reflects 'timeliness' and was part of the bi-polar adjectives reflecting this attribute in the results of the first set of reports because in all different factor analytic results this variable did not load significantly with the other variables reflecting timeliness (i.e. factor 6) on that factor. This suggests that the respondents used this variable as one of those which reflect the reliability or accuracy attribute of the reports. The reason for this may be attributed to the special type of reports"B" which includes interest rates as one of the items reported. Thus, if any changes occur in these rates during the reporting period, this makes the report irrelevant and unreliable

from the user's point of view because an outdated report is unreliable or inaccurate.

Factor 3

5 bi-polar adjectives

Loadings ranged from .62(.49) adequate-inadequate to .77(.79) enough- not enough.

All variables can be seen to reflect the amount of data in the report.

Name of factor 3: QUANTITY

Factor 4

2 bi-polar adjectives

Loadings were .40(.30) well constructed-ill constructed and .76(.73) simple-complex.

These bi-polar adjectives reflect the user's satisfaction with the format of the report in terms of physical construction.

Name of factor 4: FORMAT-PHYSICAL CONSTRUCTION.

Factor 5

3 bi-polar adjectives

Loadings ranged from .61(.48) efficient-inefficient to .83(.78) ordered-disordered.

These variables appear to measure the degree of the user's satisfaction with another aspect of the format of data, namely, logical presentation.

Name of Factor 5: FORMAT-LOGICAL PRESENTATION.

Factor 6

3 bi-polar adjectives

Loadings ranged from .69 (.60) opportune-inopportune to .92(.90) well-timed-ill-timed.

These variables measure the time factor of a report.

Name of factor 6: TIMELINESS

Factor 7

3 bi-polar adjectives

Loadings ranged from .55(.40) workable-unworkable

to .71(.67) confirmed-unconfirmed.

To determine the name to be given to Factor 7, the meanings of these bi-polar adjectives as listed in the Oxford Dictionary (a similar process to that used with the equivalent factor in analysing the final solution for the first set of reports) were examined.

Confirmed is defined as "1.- To make firm or more firm, to add strength to, establish firmly . . . 4. To strengthen (in an opinion, action or purpose). 5. To corroborate, to verify, put beyond doubt" (46).

Supportive is defined as "having the quality of supporting; sustaining" (47).

Workable is defined as "1. Of substances or materials: that can be worked, fashioned or manipulated for use; said also of the state in which they are capable of being worked" (48). The study and interpretation of the above definitions in the context of the last attribute of MIS reports, namely the COST in non-economic terms, i.e. the time and effort spent by the user in extracting the needed information from the reports, reveals that these bi-polar adjectives can be assumed to measure this attribute. The researcher agrees that a different interpretation to the above definition may lead to different results, hence this factor will be named COST? in recognition of this fact. Further discussion and the final judgement about this debatable factor will be presented later.

The second stage of the presentation of the factor analysis results of the second set of reports is a comparison between these factor results and the initial classification of the bi-polar adjectives in terms of attributes and values they were expected to measure of MIS reports*. The following table presents this comparison for each bi-polar adjective. Two aspects will be considered in the examination of this table:

(i) Comparison of initial classification with the factor analytic derived classification.

(ii) Bi-polar adjectives which changed groups.

---

* Initial classification was presented earlier in Section 6.4.4.

TABLE 8.58.

Comparison of the initial classification of bi-polar adjectives with the factor analysis results of reports "B"

Bi-polar adjectives	Initial Classification	Factor analysis results
Important-Unimportant	VALUE	VALUE
Valuable-Worthless	"	"
Meaningful-Meaningless	"	"
Material-Immaterial	"	"
Desirable-Undesirable	"	"
Effective-Ineffective	"	"
Applicable-Inapplicable	"	"
Relevant-Irrelevant	"	"
Informative - Uninformative	"	"
Necessary-Unnecessary	"	"
Beneficial- Non-beneficial	"	"
Supportive- Non-supportive	"	Cost?
Enough-Not enough	QUANTITY	QUANTITY
Sufficient-Insufficient	"	"
Complete-Incomplete	"	"
Adequate-Inadequate	"	"
Ordered-Disordered	FORMAT	FORMAT-logical presentation
Well-constructed- Ill-constructed	"	FORMAT-physical construction
Organised-Disorganised	"	FORMAT-logical presentation
Simple-Complex	"	FORMAT-physical construction
Detailed-General	"	QUANTITY
Accurate-Inaccurate	ACCURACY or RELIABILITY	ACCURACY or RELIABILITY
Reliable-Unreliable	"	"
Trustworthy- Untrustowrthy	"	"
Correct-Incorrect	"	"
Confirmed-Unconfirmed	"	COST?
Timely-Untimely	TIMELINESS	TIMELINESS
Current-Outdated	"	ACCURACY or RELIABILITY
Well-timed-Ill-timed	"	TIMELINESS
Opportune-Inopportune	"	"
Productive-Unproductive	COST	VALUE
Efficient-Inefficient	"	FORMAT-logical presentation
Workable-Unworkable	"	COST?
Appropriate-Inappropriate	"	VALUE

The above table shows that in terms of the major groupings or classifications of the bi-polar adjectives, only Format showed a change. A division of the bi-polar adjectives measuring this attribute into two groups occurred; one measuring the physical construction of the report, and the second measuring the logical presentation of the data. For the remainder of the groupings, no difference existed between the initial classification and the factor analytic derived one.

As to the bi-polar adjectives examined individually, the same conclusion arrived at with the first set of reports, applies here too. Eighty per cent of these bi-polar adjectives (twenty seven) remained in their initial classification, and only twenty per cent (seven) bi-polar adjectives changed groups. (This is built on the assumption that the subdivision of the bi-polar adjectives measuring Format into two groups represents a refinement of the scale and not a major departure from it). Suggested reasons for this change will be presented later.

A comparison of the results accepted as final solution for both reports as the last stage of the discussion and analysis seems in order. This comparison will be conducted in relation to the major groupings, and in relation to individual bi-polar adjectives, followed by a discussion on the reasons for any differences.

TABLE 8.59.

Comparison of the final solution results for the two sets of reports

	First set of reports	Second set of reports
Factor analysis of SD data	8 factors resulted (including value-applicability and value-need)	7 factors resulted (including only value in general)
Factor loadings of bi-polar adjectives common to both reports	28 (82%) bi-polar adjectives	
Bi-polar adjectives moving (6=.8%)		
Productive-Unproductive	Cost? factor	Value factor
Informative-Uninformative	Quantity factor	Value factor
Current-Outdated	Timeliness factor	Reliability factor
Efficient-Inefficient	Format-phycical construction factor	Format-logical presentation factor
Confirmed-Unconfirmed	Value-applicability factor	Cost? factor
Workable-Unworkable	Value-applicability factor	Cost? factor

To judge the above presented results, the following criterion proposed by Osgood et al will be used: "Ideal or perfect comparability here would require that individual scales maintain the same meaning, and hence the same inter-correlations with other scales, regardless of the concepts being judged . . . A less stringent condition would be that the same factors keep reappearing despite changes in the concept being judged, even though the particular scales contributing to these factors may vary."(49)

Examination of the above results reveals that it meets the less stringent condition of comparability (and hence generalizability in view of the fact that the resulting factors in the two sets of factor analysis were the same). The ideal or perfect criterion is met in a large part, thus a qualified success was attained as twenty-eight bi-polar adjectives out of a total thirty-four used loaded highly on the same factors, and only six bi-polar adjectives shifted from one factor to another. The effect of this discrepancy on the building of scales will be presented later. Of immediate concern are the reasons why these bi-polar adjectives shifted, and these can be as follows: (a) The concept/scale interaction as named by Osgood and other authors who use the SD scales is where concept measures the object rated by the respondents, i.e. MIS reports and scales refer to the bi-polar adjectives used in this rating. This interaction/effect was discussed earlier, and it is sufficient to quote the following statement from Osgood which best summarises this phenomena: "To generalise, this would mean that each concept, or concept class, will tend to produce rotation of scales toward its own characteristic attribute in the semantic space." (50)

In other words, this would mean that for each concept or concept class different factors will result, or the same factors will result but with different bi-polar adjectives loading on them.

The question which may be asked is: Are these two sets of reports one concept or two different concepts? Put in a more abstract way, are all MIS reports generated internally for the use by management one concept, or different concepts, each representing a cluster of reports which share certain characteristics? At the extreme, does each report represent a concept? An alternative question may be - do the different reports share some common ground and differ in the remaining ground?

No ready answer is available to these questions as only two sets of reports were used in this study. No generalisation can be made about the myriad types of reports which are generated internally for use by management. Moreover, due to the lack of any previous empirical studies for comparison, no objective answer can be provided. Intuitively they do represent one concept as they are reports which present accounting data to management. However, further research is necessary in this area.

(b) The discrepancy may be attributed to what is called denotative contamination, which was defined by Osgood to mean: "Most adjectival scale terms have variable denotative meanings as well as their affective connotation. Particular concepts exert a selective limitation upon scale meanings, drawing forth a denotative usage of some and the connotation of others. The denotation of masculine-feminine is elicited

by the concept Adlai Stevenson while its potency connotation is elicited by the concept dynamo"(51). To say that this was operating for either set of reports is very difficult to prove but there is the possibility that it may have had an effect. This too represents an area for future research.
(c) A third factor for this discrepancy may be related to the test instrument itself in the sense that some of the bi-polar adjectives like productive-unproductive, efficient-inefficient may not have been clear cut in their meanings as the bi-polar adjectives which did not shift, and so a different interpretation could have been exercised by some of the respondents which resulted in this discrepancy.
(d) A fourth factor may have been inconsistency per se from some of the respondents in their interpretation of the (shifting) bi-polar adjectives which resulted in this discrepancy.

All of the above-mentioned factors or some of them could have been behind the shifting of these six bi-polar adjectives from one factor to another, and no available tool can be used to answer the many questions raised in this context.

8.3.4.2. Factor pattern correlations

The factor pattern correlations of the final solution for the set of reports "B" is presented in the following table:

TABLE 8.60.

Factor pattern correlations - final solution(Reports "B")

Factors	Value	Reliability	Quantity	Format-physical construction	Formal-logical presentation	Timeliness	Cost?
Value	-						
Reliability	.24764(.05)	-					
Quantity	NS	.28493(.02)	-				
Format-physical construction	NS	NS	NS	-			
Format-logical presentation	.40014(.001)	.29394(.02)	NS	NS			
Timeliness	.35066(.005)	.32968(.005)	.31819(.01)	NS	.26782(.05)	-	
Cost?	.27569(.02)	NS	NS	NS	NS	NS	-

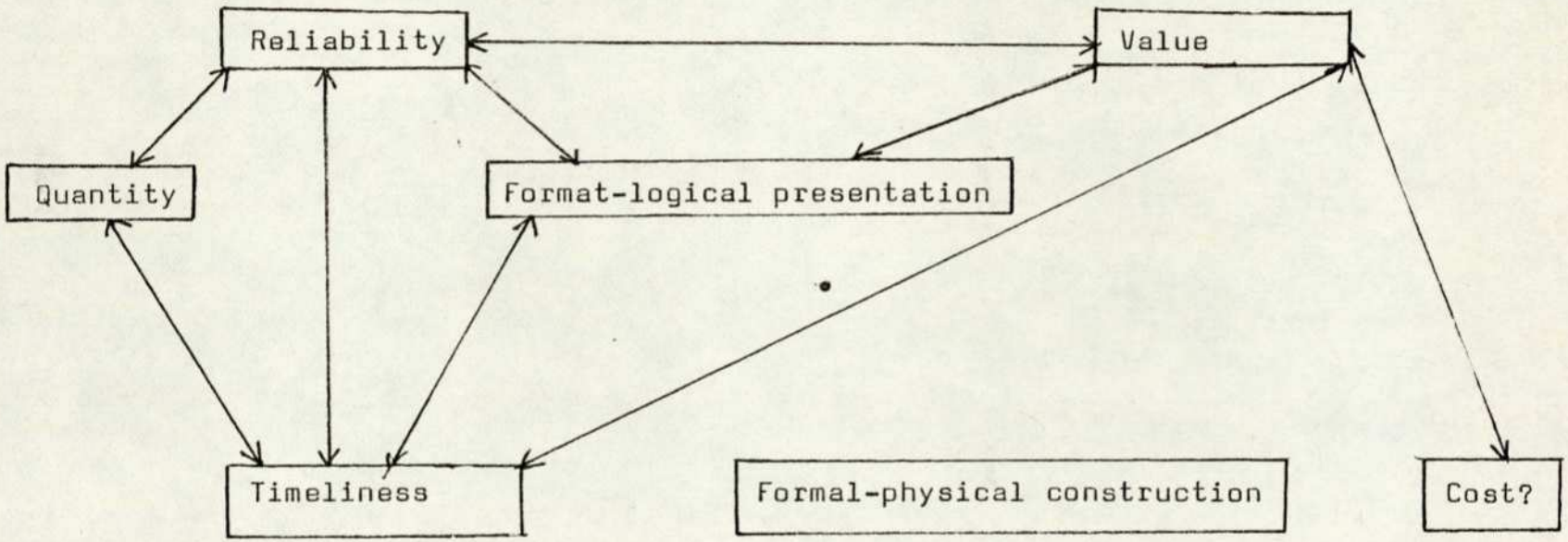
NS=Not significant at the .05 level of significance (2-tail test)

() Levels of significance are presented in parentheses (2-tail test)

The above significant correlations are presented in the following figure for ease of interpretation.

FIGURE 8.2.

Intercorrelations between factors representing different aspects of MIS reports (Reports "B")



First - Correlated factors and its significance

1. The Value factor is significantly correlated with the Timeliness factor (.005 level), a result previously obtained in relation to reports "A", and an added confirmation of previous studies.*

2. The Value factor and the Reliability factor were significantly correlated (.05 level), an expected result in view of the effect the reliability of a report has on its value as perceived by the user. (This result was also obtained in relation to reports "A", but in this case it was between the Value-applicability factor and the Reliability factor, with no significant correlation between the value-need factor and the other factor).

3. The Value factor was significantly correlated with the Format-logical presentation and the Cost? factors (.001 and .02 level respectively) - a result which confirms what is intuitively expected of attributes correlating with the Value of a report. (This result was not obtained in relation to reports "A").

4. The Reliability factor is significantly correlated with the Format-logical presentation factor (.02 level). The same argument presented in this context in relation to reports "A" applies here too.*

5. The Reliability factor is significantly correlated with the Quantity factor (.02 level).*

---

* Please see section 8.3.3.2., p.479

6. The Reliability factor is significantly correlated with the Timeliness factor (.005 level). Two explanations can be offered for this relationship:

(a) That Reliability was looked at by the respondents to mean more than the report being free from errors and mistakes, namely, reliability meant the reliable use of the data. If this explanation is accepted, then a relationship would be expected to exist between Reliability and Timeliness, as the latter attribute has a great effect on the reliable use of the data and the way it is utilised.

(b) As a result of the method used in computing these correlations using factor scores discussed and presented earlier.

The above relationship was not uncovered in relation to reports "A" .

7. The Timeliness factor is significantly correlated with the Quantity factor and the Format-logical presentation factor (.01 and .05 respectively). This is an unexpected and counter-intuitive result as a relationship between these different attributes of the reports would not be expected due to the fact that the presence of any one of them does not affect the presence of the others. An explanation which can be offered is that this may be the result of the method of computing these correlations. These significant relationships were not uncovered in reports "A".

Second - Non-correlated factors

8. The Value factor had a positive relationship with the Format-physical construction factor, and the Quantity factor (as can be seen from Table VIII.IV in the supplement to this chapter, which presents the whole matrix of the factor

pattern correlations for the final solution), but they were not significant at the .05 level. These results can be considered counter intuitive as it is expected that the user's satisfaction with these two attributes will influence and affect the value in non-monetary terms of the reports.

(These non-significant correlations were uncovered too in relation to reports "A" with the exception that Quantity was significantly correlated with one aspect of the Value factors, namely, Value-applicability.)

9. The Cost? factor is positively correlated with the other factors which represent the different attributes of the reports (table VIII.IV), but these correlations were not significant at the .05 level. These non-correlations are counter intuitive in view of the definition given to Cost (in non-economic terms) as the time and effort spent by the user in extracting the needed information from a report. Two explanations can be offered:

(a) The influence of the method used in computing these correlations.

(b) That the bi-polar adjectives which represent this attribute are incomplete and inefficient in capturing its whole sphere. It is worth mentioning that this dimension was called debatable by the researcher as an acceptance of this fact about this factor.

This same result was uncovered in relation to reports "A".

10. As was expected no significant correlation(s) were obtained between: the Quantity factor and the Format-logical presentation, the Format-physical construction factors; the Format-physical construction factor and the

Format-logical presentation, the Reliability, the Timeliness factors. This was expected as the presence of any of these attributes does not affect the presence of the others. What they all share is an assumed effect on the user's perceived value (in non-monetary terms) of the reports.

The same results as above were obtained for reports "A".

8.3.5. Results for the two sets of reports combined

The two sets of reports were combined together and factor analysed. In order to perform this factor analysis, the original matrix of data of 71 (respondents) x 34 (bi-polar adjectives) x 2 (sets of reports) was collapsed into a 34 x 34 intercorrelations matrix of every bi-polar adjective with every other bi-polar adjective, summation being done over subjects and reports. The summation over the two sets of reports was achieved by computing the median of each respondent's two scores on every bi-polar adjective.* The same process described earlier concerning the computation of Kendall's τ (Tau), the coding of this data, the running of a program to factor analyse the data using this matrix of intercorrelations was repeated.**

The following seven tables, from table 8.61 to table 8.67, present the original factor analysis results for each factor separately using different methods of analysis and different rotation.

---

* As it was only two reports, the mean or the sum of the two scores could have been used and yielded the same results as the median.

** Please refer to section 8.3.2., p.437

The same six procedures concerning the acceptance of a variable's loading on a factor and hence, the acceptance of the variable as part of the variables delineated by the factor, the criterion used in ascending the DELTA in the oblique rotation for the first two methods of factor analysis, the factor numbers and their significance, and lastly the formula used in computing the significance levels, were applied in the analysis of the results of the two sets of reports together.* The loadings of the variables on the factors were all significant at and beyond the .01 level of significance (2-tail test), with some exceptions indicated in the tables.

---

* Please refer to section 8.3.3., p. 437

TABLE 8.61

The two reports together - Factor1 (N=71)

Methods of factoring with different rotation and different DELTA / Variables (Bi-polar adjectives)	Principal-component analysis					Principal (common) factor analysis					RAO's canonical factor analysis		ALPHA factor analysis	
	Orthogonal Rotation (VARIMAX)	Oblique rotation				Orthogonal Rotation (VARIMAX)	Oblique rotation				Orthogonal Rotation (VARIMAX)	Oblique rotation	Orthogonal Rotation (VARIMAX)	Oblique rotation
		δ=[illegible]	δ=-.1	δ=-.2	δ=-.3		δ=0	δ=-.1	δ=-.2	δ=-.3		δ=[illegible]		δ=0
Valuable-Worthless	.83	.85(.82)	.85(.84)	.85(.86)	.85(.90)	.82	.84(.80)	.84(.82)	.84(.85)	.84(.90)	.82	.83(.78)	.82	.84(.80)
Beneficial-Non-beneficial	.77	.80(.77)	.80(.78)	.80(.80)	.80(.82)	.74	.78(.73)	.78(.75)	.78(.77)	.78(.81)	.74	.78(.73)	.74	.77(.72)
Necessary-Unnecessary	.78	.80(.78)	.80(.79)	.80(.80)	.80(.83)	.74	.77(.73)	.77(.75)	.77(.77)	.77(.81)	.74	.77(.73)	.74	.76(.73)
Relevant-Irrelevant	.68	.74(.62)	.75(.64)	.76(.65)	.77(.68)	.65	.73(.60)	.74(.62)	.75(.65)	.76(.69)	.64	.71(.57)	.67	.74(.60)
Desirable-Undesirable	.73	.74(.77)	.74(.78)	.73(.79)	.72(.81)	.67	.69(.70)	.69(.72)	.69(.73)	.68(.76)	.67	.70(.71)	.67	.70(.72)
Meaningful-Meaningless	.67	.71(.64)	.72(.65)	.72(.67)	.72(.70)	.61	.67(.57)	.67(.59)	.68(.61)	.69(.65)	.60	.66(.57)	.63	.68(.59)
Effective-Ineffective	.62	.69(.52)	.70(.53)	.71(.55)	.73(.57)	.60	.67(.47)	.69(.49)	.70(.53)	.72(.57)	.60	.66(.44)	.62	.68(.48)
Appropriate-Inappropriate	.57	.68(.45)	.68(.47)	.69(.48)	.71(.51)	.55	.66(.43)	.67(.46)	.69(.49)	.71(.53)	.54	.64(.41)	.57	.67(.45)
Important-Unimportant	.66	.66(.60)	.66(.63)	.67(.65)	.67(.68)	.66	.64(.54)	.65(.57)	.65(.61)	.65(.65)	.68	.64(.54)	.65	.63(.54)
Material-Immaterial	.53	.58(.48)	.59(.49)	.59(.50)	.60(.52)	.50	.54(.42)	.55(.44)	.56(.46)	.57(.48)	.49	.53(.41)	.51	.55(.43)
Applicable-Inapplicable	.49	.58(.42)	.59(.42)	.60(.43)	.62(.45)	.46	.56(.38)	.58(.39)	.59(.41)	.61(.43)	-	-	.47	.58(.40)
Productive-Unproductive	.53	-	-	.60(.42)	.61(.45)	.54	-	-	-	.61(.45)	.55	-	.55	-
Informative-Uninformative	-	-	-	-	-	-	-	-	-	.56(.42)	-	-	-	-
Confirmed-Unconfirmed	-	-	-	-	-	-	-	-	-	.33(.22)	-	-	-	-

TABLE 0. 62

The two reports together - Factor 2 (N-71)

Methods of factoring with different rotation and different DELTA / Variables (Bi-polar adjectives)	Principal-component analysis					Principal (common) factor analysis					RAO's canonical factor analysis		ALPHA factor analysis	
	Orthogonal Rotation (VARIMAX)	Oblique rotation				Orthogonal Rotation (VARIMAX)	Oblique rotation				Orthogonal Rotation (VARIMAX)	Oblique rotation	Orthogonal Rotation (VARIMAX)	Oblique rotation
		δ=0	δ=.1	δ=.2	δ=.3		δ=0	δ=.1	δ=.2	δ=.3		δ=0		δ=0
Correct-Incorrect	.79	.85(.81)	.85(.83)	.85(.85)	.85(.88)	.76	.82(.76)	.83(.78)	.83(.81)	.82(.86)	.73	.81(.74)	.78	.84(.80)
Trustworthy-Untrustworthy	.83	.83(.90)	.83(.91)	.83(.93)	.81(.96)	.77	.79(.86)	.79(.88)	.78(.91)	.77(.96)	.76	.78(.85)	.75	.78(.85)
Reliable-Unreliable	.74	.79(.77)	.79(.79)	.79(.81)	.79(.85)	.71	.75(.72)	.75(.74)	.75(.77)	.75(.82)	.70	.76(.74)	.69	.73(.69)
Accurate-Inaccurate	.72	.78(.73)	.79(.74)	.78(.76)	.79(.79)	.65	.73(.65)	.73(.67)	.74(.69)	.74(.72)	.65	.74(.66)	.66	.74(.67)
Efficient-Inefficient	.39	.51(.35)	.52(.36)	.53(.37)	.55(.39)	.37	.48(.29)	.49(.30)	.51(.32)	.53(.34)	.35	.48(.30)	.38	.49(.31)
Current-Outdated	.41	-	-	-	-	.34	-	-	-	-	.33	-	.36	-

TABLE 8.63

The two reports together - Factor 3 (N-71)

Methods of factoring with different rotation and different DELTA / Variables (Bi-polar adjectives)	Principal-component analysis					Principal (common) factor analysis					RAO's canonical factor analysis		ALPHA factor analysis	
	Orthogonal Rotation (VARIMAX)	Oblique rotation				Orthogonal Rotation (VARIMAX)	Oblique rotation				Orthogonal Rotation (VARIMAX)	Oblique rotation	Orthogonal Rotation (VARIMAX)	Oblique rotation
		δ-0	δ-.1	δ-.2	δ-.3		δ-0	δ-.1	δ-.2	δ-.3		δ-0		δ-0
Complete-Incomplete	.73	.76(.76)	.76(.76)	.76(.77)	.76(.78)	.64	.68(.67)	.68(.68)	.69(.69)	.69(.72)	.64	.68(.67)	.65	.69(.68)
Adequate-Inadequate	.69	.75(.67)	.75(.67)	.75(.67)	.76(.68)	.63	.70(.61)	.71(.61)	.71(.62)	.72(.63)	.63	.71(.61)	.63	.70(.62)
Sufficient-Insufficient	.67	.71(.63)	.71(.63)	.72(.64)	.72(.65)	.61	.67(.59)	.67(.59)	.68(.59)	.68(.61)	.61	.67(.59)	.61	.67(.58)
Enough-Not enough	.70	.70(.70)	.70(.70)	.70(.71)	.70(.73)	.62	.63(.63)	.63(.64)	.63(.65)	.62(.68)	.62	.63(.64)	.62	.62(.62)
Detailed-General	.63	.65(.62)	.65(.61)	.65(.61)	.65(.61)	.59	.60(.55)	.60(.55)	.60(.55)	.60(.57)	.59	.60(.55)	.58	.59(.55)
Informative-Uninformative	.51	.59(.47)	.59(.47)	.60(.46)	.61(.46)	.47	.55(.41)	.56(.41)	.56(.41)	-	.47	.56(.42)	.47	.55(.41)

TABLE 8.64

The two reports together - Factor 4 (%-71)

Methods of factoring with different rotation and different DELTA / Variables (Bi-polar adjectives)	Principal-componant analysis					Principal (common) factur analysis					RAO's canonical factor analysis		ALPHA factor analysis	
	Orthogonal Rotation (VARIMAX)	Oblique rotation				Orthogonal Rotation (VARIMAX)	Oblique rotation				Orthogonal Rotation (VARIMAX)	Oblique rotation	Orthogonal Rotation (VARIMAX)	Oblique rotation
		δ=0	δ=-.1	δ=-.2	δ=-.3		δ=0	δ=-.1	δ=-.2	δ=-.3		δ=0		δ=0
Timely-Untimely	.87	.91(.92)	.91(.93)	.91(.94)	.91(.96)	.82	.88(.89)	.88(.90)	.88(.92)	.88(.97)	.79	.84(.85)	.85	.90(.92)
Well-timed-Ill-timed	.80	.86(.83)	.86(.83)	.86(.83)	.86(.85)	.80	.87(.86)	.87(.86)	.87(.87)	.86(.90)	.76	.83(.80)	.76	.85(.82)
Opportune-Inopportune	.64	.73(.69)	.74(.71)	.74(.71)	.75(.74)	.48	.61(.52)	.62(.53)	.63(.58)	.64(.59)	.54	.65(.57)	.49	.61(.53)

TABLE 8.65

The two reports together - Factor 6 (N-71)

Methods of factoring with different rotation and different DELTA / Variables (Bi-polar adjectives)	Principal-component analysis					Principal (common) factor analysis					RAO's canonical factor analysis		ALPHA factor analysis	
	Orthogonal Rotation (VARIMAX)	Oblique rotation δ=0	δ=-.1	δ=-.2	δ=-.3	Orthogonal Rotation (VARIMAX)	Oblique rotation δ=0	δ=-.1	δ=-.2	δ=-.3	Orthogonal Rotation (VARIMAX)	Oblique rotation δ=0	Orthogonal Rotation (VARIMAX)	Oblique rotation δ=0
Simple-Complex	.71	-.72(-.73)	-.72(-.74)	-.72(-.74)	-.72(-.75)	.48	-.48(-.45)	-.49(-.46)	-.49(-.47)	-.50(-.49)	.43	.48(.45)	.52	.53(.51)
Well-constructed-Ill-constructed	.58	-.64(-.58)	-.65(-.59)	-.66(-.61)	-.66(-.62)	.50	-.54(-.48)	-.55(-.47)	-.57(-.50)	-.59(-.53)	.47	.55(.46)	.55	.54(.47)
Workable-Unworkable	.44	-.55(-.39)	-.55(-.39)	-.55(-.38)	-.55(-.38)	.46	-.53(-.38)	-.53(-.37)	-.53(-.37)	-.53(-.36)	.45	.53(.37)	.44	.53(.37)
Applicable-Inapplicable	-	-	-	-	-	-	-	-	-	-	.44	.50(.37)	-	-
Confirmed-Unconfirmed	-	-	-	-	-	.25*	-.31(-.22)*	-.31(-.21)*	-.31(-.20)*	-	.25*	.31(.20)*	.29*	.37(.28)

* Significant at the .05 level of significance (2-tail test)

TABLE 8.66

The two factors together - Factor 6 (N=71)

Methods of factoring with different rotation and different DELTA / Variables (Bi-polar adjectives)	Principal-component analysis					Principal (common) factor analysis					RAO's canonical factor analysis		ALPHA factor analysis	
	Orthogonal Rotation (VARIMAX)	Oblique rotation				Orthogonal Rotation (VARIMAX)	Oblique rotation				Orthogonal Rotation (VARIMAX)	Oblique rotation	Orthogonal Rotation (VARIMAX)	Oblique rotation
		δ=0	δ=-.1	δ=-.2	δ=-.3		δ=0	δ=-.1	δ=-.2	δ=-.3		δ=0		δ=0
Ordered-Disordered	.67	.69(.60)	.67(.58)	.64(.56)	.61(.55)	.57	.76(.66)	.74(.63)	.71(.60)	.66(.57)	.68	.74(.63)	.54	.72(.60)
Organised-Disorganised	.61	.65(.54)	.62(.52)	.59(.50)	.57(.49)	.48	.69(.55)	.67(.52)	.63(.49)	.58(.46)	.61	.69(.55)	.46	.65(.50)

TABLE 8.67

The two reports together - Factor 7 (71)

Methods of factoring with different rotation and different DELTA / Variables (Bi-polar adjectives)	Principal-component analysis					Principal (common) factor analysis					RAO's canonical factor analysis		ALPHA factor analysis	
	Orthogonal Rotation (VARIMAX)	Oblique rotation				Orthogonal Rotation (VARIMAX)	Oblique rotation				Orthogonal Rotation (VARIMAX)	Oblique rotation	Orthogonal Rotation (VARIMAX)	Oblique rotation
		δ=0	δ=.1	δ=.2	δ=.3		δ=0	δ=.1	δ=.2	δ=.3		δ=0		δ=0
Supportive-Non-supportive	.67	.71(.65)	.70(.64)	.69(.63)	.68(.62)	.49	.55(.47)	.54(.45)	.52(.44)	.50(.43)	.45	.55(.46)	.51	-.56(-.48)
Productive-Unproductive	-	.57(.45)	.55(.43)	-	-	-	.63(.49)	.60(.46)	.56(.43)	-	-	.62(.45)	-	-.63(-.49)
Confirmed-Unconfirmed	.47	.50(.45)	.50(.45)	.50(.45)	.49(.45)	-	-	-	-	-	-	-	-	-
Current-Outdated	-	-.28(-.43)*	-.30(-.43)*	-.31(-.43)*	-.32(-.44)*	-	-.09(-.26)**	-.12(-.26)**	-.15(-.27)**	-.17(-.27)**	-	-.10(-.27)**	-	.14(.30)**

* Significant at the .05 level of significance (2-tail test)

** Not significant at the .10 level of significance (2-tail test)

The results presented in the previous tables show that twenty-nine of the thirty-four bi-polar adjectives were stable, i.e. their highest loadings were on the same factors irrespective of the model used and the type of rotation performed, and only five bi-polar adjectives were unstable to varying degrees. The following table(8.68) presents these five unstable variables in terms of the model used, the type of rotation applied, and the factors where they had their highest loadings.

Table 8.69 indicates the results of the application of the four criteria used previously to decide the relevant factor for these unstable variables.

TABLE 8.68.

The five bi-polar adjectives and the factors on which they had their highest loadings, with different factor analysis methods, and different types of rotation

Methods of analysis with different rotation and different DELTA \ Variables (bi-polar adjectives)	Applicable-Inapplicable	Productive-Unproductive	Informative-Uninformative	Confirmed-Unconfirmed	Current-Outdated
P.C.A. - Orthogonal rotation - (VARIMAX)	Factor 1	Factor 1	Factor 3	Factor 7	Factor 2
P.C.A. - Oblique rotation δ - =0	"	Factor 7	"	"	Factor 7
P.C.A. - Oblique rotation δ - =.1	"	"	"	"	"
P.C.A. - Oblique rotation δ - =.2	"	Factor 1	"	"	"
P.C.A. - Oblique rotation δ - =.3	"	"	"	"	"
P.F.A. - Orthogonal rotation - (VARIMAX)	"	"	"	Factor 5	Factor 2
P.F.A. - Oblique rotation δ - =0	"	Factor 7	"	"	Factor 7
P.F.A. - Oblique rotation δ - =.1	"	"	"	"	"
P.F.A. - Oblique rotation δ - =.2	"	"	"	"	"
P.F.A. - Oblique rotation δ - =.3	"	Factor 1	Factor 1	Factor 1	"
RAO - Orthogonal rotation - (VARIMAX)	Factor 5	"	Factor 3	Factor 5	Factor 2
RAO - Oblique rotation δ - =0	"	Factor 7	"	"	Factor 7
ALPHA - Orthogonal rotation - (VARIMAX)	Factor 1	Factor 1	"	"	Factor 2
ALPHA - Oblique rotation δ - =0	"	Factor 7	"	"	Factor 7

TABLE 8.69

Unstable Variables

Variable	Factor Loadings		Criteria				Decision
	Factor	No. of cases	(i) Sign of factor loadings	(ii) Structure loadings	(iii) Kendall's τ (Tau) correlation coefficients	(iv) Subjective criterion-relevance	
Applicable-Inapplicable	1 5	12 2	Compatible loadings on both factors	.50(.37) highest loading on Factor 5 .55 (.35) highest loading on Factor 1 Factor 1 explains more of the variable's variance	Tables 8.70 and 8.71 show intercorrelations greater with variables on factor 1 (and more highly significant).	-	Accept bi-polar adjective on factor 1
Productive-Unproductive	1 7	7 7	Comparable loadings	Table 8.72 shows that whilst results are mixed, factor 1 explains more of the variable's variance in more than half of the results	Table 8.73 shows the Kendall's τ (Tau) coefficients of variables loading on factor 1. On factor 7 with stable variable the correlation is .4060 (statistically significant beyond .001 level - 2-tail test). In general, intercorrelations greater with Factor 1.	-	Accept bi-polar adjective on factor 1.

TABLE 8.69. (continued)

Unstable variables

Variable	Factor loadings			Criteria			Decision
	Factor	No. of cases	Sign[i] of factor loadings	Structure[ii] loadings	Kendall's τ[iii] (Tau) correlation coefficients	Subjective[iv] criterion-relevance	
Informative-Uninformative	3 1	13 1	Comparable loadings	.56(.42) Factor 1 .58(.41) Factor 3 Factor 3 explains minimally more of the variable's variance	Tables 8.74 and 8.75 indicate no major differences	-	Accept bi-polar adjective on Factor 3
Confirmed-Unconfirmed	1 5 7	1 8 5	Comparable loadings	Table 8.76 shows no distinctions arise and no preference can be made.	.2786 Tau correlation with factor 7 stable variable. Significant beyond the .001 level (2-tail test) Tables 8.77 and 8.78 show the variable to be more highly related to variables on Factors 5 and 7 than 1	More relevant to factor 7 as this reflects a distinct cluster	Accept bi-polar adjective on factor 7

TABLE 8.69 (continued)

Unstable variables

Variable	Factor loadings		Criteria				Decision
	Factor	No. of cases	(i) Sign of factor loadings	(ii) Structure loadings	(iii) Kendall's τ (Tau) correlation coefficients	(iv) Subjective criterion-relevance	
Current-Outdate	2 7	4 10	Sign of the loading comparable with factor 2, incomparable with factor 7 (sign -ve when factor 7 variable signs +ve). Counter-intuitive-suggests while a report is supportive and confirmed it is outdated	Table 8.79 indicates factor 2 explains more of the variable's variance than does factor 7	Tables 8.80 and 8.81 show the variable is highly and statistically significantly correlated with other variables on factor 2 in contrast with low and insignificant correlations on factor 7.	-	Accept bi-polar adjective on factor 2.

TABLE 8.70.

Kendall's τ (Tau) correlation coefficients for the bi-polar adjectives having their highest pattern loadings on factor 5*

Bi-polar Adjectives	Simple-Complex	Well-constructed-Ill-constructed	Workable-Unworkable	Applicable-Inapplicable
Simple-Complex	-			
Well-constructed-Ill constructed	.2936 (.001)	-		
Workable-Unworkable	.2452 (.003)	.4835 (.001)	-	
Applicable-Inapplicable	.2214 (.007)	.4455 (.001)	.4517 (.001)	-

* Excluding the unstable and undecided upon bi-polar adjectives.

() Significance levels are presented in parentheses (2-tail test).

TABLE 8.71

Kendall's τ (Tau) correlation coefficients for the bi-polar adjectives having their highest pattern loadings on factor 1*

Bi-polar adjectives	Valuable-Worthless	Beneficial-Non-beneficial	Necessary-Unnecessary	Relevant-Irrelevant	Desirable-Undesirable	Meaningful-Meaningless	Effective-Ineffective	Appropriate-Inappropriate	Important-Unimportant	Material-Immaterial	Applicable-Inapplicable
Valuable-Worthless	-										
Beneficial-Non-beneficial	.6888	-									
Necessary-Unnecessary	.6313	.6141	-								
Relevant-Irrelevant	.5725	.5500	.5861	-							
Desirable-Undesirable	.5882	.5378	.5811	.4798	-						
Meaningful-Meaningless	.5867	.4923	.4744	.5598	.4637	-					
Effective-Ineffective	.5621	.5104	.5026	.5610	.4818	.5507	-				
Appropriate-Inappropriate	.4978	.5165	.5508	.3925	.4173	.6001	.6256	-			
Important-Unimportant	.6683	.5090	.4819	.3748	.3742	.3842	.4837	.3222	-		
Material-Immaterial	.4369	.4580	.4047	.5307	.2830	.5243	.3386	.4770	.3771	-	
Applicable-Inapplicable	.4134	.4810	.3834	.5991	.3847	.4760	.5854	.6135	.2720	.3492	-

* Excluding the unstable and undecided upon bi-polar adjectives

All correlation coefficients are significant beyond the .001 level (2-tail test)

TABLE 8.72

Productive-Unproductive loadings on factor 7 and factor 1

Factors \ Results No.	(2)	(3)	(7)	(8)	(9)	(12)	(14)
Factor 7	.57(.45)	.55(.43)	.63(.49)	.60(.46)	.56(.43)	.62(.45)	-.63(-.49)
Factor 1	.57(.38)	.59(.40)	.56(.34)	.58(.37)	.60(.41)	.56(.33)	.56(.34)

() Pattern loadings are presented in parentheses.

All loadings are significant at and beyond the .01 Level (2-tail test).

TABLE 8.73

Kendall's τ (Tau) correlation coefficients for the bi-polar adjectives having their highest pattern loadings on factor 1*

Bi-polar adjectives	Valuable-Worthless	Beneficial-Non-beneficial	Necessary-Unnecessary	Relevant-Irrelevant	Desirable-Undesirable	Meaningful-Meaningless	Effective-Ineffective	Appropriate-Inappropriate	Important-Unimportant	Material-Immaterial	Applicable-Inapplicable	Productive-Unproductive
Valuable-Worthless	-											
Beneficial-Non-beneficial	.6888	-										
Necessary-Unnecessary	.6313	.6141	-									
Relevant-Irrelevant	.5725	.5500	.5861	-								
Desirable-Undesirable	.5882	.5378	.5811	.4798	-							
Meaningful-Meaningless	.5867	.4923	.4744	.5598	.4637	-						
Effective-Ineffective	.5621	.5104	.5026	.5610	.4818	.5507	-					
Appropriate-Inappropriate	.4978	.5165	.5508	.3925	.4173	.6001	.6256	-				
Important-Unimportant	.6683	.5090	.4819	.3748	.3742	.3842	.4837	.3222	-			
Material-Immaterial	.4369	.4580	.4047	.5307	.2830	.5243	.3386	.4770	.3771	-		
Applicable-Inapplicable	.4134	.4810	.3834	.5991	.3847	.4760	.5854	.6135	.2720	.3492	-	
Productive-Unproductive	.5010	.4721	.4664	.4553	.3433	.4073	.5599	.4659	.5347	.3457	.3570	-

* Excluding the unstable and undecided upon bi-polar adjectives.

All correlations coefficients are significant beyond the .001 level (2-tail test)

TABLE 8.74.

Kendall's τ (Tau) correlation coefficients for the bi-polar adjectives having their highest pattern loadings on factor 3

Bi-polar Adjectives	Complete-Incomplete	Adequate-Inadequate	Sufficient-Insufficient	Enough-Not enough	Detailed-General	Informative-Uninformative
Complete-Incomplete	-					
Adequate-Inadequate	.5304	-				
Sufficient-Insufficient	.4498	.5191	-			
Enough-Not enough	.3914	.3562	.4864	-		
Detailed-General	.4092	.4470	.3591	.2837	-	
Informative-Uninformative	.3157	.4791	.3727	.3115	.4406	-

All correlation coefficients are significant at and beyond the .001 level (2-tail test)

TABLE 8.75

Kendall's τ (Tau) correlation coefficients for the bi-polar adjectives having their highest pattern loadings on factor 1*

Bi-polar adjectives	Valuable-Worthless	Beneficial Non-beneficial	Necessary-Unnecessary	Relevant-Irrelevant	Desirable-Undesirable	Meaningful-Meaningless	Effective-Ineffective	Appropriate-Inappropriate	Important-Unimportant	Material-Immaterial	Applicable-Inapplicable	Productive-Unproductive	Informative-Uninformative
Valuable-Worthless	-												
Beneficial-Non-beneficial	.6888	-											
Necessary-Unnecessary	.6316	.6141	-										
Relevant-Irrelevant	.5725	.5500	.5861	-									
Desirable-Undesirable	.5882	.5378	.5811	.4798	-								
Meaningful-Meaningless	.5867	.4923	.4744	.5598	.4637	-							
Effective-Ineffective	.5621	.5104	.5026	.5610	.4818	.5507	-						
Appropriate-Inappropriate	.4978	.5165	.5508	.3925	.4173	.6001	.6256	-					
Important-Unimportant	.6683	.5090	.4819	.3748	.3742	.3842	.4837	.3222	-				
Material-Immaterial	.4369	.4580	.4047	.5307	.2830	.5243	.3386	.4770	.3771	-			
Applicable-Inapplicable	.4134	.4810	.3834	.5991	.3847	.4760	.5854	.6135	.2720	.3492	-		
Productive-Unproductive	.5010	.4721	.4664	.4553	.3443	.4073	.5599	.4659	.5347	.3457	.3570	-	
Informative-Uninformative	.4456	.4248	.4087	.4692	.3615	.2953	.4888	.3925	.3620	.2408†	.4542	.3376	-

* Excluding the unstable and undecided upon bi-polar adjectives

All correlation coefficients are significant beyond the .001 level, with the exception of the one marked (†) which was significant at the .003 level (2-tail test).

TABLE 8.76.

The loadings of the bi-polar adjective Confirmed-Unconfirmed on factors 1, 5 and 7

Factors / Method of analysis with different rotation and different DELTA	Factor 1	Factor 5	Factor 7
P.C.A. - Oblique rotation - δ=0	.29(.15)**	-.36(-.25)	*.50(.45)*
P.C.A. - Oblique rotation - δ=.1	.30(.16)**	-.36(-.24)	*.50(.45)*
P.C.A. - Oblique rotation - δ=.2	.31(.17)	-.36(-.23)	*.50(.45)*
P.C.A. - Oblique rotation - δ=.3	.32(.19)	-.35(-.22)	*.49(.45)*
P.F.A. - Oblique rotation - δ=0	.29(.16)**	*-.31(-.22)***	.29(.19)**
P.F.A. - Oblique rotation - δ=.1	.30(.17)**	*-.31(-.21)***	.28(.19)**
P.F.A. - Oblique rotation - δ=.2	.31(.19)	*-.31(-.20)***	.26(.18)**
P.F.A. - Oblqiue rotation - δ=.3	*.33(.22)*	-.31(-.19)**	.25(.18)**
RAO - Oblique rotation - δ=0	.28(.15)**	*.31(.20)***	.27(.18)**
ALPHA - Oblique rotation - δ=0	.29(.15)**	*.37(.28)***	-.33(-.24)**

The figures presented in *(Italics)* represent the highest loadings of the variable, presented in the previous table.

** Significant at the .05 level of significance (2-tail test).

All other loadings are significant at and beyond the .01 level of significance (2-tail test)

TABLE 8.77.

Kendall's τ (Tau) correlation coefficients for the bi-polar adjectives having their highest pattern loadings on factor 5

Bi-polar Adjectives	Simple-Complex	WEll-constructed-Ill-constructed	Workable-Unworkable	Confirmed-Unconfirmed
Simple-Complex	-			
Well-constructed-Ill-constructed	.2936(.001)	-		
Workable-Unworkable	.2452(.003)	.4835(.001)	-	
Confirmed-Unconfirmed	.2063(.011)	.2886(.001)	.3247(.001)	-

() Significance levels are presented in parentheses (2-tail test)

TABLE 8.78

Kendall's τ (Tau) correlation coefficients for the bi-polar adjectives having their highest pattern loadings on factor 1*

Bi-polar adjectives	Valuable-Worthless	Beneficial-Non-beneficial	Necessary-Unnecessary	Relevant-Irrelevant	Desirable-Undesirable	Meaningful-Meaningless	Effective-Ineffective	Appropriate-Inappropriate	Important-Unimportant	Material-Immaterial	Applicable-Inapplicable	Productive-Unproductive	Confirmed-Unconfirmed
Valuable-Worthless	-												
Beneficial-Non-beneficial	.6888	-											
Necessary-Unnecessary	.6313	.6141	-										
Relevant-Irrelevant	.5725	.5500	.5861	-									
Desirable-Undesirable	.5882	.5378	.5811	.4798	-								
Meaningful-Meaningless	.5867	.4923	.4744	.5598	.4637	-							
Effective-Ineffective	.5621	.5104	.5026	.5610	.4818	.5507	-						
Appropriate-Inappropriate	.4978	.5165	.5508	.3925	.4173	.6001	.6256	-					
Important-Unimportant	.6683	.5090	.4819	.3748	.3742	.3842	.4837	.3222	-				
Material-Immaterial	.4369	.4580	.4047	.5307	.2830	.5243	.3386	.4770	.3771	-			
Applicable-Inapplicable	.4134	.4810	.3834	.5991	.3847	.4760	.5854	.6135	.2720	.3492	-		
Productive-Unproductive	.5010	.4721	.4664	.4553	.3443	.4073	.5599	.4659	.5347	.3457	.3570	-	
Confirmed-Unconfirmed	.1527 (NS)	.2948	.2858	.2737	.2852	.1111 (NS)	.2751	.4153	.1688 *	.2041 *	.2730	.2655 **	-

NS=Not significant at the .05 level (2-tail test)
* Significant at the .05 level (2-tail test)
** Significant at the .002 level (2-tail test)
All other correlation coefficients are significant beyond the .001 level (2-tail test)

TABLE 8.79.

Current-Outdated loadings on factor 7 and factor 2

Factors \ Results No.	(2)	(3)	(4)	(5)	(7)	(8)	(9)	(10)	(12)	(14)
Factor 7	-.28 (-.43)*	-.30 (-.43)*	-.31 (-.43)*	-.32 (-.44)*	-.09 (-.26)**	-.12 (-.26)**	-.15 (-.27)**	-.17 (-.27)**	-.10 (-.27)**	.14 (.30)**
Factor 2	.49 (.35)	.49 (.31)	.50 (.31)	.51 (.30)	.44 (.25)	.45 (.25)	.46 (.25)	.47 (.25)	.44 (.25)	.44 (.26)

() Pattern loadings are presented in parentheses.

* Significant at the .05 level (2-tail test).

** Not significant at the.10 level (2-tail test).

All the loadings on factor 2 are significant at and beyond the .01 level (2-tail test)

TABLE 8.80.

Kendall's τ (Tau) correlation coefficients for the bi-polar adjectives having their highest pattern loadings on factor 2

Bi-polar Adjectives	Correct-Incorrect	Trustowrthy-Untrustworthy	Reliable-Unreliable	Accurate-Inaccurate	Efficient-Inefficient	Current-Outdated
Correct-Incorrect	-					
Trustworthy-Untrustworthy	.6441	-				
Reliable-Unreliable	.6264	.6153	-			
Accurate-Inaccurate	.6068	.5501	.5535	-		
Efficient-Inefficient	.3707	.2791	.3731	.4252	-	
Current-Outdated	.3871	.3158	.2991	.3696	.2741	-

All correlation coefficients are significant at and beyond the .001 level (2-tail test)

TABLE 8.81.

Kendall's τ (Tau) correlation coefficients for the bi-polar adjectives having their highest pattern loadings on factor 7 (in ten different results)

Bi-polar Adjectives	Supportive-Non-supportive	Confirmed-Unconfirmed	Current-Outdated
Supportive-Non-supportive	-		
Confirmed-Unconfirmed	.2786(.001)	-	
Current-Outdated	.0677(NS)	.1164(NS)	-

NS=Not significant at the .05 level (2-tail test)

() Correlation coefficients are presented in parentheses (2-tail test)

8.3.5.1. Final Solution

The following table presents the final solution of factor analysing the two sets of reports. It is necessary to mention that:

(a) The solution is based on the principal-component analysis as the factor model and the oblique rotation with DELTA=0 as the type of rotation performed. This is repeating the same procedure as that used for each set of reports separately.

(b) The decisions taken based on the four criteria, concerning the acceptance of some variables' loadings on certain factors, were incorporated in the final solution.

(c) The sign of the loadings on factor 5 were changed from negative to positive for ease of interpretation and analysis as was done in the previous analysis of each set of reports.

(d) The factors were named after those used with reports "A" and reports "B" and are shown on the table. No further explanations or analysis will be given as they will be a repetition of what was presented in relation to these reports.

TABLE 8.82.

Principal component analysis of SD data of the two sets of reports together (Oblique rotation δ=0, N=71)

Factor 1 (Value)	
Valuable-Worthless	.85(.82)
Beneficial-Non-beneficial	.80(.77)
Necessary-Unnecessary	.80(.78)
Relevant-Irrelevant	.74(.62)
Desirable-Undesirable	.74(.77)
Meaningful-Meaningless	.71(.64)
Effective-Ineffective	.69(.52)
Appropriate-Inappropriate	.66(.45)
Important-Unimportant	.66(.60)
Material-Immaterial	.58(.48)
Applicable-Inapplicable	.58(.42)
Productive-Unproductive	.57(.38)
Factor 2 (Reliability)	
Correct-Incorrect	.85(.81)
Trustworthy-Untrustworthy	.83(.90)
Reliable-Unreliable	.79(.77)
Accurate-Inaccurate	.78(.73)
Efficient-Inefficient	.51(.35)
Current-Outdated	.49(.35)
Factor 3 (Quantity)	
Complete-Incomplete	.76(.76)
Adequate-Inadequate	.75(.67)
Sufficient-Insufficient	.71(.63)
Enough-Not enough	.70(.70)
Detailed-General	.65(.62)
Informative-Uninformative	.59(.47)
Factor 4 (Timeliness)	
Timely-Untimely	.91(.92)
Well-timed-Ill-timed	.86(.83)
Opportune-Inopportune	.73(.69)
Factor 5 (Format-physical construction)	
Simple-Complex	.72(.73)
Well-constructed-Ill-constructed	.64(.58)
Workable-Unworkable	.55(.39)
Factor 6 (Format-logical presentation)	
Ordered-Disordered	.69(.60)
Organised-Disorganised	.65(.54)
Factor 7 (Cost?)	
Supportive-Non-supportive	.71(.65)
Confirmed-Unconfirmed	.50(.45)

( ) Pattern loadings are presented in parentheses.
All the loadings are significant at and beyond the .01 level of significance (2-tail test).

A comparison of the final solution results with the initial classification in terms of major groupings and in terms of the individual bi-polar adjectives presented in the following table, reveals the following:

(a) For the major groupings, no difference exists between the initial classification and the groupings built around the factor analysis results: one exception being the Format subdividing into two groups: physical construction of the report and logical presentation of the data. The same result yielded with the factor analysis of each report.

(b) For the individual bi-polar adjectives, twenty-five of them representing 74 per cent approximately of those used remained unchanged. Nine representing about 26 per cent changed groups. Reasons behind these changes will be subjected to an in-depth analysis later.

A further comparison between the results of the two sets of reports combined with those of each set of reports individually deals firstly with the major groupings and next with the individual bi-polar adjectives.

TABLE 8.83.

Comparison of the initial classification of bi-polar adjectives with the factor analysis results of the two sets of reports together

Bi-polar Adjectives	Initial Classification	Factor analysis results
Important-Unimportant	VALUE	VALUE
Valuable-Worthless	"	"
Meaningful-Meaningless	"	"
Material-Immaterial	"	"
Desirable-Undesirable	"	"
Effective-Ineffective	"	"
Applicable-Inapplicable	"	"
Relevant-Irrelevant	"	QUANTITY
Informative-Uninformative	"	VALUE
Necessary-Unnecessary	"	"
Beneficial-Non-beneficial	"	COST?
Supportive-Non-supportive		
Enough-Not enough	QUANTITY	QUANTITY
Sufficient-Insufficient	"	"
Complete-Incomplete	"	"
Adequate-Inadequate	"	
Ordered-Disordered	FORMAT	FORMAT-logical presentation
Well-constructed-Ill constructed	"	FORMAT-physical construction
Organised-Disorganised	"	FORMAT-logical presentation
Simple-Complex	"	FORMAT-physical construction
Detailed-General	"	QUANTITY
Accurate-Inaccurate	ACCURACY or RELIABILITY	ACCURACY or RELIABILITY
Reliable-Unreliable	"	"
Trustworthy-Untrustworthy	"	"
Correct-Incorrect	"	COST?
Confirmed-Unconfirmed		
Timely-Untimely	TIMELINESS	TIMELINESS
Current-Outdated	"	ACCURACY or RELIABILITY
Well-timed-Ill-timed	"	TIMELINESS
Opportune-Inopportune	"	"
Productive-Unproductive	COST	VALUE
Efficient-Inefficient	"	ACCURACY or RELIABILITY
Workable-Unworkable	"	FORMAT-physical construction
Appropriate-Inappropriate	"	VALUE

First - Major groupings

Compared with the results for reports "A", six factors were the same. In addition, there was one general factor to represent value in non-economic terms rather than the value-applicability, value-need factors obtained with factor analysis of reports "A". As to reports "B", a comparison produced no differences.

Second - Individual bi-polar analysis

The following table presents the bi-polar adjectives which changed factors from one analysis to another in relation to each set of reports compared with the two sets combined.

TABLE 8.84.

Bi-polar adjectives which changed factors in the factor analysis of reports "A", reports "B", and the two sets of reports combined

Reports / Bi-polar adjectives	Reports "A"	Reports "B"	Two sets of reports combined
Productive-Unproductive	Cost? factor	-	Value factor
Current-Outdated	Timeliness factor	-	Reliability factor
Confirmed-Unconfirmed	Value-applicability factor	-	Cost? factor
Efficient-Inefficient	Format-physical construction factor	Format-logical presentation factor	Reliability factor
Workable-Unworkable	Value-applicability factor	Cost? factor	Format-physical construction factor
Informative-Uninformative	-	Value factor	Quantity factor

The results presented in the above table shows that for reports "A" only five variables shifted from one factor to another - assuming that the two factors which represent value for reports "A" are equivalent to the general one obtained for the two sets of reports together. This represents only 15 per cent of all variables used. For reports "B" there were only three variables representing 9 per cent. These results confirm the stability of the majority of variables used in the test instrument.

This result was statistically and mathematically expected, as only two sets of reports were factor analysed using the median of the respondents' two scores on each bi-polar adjective. The consequence was a result somewhere in the middle of the two sets of previous factor analysis results. If we compare the variables which shifted factors with those which shifted when the analysis was performed on each report separately, i.e. Productive, Informative, Current, Efficient, Confirmed and Workable, we find that they are all part of this cluster, and that no new shifting variables were uncoverd.

8.3.5.2. Factor pattern correlations

The following table presents the factor pattern correlations of the final solution presented earlier. (Principal-component analysis - oblique rotation - δ=0).

TABLE 8.85.

Factor pattern correlations - final solution (The two reports together)

Factors	Value	Reliability	Quantity	Timeliness	Format-physical construction	Cost?	Format-logical presentation
Value	-						
Reliability	.27882(.02)	-					
Quantity	.25519(.05)	.31453(.01)	-				
Timeliness	.34179(.005)	.25715(.05)	NS	-			
Format-physical construction	NS	.30919(.01)	NS	NS	-		
Cost?	NS	NS	NS	NS	NS	-	
Format-logical presentation	NS	NS	NS	NS	NS	NS	-

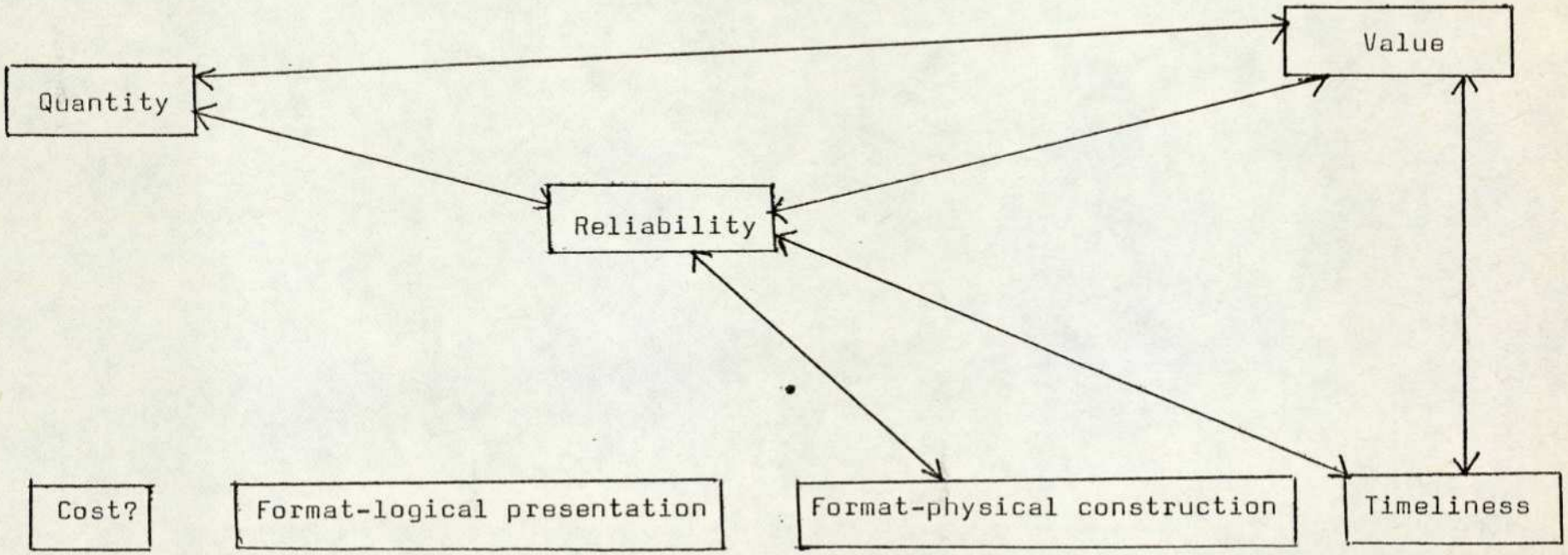
NS=Not significant at the .05 level of significance (2-tail test)

() Levels of significance are presented in parentheses (2-tail test).

The above significant intercorrelations can be presented in the following figure.

FIGURE 8.3.

Intercorrelations between factors representing different aspects of MIS reports
(The two reports together)



The intercorrelations presented in the above table and reproduced in the above figure reveal the following:

(a) The Value factor is significantly correlated with the Reliability, the Quantity, and the Timeliness factors (.02, .05, and .005 level respectively).

(b) The Reliability factor is significantly correlated with the Quantity, the Timeliness, and the Format-physical construction factors (.01, .05, and .01 level respectively).

(c) While there is a positive correlation between the Value factor and the Format-phycical construction, the Cost? and the Format-logical presentation factors,.(as can be seen from the figures in Table VIII.VI in the supplement of the chapter), these correlations were not significant at the .05 level (2-tail test).

A comparison between the factor pattern correlations for reports "A", reports "B", and the two reports together seems in order and is presented in the following table.

TABLE 8.86

Comparison of factor pattern correlations(final solution) for Reports "A", reports "B", and the two sets of reports together

Factors and Reports / Factors	Value			Reliability			Quantity			Timeliness			Format-physical construction			Cost?			Format-logical presentation		
	"A"	"B"	"A&B"	"A"	"B"	"A&B"	"A"	"B"	"A&B"	"A"	"B"	"A&B"	"A"	"B"	"A&B"	"A"	"B"	"A&B"	"A"	"B"	"A&B"
Value	-	-	-																		
Reliability	S*	S	S	-	-	-															
Quantity	S*	NS	S	S	S	S	-	-	-												
Timeliness	S	S	S	NS	S	S	NS	S	NS	-	-	-									
Format-physical construction	NS	NS	NS	NS	NS	S	NS	NS	NS	NS	NS	NS	-	-	-						
Cost?	NS	S	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	-	-	-			
Format-logical presentation	NS	S	NS	S	S	NS	NS	NS	NS	NS	S	NS	NS	NS	NS	NS	NS	NS	-	-	-

S= significant at and beyond the .05 level of significance (2-tail test)

NS= Not Significant at the .05 level of significance (2-tail test)

* Significant with Value-applicability and non Value-need.

This table shows that out of twenty-one different types or kinds of intercorrelation between the different factors, thirteen remained unchanged for either set of reports or for the two sets of reports together, and that eight intercorrelations between the factors changed either from significant to insignificant or vice versa.

8.3.6. Summary and Conclusions

To conclude the analysis and discussion presented in this chapter, an attempt to provide answers to the following unresolved problems, mentioned in the main body of the chapter, will be made.

(1) Reasons behind the shift of some bi-polar adjectives from one group to another, between the initial classification and the factor analytic results.

The initial classification of the bi-polar adjectives was compared with the final solution of the factor analysis results for reports "A", reports "B", and reports "A" and "B" together. This revealed that in the first two cases seven bi-polar adjectives changed groups, and in the last case there were nine bi-polar adjectives changing.* An analysis to discover the factors behind these changes revealed that they may be attributed to either all or some of the following reasons:

(a) The difference in culture between the Americans and the British may be a reason behind the shift of the variable Supportive from the

---

* Please refer to section 8.3.3.1. p.473, section 8.3.4.1., p. 519, section 8.3.5.1., p.561, for the bi-polar adjectives which changed groups.

Value group to the Cost? group. This is because in devising the test instrument used in this part of the study, the bi-polar adjectives chosen to reflect the value (in non-monetary terms) were those used before in a previous study in the US, and were not subjected to a test of relevance in the UK, which was the case with the bi-polar adjectives used to reflect the different attributes of the MIS reports.*

(b) The alternative interpretations of some bi-polar adjectives (e.g. informative, efficient) may be a reason behind their shift from one group to another. Informative as an example, shifted from the Value group to the Quantity with reports "A", while for reports "B" it remained in its initial grouping. If we add to this, the fact that, in relation to the former reports the next highest loadings were on the Value factor, while for the latter reports the next highest loadings were on the Quantity factor, it seems quite clear that informative was interpreted in two different ways by the respondents. The first as the amount of information accrued through the data presented in the reports - a quantity attribute - and second, as a general reflection of the informative nature of the reports - a value aspect of the reports.

---

* Please refer to section 6.4.4., p. 317, for a discussion about the building of the test instrument.

Another example is the bi-polar adjective Efficient-Inefficient which shifted from the Cost (in non-economic terms) attribute in the initial classification to the Format-physical construction factor for reports "A", and to the Format-logical presentation factor for Reports "B". This may have been due to the respondents interpreting this variable as a reflection of the Format attribute of the reports, giving it two meanings; one as the result of a well-constructed report, and the second as being an outcome of a logical and organised report.

(c) A third reason for the shift can be attributed to the sample of respondents used in the initial classification of the bi-polar adjectives used to reflect the different attributes of MIS reports, as opposed to the sample of respondents used in the final application of the test instrument.

As was mentioned earlier in Chapter 6, thirty-four respondents comprising twelve M.Sc. students, sixteen researchers and post-graduate students, and six internal auditors took part in answering a questionnaire seeking the classification of bi-polar adjectives into groups to reflect the different attributes of MIS reports*, whereas the respondents who took part in the final application were all managers (or decision makers, users) of MIS reports in their actual environment.

---

* Please refer to section 6.4.4., p. 317, for a complete discussion,

The argument here is the traditional one long debated in both the behavioural and accounting literature (52) concerning the validity of using students as surrogates for businessmen or decision makers. Thus, the difference between the two samples in terms of the respondents' experiences, and their settings (artificial vs. real world) may be the reason behind the shift in some of these variables.

(d) A final possible reason for the shift can be attributed to the difference between the statistical properties of the measure used in selecting the bi-polar adjectives and to which group they belonged for the initial classification. This was done by ranking the bi-polar adjectives in terms of their frequency distributions, compared with the factor analysis performed on the data collected through the questionnaire. A comparison of these two techniques leads to one conclusion only, which is that the first measure or technique is very crude, and that all the weight must be given to the better method which is the factor analysis.

To conclude, it is sufficient to say that the initial classification was needed in order to choose a manageable number of bi-polar adjectives from the many available to reflect each attribute of MIS reports to be used in the test instrument.

It was not intended to be a yardstick against which the scales for use by internal auditors and others for the aim of evaluating MIS reports would be compared. It is only the factor analysis results which are the main base upon which the scales will be built.

(2) The difference between the factor analysis results of reports "A" and "B" and its implications for the building of the scales.

In comparing the factor analysis results of the two reports, a qualified success was claimed in terms of their generalizability and the justification of their use in the development of scales to be used in eliciting the managers' (users') perceptions of MIS reports. This was claimed as twenty-eight bi-polar adjectives out of the thirty-four used in the test instrument maintained their same meaning, with their highest loadings on the same factors in the results of the two reports. A question which may be asked is what are the implications of the remaining six variables shifting from one factor to another?

To provide an answer to this crucial question, it is worth reiterating the first point made previously in the discussion of the reasons behind this shift. The concept/scale interaction assume that a relationship exists between the concepts being judged by the respondents (e.g. reports) and the scales used in this process (i.e. bi-polar adjectives). The researcher opted for intuition and accepted the two sets of reports as being one concept only. If this argument is accepted, then the implication

for the six variables which shifted from one factor to another is that they cannot be relied on in building scales since they are unstable and can be interpreted to mean different things to different respondents. Consequently they will be discarded from the scales, in order not to affect their generalizability.

A final point which is worth mentioning in relation to the discrepancies between the factor analysis results of reports "A" and reports "B" is the appearance of two factors to represent value in the former case, while only one general factor appeared for the latter. In the researcher's opinion this cannot be considered in the same light as the discrepancy in relation to the bi-polar adjectives, since the variables loading on the general factor are the same as those loading on the two value factors, and in both cases they can be used to measure value (in non-monetary terms) of MIS reports. This division of the general value factor into two factors, the first measuring applicability and the second measuring need, is seen as a finer refinement of this aspect of MIS reports. Hence, in the building of scales the researcher will opt for the two value factors rather than the general one as they are more differentiating of this aspect of the MIS reports, and provide more information about the users' perceptions of this value.

(3) The Cost? debatable factor, the bi-polar adjectives delineated by it, and their place in the scales to be suggested based on factor analysis results.

In presenting the final solution of the factor analysis performed on the SD data for either reports or for both of them together, the researcher accepted the cluster of variables delineated by this factor as reflecting the Cost (in non-economic terms) attribute of the reports, and based this decision on the meaning of these variables as defined by the Oxford dictionary. This was the only base upon which the decision was made. Different interpretation of these meanings can lead to different names (reflecting attributes of the reports) to this factor. The researcher added the interrogation mark and called it a debatable factor. This points to the decision which has to be made about this factor and the variables highly loading on it in terms of the scales to be suggested. The decision is to discard the variable(s) which loaded on this factor, and accept the fact that bi-polar adjectives which were intended to measure this attribute failed to achieve this aim. This is also facilitated if the decision taken in relation to the second problem discussed above is implemented. This would result in discarding all the variable(s) loading on this factor with the exception of the variable Supportive which, even if we accept the interpretation given before to its meaning as reflecting Cost, cannot be expected to capture the whole sphere of Cost as defined to mean the time and effort spent by the user in extracting the needed information from the report. One

interpretation or justification for the failure to capture this attribute and measure it may be that this time and effort can be affected by the Quantity of the data in the report, the format of the report, the accuracy and reliability of the data, and lastly its timeliness. This can be the reason why the bi-polar adjectives which were intended to measure it shifted to other attributes as uncovered by the results of the factor analysis.

To end our discussion about this attribute, it is worth mentioning that failing to capture its whole sphere does not mean that it does not exist, and that safely it can be said to be imbedded in other attributes. What this study showed is that the bi-polar adjectives intended to measure it shifted to other attributes, and that this point is worth researching into in the future to try and answer whether this attribute represente a cohesive one or not, and what bi-polar adjectives can be added to the test instrument in order to measure it.

As a result of the discussion presented above, the bi-polar adjectives used to build the scales are now twenty-seven. The following table presents the bi-polar adjectives which will be used to develop the scales and the aspect (value and attributes) of MIS reports they measure.

TABLE 8.87.

Bi-polar adjectives and the Values and Attributes of MIS reports they measure

Bi-polar adjectives	Values and Attributes of MIS reports
Applicable-Inapplicable	VALUE-applicability
Effective-Ineffective	" "
Relevant-Irrelevant	" "
Meaningful-Meaningless	" "
Appropriate-Inappropriate	" "
Necessary-Unnecessary	VALUE-need
Important-Unimportant	" "
Beneficial-Non-beneficial	" "
Valuable-Worthless	" "
Desirable-Undesirable	" "
Material-Immaterial	" "
Sufficient-Insufficient	QUANTITY
Adequate-Inadequate	"
Enough-Not enough	"
Detailed-General	"
Complete-Incomplete	"
Ordered-Disordered	FORMAT-Logical presentation
Organised-Disorganised	" " "
Reliable-Unreliable	ACCURACY or RELIABILITY
Trustworthy-Untrustworthy	" "
Correct-Incorrect	" "
Accurate-Inaccurate	" "
Timely-Untimely	TIMELINESS
Well-timed-Ill-timed	"
Opportune-Inopportune	"
Simple-Complex	FORMAT-physical construction
Well-constructed-Ill-constructed	" " "

REFERENCES

1. Osgood, C.E., Suci, G.J., and Tannenbaum, P.H., The Measurement of Meaning, University of Illinois Press, Urbana, 1957.

2. Osgood, C.E., Studies on the generality of affective meaning systems, American Psychologist, 1962, Vol.17, pp.10-28.

3. Ibid, p.12.

4. Ibid, p.19.

5. Osgood, C.E., May, W.H., and Mirron, M.S., Cross-cultural universals of affective meaning, University of Illinois Press, Urbana, 1975.

6. Osgood, C.E., op.cit., p.23.

7. Ibid, pp.24-25.

8. Nunnally, J.C., Jnr., Introduction to psychological measurement, McGraw-Hill Book Co., N.Y., 1970, pp.441-442.

9. A) Gallagher, C.A., The measurement and analysis of managers' perceptions of the value of selected information, Unpublished DBA dissertation, Florida State University, 1971.

   B) Kelly, J.A., The analysis and measurement of value of selected non-financial project management information, Unpublished DBA dissertation, Florida State University, 1974.

10. Munro, M.C., A comparison of the decision analysis and data analysis methods for determining management's information needs, Unpublished Ph.D. dissertation, University of Minnesota, 1975.

11. Osgood, C.E., Suci, G.J., and Tannenbaum, P.H., op.cit,p.186.

12. Rummel, R.J, Understanding factor analysis, Conflict Resolution, 1967, Vol.XI, No.4, p.445.

13. Ibid.

14. Rummel, R.J., Applied factor analysis, Northwestern University Press, Evanston, 1970, pp.302-303.

15. Ibid, p.303.

16. See as an example:
    (a) Labovitz, S., The assignment of numbers to rank order categories, American Sociological Review, Vol.35, No.3, June 1970, pp.515-524.
    (b) Labovitz, S., Statistical usage in sociology: sacred cows and ritual, Sociological methods and research, Vol.1, No.1, 1972, pp.13-37.
    (c) Havlicek, L.L., & Peterson, N.L., Effect of the violation of assumptions upon significance levels of the Pearson $_r$, Vol.84, No.2, 1977, pp.373-377.

17. Labovitz, S., The assignment of numbers to rank order categories, op.cit., p.515.

18. Rummel, R.J., Applied factor analysis, op.cit., p.303.

19. Ibid.

20. Ibid, pp.280-286.

21. Hays, W.L., Statistics for the social sciences, Holt, Rinehart & Winston, London, 1973, Second Edition, p.796.

22. See for example:
    (a) Ibid, pp.796-797.
    (b) Gibbons, J.D., Non-parametric methods for quantitative analysis, Holt, Rinehart & Winston, N.Y., 1976, pp. 296-298.

23. Harman, H.H., Modern factor analysis, The University of Chicago Press, Chicago, Third Edition, Revised 1976, p.134.

24. Rummel, R.J., Applied factor analysis, op.cit., p.354.

25. Ibid, pp.362-364.

26. Ibid, p.373.

27. Ibid, pp.372-385.

28. Ibid, p.170.

29. Cattell, R.F., Factor analysis: an introduction to essentials, I. the purpose and underlying models, Biometrics, Vol.21, March 1965, p.207.

30. Rummel, R.J., Applied factor analysis, op.cit., p.386.

31. Cattell, R.F., op.cit., p.209.

32. Rummel, R.J., Applied factor analysis, op.cit., p.388.

33. Ibid, p.386.

34. See as an example:
    (a) Ibid, p.392.
    (b) Harman, H.H., op.cit., pp.290-299.

35. Rummel, R.J., Applied factor analysis, op.cit., pp.435-443.

36. Cattell, R.B., Personality and Motivation Structure and Measurement, World Book Co., N.Y., 1957, pp.287-296.

37. Ibid, p.289.

38. Ibid.

39. Burt, C., & Banks, C., A factor analysis of body measurements for British adult males, American Eugenics, Vol.13, 1947, pp.238-256, as cited by: Child, D., The essentials of factor analysis, Holt, Rinehart & Winston, London, 1976, pp.97-98.

40. Rummel, R.J., Applied factor analysis, op.cit., pp.396-405.

41. The Shorter Oxford English Dictionary: on historical principles, Prepared by Little, W., Fowler, H.W., & Coulson, J., Revised and Edited by: Onions, C.T., Oxford University Press, London, 1966, p.2087.

42. Ibid, p. 1592.

43. Mock, T.J., The evaluation of alternative information structures, Unpublished Ph.D. dissertation, University of California, 1969.

44. Haseley, A.F., Information and decision making in a management game, Unpublished Ph.D. dissertation, Purdue University, 1969.

45. Ibid.

46. The Shorter Oxford English Dictionary: on historiaal principles, op.cit., p.367.

47. Ibid, p.2087.

48. Ibid, p.2449.

49. Osgood, C.E., Suci, G.J., & Tannenbaum, P.H., op.cit.,p.176.

50. Osgood, C.E., op.cit., p.27.

51. Ibid.

52. See for example:
    (a) Dickhaut, J.W., Livingstone, J.L., & Watson, D.J.H., "On the use of surrogates in behavioural experimentation", Supplement to Volume XLII of the Accounting Review, 1972, pp.455-471.
    (b) Bimberg, J.G., & Nath, R., "Laboratory Experimentation in accounting research", The Accounting Review, January, 1968, pp.38-45.

SUPPLEMENT TO THE CHAPTER

Table VIII.I

Factor structure matrix for reports "A" (oblique rotation -δ-O-N-71)

Bi-polar adjectives	Value-applicability FACTOR 1	Value-need* FACTOR 2	Quantity FACTOR 3	Format-logical presentation FACTOR 4	Reliability* FACTOR 5	Timeliness FACTOR 6	Format-physical construction FACTOR 7	FACTOR 8	Cost? FACTOR 9
Important-Unimportant	.12527	-.82200	-.03082	-.01631	.03112	.28618	.00714	.07659	.23467
Valuable-Worthless	.29386	-.81793	.10460	.05751	-.03445	.17673	.01797	.15234	.01320
Meaningful-Meaningless	.63936	-.35472	.32474	.32746	-.10201	.36615	.10083	.35468	.39869
Material-Immaterial	.44184	-.64412	.08677	.24872	-.28296	.30866	.32300	.46187	.19234
Desirable-Undesirable	.47898	-.67276	.20153	.05983	-.07036	.24971	-.01858	-.32019	-.06624
Effective-Ineffective	.80667	-.33717	.32781	-.04157	-.23439	.27466	.13660	.06681	.10299
Applicable-Inapplicable	.81584	-.25417	.37860	.25122	-.38285	.28508	.13633	-.01914	.20573
Relevant-Irrelevant	.73346	-.33131	.25451	.26729	-.26733	.39479	.29838	.23278	.24717
Informative-Uninformative	.46256	-.29854	.66277	.03423	-.32251	.10235	.05429	.12806	.05391
Necessary-Unnecessary	.21956	-.84640	.06209	.02250	-.15956	.28427	.13998	.01001	.07950
Beneficial-Non-beneficial	.24327	-.82419	.17656	-.02193	-.22792	.28962	.20344	-.08307	.17061
Supportive-Non-supportive	.34515	-.32762	.24352	.09579	-.20488	.37836	.04543	.03827	.73177
Complete-Incomplete	.22548	.05063	.55084	.50470	-.24400	-.11506	.16868	-.08182	.17956
Sufficient-Insufficient	.32086	-.20944	.79259	.28920	-.08335	.24703	.10768	-.06956	-.05917
Adequate-Inadequate	.28424	-.08502	.75153	.06835	-.34519	.07432	.34578	.17506	.06674
Enough-Not enough	.21982	.07826	.68724	.04573	-.10004	.21569	-.10752	-.04475	.09830
Ordered-Disordered	.10381	-.07495	.10126	.33978	-.33594	.21325	.21000	.13052	.05658
Organised-Disorganised	.25637	-.09178	.14221	.08485	-.35442	.22473	.39594	.09268	.09456
Simple-Complex	.07224	-.05866	.06039	.20831	-.15912	.15536	.83883	-.01477	.01777
Well-constructed-Ill-constructed	.33315	-.24935	.24069	.40349	-.17967	.27077	.55391	.16442	.24145
Detailed-General	-.12260	-.13829	.61943	.28788	-.31487	.04383	-.10631	-.28855	.10927
Accurate-Inaccurate	.31501	-.16358	.35003	.39521	-.49172	.07892	.01861	.56293	.02502
Reliable-Unreliable	.06853	-.08120	.02788	.19460	-.83881	.06332	.28546	.13760	.24769
Correct-Incorrect	.31335	-.02931	.28955	.25377	-.75680	.25194	.03236	.11636	-.21462
Confirmed-Unconfirmed	.44007	-.01777	.15028	.32660	-.16637	.12370	.42321	-.35415	.30947
Trustworthy-Untrustworthy	.31318	-.09054	.28948	.30436	-.80855	.09063	.09395	.08235	.14687
Correct-Outdated	.38202	-.21523	.37436	.41950	-.30498	.42771	.02790	-.13005	-.28097
Well-timed-Ill-timed	.20981	-.48705	.15936	.10238	-.05478	.81841	.26498	-.13272	.07995
Opportune-Inopportune	.23971	.01109	.10798	.30640	-.15099	.71328	.15468	.28107	.29125
Timely-Untimely	.35071	-.31585	.15016	.04903	-.21032	.87145	.14426	.03506	.20578
Efficient-Inefficient	.27751	-.17027	.00256	.34627	-.30813	.41840	.46897	.48935	.34106
Appropriate-Inappropriate	.63384	-.26538	.23181	.29677	-.46903	.39413	-.01703	.00950	.32072
Productive-Unproductive	.40442	-.33707	.07197	-.30077	-.32751	.45484	.16116	-.01740	.54981
Workable-Unworkable	.55541	-.38977	.26951	.18408	-.35410	.37034	.44892	.22881	.05471

* In the final solution the signs of the loadings were reversed

TABLE VIII.II

Factor pattern correlation matrix for reports "A"

Factors	Value-applicability FACTOR 1	Value-need * FACTOR 2	Quantity FACTOR 3	Format-logical presentation FACTOR 4	Reliability* FACTOR 5	Timeliness FACTOR 6	Format-physical construction FACTOR 7	FACTOR 8	Cost? FACTOR 9
Value-applicability	1.00000	-.27179	.27061	.15602	-.25055	.28870	.15714	.08224	.14675
Value-need*	-.27179	1.00000	-.10715	-.02501	.11574	-.25546	-.09109	-.02974	-.09266
Quantity	.27061	-.10715	1.00000	.18724	-.23807	.11624	.02495	-.04070	.03445
Format-logical presentation	.15602	-.02501	.18724	1.00000	-.24084	.12494	.17754	.05345	.04762
Reliability*	-.25055	.11674	-.23807	-.24084	1.00000	-.15347	-.13529	-.10442	-.11803
Timeliness	.28870	-.25546	.11624	.12494	-.15347	1.00000	.13308	.04929	.14779
Format-physical construction	.15714	-.09109	.02495	.17754	-.13529	.13308	1.00000	.07102	.12561
Factor 8	.08224	-.02974	-.04070	.05345	-.10442	.04929	.07102	1.00000	.05133
Cost?	.14675	-.09266	.03445	.04762	-.11803	.14779	.12561	.05133	1.00000

* As a result of reversing the signs of the loadings, the correlation coefficients of these two factors with the other factors has to be reversed.

Table VIII.III

Factor structure matrix for reports "B" (Oblique rotation - δ=0-N=71)

Bi-polar adjectives	Value FACTOR 1	Reliability FACTOR 2	Quantity FACTOR 3	Format-physical construction FACTOR 4	Format-logical presentation FACTOR 5	Timeliness* FACTOR 6	Cost? FACTOR 7
Important-Unimportant	.70588	.09328	.20596	-.23192	.61362	-.28365	.34086
Valuable-Worthless	.87922	.23514	.31865	.07444	.45893	-.36246	.38652
Meaningful-Meaningless	.72430	.21606	.17065	.35432	.48621	-.14616	.03006
Material-Immaterial	.62505	.41149	.01349	.94079	.53015	-.25891	.07190
Desirable-Undesirable	.81613	.22440	.18069	.03136	.20473	-.26373	.31484
Effective-Ineffective	.77986	.24202	.38048	.13601	.60793	-.40505	.44454
Applicable-Inapplicable	.64997	.33144	.31632	.48599	.48246	-.42864	.20658
Relevant-Irrelevant	.84381	.26123	.21029	.20927	.28343	-.30932	.23787
Informative-Uninformative	.59625	.33837	.53541	-.07257	.33915	-.40738	.28035
Necessary-Unnecessary	.79613	.30371	.19638	-.02129	.33875	-.46438	.29061
Beneficial-Non-beneficial	.79043	.24579	.14999	.01687	.27614	-.47947	.25805
Supportive-Non-supportive	.41281	.15228	.36859	.22908	.03145	-.35718	.69845
Complete-Incomplete	.16257	.31569	.76469	.01824	.27817	-.34302	.01042
Sufficient-Insufficient	.29099	.32720	.73467	.15974	.16982	-.46036	.18849
Adequate-Inadequate	.34843	.32687	.61949	.06897	.36600	-.49387	.03812
Enough-Not enough	.06746	.24196	.77483	.03308	.04588	-.20963	.14730
Ordered-Disordered	.28844	.42218	.22516	.30021	.82571	-.26884	-.00087
Organised-Disorganised	.39797	.48330	.28915	.33335	.72163	-.42990	.15020
Simple-Complex	.13572	.11518	-.11360	.76002	.26411	-.16541	.11021
Well-constructed-Ill-constructed	.46432	.37034	.35823	.39685	.47246	-.32293	.13970
Detailed-General	.20217	.23123	.71437	-.36238	.11850	-.23407	-.12345
Accurate-Inaccurate	.17281	.79620	.26249	.06331	.34869	-.34286	.03109
Reliable-Unreliable	.26699	.86087	.25669	.14810	.42614	-.32763	-.01060
Correct-Incorrect	.32970	.86265	.32767	.18719	.22676	-.36280	.04318
Confirmed-Unconfirmed	.33803	.24978	-.00242	.10540	.26755	-.34990	.71010
Trustworthy-Untrustworthy	.21170	.85741	.30127	.11195	.15899	-.22630	.16695
Correct-Outdated	.33950	.53597	.24114	.27259	.29545	-.39006	-.22313
Well-timed-Ill-timed	.32329	.40316	.32082	.12123	.23611	-.91965	.09321
Opportune-Inopportune	.41405	.17621	.24533	.21109	.32731	-.69482	.42235
Timely-Untimely	.22339	.28503	.39228	.04843	.17252	-.85826	.18297
Efficient-Inefficient	.30031	.45431	.27437	.30147	.61275	-.35504	.23601
Appropriate-Inappropriate	.75371	.34200	.25963	.41526	.46338	-.44470	.37691
Productive-Unproductive	.63683	.09150	.20176	-.13326	.59041	-.41412	.45400
Workable-Unworkable	.46781	.34436	.38668	.49556	.42602	-.22451	.54766

* In the final solution the signs of the loadings were reversed

TABLE VIII.IV

Factor pattern correlation matrix for Reports "B"

Factors	Value FACTOR 1	Reliability FACTOR 2	Quantity FACTOR 3	Format-physical construction FACTOR 4	Format-logical presentation FACTOR 5	Timeliness* FACTOR 6	Cost? FACTOR 7
Value	1.00000	.24764	.21497	.10119	.40014	-.35066	.27569
Reliability	.24764	1.00000	.28493	.16896	.29394	-.32968	.02499
Quantity	.21497	.28493	1.00000	.02346	.16486	-.31819	.10034
Format-physical construction	.10119	.16896	.02346	1.00000	.16612	-.10487	.08059
Format-logical presentation	.40014	.29394	.16486	.16612	1.00000	-.26782	.10534
Timeliness*	-.35066	-.32968	-.31819	-.10487	-.26782	1.00000	-.19554
Cost?	.27569	.02499	.10034	.08059	.10534	-.19554	1.00000

* As a result of reversing the signs of the loadings, the correlation coefficients of this factor with the other factors has to be reversed

Table VIII.V

Factor structure matrix for the two sets of reports together (Oblique rotation - δ=0-N=71)

Bi-polar adjectives	Value FACTOR 1	Reliability FACTOR 2	Quantity FACTOR 3	Timeliness FACTOR 4	Format-physical construction* FACTOR 5	Format-logical presentation FACTOR 6	Cost? FACTOR 7
Important-Unimportant	.65524	.03261	.10662	.26659	.15011	.29024	.50598
Valuable-Worthless	.84827	.16899	.24665	.32231	-.07806	.20380	.30314
Meaningful-Meaningless	.71053	.30907	.22486	.27688	-.32827	.15198	.28886
Material-Immaterial	.57643	.42988	.03850	.23929	-.24094	.13700	.44392
Desirable-Undesirable	.74199	.20416	.25890	.28269	-.10304	.16689	-.13416
Effective-Ineffective	.69251	.27953	.40750	.41038	-.20744	.43907	.20156
Applicable-Inapplicable	.58387	.38571	.39975	.35695	-.50889	.24290	.10215
Relevant-Irrelevant	.74451	.39744	.24119	.35054	-.41221	.34523	.18450
Informative-Uninformative	.55017	.30672	.59200	.24799	-.03370	.19542	.10124
Necessary-Unnecessary	.79885	.28944	.15929	.35009	-.09652	.21191	.13497
Beneficial-Non-beneficial	.80117	.20364	.26915	.36013	-.13953	.18187	.16710
Supportive-Non-supportive	.33479	.17864	.28044	.35469	-.12118	.70740	-.00282
Complete-Incomplete	.14034	.35480	.75564	.11136	-.15327	.12612	.23878
Sufficient-Insufficient	.30307	.32387	.71249	.36430	-.19370	.08859	-.08339
Adequate-Inadequate	.38238	.37918	.74876	.27446	-.20569	.05488	.15967
Enough-Not enough	.04809	.19595	.69524	.25108	-.02484	.14545	-.23999
Ordered-Disordered	.21943	.56733	.17091	.24641	-.41676	-.00377	.69239
Organised-Disorganised	.34614	.55076	.23012	.31241	-.41513	.10020	.65141
Simple-Complex	.03089	.14441	-.02851	.20147	-.71604	.06536	.10257
Well-constructed-Ill-constructed	.39637	.32312	.33320	.19853	-.63928	.08731	.45175
Detailed-General	.24600	.25787	.65499	.08393	.29136	-.25094	.18752
Accurate-Inaccurate	.29609	.78321	.35032	.33259	-.19521	.11492	.17641
Reliable-Unreliable	.18300	.79041	.24425	.19676	-.24140	.03841	.31688
Correct-Incorrect	.22786	.85088	.38086	.24100	-.23646	.01860	.21791
Confirmed-Unconfirmed	.28957	.30957	.05303	.13650	-.36241	.50489	.02263
Trustworthy-Untrustworthy	.17493	.83383	.29119	.14944	-.16533	.08620	-.01893
Correct-Outdated	.35288	.48627	.23973	.36261	-.38841	-.28376	.03846
Well-timed-Ill-timed	.41533	.26713	.26313	.86463	-.25605	-.01457	.03972
Opportune-Inopportune	.21391	.19285	.19993	.73451	-.20136	.40399	.31928
Timely-Untimely	.29079	.25894	.19613	.91200	-.13241	.16159	.00804
Efficient-Inefficient	.36951	.50759	.13064	.43986	-.32082	.31014	.39870
Appropriate-Inappropriate	.66335	.47222	.30870	.38630	-.52029	.41855	.22688
Productive-Unproductive	.57255	.16778	.15397	.43417	.01377	.57256	.35775
Workable-Unworkable	.43331	.47469	.30269	.34973	-.54822	.40115	.17133

* In the final solution the signs of the loadings were reversed

TABLE VIII.VI

Factor pattern correlation matrix for the two sets of reports together

Factors	Value FACTOR 1	Reliability FACTOR 2	Quantity FACTOR 3	Timeliness FACTOR 4	Format-physical construction* FACTOR 5	Format-logical presentation FACTOR 6	Cost? FACTOR 7
Value	1.00000	.27882	.25519	.34179	-.16821	.22752	.20694
Reliability	.27882	1.00000	.31453	.25715	-.30919	.07297	.19135
Quantity	.25519	.31453	1.00000	.22718	-.06938	.06414	.03608
Timeliness	.34179	.25715	.22718	1.00000	-.19639	.19183	.10545
Format-physical construction*	-.16821	-.30919	-.06938	-.19639	1.00000	-.11336	-.10853
Format-logical presentation	.22752	.07297	.06414	.19183	-.11336	1.00000	.06842
Cost?	.20694	.19135	.03608	.10545	-.10853	.06842	1.00000

* As a result of reversing the signs of the loadings, the correlation coefficients of this factor with the other factors has to be reversed.

CHAPTER 9

RELIABILITY COEFFICIENTS OF THE SCALES MEASURING THE VALUE AND ATTRIBUTES OF M.I.

9.1. Introduction

9.2. Statistics chosen for analysis

9.3. Reliability coefficients results

- 9.3.1. The Value-applicability scale
- 9.3.2. The Value-need scale
- 9.3.3. The Quantity-attribute scale
- 9.3.4. The Accuracy or Reliability-attribute scale
- 9.3.5. The Timeliness-attribute scale
- 9.3.6. The Format-attribute (experimental) scale

9.4. Summary and conclusions

CHAPTER 9

RELIABILITY COEFFICIENTS OF THE SCALES MEASURING THE VALUE AND ATTRIBUTES OF M.I.

9.1. Introduction

In the preceding chapter, the results of factor analysing the S.D. data collected by using the test instrument enabled the study of bi-polar adjectives' clustering to determine:

(i) whether the adjectives tapped the different aspects of the MIS reports;

(ii) whether they were stable thus enabling the building of scales to evaluate MIS reports through the users' perceptions of their value and attributes.

The conclusions drawn were that:

(i) 27 bi-polar adjectives behaved in a stable manner;

(ii) they grouped into meaningful clusters representing different aspects of the reports they were measuring.

Buidling of scales through factor analysis validate their use; however to enable generalisability of the scales a reliability test is required since "Reliability concerns the extent to which one can safely generalise from the results obtained by applying a measurement method to people in one situation at one point in time to the application of the same, or a supposedly comparable, measure of the same trait to the same people in a similar situation at another point in time. If one can safely generalise in these ways, it can be said that a measure

is highly reliable; if not, it must be admitted that there is considerable measurement error in some way related to the nature of the measuring instrument or the way in which it is used."(1)

If the reliability coefficients are high in magnitude, this is an indication of reliability and hence, it would be possible to generalise the scales usage.

As well as the issue of generalisability it is also worth noting that in order to justify summation of the bi-polar adjectives to obtain a total score on a scale, it is necessary to indicate that the scales are homogeneous, i.e. each individual item of a scale shares the same underlying aspect of the report that scale measures.

The different methods of estimating the reliability coefficient include re-test method; alternative-form method; subdivided test method; internal consistency methods.(2)

Of these methods the internal consistency measure was chosen since the requirements of the other methods in terms of number of participants and amount of time precluded their use.

The logic behind the use of this method is that "the reliability of a test can be estimated from the internal consistency of the items within it. If the average correlation between items within a test is high, the internal consistency is high. If the average correlation is near zero, the internal consistency is near zero."(3)

The internal consistency equation estimates the correlation between an existing test and a hypothetical equivalent form, one that may never actually be constructed. Because logically the best estimate of reliability is obtained by correlating alternative forms of a measure, one has a right to wonder how a good estimate of reliability can be obtained from the correlations between the items on one test. A good estimate can be obtained if the following two assumptions are correct: (i) the average correlation between items within the existing test is the same as the average correlation between items within the hypothetical alternative form; (ii) the average correlation between items in the existing test is the same as the average cross-correlation between items in the existing test and items in the hypothetical test. To prove that these two assumptions are correct, a need exists to actually construct this hypothetical test and correlate each item on the existing test with each item on the hypothetical test. While this ideal situation has its benefits, limitations of time and the availability of research sites for the application of this hypothetical test preclude implementation of this idea. The ascertaining of the correctness of these assumptions requires to be tested in future research. The two major sources of measurement error resulting from internal consistency measures are: (i) the methods do not consider measurement error due to changes in scores over time; (ii) methods based on internal consistency do not always take full account of the measurement error due to the sampling of content because there are

subtle factors working to make the items within a test correlate more highly with one another than they would correlate with the items on an equivalent form, since the "good" items will be used in constructing the first test, and consequently less good items will be used in the second test. A study of these two sources of measurement error in relation to the research reveals that the first one does not apply to the scales or measures proposed in this study since they are not measures for scaling persons but measures to be used in scaling stimuli (objects) and by consequence are not amenable to changes in scores over time. Regarding the second source, the researcher did not try to build a second test, and so this also does not materialise in this research.

To conclude the introduction, the internal consistency method of estimating reliability was used to test the scales proposed for the evaluation of M.I. and was also used in testing different experimental scales derived from the original ones.

9.2. Statistics chosen for analysis

Before presenting the formula used in the computations of the coefficients to test the different scales it is necessary to make a case for using a parametric statistic instead of a non-parametric one, especially as the researcher argued in the preceding chapter for the use of the Kendall's τ correlation coefficients in the factor analysis study instead of the parametric product-moment correlation.

Firstly a non-parametric statistic equivalent to the reliability coefficient methods does not exist. Those that are available to test the Null hypothesis that the K variables were drawn from the same population (e.g. Friedman 2-way ANOVA by ranks and Kendall's W. coefficient of concordance) and are applicable for ordinal measurement also require an assumption of ranks in the data which cannot be met. (4)

Consequently the formula used for the computation of the reliability coefficients is the Coefficient ALPHA, (known sometimes as the Cronbach's ALPHA), it is available in the SPSS (Statistical Package for the Social Sciences) and is as follows:

$$\alpha = \frac{K}{K-1} \left(1 - \frac{\bar{S}^{-2}}{S_T^2}\right)$$

where: K= number of items (variables)

$\bar{S}^{-2}$ = average item (variable) variance

S_T^2 = the variance of the sum over the K items (variables).

This coefficient estimates the correlation between an existing test and a hypothetical form (test).

The levels of the reliability coefficients acceptable for scales is ·60 slightly above that suggested by Nunnally(5).

9.3. Reliability coefficients results

This section presents the results of the reliability study conducted on the S.D. data collected through the test instrument in relation to the two sets of reports investigated.

The following approach is used:

(i) A reliability coefficient for each scale (original and experimental) which purports to measure an aspect of the MIS report will be presented. The experimental scales are constructed from the original scale to determine whether the proposed scales are rigid, i.e. to be used in their original form or whether some of the bi-polar adjectives can be removed without affecting to a great extent the reliability of the scale.

(ii) Reliability coefficients were computed using the data of each set of reports with the aim of uncovering the minimum reliability coefficient which can be attached to a scale.

(iii) Reliability coefficients were computed for all scales with the exception of two scales: that purporting to measure the Format-physical construction, and that measuring the Format-logical presentation of the data, since each of them were represented by only two bi-polar adjectives so the coefficient Alpha could not be computed. The factor analysis study revealed the stability of their loadings on these factors (scales) throughout the different results, and the Kendall's τ (Tau) correlation coefficients between each of these two variables were high in magnitude and also very highly significant. In view of this, the researcher experimented with these two scales by combining them together to represent the Format in general in order to study the reliability of such process and explore the possibilities of its use.

9.3.1. The Value-applicability scale

This scale was formed with the following bi-polar adjectives: Meaningful-Meaningless, Effective-Ineffective, Applicable-Inapplicable, Relevant-Irrelevant, and Appropriate-Inappropriate. This scale is the original scale, as it conforms exactly to the results of the factor analysis. Six different experiments were conducted on this scale through the process of alternating the presence of either one or two of the following three bi-polar adjectives: Applicable-Inapplicable, Relevant-Irrelevant, and Appropriate-Inappropriate, the reason being that these three bi-polar adjectives as defined by the Oxford Dictionary*, and as mentioned in Roget's Thesaurus of English Words and Phrases can be considered synonymous. Hence, these experiments were conducted to study the effect, if any, of the absence of all of them or some of them have on the reliability of the scale, and consequent implications.

The following table presents the reliability coefficients computed for the above scale.

---

* Applicable is defined as ". . . 2 - Capable of being applied; having reference. 3 - Fit or suitable". (6)

Relevant is defined as "1 - Bearing upon, connected with, pertinent to, the matter in hand" (7)

Appropriate is defined as ". . . 3 - Attached as an attribute, quality, or right; peculiar, own. 4 - Specially suitable, proper". (8)

TABLE 9.1

Reliability Coefficients of the scale measuring the VALUE-applicability of MIS reports

Bi-polar adjectives \ Scales	Original Scale	Experimental Scales (1)	(2)	(3)	(4)	(5)	(6)
Meaningful-Meaningless	✓	✓	✓	✓	✓	✓	✓
Effective-Ineffective	✓	✓	✓	✓	✓	✓	✓
Applicable- Inapplicable	✓			✓		✓	✓
Relevant-Irrelevant	✓	✓			✓	✓	
Appropriate-Inappropriate	✓		✓		✓		✓
Coefficient Alpha using data collected with reports "A"	•78693	•67475	•70825	•73441	•74755	•73952	•76389
Coefficient Alpha using data collected with reports "B"	•93096	•86274	•87736	•86319	•91152	•90204	•91190

(✓) denotes bi-polar adjective included in the scale

The above figures reveal that with either the original or the experimental scales, the coefficients Alphas for thedata of both reports were high in terms of the standard set in the previous section (a reflection among others of the homogeneity of thebi-polar adjectives included in these scales). A comparison between these scales shows the highest Alpha was for the original scale, followed by the scale formed in experiment (6), the difference being ·02 between them. The conclusion from these results is that the original scale is more reliable than any other scale tested in these experiments, hence enabling the safe generalisation about its future use in measuring the value-applicability of MIS reports.

9.3.2. The Value-need scale

The original scale for measuring the value-need of MIS reports was formed of the following bi-polar adjectives Important-Unimportant, Valuable-Worthless, Material-Immaterial, Desirable-Undesirable, Necessary-Unnecessary, and Beneficial-Non-beneficial. The experimental scales were conducted by alternating the presence of one bi-polar adjective from each or from both of these two sets of bi-polar adjectives, the first comprising: Important-Unimportant, and Necessary-Unnecessary; the second formed of: Valuable-Worthless, and Beneficial-Non-beneficial. These experiments which totalled eight were conducted on the premise that the bi-polar adjectives in either set can be considered synonymous using their meaning as defined

by the Oxford Dictionary and Webster's Dictionary*, and Roget's Thesaurus of English Words and Phrases.

The reliability coefficients computed for the above scale are presented in the following table.

---

* Important is defined as "1 - Having much impact or significance; weighty, grave, significant; 2 - Having an air of importance; consequential" (9)

Necessary is defined as "1 - Indispensable, requisite, needful; that cannot be done without". (10)

Valuable is defined as "a - (i) Of material or monetary value; having value for use or for exchange. 2 - Having value or worth, of great use or service, to a person or for a purpose. b - Possessed of qualities which confer value or bring into high estimation" (11)

Beneficial is defined as "1 - Conferring benefits: conducive to personal or social well-being. 2 - Receiving or entitling one to receive advantage, use, or benefit". (12)

TABLE 9.2.

Reliability coefficients of the scale measuring the VALUE-need of MIS reports

Bi-polar adjectives \ Scales	Original Scale	Experimental Scales (1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Important-Unimportant	✓		✓		✓	✓	✓		✓
Valuable-Worthless	✓	✓	✓			✓		✓	✓
Material-Immaterial	✓	✓	✓	✓	✓	✓	✓	✓	✓
Desirable-Undesirable	✓	✓	✓	✓	✓	✓	✓	✓	✓
Necessary-Unnecessary	✓	✓		✓		✓	✓	✓	
Beneficial-Non-beneficial	✓			✓	✓		✓	✓	✓
Coefficient Alpha using data collected with reports "A"	•76519	•58674	•56770	•61290	•58654	•68324	•70367	•70095	•69347
Coefficient Alpha using data collected with reports "B"	•88562	•84013	•81716	•82608	•78745	•86652	•84802	•87097	•85178

(✓) denotes bi-polar adjective included in the scale

The figures reveal that the original scale and the experimental scales (3), (5), (6), (7) and (8) satisfy the standard of acceptance for the coefficients Alpha, while in experiments (1), (2), and (4), the coefficients computed using the data of reports "A" reflect the minimum reliability which can be attached to the scales, and fall below the standard set. The higher coefficients achieved were those of the original scale, followed by the scale formed for experiments (6) and (7) where the difference is ·06 (using the same data of reports "A"). From this analysis it may be concluded that the original scale built upon the results of the factor analysis can be used in measuring this aspect of MIS reports as it was proved to be a homogeneous scale and highly reliable as well.

9.3.3. The Quantity-attribute scale

The bi-polar adjectives included in this scale were: Complete-Incomplete, Sufficient-Insufficient, Adequate-Inadequate, Enough-Not enough, and Detailed-General. As with the previous scales, the three bi-polar adjectives, Sufficient-Insufficient, Adequate-Inadequate, Enough-Not enough, were considered synonymous, a decision based on their meaning as defined by the Oxford Dictionary* and Roget's Thesaurus of English Words and Phrases, hence

---

* Sufficient is defined as "1 - Of a quantity, extent or scope adequate to a certain purpose or object" (13)

Adequate is defined as ". . 2 - Commensurate in fitness; sufficient, suitable. 3 - Logic. Fully representing". (14)

Enough is defined as "1 - Sufficient in quantity or number; used in concord with substantive, which it usually follows, or predicatively". (15)

the experiments were conducted by forming scales by alternating the presence of either two or one of these three bi-polar adjectives.

The following table presents the Coefficient Alpha for the above scale.

TABLE 9.3.

Reliability coefficients of th scale measuring the QUANTITY-attribute of MIS reports

Scales / Bi-polar adjectives	Original Scale	Experimental Scales (1)	(2)	(3)	(4)	(5)	(6)
Complete-Incomplete	✓	✓	✓	✓	✓	✓	✓
Sufficient-Insufficient	✓			✓		✓	✓
Adequate-Inadequate	✓	✓			✓		✓
Enough- Not enough	✓		✓		✓	✓	
Detailed-General	✓	✓	✓	✓	✓	✓	✓
Coefficient Alpha using date collected with reports "A"	·69710	·58030	·42298	·53352	·57565	·63113	·65208
Coefficient Alpha using data collected with reports "B"	·82535	·75835	·74913	·74615	·78428	·79480	·80127

(✓) denotes bi-polar adjective included in the scale

The table indicates that the original scale and experiments (5) and (6) only satisfy the standard of acceptance for their Alpha computed using the data of reports "A". Comparison shows the original scale has the highest Alpha followed by experiment (6), the difference being ·04. As before, the original scale was indicated to be the highest in satisfying the requirements for use in measuring this aspect of MIS reports.

9.3.4. The Accuracy or Reliability-attribute scale

The following bi-polar adjectives formed the scale; Accurate-Inaccurate, Reliable-Unreliable, Correct-Incorrect, and Trustworthy-Untrustworthy. No experiments were performed with this scale, as it was felt that each bi-polar adjective adds a dimension to the attribute under measurement. Coefficient Alpha computed for the above scale using the data collected with reports "A" and "B" is ·61394 and ·86044 respectively. The study of these figures reveals that using the data of either reports, Alpha is above the standard set for acceptance of a reliable scale. What is noticeable is that using reports "A" only, the coefficient attained by the scale is lower than any previous scale, while this is not the case using the data of reports "B". No immediate answer can be given to this finding other than to say that possibly the type of reports investigated had an effect on the bi-polar adjectives scores, and hence their reliability coefficients. In conclusion it can be said that this scale satisfied the requirements of reliability, homogeneity and can be used to measure the Accuracy or Reliability attribute of MIS reports.

9.3.5. The Timeliness-attribute scale

This scale was formed using the following three bi-polar adjectives: Well-timed - Ill-timed, Timely-Untimely, and Opportune-Innopportune. No experiments were conducted on this scale, as alternating the presence of the first two bi-polar adjectives on the assumption that they were to an extent synonymous would have resulted in a scale formed of only two items, with the consequence being that coefficient Alpha could not be computed. The results of computing the Alpha for this scale using the data of reports "A" and "B" is ·78271 and ·84402 respectively. These figures reflect the reliability and homogeneity of the proposed scale, they exceed the standard of acceptance for a reliable scale, and hence it can be used to measure the timeliness-attribute of MIS reports.

9.3.6. The Format-attribute (experimental) scale

As was mentioned previously in the introduction to this section, the two scales purported to measure the Format-physical construction (comprising Simple-Complex, and Well-constructed - Ill-constructed) and the Format-logical presentation of the data (comprising Ordered-Disordered, and Organised-Disorganised) were not subjected to reliability tests since each consisted of two bi-polar adjectives, and hence, the coefficient Alpha could not be computed. The researcher decided to experiment with these two scales by combining them together to form a general Format scale. The coefficient Alpha computed for this experimental scale using the data collected with reports "A" and "B" is ·66342 and ·74757 respectively. These

figures show that in terms of reliability this scale satisfies the minimum standard set in this respect, an expected result in view of the fact that both of the original scales measure one general attribute, i.e. Format. While this result can be used as a base upon which a decision can be taken to combine these two scales into a general one, the researcher is inclined to follow the factor analysis results and propose the use of these two scales in view of the fact that they present a finer distinction of the dimensions embedded in this attribute, and that they will provide more information about the user's satisfaction with it which would be lost by combining them into one scale only.

9.4. Summary and Conclusions

To summarise and conclude the discussion concerning the results presented in the previous sections about the reliability of the scales proposed for use by internal auditors and others in eliciting the users' perceptions of MIS reports, and their degree of satisfaction with them, the following can be said:

(i) All original scales proposed to measure the Value and attributes - with the exception of the Format scales - of MIS reports achieved higher reliability than the experimental scales and hence they present the best choice of scale.

(ii) The two scales proposed for measuring the Format-attribute of the reports are better separate than combined.

(iii) The experimental scales compared with original scales can be used by internal auditors and others in place of the latter if they prefer to do so, on

condition that they have a coefficient Alpha above the standard set for accepting a scale as reliable (which is ·60), these coefficients were presented in the table for the scales when experiments were conducted.

Finally, it is worth mentioning that the preference by the researcher for the original scales in place of some of the experimental ones which achieved a coefficient Alpha near to the coefficient of the original one (e.g. ·02 difference between the original scale and experiment (6) for Value-applicability) is that the bi-polar adjective taken out in this case did in fact lower the coefficient. Further research would enable more discrimination between scales.

REFERENCES

(1) Nunnally, J.C. Jnr., Introduction to Psychological Measurement, McGraw-Hill Book Co., N.Y., 1970, p.108

(2) Ibid, pp.122-26

(3) Ibid, p.550

(4) Siegel, S., Non-parametric statistics for the behavioural sciences, McGraw-Hill Book Co., N.Y., 1956, pp.166-172 and pp.229-238

(5) Nunnally, J.C.,Jnr., Psychometric Theory, McGraw-Hill Book Co., N.Y., 1967, p.226

(6) The Shorter Oxford English Dictionary: on historical principles, prepared by Little, W., Fowler, H.W., & Coulson, J., Revised and edited by: Onions, C.T., Oxford University Press, London, 1966, p.86

(7) Ibid, p.1696

(8) Ibid, p.88

(9) Ibid, p.968

(10) Ibid, p.1315

(11) Ibid, p.2332

(12) Webster's New Collegiate Dictionary, A Meriam-Webster, London: G. Bell & Sons Ltd., 1974, p.103

(13) The Shorter Oxford English Dictionary: on historical principles, op.cit., p.2071

(14) Ibid, p.22

(15) Ibid, p.614

CHAPTER 10

INFERENTIAL ANALYSIS OF THE NEW APPROACH TO THE EVALUATION OF MANAGEMENT INFORMATION

10.1 Introduction

10.2 General rules applied in testing hypotheses

10.3 Analysis of hypotheses: results and comments

10.3.1 Hypotheses relating to managers' estimates of the monetary value and S.D. scores of the reports

10.3.1.1 Analysis of hypothesis one

10.3.1.2 Analysis of hypothesis two

10.3.1.3 Analysis of hypothesis three

10.3.1.4 Conclusions and discussion of the results of the first three hypotheses

10.3.1.5 Analysis of hypothesis four

10.3.1.6 Analysis of hypothesis five

10.3.2 Hypotheses relating to some factors which may influence managers' perceptions of the reports

10.3.2.1 Analysis of hypothesis six

10.3.2.2 Analysis of hypothesis seven

10.3.2.3 Analysis of hypothesis eight

10.3.2.4 Analysis of hypothesis nine

10.3.3 Hypotheses relating to managers' position in the organizational hierarchy

10.3.3.1 Analysis of hypothesis ten

10.3.3.2 Analysis of hypothesis eleven

10.3.3.3 Analysis of hypothesis twelve

10.3.4 Hypotheses relating to the amount of budget the manager is responsible for

10.3.4.1 Analysis of hypothesis thirteen

10.3.4.2 Analysis of hypothesis fourteen

10.3.4.3 Analysis of hypothesis fifteen

10.3.5 Hypotheses relating to the number of parts in the reports reviewed by managers

10.3.5.1 Analysis of hypothesis sixteen

10.3.5.2 Analysis of hypothesis seventeen

10.3.6 Hypothesis relating to managers' satisfaction with the reports meeting their control and planning needs

10.3.6.1 Analysis of hypothesis eighteen

10.4 Analysis of remaining questionnaire data

10.5 Summary and conclusions

CHAPTER 10

INFERENTIAL ANALYSIS OF THE NEW APPROACH TO THE EVALUATION OF MANAGEMENT INFORMATION

10.1 Introduction

This chapter involves the testing of the hypotheses formulated in order to test the validity and applicability of the measures proposed for evaluating M.I.; to uncover those variables which influence respondents' answers to these measures; and to discover any relationship which may exist between these factors, using the data collected through this fourth questionnaire. The statistics used in this process were Pearson's P.M. correlation, "F" statistics and "t" statistics as inferential tests for interval data. For the original data, Kendall's τ (Tau), Wilcoxon matched-pairs signed-ranks test, and the Median test, were used. These tests were performed on all respondents grouped together, and wherever appropriate, relevant and amenable to computations, they were also performed for the respondents in each stratum, and in each group representing a type of activity.

This chapter will also present the analysis of the responses to remaining questions which were not presented in previous chapters.

10.2 General rules applied in testing hypotheses

For testing each hypothesis presented in this chapter, the following rules will be applied:

(i) The results from the two reports will be combined together for purposes of interpretation and for reaching a decision concerning acceptance or rejection, since the two reports represent part of a group of accounting reports generated internally for use by management. This means that they can be treated as cumulative in their effect.

(ii) Significance levels for the acceptance of a hypothesis or its rejection is set at the .05 level with either two-tail test or one-tail test depending on the circumstances of each hypothesis.

(iii) The results for each hypothesis will be presented for all respondents grouped together, for the two groups which represent a distinct type of activity in company XXX where the research was conducted, and finally for each stratum in the sample.

In accepting or rejecting a hypothesis it must be said that the groups and the departments have, in general, a very small number with the exception of group 2 and departments type "E". Hence, the results for all respondents plus any other results from the groups and the departments which may shed some light on the area tested, will be the main base upon which the decision will rest. This does not deny the fact that the results for the groups and those of the departments does help in uncovering some of the differences between the respondents in the area tested and they can be considered a useful domain for relationships and differences to be tested in future research.

10.3 Analysis of hypotheses: results and comments

10.3.1 Hypotheses relating to managers' estimates of the of the monetary value and SD scores of the reports

10.3.1.1. Analysis of hypothesis one.

The first hypothesis concerns the relationship, if any, which exists between the different scales measuring the values and attributes of MIS reports and the monetary value estimates.

It reads as follows:

> "There is a relationship between managers' estimates of MIS reports' monetary value and their scores on the SD scales measuring its value (non-monetary) and its attributes."

To test the hypothesis, a non-parametric measure of association was applied, as the data concerning the SD scales are ordinal. Kendall's τ (Tau) was used for this purpose, and the results of correlating the monetary value estimates of reports "A" and "B" with the scales for each level of aggregating the respondents, (i.e. all respondents together, two groups, each department) is presented in table 10.1.

This table indicates the following:

(1) For all respondents (N=70). Using the results from both reports, it can be said that there is a positive and statistically significant relationship between the monetary value estimates and all SD scales measuring values or attributes of MIS reports, with the exception of one scale only, namely, Format-physical construction of the report.

(2) For the two groups. Using the results of both reports, the following was uncovered:

(a) Group 1 (N=15). There is a positive and statistically significant relationship between the monetary value estimates and the SD scales measuring values and attributes of MIS reports, with the exception of the Timeliness scale and the Format-physical construction scale. The former is considered supportive and suggestive of the existence of this positive relationship as the significance level is between the .05 and .10 levels.

TABLE 10.1.

Kendall's τ (Tau) correlation coefficients of the monetary value of the reports and the S.D. Scales

Respondents & Reports / SD Scales	Reports	All respondents N=70	Groups		Departments				
			Group 1 N=15	Group 2 N=55	Type "A" N=3	Type "B" N=12	Type "C" N=10	Type "D" N=15	Type "E" N=30
S.D. Value - Applicability Scale	A	.1390 (.089)*	NS	NS	NS	NS	NS	NS	NS
	B	.3677 (.001)	.4020 (.037)	.3103 (.001)	NS	.4961 (.025)	NS	.3586 (.063)*	.2990 (.021)
S.D. Value - Need scale	A	.2271 (.006)	NS	.2510 (.007)	NS	NS	.4113 (.098)*	NS	.2229 (.084)*
	B	.5014 (.001)	.6139 (.002)	.4740 (.001)	NS	.7042 (.002)	.5305 (.033)	.4459 (.021)	.4401 (.001)
S.D. Quantity Scale	A	NS	NS	NS	NS	NS	NS	NS	NS
	B	.2738 (.001)	NS	.2533 (.007)	NS	NS	NS	NS	.2915 (.024)
S.D. Format - logical presentation scale	A	NS	NS	NS	NC	NS	NS	NS	NS
	B	.2727 (.001)	.4275 (.027)	.2422 (.010)	NS	.5334 (.016)	NS	NS	.3158 (.015)
S.D. Reliability or Accuracy Scale	A	NS	NS	NS	NS	NS	NS	.3950 (.041)	NS
	B	.1711 (.037)	.4818 (.012)	NS	NS	.5902 (.008)	NS	NS	.2171 (.092)*
S.D. Timeliness scale	A	.1933 (.018)	NS	.2228 (.017)	NS	NS	NS	NS	.3244 (.012)
	B	.3017 (.001)	.3470 (.072)*	.2782 (.003)	NS	NS	NS	NS	.2871 (.026)
S.D. Format - physical construction scale	A	NS	NS	NS	NS	NS	NS	NS	.2569 (.047)
	B	NS	NS	NS	NS	NS	NS	NS	NS

NS=Not significant at the .10 level of significance (2-tail test) NC= Not computable

* Significance $>.05 <.10$ (2-tail test) considered suggestive and supportive.

( ) Significance levels are presented in parentheses (2-tail test)

(b) Group 2 (N=55). As with Group 1, a statistically significant and positive relationship was uncovered between the monetary value estimates and the scaleswhich measures the values and attributes of MIS reports, with the exception of two scales, namely the Reliability or Accuracy scale, and the Format-physical construction scale.

(3) For each department. Using the results of the two reports, the following was uncovered for each department:

(a) Department type "A" (N=3). No statistically significant relationship was found between the monetary value estimates and all SD scales.

(b) Department type "B" (N=12). There is a strong positive and significant relationship between the monetary value estimates and the two scales measuring values in non-monetary terms, and also between the monetary value and two attributes scales, the first the Format-logical presentation of the data in the reports, and the second the Reliability or Accuracy of the data. No significant relationship was uncovered between the monetary estimates and the remaining three SD scales.

(c) Department type "C" (N=10). The only significant and positive relationship was between the monetary estimates and the value-need scale; the other relationships were all non-significant.

(d) Department type "D" (N=15). A statistically significant and positive relationship was found between the monetary estimates and two SD scales - Value-need scale and

the Reliability or Accuracy scale. A suggestive and supportive relationship was uncovered between the monetary estimates and the Value-applicability scale. All other relationships were not significant from a statistical point of view.

(e) Department type "E" (N=30). Positive relationships between monetary value estimates and the different SD scales were all statistically significant with the exception of the Reliability or Accuracy scale which was nonetheless supportive and suggestive of this relationship.

Before discussing this hypothesis, it is worth mentioning that results of the groups and the departments while not directly affecting the acceptance of the hypothesis or its rejection, do uncover differences between the respondents and consequently shed some light on the area investigated. The most striking of these results is that while for departments type "A" there was no statistically significant relationship between the monetary estimates and the SD scales, these positive relationships were statistically significant for departments type "E" (with the exception of the Reliability or Accuracy scale which was supportive and suggestive). Whether this is a real difference between the respondents of the two departments,or the results of (n) as the former had only three respondents, needs further exploration. The relationships between the monetary value estimates and the SD scales and their statistical significance when comparing between the groups or the departments, indicate differences, and any generalisations will need further testing in future research. From a statistical point of view, the correlation

coefficients between the monetary value estimates and the SD scales presented in the previous table, are large enough for the acceptance of the hypothesis of a relationship existing between the monetary value estimates of an MIS report and the SD scales measuring the respondent's perceptions of its values and attributes. These scales include the Format-physical construction which, while not significant at the .05 level (2-tail test) for all respondents, was accepted as part of the scales having a relationship with the monetary estimates, because firstly, the correlation coefficients of this scale with the monetary value were positive (.0379 for reports "A" and .0631 for reports "B"), on the same line as the relationships between the monetary value and the other scales, and secondly, because the correlation coefficient between these two variables was positive and significant at the .05 level (2-tail test) for departments type "E".

Summary. Hypothesis one is accepted.

10.3.1.2. Analysis of Hypothesis Two. This hypothesis concerns the relationship between the two SD scales measuring the value of MIS reports and the remaining five scales measuring its attributes. It reads as follows:

> "There is a relationship between the two SD value scales, and between them and the SD attributes scales."

To test this hypothesis, Kendall's τ (Tau) correlation coefficients as a non-parametric measure of association was used, as the data collected through the SD scales were ordinal.

The following tables from 10.2 to 10.8 present the results for all respondents, groups and departments. The results for departments type "A" were not presented as they were in the majority non-statistically significant and in the remaining cases uncomputable.

TABLE 10.2

Kendall's τ (Tau) Correlation Coefficients of the S.D. Scales measuring value and the S.D. Scales measuring the attributes (All respondents N=71)

Reports & S.D. scales / S.D. scales	Reports	S.D. Value-applicability scale	S.D. Value - need scale
S.D. Value - applicability scale	A	-	
	B	-	
S.D. Value - need scale	A	.3928(.001)	-
	B	.6044(.001)	-
S.D. Quantity scale	A	.3350(.001)	.1454(.073)*
	B	.3084(.001)	.2261(.006)
S.D. Format - logical presentation scale	A	.3308(.001)	NS
	B	.4724(.001)	.3597(.001)
S.D. Reliability or Accuracy scale	A	.4041(.001)	NS
	B	.3178(.001)	.2884(.001)
S.D. Timeliness scale	A	.3421(.001)	.2852(.001)
	B	.3818(.001)	.3161(.001)
S.D. Format - physical construction scale	A	.1802(.027)	NS
	B	.4265(.001)	.1889(.020)

NS = Not significant at the .10 level of significance (2-tail test)

* Significance $>$ .05 $<$ .10 (2-tail test) considered suggestive and supportive.

** Significance levels are presented in parentheses (2-tail test)

TABLE 10.3

Kendall's τ (Tau) correlation coefficients of the S.D. scales measuring value and the S.D. scales measuring the attributes (N=16 Group 1)

Reports and S.D. scales / S.D. scales	Reports	S.D. Value - applicability scale	S.D. Value - need scale
S.D. value - applicability scale	A	-	
	B	-	
S.D. value - need scale	A	.7472(.001)	-
	B	.5615(.003)	-
S.D. Quantity scale	A	.3351(.071)*	.4464(.016)
	B	NS	NS
S.D. Format - logical presentation scale	A	.4703(.012)	.3825(.039)
	B	.6426(.001)	.4509(.015)
S.D. Reliability or Accuracy scale	A	.5883(.002)	.4515(.015)
	B	.3471(.061)*	.6014(.002)
S.D. Timeliness scale	A	NS	NS
	B	NS	.3630(.050)
S.D. Format - physical construction scale	A	NS	NS
	B	NS	NS

NS = Not significant at the .10 level of significance (2-tail test)

* Significance $>$ .05 $<$ .10 (2-tail test) considered suggestive and supportive

** Significance levels are presented in parentheses (2-tail test)

TABLE 10.4

Kendall's τ (Tau) correlation coefficients of the S.D. scales measuring value and the S.D. scales measuring the attributes (N=55 Group 2)

Reports and S.D. Scales / S.D. scales	Reports	S.D. Value - applicability scale	S.D. Value - need scale
S.D. Value - applicability scale	A	-	
	B	-	
S.D. Value - need scale	A	.2960(.002)	-
	B	.6158(.001)	-
S.D. Quantity scale	A	.3574(.001)	NS
	B	.3542(.001)	.1892(.042)
S.D. Format - logical presentation scale	A	.2926(.002)	NS
	B	.4361(.001)	.3391(.001)
S.D. Reliability or Accuracy scale	A	.3679(.001)	NS
	B	.3063(.001)	.2055(.027)
S.D. Timeliness scale	A	.3922(.001)	.2839(.003)
	B	.4378(.001)	.2915(.002)
S.D. Format - physical construction scale	A	.1886(.042)	NS
	B	.4467(.001)	.2316(.013)

NS = Not significant to the .10 level of significance (2-tail test)

* Significance levels are presented in parentheses (2-tail test)

TABLE 10.5

Kendall's τ (Tau) correlation coefficients of the S.D. scales measuring value and the S.D. scales measuring the attributes (Departments type "B" N=13)

Reports and S.D. scales / S.D. scales	Reports	S.D. Value - applicability scale	S.D. Value - need scale
S.D. value - applicability scale	A	-	
	B	-	
S.D. Value - need scale	A	.7972(.001)	-
	B	.5333(.012)	-
S.D. Quantity scale	A	NS	.3836(.068)*
	B	NS	NS
S.D. Format - logical presentation scale	A	.4522(.032)	.4490(.033)
	B	.6167(.004)	.4933(.019)
S.D. Reliability or Accuracy scale	A	.6035(.005)	.4824(.022)
	B	.3674(.081)*	.6260(.003)
S.D. Timeliness scale	A	NS	.4476(.034)
	B	NS	.4190(.047)
S.D. Format - physical construction scale	A	NS	.3947(.061)*
	B	NS	NS

NS = Not significant at the .10 level of significance (2-tail test)

* Significance $>$ .05 $<$ .10 (2-tail test) considered suggestive and supportive

** Significance levels are presented in parentheses (2-tail test)

TABLE 10.6

Kendall's τ (Tau) correlation coefficient of the S.D. scales measuring value and the S.D. scales measuring the attributes (Departments type "C" N=10)

Reports and S.D. scales / S.D. scales	Reports	S.D. Value - applicability scale	S.D. Value - need scale
S.D. Value - applicability scale	A	-	
	B	-	
S.D. Value - need scale	A	.4474(.072)*	-
	B	.4706(.059)*	-
S.D. Quantity scale	A	NS	NS
	B	.6589(.009)	NS
S.D. Format - logical presentation scale	A	NS	NC
	B	.5177(.038)	NS
S.D. Reliability or Accuracy scale	A	NS	NS
	B	.7470(.003)	NS
S.D. Timeliness scale	A	.4935(.047)	NS
	B	.7530(.003)	NS
S.D. Format - physical construction scale	A	NS	NS
	B	.5412(.030)	NS

NS = Not significant at the .10 level of significance (2-tail test)

NC = Not computable

* Significance $>$ .05 $<$ .10 (2-tail test) considered suggestive and supportive

** Significance levels are presented in parentheses (2-tail test)

TABLE 10.7

Kendall's τ (Tau) correlation coefficients of the S.D. scales measuring value and the S.D. scales measuring the attributes (Departments type "D" N=15)

Reports and S.D. scales / S.D. scales	Reports	S.D. Value - applicability scale	S.D. Value - need scale
S.D. Value - applicability scale	A	-	
	B	-	
S.D. Value - need scale	A	NS	-
	B	.5615(.004)	-
S.D. Quantity scale	A	NS	NS
	B	.3483(.071)*	NS
S.D. Format - logical presentation scale	A	.5656(.004)	.3510(.069)*
	B	.5633(.004)	.3442(.074)*
S.D. Reliability or Accuracy scale	A	.3652(.058)*	.3195(.097)*
	B	NS	NS
S.D. Timeliness scale	A	.6096(.002)	NS
	B	.4390(.023)	NS
S.D. Format - physical construction scale	A	NS	NS
	B	NS	NS

NS = Not significant at the .10 level of significance (2-tail test)

* Significance $>$ .05 $<$ .10 (2-tail test) considered suggestive and supportive

** Significance levels are presented in parentheses (2-tail test)

TABLE 10.8

Kendall's τ (Tau) correlation coefficients of the S.D. scales measuring value and the S.D. scales measuring the attributes (Departments type "E" N=30)

Reports and S.D. scales / S.D. scales	Reports	S.D. Value - applicability scale	S.D. Value - need scale
S.D. Value - applicability scale	A	-	
	B	-	
S.D. Value - need scale	A	.2736(.034)	-
	B	.7143(.001)	-
S.D. Quantity scale	A	.4135(.002)	NS
	B	.2647(.040)	NS
S.D. Format - logical presentation scale	A	.2132(.098)*	NS
	B	.3946(.003)	.3535(.007)
S.D. Reliability or Accuracy scale	A	.4034(.002)	NS
	B	.2790(.031)	.3236(.013)
S.D. Timeliness scale	A	.3007(.020)	.3612(.006)
	B	.4398(.001)	.4036(.002)
S.D. Format - physical construction scale	A	NS	NS
	B	.5487(.001)	.4372(.001)

NS = Not significant at the .10 level of significance (2-tail test)

* Significance $>$ .05 $<$ .10 (2-tail test) considered suggestive and supportive

** Significance levels are presented in parentheses (2-tail test)

For the groups and the departments, the tables are self explanatory. All correlation coefficients presented which were statistically significant at and beyond the .05 level (2-tail test) and also those considered suggestive and supportive, were positive. Differences between the respondents in the two groups or the departments in the relationships between these scales and whether these differences represent a true state in the populations needs further testing.

As to the results of all respondents aggregated together, the correlation coefficients show that for both reports there is:

(a) a positive and highly statistically significant relationship between the two scales measuring the value (non-monetary) of MIS reports, and

(b) a positive and statistically significant relationship exists between the two value scales and the five SD scales measuring the attributes of MIS reports.

In view of the above results and following the rules of hypotheses testing presented earlier, it can be said that in a statistical framework, the correlation coefficients are fairly high and statistically significant leading to the acceptance of the hypothesis of a relationship existing between the two SD value scales, and between them and the SD attributes scales.

Summary. Hypothesis two is accepted.

10.3.1.3. Analysis of Hypothesis Three.

This hypothesis tests for the ability to differentiate between the different respondents in their satisfaction with

the MIS reports investigated, through the monetary value estimates they give to the reports and their scores on the SD scales. It reads as follows:

> "Managers differ in the value (monetary and non-monetary) and in the SD attributes scores they attach to the reports investigated."

To test for this hypothesis, a t-test for paired observations was used, because the two estimates were dependent observations made by each participating manager. As to their scores on the SD scales which are measured on the ordinal level, the Wilcoxon matched-pairs signed-ranks was used to test the statistical significance of the differences between the two scores. The following two tables present the results for all respondents grouped together, for the two groups, and finally for the different departments (strata) in the sample.

TABLE 10.9

T-test results of monetary value estimates for Reports "A" versus the monetary value estimates for Reports "B"

Results / Respondents	Computed T-value	ϕ	2-tail prob.
All respondents together (N=70)	2.23	69	.029**
Group 1 (N=15)	.14	14	.889
Group 2 (N=55)	2.51	54	.015**
Departments type "A" (N=3)	0	2	1.000
Departments type "B" (N=12)	.14	11	.890
Departments type "C" (N=10)	.55	9	.595
Departments type "D" (N=15)	3.19	14	.007**
Departments type "E" (N=30)	1.73	29	.095*

* Significance $>.05$ $<.10$ (2-tail test) considered supportive and suggestive.

** Significance at and beyond the .05 level (2-tail test)

TABLE 10.10

Wilcoxon matched pairs signed ranks test results for the SD. scales for reports "A" versus the SD. scales for reports "B"

Respondents / SD. Scales	All respondents (N=71)		Groups				Departments									
			Group 1 (N=16)		Group 2 (N=55)		type "A" (N=3)		type "B" (N=13)		type "C"(N=10)		type "D"(N=15)		type "E"(N=30)	
	Z	2-tail prob.	Z	2-tail prob.	Z	2-tail prob.	Z	2-tail prob.	Z	2-tail prob.	Z	2-tail prob.	Z	2-tail prob.	Z	2-tail prob.
SD. Value - applicability scale	-5.0351	.0000**	-.4890	.6248	-5.3141	.0000**	-.4472	.6547	-.2962	.7671	-1.6903	.0910*	-3.1238	.0018**	-3.9736	.0001**
SD. Value - need scale	-6.2606	.0000**	-2.3412	.0192**	-5.7244	.0000**	-.4472	.6547	-2.2228	.0262**	-1.8363	.0663*	-3.4078	.0007**	-4.2034	.0000**
SD. Quantity scale	-2.2374	.0253**	-.2272	.8203	-2.3981	.0165**	-1.6036	.1088	-.9021	.3670	-.9802	.3270	-.6276	.5303	-2.2604	.0238**
SD. Format - logical presentation scale	-3.7501	.0002**	-1.6093	.0912*	-3.3138	.0009**	0	1.0000	-1.7770	.0756*	-.8293	.4069	-2.0732	.0382**	-2.7066	.0068**
SD. Reliability or Accuracy scale	-3.0613	.0001**	-2.1405	.0323**	-3.2072	.0013**	-1.0000	.3173	-1.8955	.0580*	-1.1847	.2361	-2.0386	.0415**	-2.2203	.0264**
SD. Timeliness Scale	-3.1448	.0017**	-.8002	.4236	-3.0646	.0022**	0	1.0000	-.8293	.4069	-.8885	.3743	-1.2003	.2300	-3.0986	.0019**
SD. Format - physical construction scale	-5.7430	.0000**	-2.5992	.0093**	-5.1232	.0000**	-1.0000	.3173	-2.6656	.0077**	-2.0284	.0425**	-2.8304	.0046**	-3.7714	.0002**

* Significance $>.05$ $<.10$ (2-tail test) considered supportive and suggestive

** Significance at and beyond the .05 level (2-tail test)

The results presented in the previous tables show that the difference between the monetary value estimates of the two reports are statistically significant for all respondents grouped together, Group 2, and departments type "D", and suggestive and supportive for departments type "E" (significance between .05 and .10 - 2-tail test). As to the difference in the respondents' scores on SD scales between the two reports, all differences were statistically significant for all respondents grouped together, Group 2, and departments type "E". Differences for Group 1 and the remaining departments varied between non-significant results for departments type "A" to some significant or supportive differences for other departments and Group 1.

Using the set of rules for the acceptance or the rejection of a hypothesis, it can be said that from a statistical point of view the results sustain the hypothesis that a difference exists in the value and SD attribute scores attached to the two reports by the managers.

Summary: Hypothesis three is accepted.

10.3.1.4. Conclusionsand discussion of the results of first three hypotheses

The three hypotheses discussed and analysed so far resulted in the acceptance, statistically sustained, of the following:

(a) Relationships existing between managers' monetary value estimates and their scores on the SD scales

(b) Relationshipsexisting between the two SD value scales and between them and the SD attribute scales

(c) Differences existing between managers' monetary value estimates and their scores on the SD scales in the two reports investigated in the study.

These results show very clearly the validity of the approach used in this research. The decision maker (the user of the report) estimates in monetary terms the value of the information and the value and attributes of the reports through the proposed SD scales. The first and second hypotheses show that the proposed measures do work in practice and do reflect the users' perceptions of the value and attributes of MIS reports. The third hypothesis indicates the power of these measures in differentiating between managers' perceptions of the value and attributes of the two reports investigated.

10.3.1.5. Analysis of Hypothesis Four

This hypothesis assumes no relationships exist between the different SD attribute scales. It reads as follows:

> "There are no relationships between the different scales measuring the attributes of MIS reports."

As with other hypotheses, the data associated with it is ordinal, hence Kendall's τ (Tau) correlation coefficients was used as the inferential test. The following seven tables from 10.11 to 10.17 present the results. No results are presented for departments type "A" (N=3) as the majority of the coefficients were not statistically significant and the remaining ones were uncomputable.

TABLE 10.11

Kendall's τ (Tau) Correlation Coefficients of the S.D. Scales Measuring the Attributes (All respondents N=71)

Reports and SD scales / SD scales	Reports	SD Quantity scale	SD Format - logical presentation scale	SD Reliability or Accuracy scale	SD Timeliness scale	SD Format - physical construction scale
SD Quantity scale	A	-				
	B	-				
SD Format - logical presentation scale	A	.2561(.002)	-			
	B	.2621(.002)	-			
SD Reliability or Accuracy scale	A	.2716(.001)	.4845(.001)	-		
	B	.3107(.001)	.4201(.001)	-		
SD Timeliness scale	A	.1338(.099)*	.2357(.001)	.1484(.068)*	-	
	B	.3771(.001)	.3111(.001)	.3154(.001)	-	
SD Format - physical construction scale	A	.1571(.053)*	.3571(.001)	.1398(.085)*	.2424(.003)	-
	B	NS	.3935(.001)	.2206(.007)	.2613(.002)	-

NS=Not signficant at the .10 level of significance (2-tail test)

* Significance $>.05<.10$ (2-tail test) considered suggestive and supportive

** Significance levels are presented in parentheses (2-tail test)

TABLE 10.12

Kendall's τ (Tau) Correlation Coefficients of the S.D. Scales Measuring the Attributes (Group 1 N=16)

Reports and SD scales / SD scales	Reports	SD Quantity scale	SD Format - logical presentation scale	SD Reliability or Accuracy scale	SD Timeliness scale	SD Format - physical construction scale
SD Quantity scale	A	-				
	B	-				
SD Format - logical presentation scale	A	NS	-			
	B	NS	-			
SD Reliability or Accuracy scale	A	NS	.4796(.010)	-		
	B	NS	.4507(.015)	-		
SD Timeliness scale	A	NS	NS	NS	-	
	B	.3620(.051)	NS	NS	-	
SD Format - physical construction scale	A	NS	.4623(.013)	NS	.4361(019)	-
	B	NS	6122(.001)	NS	NS	-

NS=Not significant at the .10 level of significance (2-tail test)

* Significance levels are presented in parentheses (2-tail test)

TABLE 10.13

Kendall's τ (Tau) Correlation Coefficients of the S.D. Scales Measuring the Attributes (Group 2 N=55)

Reports and SD scales / SD scales	Reports	SD Quantity scale	SD Format - logical presentation scale	SD Reliability or Accuracy scale	SD Timeliness scale	SD Format - physical construction scale
SD Quantity scale	A	-				
	B	-				
SD Format - logical presentation scale	A	.2921(.002)	-			
	B	.3315(.001)	-			
SD Reliability or Accuracy scale	A	.2985(.002)	.4683(.001)	-		
	B	.3971(.001)	.4086(.001)	-		
SD Timeliness scale	A	NS	.2263(.015)	.1715(.065)*	-	
	B	.3839(.001)	.3564(.001)	.3711(.001)	-	
SD Format - physical construction scale	A	.2027(.029)	.3346(.001)	.1546(.096)*	.1758(.059)*	-
	B	.1528(.100)*	.3336(.001)	.2519(.007)	.3394(.001)	-

NS=Not significant at the .10 level of significance (2-tail test)

* Significance $>.05<.10$ (2-tail test) considered suggestive and supportive

** Significance levels are presented in parentheses (2-tail test)

TABLE 10.14

Kendall's τ (Tau) Correlation Coefficients of the
S.D. Scales Measuring the Attributes (Department type "B" N=13)

Reports and SD scales / SD scales	Reports	SD Quantity scale	SD Format - logical presentation scale	SD Reliability or Accuracy scale	SD Timeliness scale	SD Format - physical construction scale
SD Quantity scale	A	-				
	B	-				
SD Format - logical presentation scale	A	NS	-			
	B	NS	-			
SD Reliability or Accuracy scale	A	NS	.5198(.014)	-		
	B	NS	.4895(.020)	-		
SD Timeliness scale	A	NS	.4069(.053)*	NS	-	
	B	NS	NS	.4414(.036)	-	
SD Format - physical construction scale	A	NC	.4096(.052)*	NS	.6477(.003)	-
	B	-.4001(.057)*	.6208(.004)	NS	NS	-

NS= Not significant at the .10 level of significance (2-tail test)

NC= Not computable

* = Significance $>.05<.10$ (2-tail test) considered suggestive and supportive

** Signficance levels are presented in parentheses (2-tail test)

TABLE 10.15

Kendall's τ (Tau) Correlation Coefficients of the S.D. Scales Measuring the Attributes (Departments type "C" N=10)

Reports and SD scales / SD scales	Reports	SD Quantity scale	SD Format - logical presentation scale	SD Reliability or Accuracy scale	SD Timeliness scale	SD Format - physical construction scale
SD Quantity scale	A	-				
	B	-				
SD Format - logical presentation scale	A	NC	-			
	B	.5349(.032)	-			
SD Reliability or Accuracy scale	A	NS	NS	-		
	B	.7859(.002)	.5478(.028)	-		
SD Timeliness scale	A	NS	NS	NS	-	
	B	.6279(.012)	.5581(.025)	.6430(010)	-	
SD Format - physical construction scale	A	NS	NS	NS	NS	-
	B	.4884(.050)	.4186(.093)*	.4525(.069)*	.7442(.003)	-

NS=Not significant at the .10 level of significance (2-tail test)

NC=Not computable

* Significance $>.05<.10$ (2-tail test) considered suggestive and supportive

** Significance levels are presented in parentheses (2-tail test)

TABLE 10.16

Kendall's τ (Tau) Correlation Coefficients of the S.D. Scales Measuring the Attributes (Departments type "D" N=15)

Reports and SD scales SD scales	Reports	SD Quantity scale	SD Format - logical presentation scale	SD Reliability or Accuracy scale	SD Timeliness scale	SD Format - physical construction scale
SD Quantity scale	A	-				
	B	-				
SD Format - logical presentation scale	A	NS	-			
	B	NS	-			
SD Reliability or Accuracy scale	A	NS	.4902(.011)	-		
	B	NS	NS	-		
SD Timeliness scale	A	.3193(.098)*	.6946(.001)	.5734(.003)	-	
	B	.4514(.019)	.5378(.006)	.6064(.002)	-	
SD Format - physical construction scale	A	NS	.5299(.006)	.3745(.052)*	NS	-
	B	NS	NS	NS	NS	-

NS=Not significant at the .10 level of significance (2-tail test)

* Significance $>.05<.10$ (2-tail test) considered suggestive and supportive

** Significance levels are presented in parentheses (2-tail test)

TABLE 10.17

Kendall's τ (Tau) Correlation Coefficients of the S.D. Scales Measuring the Attributes (Departments type "E" N=30)

Reports and SD scales SD scales	Reports	SD Quantity scale	SD Format - logical presentation scale	SD Reliability or Accuracy scale	SD Timeliness scale	SD Format - physical construction scale
SD Quantity scale	A	-				
	B	-				
SD Format - logical presentation scale	A	.4698(.001)	-			
	B	.2898(.025)	-			
SD Reliability or Accuracy scale	A	.4337(.001)	.5371(.001)	-		
	B	.3628(.005)	.4522(.001)	-		
SD Timeliness scale	A	NS	NS	NS	-	
	B	.2341(.070)*	NS	.2503(.053)*	-	
SD Format - physical construction scale	A	.3981(.003)	.3136(.015)	NS	.2774(.032)	-
	B	.2150(.096)*	.4308(.001)	.3359(.010)	.4106(.002)	-

NS=Not significant at the .10 level of significance (2 tail-test)

* Significance $>.05<.10$ (2 tail-test) considered suggestive and supportive

** Significance levels are presented in parentheses (2 tail-test)

The figures presented in the previous tables reveal the following:

(a) The correlation coefficients between all scales measuring the attributes of MIS reports are for all respondents positive and highly statistically significant, (using both sets of reports) with one exception, namely, the correlation between the SD scale measuring Quantity and the SD scale measuring Format - physical construction which was nonetheless suggestive and supportive (.053 2-tail test).

(b) As the tables for the groups and the departments show, not all correlations were significant, and some were not computable.

(c) All correlation coefficients were positive for all respondents grouped together and for the groups and the departments (with one exception only). The correlation between the Quantity scale and the Format-physical construction was negative and significant at the .057 (2-tail test) considered supportive and suggestive, (see table 10.14).

In view of the results for all respondents grouped together, it can be said that statistically the hypothesis of no relationship between the different SD scales measuring the attributes of MIS reports is rejected, and that statistically a positive relationship exists between these scales.

No explanation can be offered about these relationships as it needs a deep and thorough analysis of the respondents' perceptions of the different attributes of the reports, and

their inter-relationships, which was not conducted as it did not represent a part of the present study.

One final word in relation to the results uncovered through the test of this hypothesis concerns a comparison between these results and the factor pattern correlations shown between the different factors which represent the different scales measuring the attributes of the reports. Such a comparison shows that not only were the scales (represented by factors) correlated but in fact all scales were positively intercorrelated.

Summary: Hypothesis four is rejected.

10.3.1.6. Analysis of Hypothesis five

This hypothesis assumes that the different strata in the sample and the two groups in to which they were combined with relation to the type of activity performed in each stratum (department) differ in their monetary value estimates of the reports and in their scores on the SD scales. It reads as follows:

> "Managers in different strata/groups differ in the value (monetary and non-monetary) given to a report and to the perceived attributes."

To test for this hypothesis, F-test and t-test were used for the monetary value estimates as the data concerned was interval. The former is used to test whether the mean of this monetary value is statistically different between the five departments, while the latter is used to test the difference in the mean of this monetary value between the two groups. As to the scores on the SD scales which represent

data measured on the ordinal level, the median test was used to test whether the median of the five strata and the two groups was statistically different. The results of these tests are presented in the following tables.

TABLE 10.18

F-test for monetary value estimates between the different departments (Reports"A")

A N A L Y S I S O F V A R I A N C E

Departments	Sum	Mean	Std. Dev.	Sum of Sq.	N
Type "A"	13000.0000	4333.3333	5008.3264	.50166E+08	(3)
Type "B"	9500.0000	791.6667	1104.2960	.13414E+08	(12)
Type "C"	5400.0000	540.0000	359.6294	1164000.0000	(10)
Type "D"	4600.0000	306.6667	197.1825	544333.3333	(15)
Type "E"	5360.0000	178.6667	294.4865	2514946.667	(30)
Total	37860.0000	540.8571	1299.1957	.1164E+09	(70)

A N O V A T A B L E

	Sum of Squares	Degrees of Freedom	Mean Square
Between Groups	.486E+08	(4)	.121E+08
Within Groups	.678E+08	(65)	.104E+07
Total	.116E+09	(69)	
F=11.6623	Sig.=.0000		

TABLE 10.19

F-test for monetary value estimates between the different departments (Reports "B")

A N A L Y S I S O F V A R I A N C E

Departments	Sum	Mean	Std.Dev.	Sum of Sq.	N
Type "A"	13000.0000	4333.3333	5008.3264	.50166E+08	(3)
Type "B"	9325.0000	777.0833	1417.6428	.22106E+08	(12)
Type "C"	4550.0000	455.0000	411.2650	1522250.0000	(10)
Type "D"	2450.0000	163.3333	181.7245	462333.3333	(15)
Type "E"	3240.0000	108.0000	208.0973	1255830.0000	(30)
Total	32565.0000	465.2143	1355.4195	.12676E+09	(70)

A N O V A T A B L E

	Sum of Squares	Degrees of Freedom	Mean Square
Between Groups	.512E+08	(4)	.128E+08
Within Groups	.755E+08	(65)	.116E+07
Total	.126E+09	(69)	
F=11.0287	Sig.=.0000		

TABLE 10.20

Median test for the scores on the S.D. scales between the different departments

Reports and test results / S.D.scales	Reports	Test results (N=71)		
		χ^2	ϕ	2-tail prob.
S.D. Value -applicability scale	A	5.3879	4	.2498
	B	2.2694	4	.6863
S.D. Value - need scale	A	3.2635	4	.5147
	B	5.0834	4	.2789
S.D. Quantity scale	A	1.9307	4	.7485
	B	5.8794	4	.2083
S.D. Format - logical presentation scale	A	3.8790	4	.4226
	B	.6423	4	.9582
S.D. Reliability or Accuracy scale	A	1.2726	4	.8660
	B	.5316	4	.9703
S.D. Timeliness scale	A	5.2087	4	.2665
	B	4.1388	4	.3875
S.D. Format - physical construction scale	A	4.3463	4	.3612
	B	.1849	4	.9960

TABLE 10.21

T-test for monetary value estimates between the two groups (N=70)

Results / Reports	Separate variance estimate		
	Computed T-value	ϕ	2-tail prob.
Reports "A"	1.82	14.11	.090
Reports "B"	1.86	14.08	.084

TABLE 10.22

Median test for the scores on the SD Scales between the two groups

Reports & Test results / SD Scales	Reports	Test results (N=71) χ^2	2-tail prob.
SD Value - applicability scale	A	.9544	.3286
	B	.3668	.5448
SD Value - need scale	A	.1212	.7278
	B	.3668	.5448
SD Quantity scale	A	.1428	.7056
	B	.0484	.8258
SD Format - logical presentation scale	A	.0484	.8258
	B	.0030	.9562
SD Reliability or Accuracy scale	A	.0030	.9562
	B	.0122	.9120
SD Timeliness scale	A	.1109	.7391
	B	.0122	.9120
SD Format - physical construction scale	A	.0370	.8475
	B	.0004	.9838

The figures presented in the previous tables show:

(a) There is a difference between the mean of the monetary value estimates of the different departments which is highly statistically significant ($<.001$) for both reports. This test was taken a step further by conducting a t-test between every two departments to uncover whether this difference in the mean is between all departments or some of them (pooled variance technique and separate variance technique were used depending on an F-test). The results are shown in table 10.23 and reveal that this difference is not between all departments but confined only to departments type "C" and departments type "E" (significant at and beyond the .05 level - 2-tail test). A suggestive and supportive difference in the means was found between departments type "B" and departments type "E" (reports "A" only) and between departments type "C" and departments type "D" (both reports).

(b) The median test between the different departments in their scores on the SD scales uncovered no significant differences between them. Thus no need existed for conducting this test between every two departments.

TABLE 10.23

T-test for monetary value estimates between every two departments

Reports & Departments & Results / Departments	Reports	DEPARTMENTS TYPE "A"			DEPARTMENTS TYPE "B"			DEPARTMENTS TYPE "C"			DEPARTMENTS TYPE "D"			DEPARTMENTS TYPE "E"		
		Computed T-value	Ø	2-tail prob.	Computed T-value	Ø	2-tail prob.	Computed T-value	Ø	2-tail prob.	Computed T-value	Ø	2-tail prob.	Computed T-value	Ø	2-tail prob.
Departments:																
Type "A"	A	-	-	-												
	B	-	-	-												
Type "B"	A	1.22	2.05	.348	-	-	-									
	B	1.22	2.08	.347	-	-	-									
Type "C"	A	1.31	2.01	.320	.74	13.71	.469	-	-	-						
	B	1.34	2.01	.312	.75	13.17	.467	-	-	-						
Type "D"	A	1.39	2	.298	1.50	11.56	.159	1.87	12.64	.084*	-	-	-			
	B	1.44	2	.286	1.49	11.29	.164	2.11	11.37	.059*	-	-	-			
Type "E"	A	1.44	2	.287	1.90	11.63	.082*	3.18	38	.003**	1.52	43	.136	-	-	-
	B	1.46	2	.281	1.63	11.19	.132	2.56	10.58	.026**	.88	43	.386	-	-	-

* Significance $>.05$ $<.10$ (2-tail test) considered suggestive and supportive.

** Significance at and beyond the .05 level (2-tail test)

(c) The t-test between the two groups testing the difference in the mean of their monetary value estimates revealed a suggestive and supportive result (significance levels between .05 and .10 - 2-tail test).

(d) As to the median test between the two groups in their scores on the SD scales, the results were not significant.

In a statistical framework, it can be said that while the difference in the means of the different departments' monetary estimates were highly statistically significant, and that those for the two groups were supportive and suggestive of a difference, the remaining tests uncovered no statistically significant differences in the median either of the departments or of the two groups in their scores on the SD scales. As a result, hypothesis four cannot be accepted.

The lack of a difference between the different departments (and groups) in the median of their scores on the SD scales compared to the difference in the means of their monetary estimates can be attributed to an occupational variation in the utility for money versus a concensus regarding attributes of selected information. Also, managerial experiences that influence the scores of the value measures in opposite directions may have been a causative factor. For example, a manager may feel that a report ("A" or "B") is a valuable tool for managing his department, so he may score it relatively high on the SD scales (values and attributes) but assign a low monetary

value to its use because of redundancy to an existing departmental information system. The converse of this dichotomy may also occur.

A review of the ranked data for the respondents in the different departments* indicates that the majority ranked the values and attributes relatively highly and around the same range, but the corresponding monetary value estimates had a comparatively wider range.* These findings could be a significant causative factor for the highly statistically difference in the means of the monetary value estimates as compared with the non-statistical difference in the median of their scores on the SD scales.

Summary: Hypothesis five is rejected.

10.3.2. Hypotheses relating to some factors which may influence managers' perceptions of the reports

10.3.2.1. Analysis of Hypothesis six

This hypothesis refers to the influence of the respondent's participation (consultation) in the design of the reports; it reads:

> "With managers who participate in report design, the value (monetary and non-monetary) and the SD attributes scores are higher than for those who do not participate in the design."

Of the seventy-one who answered the questionnaire, five stated that they were consulted and participated in the design of reports "A", while seven were consulted and participated in the design of reports "B".** To test for

---

* Please refer to sections 7.5.3., p. 349, and 7.6.3., p. 365.

** For the distribution of the managers over the different strata, please refer back to section 7.4., p. 343.

the statistical significance of the difference in the means of the monetary value estimates between managers who participated in the design versus those who did not participate, a t-test using a separate variance technique was used, while for the scores on the SD scales, a median test was used to test for the statistical significance of the difference in their medians. As the hypothesis stipulates a direction for these differences, one-tail probability test was used. Finally, the very small number of managers who did participate in the reports' design in comparison with those who did not, resulted in the test being performed with all respondents as it would have been meaningless to perform it with respondents divided into their groups or departments.

The t-test results were for reports "A" a computed t-value=1.01 (df 4.01, significant at the .185), and for reports "B" a computed t-value=1.55 (df 6.05, significant at the .086). While this second set of figures can be considered suggestive and supportive of a difference in the means of the monetary value estimates between managers who participated in the report design versus those who did not participate, from a statistical point of view, these differences cannot be considered significant at the .05 level (one-tail test).

The results of the median test (presented in table 10.24) uncovered that in relation to reports "A" no statistically significant differences were found, while in relation to

reports "B" the differences in the medians of the two value scales were significant at the .05 level (one-tail test), (with the differences in the medians of the Quantity scale and the Timeliness scale supportive and suggestive). A comparison of the medians of the remaining scales were not statistically significant, nor supportive in this context. In a statistical framework, these results while supportive of a difference existing in the medians of the scores on the SD scales between managers who participated in report design versus those who did not participate, cannot be considered enough for the support of the existence of these differences.

Summary: In view of the above analysis and discussion, hypothesis six is rejected, hence the respondent's participation (consultation) in the reports' design had no statistically significant influence or effect on his estimates of these reports' monetary value, neither on his scores on the SD scales.

TABLE 10.24

Median test for the scores on the SD scales for managers who participated in reports design versus managers who did not participate

Reports & results / SD Scales	Reports	Results	
		χ^2	1-tail prob.
SD Value - applicability scale	A	.0528	.4092
	B	3.2152	.0365**
SD Value - need scale	A	.9225	.1684
	B	3.2152	.0365**
SD Quantity scale	A	.4149	.2598
	B	2.6628	.0514*
SD Format - logical presentation scale	A	.0011	.4870
	B	.0127	.4552
SD Reliability or Accuracy scale	A	.6306	.2136
	B	.0451	.4160
SD Timeliness Scale	A	.0024	.4803
	B	2.0076	.0783*
SD Format - physical construction scale	A	.0141	.4528
	B	.0846	.3856

* Significance $>.05<.10$ (one tail test) considered supportive and suggestive.

** Significance at the .05 level (one tail test).

10.3.2.2. Analysis of Hypothesis seven

This hypothesis is related to the influence of managers' previous experience in designing information systems on their estimates of the monetary value of the report and also on their scores on the SD scale.

> "Managers with previous experience in designing information systems will differ in the value (monetary and non-monetary) and attributes they attach to the reports compared with those managers without previous experience."

The answers to the question posed in the questionnaire about the respondent's previous experience in designing information systems revealed that nine out of the seventy-one respondents had this experience (12.6%).* To test this hypothesis, two types of inferential tests, namely, t-test and median test, were used. The results of a t-test for the difference in the means of these two groups of managers, using the separate variance technique, were for reports "A" a computed t-value -.92 (df 48.03, significant at the .360 (2-tail test)), and for reports "B" a computed t-value -.85 (df 46.22, significant at the .402 (2-tail test)). These results show that the differences in the means were not statistically significant at the .05 level (2-tail test). Likewise, the median test results presented in the following table show that the differences in the medians of their scores on the SD scales measuring values and attributes of both reports were not statistically significant at the .05 level (2-tail test).

---

* For the distribution of the managers over the different strata, please refer to section 7.4, p. 343.

The above results do not support the hypothesis: the respondent's previous experience in designing information systems did not significantly influence his monetary value estimates of the reports, nor his scores on the SD scales.

Summary: Hypothesis seven is rejected.

TABLE 10.25

Median test for the scores on the SD Scales for managers with previous experience in designing information systems versus those who do not have this experience

Reports & Results / SD Scales	Reports	Results	
		χ^2	2-tail prob.
SD Value - applicability scale	A	.1012	.7504
	B	.2387	.6252
SD Value - need scale	A	.5756	.4480
	B	.2387	.6253
SD Quantity scale	A	.0229	.8798
	B	.0020	.9639
SD Format - logical presentation scale	A	.0020	.9639
	B	.1191	.7300
SD Reliability or Accuracy scale	A	.1191	.7300
	B	2.2373	.1347
SD Timeliness scale	A	.0496	.8238
	B	.5866	.4438
SD Format - physical construction scale	A	.1985	.6559
	B	.0163	.8983

10.3.2.3. Analysis of Hypothesis eight

This hypothesis concerns the relationship, if any, which may exist between the number of personnel supervised by each manager and both his monetary value estimates and his scores on the SD scales.

> "There is a relationship between the number of personnel supervised by the manager and the value (monetary and non-monetary) and attributes attached to the reports."

To test for this hypothesis two types of measures of association were used depending on the level of measurement attained by the data. The first is Pearson's PM between the number of personnel supervised and the monetary value estimates as both are interval data. Kendall's τ (Tau) was used to measure the association between the number of personnel supervised and the scores on the SD scales. The results are presented in the following two tables, for all respondents and for departments type "C" to departments type "E". The reason for not computing these statistics in relation to the two groups and departments type "A" and "B" is that the question posed in the questionnaire about the number of personnel supervised excluded the managers of these two departments. It was felt that as they have responsibility for the other departments, their figures may include additional personnel indirectly supervised and so the results may be inaccurate.

TABLE 10.26

Pearson's P.M. Correlations of Number of Personnel supervised and the monetary value estimates

Reports & Results / Monetary estimates	Reports	All respondents (N=55)	Departments		
			type "C" (N=10)	type"D" (N=15)	type "E" (N=30)
Monetary value estimates	A	.5000(.001)	NS	NS	.3791(.039)
	B	.6040(.001)	.6563(.039)	NS	NS

NS=Not significant at the .05 level (2-tail test)

* Significance levels are presented in parantheses

TABLE 10.27

Kendall's τ (Tau) Correlation Coefficients of Number of Personnel Supervised and the Scores on the S.D. Scales

Reports & Results / SD scales	Reports	All respondents (N=55)	Departments		
			type "C" (N=10)	type "D" (N=15)	type "E" (N=30)
SD Value - applicability scale	A	NS	-.4353(.080)*	NS	NS
	B	NS	NS	NS	NS
SD Value - need scale	A	NS	NS	NS	NS
	B	NS	NS	NS	NS
SD Quantity scale	A	NS	NS	-.3666(.057)*	NS
	B	NS	NS	NS	NS
SD Format - logical presentation scale	A	NS	NS	NS	NS
	B	NS	.4319(.083)*	NS	NS
SD Reliability or Accuracy scale	A	NS	NS	NS	NS
	B	NS	NS	NS	NS
SD Timeliness scale	A	NS	-.5013(.044)**	NS	NS
	B	NS	NS	NS	NS
SD Format - physical construction scale	A	NS	NS	NS	NS
	B	NS	NS	NS	NS

NS= Not significant at the .10 level (2-tail test)

* Significance $>$ .05 $<$ .10 (2-tail test) considered suggestive and supportive

** Significance at the .05 level (2-tail test)

The results presented in the previous tables show that the correlations between the monetary value estimates and the number of personnel supervised were positive and highly statistically significant for all respondents (.001 level, 2-tail test) while these correlations were not significant for the departments (with the exception of departments type "E" for reports "A", and departments type "C" for reports "B", which were significant at the .05 level (2-tail test)).

While there is a positive relationship between the number of personnel supervised and the monetary value estimates, there was no overall significant relationship between the former and the SD scales (with the addition that the few correlations suggestive of a relationship in this context were negative). The mixed results leads to one conclusion, which is the rejection of this hypothesis, indicating that the number of personnel does not influence managers' evaluation of the value (monetary and non-monetary) and attributes of the reports.

Summary: Hypothesis eight is rejected.

10.3.2.4. Analysis of Hypothesis nine

This hypothesis explores the existence (or otherwise) of a relationship between managers' experience in managing or supervising personnel and their estimation of the monetary value of the report, and also its value and attributes in qualitative terms.

"There is a relationship between a manager's experience in managing or supervising personnel and the value (monetary and non-monetary) and attributes attached to the reports."

As with the previous hypothesis, two types of measures of association, namely Pearson's PM and Kendall's τ (Tau) were used depending on the level of measurement of the data. Due to a different interpretation by managers in departments type "A", their answers were excluded from this analysis and hence, no analyses by groups were performed.

The Pearson's PM correlation between managers' estimates of the monetary value of the reports and their experience in managing or supervising personnel were not statistically significant either for all respondents together or for each department, (for example, for all respondents the correlations were .0393 and .0003 using their estimates for reports "A" and reports "B" respectively, significant at the .760 for the former and .998 for the latter).

The Kendall's τ (Tau) correlation coefficients between managers' experience in managing or supervising personnel and their scores on the SD scales, presented in the following table, show that with a few exceptions, correlation coefficients were neither suggestive nor supportive (significance $>.05<.10$ level, 2-tail test) nor significant at the .05 level. Moreover, the few correlations presented show mixed results in the sense that some were positive, while others were negative.

In a statistical framework, the results obtained do not support the hypothesis. There are no significant relationships

between managers' experience and their monetary estimates of the reports, nor with experience and scores on the SD scales. Thus no relationships exist between their experience as managers and their evaluation of the reports.

Summary: Hypothesis nine is rejected.

TABLE 10.28

Kendall's τ (Tau) correlation coefficients of managers' experience and their scores on the SD Scales

Reports and results / SD Scales	Reports	All respondents (N=64)	Departments			
			type B (N=13)	type C (N=10)	type D (N=15)	Type E (N=26)
SD Value - applicability scale	A	NS	NS	NS	NS	NS
	B	NS	NS	NS	NS	-.2513* (.072)
SD Value - need scale	A	NS	.4789** (.023)	NS	NS	NS
	B	NS	NS	NS	NS	NS
SD Quantity scale	A	NS	NS	NS	NS	NS
	B	NS	NS	.4138* (.096)	NS	-.2816** (.044)
SD Format - logical presentation scale	A	-.1830** (.033)	.3491* (.097)	NS	-.3305* (.086)	-.2333* (.095)
	B	NS	NS	NC	NS	NS
SD Reliability or Accuracy scale	A	NS	NS	NS	NS	NS
	B	-.1486* (.083)	NS	NS	NS	-.3247* (.021)
SD Timeliness scale	A	NS	NS	NS	NS	NS
	B	NS	NS	NS	NS	NS
SD Format - physical construction scale	A	NS	.3854* (.067)	NS	NS	NS
	B	NS	.4168** (.048)	NS	NS	NS

NS= Not significant at the .10 level (2-tail test)

NC= Not computable

* Significance $>.05$ $<.10$ level (2-tail test) considered suggestive and supportive

** Significance at the .05 level (2-tail test)

10.3.3. Hypotheses relating to managers' position in the organisational hierarchy

10.3.3.1. Analysis of hypothesis ten

This hypothesis concerns the effect, if any, of the manager's position in the organisational hierarchy on his estimates of the monetary value of the report and on his perceptions of its value and attributes on the SD scales.

> "Managers at upper levels of the organisation will place higher SD attribute scores and a higher value (monetary and non-monetary) on output reports than those at lower levels."

The scalar organisational level for each respondent was found with the help of a company's official (designated as a point of contact with the researcher). Four different levels were represented among the respondents. To test for this hypothesis, Kendall's τ (Tau) correlation coefficients was used as the level of measurement for the scalar level was ordinal. The results are presented in the following table for all respondents together only, as the computations of this statistic for the groups or the departments will be meaningless. As the hypothesis assumes a direction for the relationships, a one-tailed probability test was used.

TABLE 10.29

Kendall's τ (Tau) correlating coefficients of the scalar level and both monetary value estimates and the scores on the SD scales

Reports & results / Monetary estimates & SD scales	Reports	All respondents: Correlations & Significance	All respondents: N
Monetary value estimates	A	.4408 (.001)**	70
	B	.4645 (.001)**	70
SD Value - applicability scale	A	NS	71
	B	.2075 (.006)**	71
SD Value - need scale	A	NS	71
	B	.2468 (.003)**	71
SD Quantity scale	A	.1873 (.011)**	71
	B	.1754 (.016)**	71
SD Format - logical presentation scale	A	NS	71
	B	NS	71
SD Reliability or Accuracy scale	A	NS	71
	B	NS	71
SD Timeliness scale	A	NS	71
	B	.1095 (.089)*	71
SD Format - physical construction scale	A	NS	71
	B	NS	71

NS=Not significant at the .10 level (one-tail test)

* Significance $>.05$ $<.10$ level (one-tail test) considered suggestive and supportive

** Significance at and beyond the .05 level (one-tail test).

The results presented in the previous table show that there is a highly statistically significant positive relationship between managers' monetary value estimates and their position in the organisational hierarchy. The remaining results uncovered a highly statistically significant relationship between the SD scales measuring the Value and Quantity attribute of the reports and the managers' scalar level, with a fourth relationship (with the Timeliness scale) suggestive and supportive of this relationship, and with all the correlations positive.

In a statistical framework, this hypothesis cannot be rejected, especially since the remaining non-significant relationship was for the Reliability or Accuracy scale and the two Format scales, where we would not reasonably expect such a relationship to exist, since managers, regardless of hierarchical position are unlikely to differ in their perceptions of these two attributes. The explanation which can be offered for the significance of this relationship is that managers at upper levels, compared with managers at lower levels, in the company feel divorced from the day to day running of the different departments they supervise and are responsible for. Hence, the greater value and enhanced perceived attributes they attach to the reports which are generated to provide them with the needed information to fulfil their responsibilities seems an acceptable and expected result.

Summary: Hypothesis ten is accepted.

10.3.3.2. Analysis of Hypothesis eleven

This hypothesis explores the relationship, if any, between the manager's position in the organisational hierarchy and satisfaction with the reports meeting their control and planning needs. It explores whether the needs of managers at all levels are taken into consideration in the design of the reports or whether there is a bias towards catering for the needs of those at the upper levels at the expense of those at lower levels.

> "There is no relationship between managers' satisfaction with the degree to which the reports meet control and planning needs and managers' scalar level in the organisational hierarchy."

To test for this hypothesis, Kendall's τ(Tau) correlation coefficients was used as the data concerning the managers' scalar level and degree of satisfaction with the reports meeting needs for controlling and planning operations are measured at the ordinal level. The results are presented in the following table.

TABLE 10.30

Kendall's τ(Tau)correlation coefficients between managers' scalar level and their satisfaction with the reports meeting their control and planning needs

	Reports	All Respondents (N=71)
Control needs	A	.1364 (.093)*
	B	NS
Planning needs	A	NS
	B	NS

NS=Not significant at the .10 level (2-tail test)

* Significance $>.05$ $<.10$ level (2-tail test) considered suggestive and supportive.

As the above results show, there is no statistically significant relationship between managers' level in the organisational hierarchy and the degree of satisfaction with the reports meeting their control and planning needs, with one such (positive) relationship (concerning the control needs) being suggestive and supportive. Hence, from a statistical point of view, this hypothesis is accepted, which indicates that the satisfaction of the managers with the reports meeting their control and planning needs is not affected by their position in the organisational hierarchy, and that there is no bias in favour of those at the upper levels in this respect.

Summary: Hypothesis eleven is accepted.

10.3.3.3. Analysis of Hypothesis twelve

This hypothesis explores the relationship between managers' position in the organisational hierarchy and the number of parts they review in the reports, to explore whether there is a bias to furnish the managers at upper levels, compared with those at lower levels, with more information, reflected in more parts being reviewed.

> "There is no relationship between managers' level in the organisational hierarchy and the number of parts in the reports that are reviewed."

To test for this hypothesis, Kendall's τ (Tau) correlation coefficients was used. The correlation coefficients were .0621 significant at the .444 level (2-tail test) for reports "A", and .0854 significant at the .300 level (2-tail test) for reports "B". These results confirm the null

hypothesis stated above as the correlations were not statistically significant at the .05 level, hence the number of parts reviewed by managers is not related to their position in the organisational hierarchy, and so no bias exists favouring those at the upper levels in this respect.

Summary: Hypothesis twelve is accepted.

10.3.4. Hypotheses relating to the amount of budget the manager is responsible for

10.3.4.1. Analysis of Hypothesis thirteen

This hypothesis relates to the relationship, if any, between the respondent's budget and his monetary estimates of the reports and also his scores on the SD scales.

> "There is a relationship between the amount of budget managers are responsible for and the value (monetary and non-monetary) and attributes they attach to the reports."

The amount of budget responsibility of each manager was not asked in the questionnaire as the company officials felt it would be a disclosure of commercial information. A solution was found whereby they provided the researcher with this data ranked in order from one to six. To test for this hypothesis Kendall's τ(Tau) correlation coefficients was used between the ranked budget and the managers' monetary value estimates and their scores on the SD scales. The results are presented in the following table for all respondents only, as it was felt that any detailed analysis by groups or departments would be meaningless since the data for the budget while valid for all respondents was not considered adequate in terms of numbers for a more detailed analysis.

TABLE 10.31

Kendall's τ (Tau) correlation coefficients of managers' ranked budget and both their monetary value estimates and the scores on the SD scales

Reports & Results / Monetary estimates & SD Scales	Reports	All respondents: Correlations & Significance	All respondents: N
Monetary value estimates	A	.5270 (.001)**	70
	B	.4752 (.001)**	70
SD Value - applicability scale	A	NS	71
	B	NS	71
SD Value - need scale	A	NS	71
	B	.1698 (.037)**	71
SD Quantity scale	A	.1571 (.053)*	71
	B	.1602 (.049)**	71
SD Format - logical presentation scale	A	NS	71
	B	NS	71
SD Reliability or Accuracy scale	A	NS	71
	B	NS	71
SD Timeliness scale	A	NS	71
	B	NS	71
SD Format - physical construction scale	A	NS	71
	B	NS	71

NS=Not significant at the .10 level (2-tail test)

* Significance $>.05$ $<.10$ level (2-tail test) considered suggestive and supportive

** Significance at and beyond the .05 level (2-tail test)

The previous results show that there is a highly statistically significant and positive relationship (at the .001 level (2-tail test)) between the respondents' budget and their monetary value estimates. There were only two positive significant relationships at the .05 level (2-tail test) and one positive correlation which can be considered suggestive and supportive (significance between .05 and .10) in the results concerning the relationships between the managers' budgets and their scores on the SD scales.

From a statistical point of view, it can be said that while some of the results are supportive of the existence of a relationship, they do not provide sufficient evidence for the acceptance of this hypothesis. Hence, it can be said that there is no significant relationship between the managers' budget responsibilities and their estimates of the value of the reports and their scores on the SD scales.

Summary: Hypothesis thirteen is rejected.

10.3.4.2. Analysis of Hypothesis fourteen

This hypothesis explores the relationship, if any, between the amount of budget a manager is responsible for, and his degree of satisfaction with the reports meeting his control and planning needs. This explores whether there is a bias to furnish managers responsible for large amounts of budget with more information those responsible for lower budget amounts.

"There is no relationship between a manager's satisfaction with the degree to which the reports meet control and planning needs and the amount of budget the manager is responsible for."

To test for this hypothesis, Kendall's τ (Tau) correlation coefficients was used to measure the degree of association - and to test for statistical significance - between the score on the scale measuring satisfaction with the reports meeting control and planning needs and ranked budget.

The results of this test are presented in the following table for <u>all</u> respondents only. No detailed analysis was performed for groups and departments.

TABLE 10.32

Kendall's τ (Tau) correlation coefficients between managers' ranked budget and their satisfaction with the reports meeting their control and planning needs

	Reports	All Respondents (N=71)
Control needs	A	.1565 (.054)*
	B	NS
Planning needs	A	NS
	B	NS

NS=Not significant at the .10 level (2-tail test).

* Significance $>.05$ $<.10$ level (2-tail test) considered suggestive and supportive.

The above results show that all correlation coefficients computed were not statistically significant at the .05 level (2-tail test), and that only one such coefficient between managers' satisfaction with reports "A" meeting their control needs and their ranked budget is suggestive and supportive (significance $> .05 < .10$, 2-tail test) of such a relationship. From a statistical point of view, it can be said that the hypothesis is accepted. The amount of budget each manager is responsible for does not affect his degree of satisfaction with the reports meeting his control and planning needs. Hence no bias exists in favour of those managers responsible for greater amounts of budget compared with those with less amounts of budget.

Summary: Hypothesis fourteen is accepted.

10.3.4.3. Analysis of Hypothesis fifteen

This hypothesis explores whether there is a relationship existing between the budget each manager is responsible for and the number of parts reviewed in the reports.

> "There is no relationship between the number of parts in the report that managers review and the amount of budget they are responsible for."

Kendall's τ (Tau) was used to test for this hypothesis. The results were for reports "A" (N=71): .1680 significant at the .039 level (2-tail test), and for reports "B" (N=69): .1354 significant at the .101 level (2-tail test). These results reveal a positive relationship, statistically

significant at the .05 level (2-tail test) for the first set of reports. As to the second set of reports, the relationship while not significant at this level is still positive and can be considered supportive in this respect. From a statistical point of view, the above results do not support the hypothesis. There is a positive relationship between the amount of budget (ranked) managers are responsible for and the number of parts they review in the reports.

Summary: Hypothesis fifteen is rejected.

10.3.5. Hypotheses relating to the number of parts in the reports reviewed by managers

10.3.5.1. Analysis of Hypothesis sixteen

This hypothesis concerns the relationship between the number of parts reviewed in the reports and managers' estimates of these reports' monetary value and their perceptions of their values and attributes on the SD scales.

> "There is a relationship between the the number of parts of the reports reviewed by managers and the value (monetary and non-monetary) and attributes attached to these reports."

The results of using Kendall's τ(Tau) correlation coefficients to measure the magnitude and statistical significance of the association between managers' estimates of the monetary value of the reports, their perceptions of their values and attributes as measured by their scores on the SD scales, and the number of parts reviewed in each set of reports, are presented in the following table, for all respondents together, and for the groups and the different departments also.

TABLE 10.33

Kendall's Tau (tau) correlation coefficients of the amount of parts in the reports reviewed by managers and both their monetary value estimates and their scores on the S.D. Scales

Reports & Respondents / Monetary value estimates and SD Scales	REPORTS	All respondents		Groups				Departments									
				Group 1		Group 2		Type "A"		Type "B"		Type "C"		Type "D"		Type "E"	
		Correlations & Significance	N	Correlations & Significance	N	Correlations & Significance	N	Correlations & Significance	N	Correlations & Significance	N	Correlations & Significance	N	Correlations & Significance	N	Correlations & Significance	N
Monetary value estimates	A	NS	70	NS	15	NS	55	NC	3	NS	12	NS	10	NC	15	.2320(.072)*	30
	B	NS	68	NS	15	NS	53	NC	3	NS	12	NS	9	.5996(.002)**	15	NS	29
SD. Value - applicability scale	A	NS	71	NS	16	NS	55	NC	3	NS	13	NS	10	.3198(.097)*	15	NS	30
	B	.1998(.016)**	69	NS	16	.2446(.010)**	53	NC	3	NS	13	.4671(.080)*	9	.4104(.033)**	15	NS	29
SD. Value - need scale	A	.1506(.051)*	71	NS	16	.1680(.071)*	55	NC	3	NS	13	NS	10	NS	15	.2635(.041)**	30
	B	.1441(.081)*	69	NS	16	.1998(.035)**	53	NC	3	NS	13	NS	9	.5683(.004)**	15	NS	29
SD. Quantity Scale	A	NS	71	NS	16	NS	55	NC	3	NS	13	NS	10	NS	15	NS	30
	B	.1854(.025)**	69	NS	16	.2007(.034)**	53	NC	3	NS	13	.6519(.015)**	9	NS	15	NS	29
SD. Format - logical presentation scale	A	NS	71	NS	16	NS	55	NC	3	NS	13	NS	10	NS	15	NS	30
	B	.1946(.019)**	69	NS	16	.2944(.002)**	53	NC	3	NS	13	.6519(.015)**	9	.4077(.035)**	15	NS	29
SD. Reliability or Accuracy scale	A	NS	71	NC	16	NS	55	NC	3	NS	13	NS	10	.4386(.023)**	15	NS	30
	B	NS	69	-.3902(.036)**	16	NS	53	NC	3	-.442(.035)**	13	.7396(.006)**	9	NS	15	NS	29
SD. Timeliness Scale	A	NS	71	NS	16	NS	55	NC	3	NS	13	NS	10	.3631(.060)*	15	NS	30
	B	.2672(.002)**	69	NS	16	.3056(.002)**	53	NC	3	NS	13	.6425(.016)**	9	NS	15	.2626(.046)**	29
SD. Format - physical construction scale	A	NS	71	NS	16	NS	55	NC	3	.4134(.050)**	13	NS	10	NS	15	NS	30
	B	NS	69	NS	16	NS	53	NC	3	NS	13	NS	9	NS	15	NS	29

NS=Not significant at the .10 level (2-tail test)

NC=Not computable

* Significance >.05 <.10 level (2-tail test) considered suggestive and supportive

** Significance at and beyond the .05 level (2-tail test)

The results presented in the table can be summarised as follows:

(a) No significant relationship (at the .05 level (2-tail test)) exists between the number of parts reviewed in the reports and the monetary value estimates. (With one exception only concerning reports "B" for the managers in departments type "D", and a second correlation suggestive and supportive of this positive relationship significant between the .05 and .10 level (2-tail test), for reports "A" for managers in departments type "E").

(b) With correlations between managers' scores on the SD scales and the number of parts reviewed in the reports, mixed results were obtained. In terms of significance, not all of the correlations were significant at the .05 level (2-tail test). Moreover, a few of the correlations were uncomputable (for group 1 departments type "A", and departments type "D"). In terms of the sign of these correlations, while the majority were positive, two were negative, namely the correlations between the number reviewed in reports "B" and managers' scores on the Reliability or Accuracy scale for group 1 and departments type "B".

In a statistical framework, the results presented do not provide sufficient support for the hypothesis. The number of parts reviewed does not influence managers' estimates of their monetary value, nor their scores on the SD scales.

Summary: Hypothesis sixteen is rejected.

10.3.5.2. Analysis of Hypothesis seventeen

This hypothesis explores the relationship, if any, between managers' degree of satisfaction with the reports in meeting control and planning needs and the number of parts they review in these reports.

> "There is a relationship between the the number of parts reviewed in the reports and managers' degree of satisfaction with these reports meeting their control and planning needs."

Kendall's τ (Tau) was used to test this hypothesis as the data concerned is measured at the ordinal level. The results presented in the following table show that for all respondents there is a positive relationship between the number of parts reviewed in the reports and managers' degree of satisfaction with these reports meeting their control and planning needs. These positive relationships were all statistically significant at the .05 level (2-tail test). As for the groups and departments, the table shows that a majority of these correlations were either statistically significant at and beyond the .05 level (2-tail test), or supportive of this positive relationship with significance between .05 and .10 level (2-tail test),(with a few of the remaining not computable especially for departments type "A").

Thus it can be said that the results support the hypothesis; there is a positive relationship between the number of parts managers review in the reports and their degree of satisfaction with these reports meeting their control and planning objectives.

Summary: Hypothesis seventeen is accepted.

TABLE 10.34

Kendall's T (Tau) correlation coefficients of the amount of parts in the reports reviewed by managers and their degree of satisfaction with these reports in meeting their control and planning needs

Reports & Respondents / Control & Planning Needs	REPORTS	All respondents		Groups				Departments									
				Group 1		Group 2		Type "A"		Type "B"		Type "C"		Type "D"		Type "E"	
		Correlations & Significance	N	Correlations & Significance	N	Correlations & Significance	N	Correlations & Significance	N	Correlations & Significance	N	Correlations & Significance	N	Correlations & Significance	N	Correlations & Significance	N
Control needs	A	.1981(.015)**	71	.3142(.090)*	16	.1843(.047)**	55	NC	3	NS	13	NS	10	NS	15	.2696(.037)**	30
	B	.1935(.019)**	69	.3757(.043)**	16	NS	53	NC	3	.4301(.041)**	13	.7184(.008)**	9	NS	15	NS	29
Planning needs	A	.2614(.002)**	71	.3430(.064)*	16	.2628(.005)**	55	NC	3	.4042(.055)*	13	NS	10	NS	15	.3437(.008)**	30
	B	.2159(.009)**	69	NC	16	.2727(.004)**	53	NC	3	NS	13	.4899(.066)*	9	.4497(.020)**	15	NS	29

NS=Not significant at the .10 level (2-tail test)

NC=Not computable

* Significance >.05 <.10 level (2-tail test) considered suggestive and supportive

** Significance at and beyond the .05 level (2-tail test)

10.3.6. Hypothesis relating to managers' satisfaction with the reports meeting their control and planning needs

10.3.6.1. Analysis of Hypothesis eighteen

This hypothesis concerns the relationship, if any, between managers' degree of satisfaction with the reports meeting their control and planning needs and both their estimates of those reports' monetary value and their scores on the SD scales.

> "There is a relationship between managers' degree of satisfaction with the reports meeting their control and planning needs and the value (monetary and non-monetary) and attributes they attach to these reports."

Kendall's τ (Tau) correlation coefficients was used to test for this hypothesis, and the results are presented in the following two tables. The first of these measures the relationship with control, while the second measures the relationship with planning. Finally, these two tables present the results for all respondents, for the two groups, and for the different departments in the sample.

TABLE 10.35

Kendall's τ (Tau) correlation coefficients of managers' degree of satisfaction with the reports meeting their control needs and both their monetary estimates of the reports and their scores on the SD Scales

Reports & Respondents / Monetary estimates & SD Scales	REPORTS	All respondents		Groups				Departments									
				Group 1		Group 2		Type "A"		Type "B"		Type "C"		Type "D"		Type "E"	
		Correlations & Significance	N	Correlations & Significance	N	Correlations & Significance	N	Correlations & Significance	N	Correlations & Significance	N	Correlations & Significance	N	Correlations & Significance	N	Correlations & Significance	N
Monetary value estimates	A	NS	70	NS	15	NS	55	NC	3	NS	12	NS	10	NS	15	NS	30
	B	.2152(.008)**	70	NS	15	.1985(.033)**	55	NS	3	NS	12	NS	10	NS	15	.2471(.056)*	30
SD Value - applicability scale	A	.4552(.001)**	71	.5022(.007)**	16	.4594(.001)**	55	NC	3	.5074(.016)**	13	NS	10	NS	15	.6135(.001)**	30
	B	.5584(.001)**	71	.4607(.013)**	16	.5804(.001)**	55	NS	3	.4583(.030)**	13	.6342(.011)**	10	.3474(.072)*	15	.7231(.001)**	30
SD Value - need scale	A	.3399(.001)**	71	.5179(.006)**	16	.3162(.001)**	55	NC	3	.5560(.009)**	13	NS	10	.3839(.047)**	15	.3212(.013)**	30
	B	.4203(.001)**	71	NS	16	.4489(.001)**	55	NS	3	NS	13	NS	10	NS	15	.6417(.001)**	30
SD Quantity scale	A	.3015(.001)**	71	.4253(.022)**	16	.2719(.004)**	55	NC	3	.4456(.034)**	13	NS	10	NS	15	.3677(.005)**	30
	B	.1944(.017)**	71	NS	16	.2607(.005)**	55	NS	3	NS	13	.5766(.021)**	10	NS	15	NS	30
SD Format - logical presentation scale	A	.2608(.001)**	71	.5073(.002)**	16	.2095(.024)**	55	NC	3	.5992(.005)**	13	NS	10	.4553(.018)**	15	NS	30
	B	.3611(.001)**	71	.3769(.042)**	16	.3610(.001)**	55	NS	3	NS	13	.4513(.070)*	10	.5604(.004)**	15	.2771(.032)**	30
SD Reliability or Accuracy scale	A	.2454(.003)**	71	.3073(.097)**	16	.2301(.014)**	55	NC	3	NS	13	NC	10	.3246(.092)*	15	.2613(.043)**	30
	B	.2689(.001)**	71	NS	16	.3222(.001)**	55	NS	3	NS	13	.6932(.006)**	10	NS	15	.2904(.025)**	30
SD Timeliness scale	A	.3023(.001)**	71	.3573(.054)*	16	.3038(.002)**	55	NC	3	.4025(.056)*	13	NS	10	.4230(.020)**	15	NS	30
	B	.3464(.001)**	71	NS	16	.4426(.001)**	55	NC	3	NS	13	.7772(.002)**	10	.4702(.015)**	15	.3556(.006)**	30
SD Format - physical construction scale	A	.2726(.001)**	71	.2703(.004)**	16	NS	55	NC	3	NS	13	NS	10	.5158(.008)**	15	NS	30
	B	.3613(.001)**	71	NS	16	.3953(.001)**	55	NC	3	NS	13	.7020(.005)**	10	NS	15	.5129(.001)**	30

NS=Not significant at the .10 level (2-tail test)

NC=Not computable

* Significance $>.05$ $<.10$ level (2-tail test) considered suggestive and supportive

** Significance at and beyond the .05 level (2-tail test)

TABLE 10.36

Kendall's τ (1aul correlation coefficients of managers' degree of satisfaction with the reports meeting their planning needs and both their monetary estimates of their reports and their scores on the S.D. Scales

Reports & Respondents / Monetary estimates and S.D. Scales	REPORTS	All respondents		Groups				Departments									
				Group 1		Group 2		Type "A"		Type "B"		Type "C"		Type "D"		Type "E"	
		Correlations & Significance	N	Correlations & Significance	N	Correlations & Significance	N	Correlations & Significance	N	Correlations & Significance	N	Correlations & Significance	N	Correlations & Significance	N	Correlations & Significance	N
Monetary Value estimates	A	NS	70	NS	15	NS	55	NS	3	NS	12	NS	10	NS	15	NS	30
	B	.3177(.001)**	70	NS	15	.3417(.001)**	55	NC	3	.4277(.053)*	12	NS	10	.5955(.002)**	15	.3502(.006)**	30
SD. Value - applicability scale	A	.3058(.001)**	71	.3592(.053)*	16	.2921(.002)**	55	NS	3	.4461(.034)**	13	NS	10	NS	15	.3002(.020)**	30
	B	.5243(.001)**	71	.5918(.002)**	16	.5074(.001)**	55	NS	3	.6015(.005)**	13	.4447(.074)*	10	.4641(.016)**	15	.5627(.001)**	30
SD. Value - need scale	A	.2761(.001)**	71	.3167(.088)*	16	.2619(.005)**	55	NS	3	.5002(.018)**	13	NS	10	.3839(.047)*	15	.3268(.012)**	30
	B	.4272(.001)**	71	.4013(.030)**	16	.4611(.001)**	55	NC	3	.4870(.021)**	13	NS	10	.4024(.037)**	15	.5857(.001)**	30
SD. Quantity scale	A	NS	71	NS	16	NS	55	NS	3	NS	13	NS	10	NS	15	NS	30
	B	.1718(.075)**	71	NS	16	.2761(.003)**	55	NC	3	NS	13	NS	10	NS	15	.2912(.024)**	30
SD. Format - logical presentation scale	A	.2162(.008)**	71	NS	16	NS	55	NC	3	.6468(.003)**	13	NS	10	.3725(.053)*	15	NS	30
	B	.4511(.001)**	71	.6770(.001)**	16	.4023(.001)**	55	NS	3	.7213(.001)**	13	.5616(.024)**	10	.3222(.095)*	15	.3363(.010)**	30
SD. Reliability or Accuracy scale	A	.1955(.016)**	71	NS	16	.1929(.038)**	55	NS	3	NS	13	NS	10	.4193(.030)**	15	NS	30
	B	.2044(.012)**	71	.3418(.065)*	16	.1709(.066)*	55	NC	3	.3947(.061)*	13	.4751(.056)*	10	NS	15	.2879(.026)**	30
SD. Timeliness Scale	A	.2644(.002)**	71	.5145(.006)**	16	.1980(.033)**	55	NS	3	.4893(.020)**	13	NS	10	NS	15	NS	30
	B	.3073(.001)**	71	.3467(.062)*	16	.4189(.001)**	55	NS	3	.3920(.063)*	13	.5616(.024)**	10	NS	15	.4495(.001)**	30
SD. Format- physical construction scale	A	.3159(.001)**	71	.3317(.074)*	16	.3135(.001)**	55	NS	3	NS	13	.5195(.037)**	10	.6667(.001)**	15	NS	30
	B	.3791(.001)**	71	.4751(.011)**	16	.3410(.001)**	55	NS	3	.4758(.024)**	13	.6105(.015)**	10	NS	15	.4165(.002)**	30

NS=Not significant at the .10 level (2.tail test)

NC=Not computable

* Significance >.05 <.10 level (2-tail test) considered suggestive and supportive

** Significance at and beyond the .05 level (2-tail test)

The results shown in the previous tables can be summarised as follows:

(a) For all respondents together, the correlation coefficients were all positive and highly statistically significant at and beyond the .05 level (2-tail test) with only one exception. The correlation between monetary value estimates for reports "A" and managers' degree of satisfaction with these reports meeting their control and planning needs, was not significant at this level.

(b) For the Groups. Overall, the correlation coefficients were also positive and statistically significant at and beyond the .05 level (2-tail test). Some positive correlations were suggestive and supportive of the relationships investigated with significance between .05 and .10 (2-tail test). Only a few correlations were statistically non-significant.

(c) For the departments. The same pattern of results uncovered for the groups was revealed for the departments (if we exclude the correlations of departments type "A" which were either not computable or not statistically significant at the .10 level (2-tail test)).

From a statistical point of view, it can be said that the above results support this hypothesis. There is a positive relationship between managers' degree of satisfaction with the reports meeting their control and planning needs and both their estimates of these reports' monetary value and

their perceptions of values and attributes as measured on the SD scales.

Summary: Hypothesis eighteen is accepted.

10.4. Analysis of remaining questionnaire data

Four areas investigated in the study are presented in this section. They represent areas not included in the testing of the hypotheses, but which nonetheless provide additional information concerning managers' perceptions of the reports under study. They include (i) whether or not a manager wished to continue receiving the reports; (ii) for reports "A", the amount of detail and whether they would prefer a summary only of controllable expenses instead of the full reports, and any other changes they would like to see in these reports; (iii) for reports "B", the amount of detail, and any changes they would like to see in the reports, and (iv) respondents' general comments about the reports.

(i) Whether or not managers wished to continue receiving the reports.

The results show that for reports "A", all respondents wish to continue receiving them (even the one manager in department type "E" who did not review any parts of the reports). This result reveals a general satisfaction and continuous felt need for these reports.

As to reports "B", analysis of managers' answers to this question showed that 65 managers (representing 92% of the sample) expressed their wish to continue receiving the reports while only 6 managers would like to discontinue receiving them, (one manager qualified his answer by wanting

to receive the summary reports). These six managers were distributed as follows: two managers in departments type "D", and four managers in departments type "E".

A test for the statistical significance of the difference between the monetary value estimates and the scores on the SD scales between managers who wish to continue receiving these reports and those who do not wish to continue receiving them was performed for those in departments type "E" where the numbers of the two groups allows a meaningful test to be performed. The results for the t-test, using a separate variance technique between these two groups in their monetary value estimates, was a computed t-value 2.45 (df 21.74, significant at the .021 (2-tail test)).

The results of a Fisher test for the difference between their medians on the SD scales (used because (N) was 30, and because two of the scales had an expected frequency of less than five (1)), are presented in the following table.

TABLE 10.37

Median test for the scores on the SD scales for managers who wish to continue receiving reports "B" compared with managers who do not wish to continue receiving them

SD scales	2-tail prob. (N=30)
SD Value- applicability scale	.0498*
SD Value - need scale	NS
SD Quantity scale	.0498*
SD Format - logical presentation scale	.0498*
SD Reliability or Accuracy scale	NS
SD Timeliness scale	NS
SD Format - physical construction scale	NS

NS=Not significant at the .05 level (2-tail test)

* Significant at the .05 level (2-tail test)

As the previous results show there are statistically significant differences existing in the mean of the monetary value estimates of the two groups of managers, similarly their medians on the SD scales were statistically significantly different (at the .05 level of significance also). These scales being value-applicability, quantity, and format - logical presentation.

The results provide further confirmation of the validity of utilising the users' perceptions in evaluating MIS reports, though applying the proposed measures employed in this study. They genuinely reflect managers' satisfaction or dissatisfaction with the reports. This can be seen from results concerning the SD scales which reflected and uncovered the areas where dissatisfaction occurs. In the present case, it is the value-applicability of the reports which is affected by the type and quantity of the data, and its logical presentation - the three scales where differences in the medians were statistically significant. These results also uncovered the areas where the satisfaction of both groups exists, which can be considered to be the remaining scales - where no statistically significant differences were found in the medians.

(ii) For reports "A", amount of detail, whether they would prefer a summary of controllable expenses instead of the full reports, and any changes they they would like to see in the reports.

This three-part question was included at the request of company XXX officials.

The first part asked the manager to rate the amount of detail in the reports on a seven point scale. The second part asked - if their rating was above (4) which was labelled "about right" - whether they would like a summary of controllable expenses only. The descriptive statistics associated with managers' answers to these two parts are presented in the following table.

TABLE 10.38

Amount of detail in reports "A" and the managers preferring a summary of controllable expenses only

Respondents / Description	Groups		Departments				
	(1) (N=16)	(2) (N=55)	type "A" (N=3)	type "B" (N=13)	type "C" (N=10)	type "D" (N=15)	type "E" (N=30)
Mean (grand)	4.31	4.24	5.33	4.08	4.50	3.93	4.30
Standard deviation	1.078	.881	1.155	.954	.850	1.163	.702
Median	4	4	6	4	4	4	4
Range	3-6	1-6	4-6	3-6	4-6	1-6	3-6
Number of managers preferring a summary only	3	11	1	2	4	1	6

The above figures show that the averages relating to amount of detail in the reports are around (4), labelled as "about right" (with the exception of departments type "A" which were around the "slightly too much"). The managers who wished to receive only a summary of controllable expenses instead of the full reports numbered 14 (representing 20% of all managers in the sample) which can be taken as another indication of the importance managers attach to these reports in the performance of their duties and the discharge of their responsibilities. Kendall's τ (Tau) correlation coefficients were computed between managers' rating on this scale and their rating on the bi-polar adjective (detailed-general) to test whether or not there are significant correlations between these two ratings, the results of which are presented in the following table.

TABLE 10.39

Kendall's τ (Tau) correlation coefficients between managers' rating of the amount of detail in reports "A" and their rating on the bi-polar adjective detailed-general

Respondents	Correlations & Significance (2-tail test)
Group 1 (N=16)	.5294 (.005)*
Group 2 (N=55)	.2747 (.004)*
Departments type "A" (N=3)	NS
Departments type "B" (N=13)	.6191 (.004)*
Departments type "C" (N=10)	NS
Departments type "D" (N=15)	NS
Departments type "E" (N=30)	.3908 (.003)*

NS=Not significant at the .05 level (2-tail test)

* Significant at and beyond the .05 level (2-tail test)

The figures presented in the previous table show a positive correlation. The mixed results for the significance of these correlations, especially in the case of the departments, may be attributed to the constraints imposed on the respondents by the third part of this question asking those who rated it above (4) whether they would prefer a summary of controllable expenses only. In order to avoid such a choice they rated it (4) or below, an explanation which is supported by the statistics presented in table 10.38 and which can also be sustained by a frequency analysis of managers'

answers. This shows 51 managers (72% approximately) out of 71 in the sample rated it (4) or below.

The second part of this question asks managers about the changes they would like to see in the reports. Twenty-nine managers, representing 41% of the sample, answered this part. These answers were reported in summary to company officials (without authors' names) for consideration in their future revisions of these reports.

(iii) For reports "B", amount of detail, and any changes they would like to see in the reports

This question, similar to the one discussed before, was added at the request of company XXX. The first part asked the managers to rate on a seven-point scale the amount of detail in reports "B". These ratings using descriptive statistics are presented in the following table.

TABLE 10.40

Amount of detail in reports "B"

Respondents / Statistics	Groups		Departments				
	(1) (N=16)	(2) (N=55)	type "A" (N=3)	type "B" (N=13)	type "C" (N=10)	type "D" (N=15)	type "E" (N=30)
Mean (Grand)	4.50	4.71	4.67	4.46	4.70	4.67	4.73
Standard deviation	.966	1.15	1.15	.967	1.06	1.34	1.11
Median	4	4	4	4	4	4	4
Range	3-6	2-7	4-6	3-6	4-7	2-7	3-7

The above figures show that for all departments and groups, the amount of detail contained in this set of reports is between "about right" and "slightly too much"; compared with figures for the first set of reports it shows some degree of dissatisfaction with this aspect of the reports, and a need exists for its improvement in future revisions.

Kendall's τ (Tau) correlation coefficients was computed to measure the degree of association and its significance between managers rating the amount of detail in reports "B" and their rating of the same reports using the bi-polar adjective detailed-general. The results are presented in the following table.

TABLE 10.41

Kendall's τ (Tau) correlation coefficient managers' rating of the amount of detail in reports "B" and their rating on the bi-polar adjective Detailed-General

Respondents	Correlations & Significance (2-tail test)
Group 1 (N=16)	.5232 (.005)**
Group 2 (N=55)	.2065 (.027)**
Departments type "A" (N=3)	NC
Departments type "B" (N=13)	.5963 (.005)**
Departments type "C" (N=10)	NS
Departments type "D" (N=15)	.4361 (.024)**
Departments type "E" (N=30)	.2381 (.065)*

NS=Not significant at the .10 level (2-tail test)

NC=Not computable

** Significance $>$ .05 $<$ .10 level (2-tail test) considered suggestive and supportive

* Significance at and beyond the .05 level (2-tail test)

The above results show positive correlations between managers' rating of the details contained in the set of reports, and that these correlations for the groups and departments type "B" and "D" were highly statistically significant at the .05 level (2-tail test), with the correlation coefficient for departments type "E" as suggestive and supportive of this relationship. Only one result was not statistically significant and this was for departments type "C", with the coefficient for departments type "A" uncomputable. The above results can be taken as a general indication of managers' consistency in their answers to the questionnaire. Moreover, these results reveal that the use of either a direct approach, or an indirect one (eliciting managers' perceptions of the different aspects of the reports) are likely to yield the same results, a point which will not be elaborated further as it is out of the mainstream of the study, but which is worth mentioning as a point for future research. The second part of this question, asking managers about the changes they would like to see in the reports was answered by twenty four managers representing 34% of the sample. The answers which covered different aspects and components of the data presented in these reports were reported to company officials in summary (without authors' names) for their consideration in future revisions of these reports.

(iv) Respondents' general comments.

This questionnaire included an open-ended question asking managers for their general comments and suggestions. A total of thirty-four managers answered the question, representing approximately 48% of the sample. These included suggestions and criticisms of specific aspects of the two sets of reports under investigation and added more information concerning changes they would like to see made to the reports. A summary of the salient features in these comments was presented as before to company officials (without authors' names) for consideration in future revisions of the reports.

10.5. Summary and Conclusions

This chapter has presented the analysis of the data gathered through the questionnaire used to test different hypotheses formulated with the aim of (i) testing the validity and applicability of the measures proposed for evaluating MIS reports; (ii) uncovering the different factors influencing respondents' answers to these measures; and (iii) exploring the existence of a relationship between some of these factors. The following table presents a summary of the results of the hypotheses testing discussed in this chapter.

TABLE 10.42

A Summary of the Results of Inferential Analyses

Hypothesis	Result of the tests
One There is a relationship between managers' estimates of MIS reports' monetary value and their scores on the SD scales measuring its value (non-monetary) and its attributes.	Accepted
Two There is a relationship between the two SD value scales, and between them and the SD attribute scales.	Accepted
Three Managers differ in the Value (monetary and non-monetary) and in the SD attribute scores they attach to the reports investigated.	Accepted
Four There are no relationships between the different scales measuring the attributes of MIS reports.	Rejected
Five Managers in different strata/groups differ in the Value (monetary and non-monetary) given to a report and to the perceived attributes.	Rejected
Six With managers who participate in report design, the Value (monetary and non-monetary) and the SD attribtue scores are higher than for those who do not participate in the design.	Rejected

Hypothesis	Result of the tests
Seven Managers with previous experience in designing information systems will differ in the Value (monetary and non-monetary) and attributes they attach to the reports compared with those managers without previous experience.	Rejected
Eight There is a relationship between the number of personnel supervised by the manager and the Value (monetary and non-monetary) and attributes attached to reports.	Rejected
Nine There is a relationship between a manager's experience in managing or supervising personnel and the Value (monetary and non-monetary) and attributes attached to the reports.	Rejected
Ten Managers at upper levels of the organisation will place higher SD attribute scores and a higher value (monetary and non-monetary) on output reports than those at lower levels.	Accepted
Eleven There is no relationship between managers' satisfaction with the degree to which the reports meet control and planning needs and managers' scalar level in the organisational hierarchy.	Accepted

Hypothesis	Result of the tests
Twelve There is no relationship between managers' level in the organisational hierarchy and the number of parts in the reports that are reviewed.	Accepted
Thirteen There is a relationship between the amount of budget managers are responsible for and the Value (monetary and non-monetary) and attributes they attach to the reports.	Rejected
Fourteen There is no relationship between a manager's satisfaction with the degree to which the reports meet control and planning needs and the amount of budget the manager is responsible for.	Accepted
Fifteen There is no relationship between the number of parts in the report that managers review and the amount of budget they are responsible for.	Rejected
Sixteen There is a relationship between the number of parts reviewed by managers and the value (monetary and non-monetary) and attributes attached to these reports.	Rejected

Hypothesis	Results of the test
Seventeen There is a relationship between the number of parts reviewed in the reports and managers' degree of satisfaction with these reports meeting their control and planning needs.	Accepted
Eighteen There is a relationship between managers' degree of satisfaction with the reports meeting their control and planning needs and the value (monetary and non-monetary) and attributes they attach to these reports.	Accepted

REFERENCES

(1) Siegel, S., Non-parametric statistics for the Behavioural Sciences, McGraw-Hill Co. Inc., NY, 1956, p.112.

CHAPTER 11

SUMMARY, CONCLUSIONS, RECOMMENDATIONS OF THE STUDY, AND RECOMMENDATIONS FOR FURTHER RESEARCH

11.1. Introduction

11.2. Summary of the study
- 11.2.1. Summary of the methodology
- 11.2.2. Summary of the results

11.3. Conclusions and recommendations of the study

11.4. Recommendations for further research

CHAPTER 11

SUMMARY, CONCLUSIONS, RECOMMENDATIONS OF THE STUDY, AND RECOMMENDATIONS FOR FURTHER RESEARCH

11.1 Introduction

This last chapter of the dissertation presents: first, a summary of the study comprising a summary of the methodology and a summary of the results uncovered and presented throughout the thesis; second, conclusions and recommendations concerning the use and implementation of the audit of MIS by internal auditors. Third, recommendations are made for necessary further research to be conducted into the audit of MIS resulting from the results uncovered in this research in order to provide more light on this area of investigation; recommendations are also made to improve the techniques for the evaluation of management information.

11.2 Summary of the study

11.2.1 Summary of the methodology

The stated objectives of this study were to investigate the 'state of the art' with respect to the audit of MIS; the value attached to present tools available for use in the evaluation of MIS reports and MIS efficiency and effectiveness; the benefits of these audits as perceived by auditors and auditees. This has provided the researcher with the foundation from which to progress and develop a new approach (tool) to be used by internal auditors in the evaluation of management information.

The data necessary for the first part of this investigation was collected through two means: first, the use of postal questionnaires on a sample of internal auditors, managers, and MIS managers from fifty-six companies in the U.K.; and second, companies' published data (financial and non-financial).

Of the different approaches for use in the evaluation of MIS reports, the researcher chose to apply the method based on the user's perceptions, for reasons of practicality, feasibility, and its potential for broad applications compared with the other procedures available for use in this context.

The new approach includes the following:

(i) measures and elicited bases of information value;

(ii) measures of information attributes;

(iii) measures of maximum information value.

Development of this new approach proceeded from data collected in a fourth questionnaire mailed to seventy-one managers in a financial institution. Two periodic reports "A" and "B" met the criteria for selection.

All four instruments used to gather and collect the data were structured questionnaires, pilot tested, with the results of these pilot tests incorporated wherever practical in the final test of the instruments.

The analysis of the questionnaires and companies' published data yielded results which are summarized and presented in the following section. This will be followed by the different conclusions and recommendations derived from the study.

11.2.2 Summary of the results

The summary of the results presented in this section will deal first with the audit of MIS, and second with the new approach (tool) for the evaluation of management information provided to the managers through MIS reports.

First - The audit of MIS

(i) The number of auditing staff working in the U.K. offices of the companies in the survey (N=54) ranged from one auditor to seventy-four auditors per company with the average=13, the S.D. = 17, and the median 6. Using the sample mean, the mean

number of auditors working in the population of companies in the survey range (with 95% confidence) from 9 to 18 auditors.

Inferential tests revealed a positive and statistically significant relationship between: the number of auditing staff and the intensity of the audits as measured by the number of auditors performing MIS audits; the number of auditing staff and the size of the company as measured by the number of employees and by the turnover.

No significant relationship exists between the number of auditing staff and the following audit parameters: performance of MIS audits as a special assignment; the review of internally generated reports to determine whether they meet managers' needs and the review of MIS for efficiency and effectiveness.

(ii) Forty per cent of companies in the sample audit MIS as a specific assignment(s), forty-nine per cent of the sample audit MIS indirectly when auditing other functions/departments, and the remaining eleven per cent do not audit MIS.

Tests performed on the data pertaining to this aspect of the audit revealed different results. A positive and significant relationship exists between the audit of MIS and the size of the company as measured by its turnover, while a non-significant relationship exists between the latter and the approach used by auditors in the audit. The relationship between the audit of MIS and the number of auditing staff was positive and significant.

Results also showed that no differences exist between auditors following different approaches in the audit of MIS and their perceptions of the audit scope, the influence of the audits and the ideal MIS audit scope.

(iii) Ninety per cent of the companies which audit MIS perform both compliance and operational audit, while the remaining ten per cent only perform compliance audit.

(iv) Over half the companies in the sample (53.1%) practise a continuous audit of MIS while the other audit frequencies (at least once a year, every 1-2 years, other) share the remaining percentage.

(v) Audit intensity, as measured by the estimated percentage of the audit department's total available time spent on auditing MIS, was on average 30.8% with a S.D. of 26.9% and a median of 20%.

Using the sample mean, it can be said that, with 95% confidence, in this population the estimated time spent by the internal audit departments auditing MIS lies between 22.7% to 38.9% of their available time (noting that the number of auditors in a department will have an influence on this figure).

Audit intensity, as measured by the number of auditors involved in the MIS audit, was on average 5 auditors with a S.D. of 11 auditors, and a median of 2 auditors.

Using the sample mean, the number of auditors involved in the MIS audit in the population can be said to range (with 95% confidence) between 2 auditors to 8 auditors.

Statistical tests performed relating these variables with the other variables in this study revealed a non-significant relationship between intensity (either as a percentage of the audit department's total available time or as number of auditors involved) and auditors reviewing internally generated reports to determine whether they meet managers' needs; with auditors reviewing MIS for efficiency and effectiveness; with the degree of importance auditors attach to the different categories and items describing the audit scope; and with the benefits of operational and compliance audits ranked in terms of importance.

Tests relating company variables to intensity revealed a

positive and significant relationship between size and intensity as measured by the number of auditors performing the audits. All other relationships in this respect were non-significant.

Statistical tests also revealed a positive relationship between intensity as a percentage of the department's total available time spent on these audits and the auditors' perceptions of the compliance audit benefits scaled against the costs.

Lastly, managers' answers revealed a positive relationship between their perceptions of the closeness of their working relationship with internal auditors and intensity measured as a percentage of the department's total available time spent on these audits. MIS managers' answers revealed that a positive relationship exists between the closeness of their working relationship with internal auditors, and intensity as measured as the number of auditors performing the audits.

(vi) In seventy per cent of the companies in the sample, a degree in accounting or experience in accounting were the qualifications required in the employment of internal auditors to audit MIS, this was followed by experience in EDP and experience in managerial positions as the second qualification used by nearly a third of companies in this context.

(vii) Auditors' ranking, in terms of importance, the categories and items inside each category as practised in their MIS audit at present, revealed that reporting is considered to be the most important category where the audit attention is directed, followed by data collection as second in importance, while communication was last. Within the reporting category, the items in order of importance were accuracy, followed by relevance to managers' needs, completeness, timeliness.

(viii) In over 80% of the companies in the sample, internal auditors audit and review the internally generated reports in order to determine whether these reports meet managers' needs. This review is performed in the department receiving the reports in two thirds of these companies. A questionnaire was the main tool used by auditors in this context (59.4%) followed by discussion with the users (43.3%).

The results also show that the median of all three types of respondents (with no statistically significant differences between them) indicates they were merely satisfied with the method(s) used, around the (4) point of the scale, which was labelled satisfied.

(ix) In the sample of internal auditors two thirds of the companies require their MIS department or other department(s) to review the reports to determine their relevance to managers' needs. In those companies requiring a review of the reports, around two thirds also rely on the MIS department and its different sections to perform it. The methods used in this process are discussion, either informally or formally through a committee (used in two-thirds of the sample) and followed by the use of a questionnaire.

All three types of respondents were just 'satisfied' with the methods used (point (4) on the scale).

(x) Only 26 companies, just over a half of the sample, expect their internal auditors to review (audit) and report on the overall efficiency and effectiveness of their MIS. Sources of the criteria used by internal auditors in the evaluation of MIS were clustered around the user of MIS services, the auditors' experience and the MIS itself. Other sources less frequently used were results of other companies, original feasibility studies and needs analysis and parent company. The two methods most widely used by internal auditors in the

process of evaluating MIS were discussion and audit programmes.

All participants (no statistical difference existing between them) were merely satisfied with the methods used in this context.

(xi) Thirty-five companies representing over 70% of the sample require other department(s) to perform a review of MIS for efficiency and effectiveness, with the MIS department represented either by the group department or by the senior manager to whom this department reports as the most widely used means in this process.

(xii) Forty-seven of the forty-eight respondents answered 'yes' to a question about whether the audit report points out weaknesses in the current MIS, and of this forty-seven, forty-six stated they make recommendations for correcting weaknesses.

(xiii) In rating the benefits of MIS audits compared with costs, internal auditors perceived the performance of both audits as beneficial, with operational audits rated higher on the scale than compliance audits.

(xiv) MIS managers' median ratings of the benefits of the MIS audits scaled against costs, was higher than the median ratings of managers, nonetheless, the difference was not statistically significant.

(xv) Internal auditors' rankings of the benefits of operational and compliance audits in terms of importance show that increased internal control system reliability and increased MIS efficiency by uncovering weaknesses and suggesting improvements were first and second in importance, respectively, in the operational audit benefits, while improvement in internal control was the first in importance in compliance audit benefits.

(xvi) Managers and MIS managers perceived the benefits accruing from compliance audits as more important than those resulting from operational audits. This was manifested by the first and second ranks being occupied by compliance audit benefits (i.e. insure and improve internal controls, and uncover and eliminate actions which do not conform with corporate policies and procedures) with the third place in rank being an operational audit benefit (i.e. increases MIS efficiency - uncover weaknesses and suggests improvements).

Moreover, statistical tests performed on the data collected in this respect revealed differences between managers and MIS-managers in the ranking of the different items representing audit benefits.

(xvii) Managers perceive the MIS audit as having a positive influence on their confidence in the data they receive. Their mean and median rating was higher than those of internal auditors and MIS managers. The difference in the medians was statistically significant between managers and internal auditors only.

All three types of respondents perceive the MIS audit as having a positive effect on management decisions. Inferential tests performed in this context revealed no statistically significant differences between respondents.

The mean and the median of the respondents' ratings concerning the induced improvements in MIS were positive, reflecting a general satisfaction with the performance of the audits and their effects, while internal auditors scored higher in comparison with managers and MIS managers, the differences were statistically significant between them and the latter only.

Finally, tests revealed that an association exists between

respondents' perceptions of the audits' effects on the improvement in MIS and the perceived level of closeness in their relationship with internal auditors.

(xviii) Internal auditors and MIS managers perceive their working relationship as moderately close, as the means and medians are around point (5) in a seven point scale. Tests performed on the data revealed no statistical difference between them.

MIS managers expressing their opinions of being audited and their work reviewed by internal auditors, revealed a positive attitude in this context and a great appreciation of the work as performed by internal auditors.

The same results as above (with one addition) were uncovered for the working relationship between internal auditors and managers, the addition being that statistical tests uncovered a significant association existing between managers' perceived level of understanding MIS audits and their perceptions of the closeness of their working relationship with internal auditors.

(xix) Attainment of pre-established objectives, top management opinions, uncovering problem areas - cost savings and fraud detected - and an auditees' actions on auditor's findings were the most widely used methods to evaluate the internal audit department in the companies taking part in the survey.

Second - The evaluation of management information

(i) In giving their estimates of the monetary value of two sets of reports, managers - while valuing both reports - gave higher estimates for reports "A" than for reports "B". The increases were 2% for departments type "B", 19% for departments type "C", 88% for departments type "D" and 60% for departments type "E". Departments type "A" showed no difference.

For the two groups, the increases were 1% and 62% respectively.

(ii) No distinguishable difference existed between managers in the bases they chose for their estimates of the value of the two sets of reports.

(iii) Using the SD scales, managers, while perceiving both reports as being valuable and possessing good attributes, scored reports "A" between quite favourable and very favourable and reports "B" between slightly favourable and quite favourable. Also, statistical tests performed on the data uncovered that there was a significant relationship between the different scales measuring the attributes of MIS reports.

(iv) Managers were willing to pay more for custom-tailored reports and gave higher scores on the bi-polar adjectives reflecting their value in non-monetary terms.

(v) With regard to the reports meeting the controlling and planning needs of managers, reports "B" received lower ratings than reports "A" in this respect. The two sets of reports were rated higher for meeting the controlling objective than the planning objective, and reports "A" received better ratings than reports "B".

Inferential tests performed on the data pertaining to this area also revealed a relationship between managers' degree of satisfaction with the reports meeting their control and planning needs and the value (monetary and non-monetary) and attributes they attached to these reports.

(vi) For reports "A" five managers felt they were consulted about the design of the reports prior to their implementation, while seven managers felt they were consulted about reports "B".

Tests performed revealed that no statistically significant relationship exists between participation in report design and the value (monetary and non-monetary)and the S.D. attribute scores of the report. The same result of no relationship was

uncovered between experience in information systems' design and the value (monetary and non-monetary) and the S.D. attribute scores of the report.

(vii) The factors of manager's experience in managing or supervising personnel; number of personnel supervised by the manager; budget; and number of parts of a report reviewed by the manager are not significantly related to the value (monetary and non-monetary) and the S.D. attribute scores of the report.

(viii) Managers at upper levels of the organization have higher S.D. attribute scores and place a higher value (monetary and non-monetary) on output reports than those at lower levels.

(ix) Of the managers who answered the questions about the parts reviewed, forty-four managers reviewed all parts of reports "A" and one manager only said that none of the parts are reviewed. For reports "B" thirty-eight managers said that all parts were reviewed and four managers said none of the parts were reviewed. In relation to the distribution of managers who review some parts of the reports, no differences were uncovered with regard to both sets of reports.

Statistical tests revealed that a positive relationship existed between the number of parts reviewed by managers and the amount of budget they are responsible for. Tests also revealed the same result between the number of parts reviewed and managers' degree of satisfaction with the reports meeting their control and planning needs.

11.3 Conclusions and recommendations of the study

The conclusions presented in this section are based on the analysis of the data gathered from the survey instruments and are subject to the limitations of sampling.

(1) A majority of companies in the population audit their MIS. A positive relationship exists between the size of the company as measured by turnover and the audit of MIS, indicating that the larger the company the greater is the likelihood that they will be auditing their MIS. It also seems relevant to note that a direct operational audit of the MIS through special assignment(s) enhances the auditors' perceptions of its benefits scaled against costs.

(2) Internal auditors perform the audit of MIS taking a management perspective. Nonetheless, differences exist between respondents as to their view of an ideal MIS operational audit, e.g. managers and MIS managers rated 'reporting' as a main category in the audit higher in terms of importance than the degree of importance attached to it by auditors. Auditors perceived 'communication' as lowest in importance, the other two groups of respondents rated data processing and storage as least important. Auditors need to recognise and incorporate these differing views in their audit of MIS, if their audit is to achieve maximum benefits and be perceived as such by the users of the audit services.

(3) Benefits do arise out of the audit of MIS.

- Managers perceive that their decisions are improved when MIS is audited.
- Managers perceive a positive influence on their confidence in the data received as a result of MIS audits.
- Managers and MIS-managers express a general satisfaction with improvements in MIS induced as a result of audits.
- Managers and MIS-managers perceive the benefits of MIS audits as exceeding their costs.

It is also worth stating that managers and MIS-managers ranked the benefits resulting from compliance audits before those envisaged to result from operational audits. This

problem can be solved by communication initiated by auditors with the aim of explaining to these users the objectives and benefits of operational audits. This recommendation for an improvement in communication between those parties is sustained by results which show that managers' perceptions of the benefits of MIS audits increases with every increase in the perceived level of closeness in their relationship with internal auditors.

(4) Auditees hold a positive attitude and do appreciate the work performed by auditors and are aware of the need for such work. It seems that being an auditee does not cause a bias against the use of internal auditors in the audit of MIS.

The closeness of the auditors'working relationship with managers has a positive effect on managers' level of understanding MIS audits. The closeness of the working relationship between auditors and both managers and MIS-managers also has a positive effect on both managers'and MIS-managers' level of perceived improvements in MIS induced by the audits. These two results mean that with good and clear communication between those parties, the auditors' work will be greatly enhanced in value for the users and will be sought after instead of being resented.

(5) The study revealed the need for a tool for use by internal auditors - and others - in the evaluation of MIS reports. The tool or approach developed in this study (by application within an existing organisation and using two sets of reports) can be said - within this limitation - to encompass the following measures:

(i) Measures of information value

These include: (a) asking the users to estimate the monetary value of report(s) and to state the bases upon which they established their estimates, and (b) use of the Semantic Differential technique to score users' perceptions of the value

(in non-monetary terms) of the reports.

The results show that in relation to (a) the question used was feasible and that asking the users for their estimates of the monetary value of a report does yield reliable estimates for the value of a specific MIS. The bases provided also proved quite successful in eliciting the users' candid answers concerning their monetary value estimates.

As to (b) the S.D. technique proved successful in measuring the value in non-monetary terms of the reports, the results were positively related to the monetary value estimates. The researcher recommends (based on the results of factor analysis and reliability tests) the use of the following two scales in this respect:

- Value-applicability scale comprising the following bi-polar adjectives:

  Meaningful - Meaningless

  Effective - Ineffective

  Applicable - Inapplicable

  Relevant - Irrelevant

  Appropriate - Inappropriate.

- Value-need scale incorporating the following bi-polar adjectives:

  Important - Unimportant

  Valuable - Worthless

  Material - Immaterial

  Desirable - Undesirable

  Necessary - Unnecessary

  Beneficial - Non-beneficial.

(ii) Measures of information attributes

The aim of incorporating these measures in the approach developed and presented here is based on the need to uncover

the situation where the basic information may be highly desirable but this potential value is unrealised because of reasons of poor delivery to the user, i.e. arrives too late, is inaccurate, too complex, etc. The measures employed the Semantic Differential technique directed at the attributes of a report which include: quantity of the data in the report, reliability on accuracy of the data, format-logical presentation of the data, format-physical construction of the report, and timeliness.

The results of the study reveal that these measures were very successful in eliciting managers' perceptions of these attributes and that they are highly related to the value measures confirming the single identity or unity of these different measures proposed in the study.

Based on the factor analysis and reliability test results the researcher recommends the use of the following scales and bi-polar adjectives to measure the users satisfaction with the attributes of MIS reports:

- Quantity-attribute scale incorporating the following bi-polar adjectives:

  Complete - Incomplete

  Sufficient - Insufficient

  Adequate - Inadequate

  Enough - Not enough

  Detailed - General

- Reliability or Accuracy-attribute scale consisting of the following bi-polar adjectives:

  Accurate - Inaccurate

  Reliable - Unreliable

  Correct - Incorrect

  Trustworthy - Untrustworthy

- Format - logical presentation of the data scale which includes the following bi-polar adjectives:

  Ordered - Disordered

  Organised - Disorganised

- Format - physical construction of the report scale comprising the following bi-polar adjectives:

  Simple - Complex

  Well-constructed - Ill-constructed

- Timeliness-attribute scale embodying the following bi-polar adjectives:

  Timely - Untimely

  Opportune - Inopportune

  Well-timed - Ill-timed

(iii) Measures of maximum information value (custom-tailored reports)

These measures include the two value measures described above but with the exclusion of the question dealing with the bases for the users' monetary estimates, it is not repeated here. The aim of these measures is to differentiate in the case of low value and poor attributes of a report, whether:

- the information has little intrinsic value and the report should be considered for elimination, or
- the information has high potential value but that value is destroyed through poor delivery to the user.

In view of the results, the researcher recommends the use of these measures as the third corner of this approach

as they performed well and proved successful in providing the necessary data needed to solve this issue.

As a concluding comment concerning these three clusters of measures proposed for use in the evaluation of MIS report(s), it is worth mentioning that their performance was not only successful in presenting a cohesive and homogeneous set of measures, but the results also show that these measures have the power to differentiate between managers' (the users') perceptions of different reports, i.e. they discriminate.

11.4. Recommendations for further research

This section presents recommendations of areas for further investigation. They are not exhaustive of such areas but only represent the salient ideas and avenues identified through this research, with the hope that the great number of hypotheses examined and studied here can be helpful in generating different starting points for further research in the theory and practice of MIS audit.

(i) Field studies of the audit of MIS

This research presents a study of MIS audit at the macro level; a void in the literature exists concerning the micro level where answers to questions about the factors influencing audit variables, the impact of the audit on the auditees, and the factors affecting the auditees' perceptions of the benefits arising from the audit will prove very valuable to those parties interested in this domain of internal auditing.

Research at the micro level is also needed in order to test the new approach recommended in this study for use by auditors in the evaluation of MIS reports. These tests can indicate the degree of success of this new tool in achieving its objectives. Tests of this new approach need also to be conducted in different types of organisations, with different types of reports, in order to enhance its generalisability and applicability. It is worth mentioning here that tests using different reports will help answer the question as to whether reports are a single concept or are different concepts and hence, whether the need exists for different SD scales to be devised to measure value (in non-economic terms) and attributes, or whether a uniform set of scales such as the ones recommended in this study, is sufficient for that purpose.

(ii) Factors influencing audit variables; impact of the audits

Results presented in the study - as detailed in the relevant chapters - showed that in relation to these two main areas of investigation, mixed results were obtained. Research is needed either by tackling these same areas to provide further evidence needed for generalisation, or by investigating some of these factors only in greater depth - still on a macro level - in order to shed more light on these factors and on their effects on the audit and its impact.

(iii) Factors affecting auditees' perceptions of the audit benefits

In this area, as with the previous areas, mixed results were obtained from the analysis of the survey data. Research

is needed into which different factors may affect the auditees' perceptions in this context. As examples: (1) Does audit intensity affect the auditees? And if so, why? And is this uniform across all types of respondents? And if not, why not? (2) Differences occur between managers and MIS managers in their ranking of audit benefits: is this a general phenomenon, or not? And in either case, why? These are only examples of questions to indicate how valuable and beneficial it would be if answers can be provided through future research.

(iv) Characteristics of MIS users

The results of this study showed that the managers' organisational level exerts a positive effect on estimates of the value of MIS reports. This can be taken as an indication of the influence the users' characteristics have on their estimates of this value. Additional research is needed in order to uncover any other characteristics having such effects, the reasons being that if some of these characteristics are controlled for by management, then the findings will be helpful in influencing the design parameters of MIS. Hence this increases the users' satisfaction with the reports meeting their needs, with the obvious result of increasing their perceived and estimated value of the reports.

(v) MIS attributes

Three areas for additional research can be delineated in the context of MIS attributes. First, research is needed to explore whether the set of attributes used in this study

which incorporated quantity, reliability, format, timeliness, and non-monetary cost is exhaustive, or whether additional attributes can be discerned which affect the value of MIS reports. Second, the non-monetary cost attribute proved to be elusive and the bi-polar adjectives purporting to measure it failed in this aim. Research is needed here to study whether this attribute is a coherent and unitary attribute or whether it is indirectly part of the other attributes as this study showed. Third, further research is needed to uncover the relationships, if any, between the different attributes of MIS reports. The need for these additional studies stems from the results where these attributes were shown to be influencing the users' perceptions of the value of MIS reports. If a set of attributes can be delineated and incorporated in MIS design parameters, then users' satisfaction with the reports can be greatly enhanced together with a positive effect on the value of the reports.

* * *

APPENDIX A

'MIS AUDIT' TEST INSTRUMENTS, LETTERS

Covering letter - Pilot test

Covering sheet - Pilot test

Internal Auditors' Questionnaire - Pilot test

Managers' Questionnaire - Pilot test

MIS managers' Questionnaire - Pilot test

Follow-up letters (1,2) - Pilot test

Covering letters - Final test

Covering sheets - Final test

Internal Auditors' Questionnaire - Final test

Managers' Questionnaire - Final test

MIS managers' Questionnaire - Final test

Follow-up letters (1,2) - Final test

The City University Business School

LIONEL DENNY HOUSE, 23 GOSWELL ROAD, LONDON EC1M 7BB 01-253 4399

December, 1977

Dear . . .,

Thank you very much for consenting to help us with our pilot test of the questionnaires. I enclose a copy of each questionnaire together with a cover sheet of explanation attached to each.

With very best wishes for all your endeavours.

Yours sincerely,

Andrew D. Chambers
The Leverhulme Senior Research Fellow
in Internal Auditing

The City University Business School

(formerly the Graduate Business Centre)

LIONEL DENNY HOUSE, 23 GOSWELL ROAD, LONDON EC1M 7BB 01-253 4399

EXT. 574

PILOT TEST OF QUESTIONNAIRES

1. PLEASE TAKE A NOTE OF THE TIME WHEN YOU START TO COMPLETE A QUESTIONNAIRE.
2. There are two Ph.D. research studies and four questionnaires. The questionnaire attached to this sheet is the one ticked below :

   - Ph.D. topic (S. Abu Ghaba):

     " The impact of computer based accounting systems upon the work of internal and external auditors with particular reference to computer fraud . "

     ☐ Questionnaire No. 1 : Internal auditor's computer questionnaire.

   - Ph. D. topic (G. Selim) :

     " Research into auditing management information systems."

     ☐ Questionnaire No. 2 : Internal auditors - Questionnaire.

     ☐ Questionnaire No. 3 : Managers - Questionnaire (This questionnaire to be completed by a manager outside the internal audit department who has experienced an internal audit)

     ☐ Questionnaire No. 4 : Questionnaire for the manager with special responsibility for the MIS.

3. We think each questionnaire will take about 20 minutes to complete.
4. The plan is to use the pilot test answers in our analysis,so please try to provide answers to all the questions.
5. We would value any comments you have - however derogatory !
6. Each questionnaire goes to 10 people for the pilot test . The final amended questionnaires will go to a further 100 approximately.
7. We are keeping a record of those who are assisting us with our research so that the results can be made available to you in due course.

G. Selim

S. Abu Ghaba

INTERNAL AUDITORS - Questionnaire

Research into auditing management information systems

This questionnaire is designed to gather information on the benefits of auditing management information systems (MIS). Specifically we want the opinions of internal auditors on the audits of management information systems in their organizations.

By "management information systems (MIS)", we are speaking of the formal system that collects, processes and communicates data to managers for use in planning and control of the company's operations. The MIS generates reports such as forecasts, budgets, inventory status, labour efficiency, variance from standard costs, profit reports, etc.

MIS may be known in some organizations by other names, and in other organizations it may have no name at all. In all cases, however, it is, at least to some extent, formalised. Its end product is information that managers use for planning and controlling operations. Sometimes this may be a product of computerised systems, but it may be provided in a variety of other ways. It may also be provided on a decentralized basis by functional divisions.

Would you please answer the following questions:

1. Your Name:

2. How many auditing staff are employed in your department? (U.K. only)

   Full-time _____ Part-time _____

3. Is the audit of the management information system (MIS) performed as a specific audit assignment(s)? YES / NO

   If 'NO', do you audit activities related to MIS when auditng specific functions/departments in your company? YES / NO

   N.B. An audit of the data processing department would amount to an audit of a part of your company's MIS.

4. What type of audit of your company's MIS do you perform?

   - Perform only a compliance audit. That is, review the MIS to ascertain that procedures are being followed and that reports are not erroneous.
   - Perform only an operational audit of the MIS. That is evaluate the effectiveness and efficiency of the MIS.
   - Perform both compliance and operational audits.

5. Do you feel that the benefits of an operational (efficiency and effectiveness) audit of the MIS would outweigh the costs of such an audit? (Circle the number that describes your opinion)

Greatly outweigh the costs			About equal to the costs			Much less than the costs
1	2	3	4	5	6	7

6. Do you feel that a compliance audit of such a system would provide benefits in excess of the costs? (Circle the number that describes your opinion)

Greatly outweigh the costs			About equal to the costs			Much less than the costs
1	2	3	4	5	6	7

7. In your company, how often are MIS audits performed?

   - continuously
   - at least once a year
   - every 1 - 2 years
   - other (please explain)

8. What proportion of your audit department's total available time is spent on auditing the MIS?

   _____ %

9. How many auditors are usually involved in an MIS audit?

_____ auditors

10. Do you draw on personnel outside the internal audit staff to work on these audits?

- No
- Computer programmers
- System designers
- Other (please explain)
- Computer analysts
- Communication experts
- Outside consultants (please describe)

11. To the best of your knowledge, please list the backgrounds (education and experience) of the individuals performing MIS audits.

12. For each of the six categories below, please rank the items listed under those categories as to how important they are in your MIS audit now. For example, if (c) accuracy of data, is most important, put a (1) to the left, or if it is second, put a (2) to the left, etc. Also rank, from (1) to (6), each of the six major categories in the order of their importance in your MIS audit.

__ I. Data collection.

____ (a) overcollection of data
____ (b) undercollection of data
____ (c) accuracy of data
____ (d) coding of data
____ (e) errors in data entry
____ (f) efficiency of data collection and entry
____ (g) evaluation of data collection and entry personnel
____ (h) evaluation of data collection and entry management
____ (i) other? (please specify and rank)

II. Data processing and storage

____ (a) security
____ (b) storage of unneeded data
____ (c) destruction of needed data
____ (d) computer programs
____ (e) evaluation of data processing organization
____ (f) evaluation of data processing personnel
____ (g) efficiency of storage methods
____ (h) evaluation of data processing management
____ (i) other? (please specify and rank)

III. Reporting

____ (a) cost efficiency

____ (b) timeliness

____ (c) format

____ (d) understandability

____ (e) relevance to manager's needs

____ (f) accuracy

____ (g) unbiased data

____ (h) completeness

____ (i) other? (please specify and rank)

IV. Communication.

____ (a) relations between managers and data processing

____ (b) relations between accounting and data processing

____ (c) semantics problems in reports

____ (d) managers' opinions of the MIS

____ (e) other? (please specify and rank)

__ V. Decision-making.

____ (a) whether the reports generated lead to good decisions on the part of managers

____ (b) whether managers get too much data

____ (c) whether managers get all the data they need

____ (d) whether managers use the data they receive

____ (e) other? (please specify and rank)

VI. MIS design.

____ (a) whether new systems are efficiently designed

____ (b) whether the purchase, hire, or lease of new EDP equipment is cost justified

____ (c) whether the new systems are designed with the user in mind

____ (d) whether the new systems are adequately explained to the users

____ (e) whether the operation of new systems meets original specifications

____ (f) other? (please specify and rank)

13. Please rank by order of importance the benefits you feel the company has gained from the operational (efficiency and effectiveness) audits of its MIS.

- Increases MIS efficiency (uncover weaknesses and suggests improvements)
- Increases manager's understanding and utilization of MIS which leads to improved decision making.
- Improves timeliness, accuracy and formats of management reports.
- Improves new systems design (especially control features)
- Improves MIS/user interface.
- Increases internal control system reliability.
- Other (please explain and rank)

14. Please do the same as above for the compliance audits of MIS.

- Confirm compliance with internal controls.
- Improve internal controls.
- Improve accuracy and reliability of the data.
- Uncover and eliminate actions which do not conform with corporate policies and procedures.
- Improve management's utilization of the MIS.
- Increase knowledge of MIS management (act as a communication link between managers and MIS management).
- Other (please explain and rank)

15. Are there any additional benefits that you feel could be gained if the MIS audit approach were modified or expanded? (please explain)

16. In your opinion, do the auditors work closely enough with the users of management reports? (managers) - (Circle the appropriate degree of closeness).

Not at all			Moderately close			Closely enough
1	2	3	4	5	6	7

17. In your opinion, do the auditors work closely enough with the MIS personnel?

Not at all			Moderately close			Closely enough
1	2	3	4	5	6	7

18. Are the internal reports that are currently generated reviewed to determine whether they meet the needs of management? YES / NO

If 'YES' (a) Where do you audit the usefulness of the reports generated by the MIS?

- at the department issuing the report ____
- at the department receiving the report ____

(b) How do you determine what data the various managers need?

- questionnaire
- mathematical models
- other (please specify)

(c) How satisfied are you with the method used?

Unsatisfied			Satisfied		Highly satisfied	
1	2	3	4	5	6	7

19. Does anyone else (such as an MIS department) try to determine if the internal reports currently generated meet the needs of management?

YES / NO

If 'YES', (a) Who?

(b) How do they do this?

- questionnaire
- mathematical models
- other (please specify)

20. Do the internal auditors report on the overall efficiency and effectiveness of the MIS? YES / NO

If 'YES', (a) Where do you obtain the criteria by which to evaluate the MIS?

(b) How do you do this?

(c) How satisfied are you with the method used?

Unsatisfied			Satisfied		Highly satisfied	
1	2	3	4	5	6	7

21. Do the auditors point out weakness in the current MIS?

YES/NO

22. Do the auditors make recommendations for correcting weaknesses?

YES/NO

If 'YES', What is your policy toward avoiding these recommendations hindering the auditor's objectivity and independence in subsequent audits?

23. Is there anyone else in the company who reviews the MIS (for efficiency and effectiveness)?

YES/NO

If 'YES', who?

24. Do you feel that managers:

(a) Place more confidence in the reports they receive when MIS has been audited?

No confidence			Somewhat more confidence			Much more confidence
1	2	3	4	5	6	7

(b) Make better decisions when MIS has been audited?

No better			Somewhat better			Much better
1	2	3	4	5	6	7

25. Has the MIS improved because of past audits?

No			Somewhat			Very much
1	2	3	4	5	6	7

26. If you were to develop the ideal operational (efficiency and effectiveness) audit of your company's MIS, how much attention would you devote to the following MIS components and problems? (Circle the number that describes the level of attention that you attach to the areas below).

	None			Some			A great deal
I. Data collection.	1	2	3	4	5	6	7
(a) overcollection of data	1	2	3	4	5	6	7
(b) undercollection of data	1	2	3	4	5	6	7
(c) accuracy of data	1	2	3	4	5	6	7
(d) coding of data	1	2	3	4	5	6	7
(e) errors in data entry	1	2	3	4	5	6	7
(f) efficiency of data collection and entry	1	2	3	4	5	6	7

		None			Some			A great deal
(g)	evaluation of data collection and entry personnel	1	2	3	4	5	6	7
(h)	evaluation of data collection and entry management	1	2	3	4	5	6	7
(i)	other? (please specify)	1	2	3	4	5	6	7
II.	Data processing and storage.	1	2	3	4	5	6	7
(a)	security	1	2	3	4	5	6	7
(b)	storage of unneeded data	1	2	3	4	5	6	7
(c)	destruction of needed data	1	2	3	4	5	6	7
(d)	computer programs	1	2	3	4	5	6	7
(e)	evaluation of data processing organization	1	2	3	4	5	6	7
(f)	evaluation of data processing personnel	1	2	3	4	5	6	7
(g)	efficiency of storage methods	1	2	3	4	5	6	7
(h)	evaluation of data processing management	1	2	3	4	5	6	7
(i)	other? (please specify)	1	2	3	4	5	6	7
III.	Reporting.	1	2	3	4	5	6	7
(a)	cost efficiency	1	2	3	4	5	6	7
(b)	timeliness	1	2	3	4	5	6	7
(c)	format	1	2	3	4	5	6	7
(d)	understandability	1	2	3	4	5	6	7
(e)	relevance to managers' needs	1	2	3	4	5	6	7
(f)	accuracy	1	2	3	4	5	6	7
(g)	unbiased data	1	2	3	4	5	6	7
(h)	completeness	1	2	3	4	5	6	7
(i)	other? (please specify)	1	2	3	4	5	6	7
IV.	Communication.	1	2	3	4	5	6	7
(a)	relations between managers and data processing	1	2	3	4	5	6	7
(b)	relations between accounting and data processing	1	2	3	4	5	6	7
(c)	semantics problems in reports	1	2	3	4	5	6	7
(d)	managers' opinions of the MIS	1	2	3	4	5	6	7
(e)	other? (please specify)	1	2	3	4	5	6	7

		None			Some			A great deal
V.	Decision-making.	1	2	3	4	5	6	7
	(a) whether the reports generated lead to good decisions on the part of managers	1	2	3	4	5	6	7
	(b) whether managers get too much data	1	2	3	4	5	6	7
	(c) whether managers get all the data they need	1	2	3	4	5	6	7
	(d) whether managers use the data they receive	1	2	3	4	5	6	7
	(e) other? (please specify)	1	2	3	4	5	6	7
VI.	MIS design.	1	2	3	4	5	6	7
	(a) whether new systems are efficiently designed	1	2	3	4	5	6	7
	(b) whether the purchase, hire, or lease of new EDP equipment is cost justified	1	2	3	4	5	6	7
	(c) whether the new systems are designed with the user in mind	1	2	3	4	5	6	7
	(d) whether the new systems are adequately explained to the users	1	2	3	4	5	6	7
	(e) whether the operation of new systems meets original specifications	1	2	3	4	5	6	7
	(f) other? (please specify)							

27. In your company, how is the internal audit function evaluated?

Some examples might be:-

- attainment of pre-established objectives
- number of audits
- auditees action on auditor findings
- uncovering problem areas (cost savings and fraud detected)
- top management opinions
- opinions of the company's external auditors
- no formal evaluation
- other (please explain)

28. How closely do you feel your views coincide with other auditors in your company?

Not at all			Somewhat closely			Exactly
1	2	3	4	5	6	7

That completes the questionnaire. Thank you very much for your co-operation. Your time, energy and knowledge are greatly appreciated. Please put the completed questionnaire in its envelope and mail at the soonest convenient time.

MANAGER - Questionnaire

Research into auditing management information systems

This questionnaire is designed to gather information on the benefits of auditing management information systems (MIS). Specifically we want the opinions of managers on the audits of management information systems in their organisations.

By "management information system (MIS)", we are speaking of the formal system that collects, processes, and communicates data to managers for use in planning and control of the company's operations. The MIS generates reports such as forecasts, budgets, inventory status, labour efficiency, variance from standard costs, profit reports, etc.

MIS may be known in some organisations by other names, and in other organisations it may have no name at all. In all cases, however, it is, at least to some extent, formalised. Its end product is information that managers use for planning and controlling operations. Sometimes this may be a product of computerised systems, but it may be provided in a variety of other ways. It may also be provided on a decentralised basis by functional divisions.

Would you please answer the following questions:

1. Your name:

2. Do you use internally generated reports in order to perform some of the tasks required by your position?

   yes / no

3. How satisfied are you with the formal MIS now in operation? (Circle the number that describes your feelings.)

Unsatisfied			Satisfied			Highly satisfied
1	2	3	4	5	6	7

4. Do you feel that the benefits of the internal audit of the MIS in the company outweigh the costs of such an audit? (Circle the number that describes your opinion.)

Much less than the cost			About equal to the cost			Greatly exceed the cost
1	2	3	4	5	6	7

5. How well do you think you understand what the internal auditors do when reviewing the MIS? (Circle the number that describes your view of your level of understanding.)

Not at all			Somewhat			Very well
1	2	3	4	5	6	7

6. Please rank by order of importance the benefits you feel the company has gained from auditing its MIS

   - Uncover and eliminate actions which do not conform with corporate policies and procedures
   - Increases management control of the MIS
   - Increases MIS efficiency (uncover weaknesses and suggests improvements)
   - Increases understanding and utilization of MIS which leads to improved decision-making
   - Improves timeliness, formats, and accuracy of management reports
   - Insure and improve internal controls
   - Other (please explain and rank)

7. Are there any additional benefits that you feel could be gained if the MIS audit approach were modified or expanded? (please explain)

8. In your opinion, do the internal auditors work closely enough with managers such as yourself? (Circle the appropriate level of closeness.)

Not at all			Moderately close			Closely enough
1	2	3	4	5	6	7

9. Do the internal auditors review your work? yes / no

If yes, please describe your opinion about this.
Some examples might be:

- The audit is helpful to the auditee. It is a positive management tool that aids in attention directing
- Audits are accepted, conditional upon the auditor acting in a professional manner
- Audits are accepted, because they are a necessary management practice
- Audits are necessary, because objective opinions are needed
- Internal auditors are very helpful, they always provide the auditees with useful advice and information
- Other (please explain)

10. Do the internal auditors review the internal reports currently generated to determine whether they meet your needs?

yes / no

if yes,

(a) How do they do this?

- Questionnaire
- Mathematical models
- Others (please specify)

(b) How satisfied are you with the method used? (Circle the number that describes your opinion.)

Unsatisfied			Satisfied			Highly satisfied
1	2	3	4	5	6	7

11. Does anyone else (such as an MIS department) try to determine if the internal reports currently generated meet your needs?

yes / no

<u>if yes</u>,

(a) Who:

(b) How do they do this?

- Questionnaire
- Mathematical models
- Others (please specify)

(c) How satisfied are you with the method used?

Unsatisfied			Satisfied			Highly satisfied
1	2	3	4	5	6	7

12. Does the audit of the MIS allow you to make better decisions?

No better			Somewhat better			Much better
1	2	3	4	5	6	7

13. Has the MIS improved because of past audits?

No			Somewhat			Very much
1	2	3	4	5	6	7

14. Do the MIS audits allow you to place more confidence in the data you receive?

No			Somewhat more			Much more
1	2	3	4	5	6	7

15. If you were to develop a guideline for evaluating the MIS for the company, how much attention would you devote to the following MIS components and problems? (Circle the number that describes the level of attention that you attach to the areas below).

	None			Some			A great deal
I. Data Collection.	1	2	3	4	5	6	7
(a) overcollection of data	1	2	3	4	5	6	7
(b) undercollection of data	1	2	3	4	5	6	7
(c) accuracy of data	1	2	3	4	5	6	7
(d) coding of data	1	2	3	4	5	6	7
(e) errors in data entry	1	2	3	4	5	6	7
(f) efficiency in data collection and entry	1	2	3	4	5	6	7
(g) evaluation of data collection and entry personnel	1	2	3	4	5	6	7
(h) evaluation of data collection and entry management	1	2	3	4	5	6	7
(i) other (please specify)	1	2	3	4	5	6	7
II. Data processing and storage.	1	2	3	4	5	6	7
(a) security	1	2	3	4	5	6	7
(b) storage of unneeded data	1	2	3	4	5	6	7
(c) destruction of needed data	1	2	3	4	5	6	7
(d) computer programs	1	2	3	4	5	6	7
(e) evaluation of data processing organisation	1	2	3	4	5	6	7
(f) evaluation of data processing personnel	1	2	3	4	5	6	7
(g) efficiency of storage methods	1	2	3	4	5	6	7
(h) evaluation of data processing management	1	2	3	4	5	6	7
(i) other (please specify)	1	2	3	4	5	6	7
III. Reporting.	1	2	3	4	5	6	7
(a) cost efficiency	1	2	3	4	5	6	7
(b) timeliness	1	2	3	4	5	6	7
(c) format	1	2	3	4	5	6	7
(d) understandability	1	2	3	4	5	6	7
(e) relevance to manager's needs	1	2	3	4	5	6	7
(f) accuracy	1	2	3	4	5	6	7
(g) unbiased data	1	2	3	4	5	6	7
(h) completeness	1	2	3	4	5	6	7
(i) other (please specify)	1	2	3	4	5	6	7

		none			some			a great deal
IV.	Communication	1	2	3	4	5	6	7
	(a) relations between managers and data processing	1	2	3	4	5	6	7
	(b) relations between accounting and data processing	1	2	3	4	5	6	7
	(c) semantic problems in reports	1	2	3	4	5	6	7
	(d) managers' opinions of the MIS	1	2	3	4	5	6	7
	(e) other? (please specify)	1	2	3	4	5	6	7
V.	Decision-making	1	2	3	4	5	6	7
	(a) whether the reports generated lead to good decisions on the part of managers	1	2	3	4	5	6	7
	(b) whether managers get too much data	1	2	3	4	5	6	7
	(c) whether managers get all the data they need	1	2	3	4	5	6	7
	(d) whether managers use the data they receive	1	2	3	4	5	6	7
	(e) other? (please specify)	1	2	3	4	5	6	7
VI.	System design	1	2	3	4	5	6	7
	(a) whether new systems are efficiently designed	1	2	3	4	5	6	7
	(b) whether the purchase, hire, or lease of new EDP equipment is cost justified	1	2	3	4	5	6	7
	(c) whether the new systems are designed with the user in mind	1	2	3	4	5	6	7
	(d) whether the new systems are adequately explained to the users	1	2	3	4	5	6	7
	(e) whether the operation of new systems meets original specifications	1	2	3	4	5	6	7
	(f) other? (please specify)	1	2	3	4	5	6	7

16. Would you think that other managers might have similar views to those expressed above?

No		Somewhat similar				Very similar
1	2	3	4	5	6	7

That completes the questionnaire. Thank you very much for your co-operation. Your time, energy, and knowledge are greatly appreciated. Please put the completed questionnaire in its envelope and mail at the soonest convenient time.

Questionnaire for the manager with special responsibility for the MIS

Research into auditing management information systems

This questionnaire is designed to gather information on the benefits of auditing management information systems (MIS). Specifically we want the opinions of those managers with special responsibilities for management information systems.

By "management information system (MIS)", we are speaking of the formal system that collects, processes, and communicates data to managers for use in planning and control of the company's operations. The MIS generates reports such as forecasts, budgets, inventory status, labour efficiency, variance from standard costs, profit reports, etc.

MIS may be known in some organizations by other names, and in other organizations it may have no name at all. In all cases, however, it is, at least to some extent, formalised. Its end product is information that managers use for planning and controlling operations. Sometimes this may be a product of computerised systems, but it may be provided in a variety of other ways. It may also be provided on a decentralized basis by functional divisions.

Would you please answer the following questions:

1. Your Name:

2. Do you feel that the benefits of the internal audit of the MIS in the company outweigh the costs of such an audit? (Circle the number that describes your opinion)

Much less than the cost			About equal to the cost			Greatly exceed the cost
1	2	3	4	5	6	7

3. Please rank by order of importance the benefits you feel the company has gained from auditing its MIS.

   - Uncover and eliminate actions which do not conform with corporate policies and procedures.
   - Increases management control of the MIS.
   - Increases MIS efficiency (uncovers weaknesses and suggests improvements)
   - Increases understanding and utilization of MIS which leads to improved decision-making.
   - Improves timeliness, formats, and accuracy of management reports.
   - Insure and improve internal controls.
   - Other (please explain and rank)

4. Are there any additional benefits that you feel could be gained if the MIS audit approach were modified or expanded? (please explain)

5. In your opinion, do the internal auditors work closely enough with managers such as yourself? (Circle the appropriate level of closeness)

Not at all			Moderately close			Closely enough
1	2	3	4	5	6	7

6. Please describe your opinion about the internal auditors reviewing your work?

Some examples might be:

- The audit is helpful to the auditee. It is a positive management tool that aids in attention directing.
- Audits are accepted, conditional upon the auditor acting in a professional manner.
- Audits are accepted, because they are a necessary management practice.
- Audits are necessary, because objective opinions are needed.
- Internal auditors are very helpful, they always provide the auditees with useful advice and information.
- Other (please explain)

7. Do the internal auditors review the internal reports currently generated to determine whether they meet the manager's needs? YES / NO

If 'YES', (a) How do they do this?

- Questionnaire
- Mathematical models
- Other (please specify)

(b) How satisfied are you with the method used?
(Circle the number that describes your opinion)

Unsatisfied			Satisfied			Highly satisfied
1	2	3	4	5	6	7

8. Does your department try to determine if the internal reports currently generated meet manager's needs? YES / NO

If 'YES', (a) How do you do this?

- Questionnaire
- Mathematical models
- Other (please specify)

(b) How satisfied are you with the method used?
(Circle the number that describes your opinion)

Unsatisfied			Satisfied			Highly satisfied
1	2	3	4	5	6	7

9. Do the internal auditors report on the overall efficiency and effectiveness of the MIS? YES / NO

If 'YES', (a) Where do they obtain the criteria by which to make the evaluation?

(b) How do they do this?

(c) How satisfied are you with the method used? (Circle the number that describes your opinion)

Unsatisfied			Satisfied			Highly satisfied
1	2	3	4	5	6	7

10. Is there anyone else in the company who reviews the MIS (for efficiency and effectiveness)? YES / NO

If 'YES', Who?

11. Has the MIS improved because of past audits?

No			Somewhat			Very much
1	2	3	4	5	6	7

12. Do you feel that managers:

(a) Place more confidence in the reports they receive when MIS has been audited?

No			Somewhat more confidence			Much more confidence
1	2	3	4	5	6	7

(b) Make better decisions when MIS has been audited?

No better			Somewhat better			Much better
1	2	3	4	5	6	7

13. If you were to develop a guideline for evaluating the MIS for the company, how much attention would you devote to the following MIS components and problems? (Circle the number that describes the level of attention that you attach to the areas below).

	None			Some			A great deal
I. Data Collection.	1	2	3	4	5	6	7
(a) overcollection of data	1	2	3	4	5	6	7
(b) undercollection of data	1	2	3	4	5	6	7
(c) accuracy of data	1	2	3	4	5	6	7
(d) coding of data	1	2	3	4	5	6	7
(e) errors in data entry	1	2	3	4	5	6	7
(f) efficiency in data collection and entry	1	2	3	4	5	6	7
(g) evaluation of data collection and entry personnel	1	2	3	4	5	6	7
(h) evaluation of data collection and entry management	1	2	3	4	5	6	7
(i) other (please specify)	1	2	3	4	5	6	7
II. Data processing and storage.	1	2	3	4	5	6	7
(a) security	1	2	3	4	5	6	7
(b) storage of unneeded data	1	2	3	4	5	6	7
(c) destruction of needed data	1	2	3	4	5	6	7
(d) computer programs	1	2	3	4	5	6	7
(e) evaluation of data processing organisation	1	2	3	4	5	6	7
(f) evaluation of data processing personnel	1	2	3	4	5	6	7
(g) efficiency of storage methods	1	2	3	4	5	6	7
(h) evaluation of data processing management	1	2	3	4	5	6	7
(i) other (please specify)	1	2	3	4	5	6	7
III. Reporting.	1	2	3	4	5	6	7
(a) cost efficiency	1	2	3	4	5	6	7
(b) timeliness	1	2	3	4	5	6	7
(c) format	1	2	3	4	5	6	7
(d) understandability	1	2	3	4	5	6	7
(e) relevance to manager's needs	1	2	3	4	5	6	7
(f) accuracy	1	2	3	4	5	6	7
(g) unbiased data	1	2	3	4	5	6	7
(h) completeness	1	2	3	4	5	6	7
(i) other (please specify)	1	2	3	4	5	6	7

		None			Some			A great deal
IV.	Communication.	1	2	3	4	5	6	7
	(a) relations between managers and data processing	1	2	3	4	5	6	7
	(b) relations between accounting and data processing	1	2	3	4	5	6	7
	(c) semantic problems in reports	1	2	3	4	5	6	7
	(d) managers' opinions of the MIS	1	2	3	4	5	6	7
	(e) other (please specify)	1	2	3	4	5	6	7
V.	Decison-making.	1	2	3	4	5	6	7
	(a) whether the reports generated lead to good decisons on the part of managers	1	2	3	4	5	6	7
	(b) whether managers get too much data	1	2	3	4	5	6	7
	(c) whether managers get all the data they need	1	2	3	4	5	6	7
	(d) whether managers use the data they receive	1	2	3	4	5	6	7
	(e) other (please specify)	1	2	3	4	5	6	7
VI.	System design.	1	2	3	4	5	6	7
	(a) whether new systems are efficiently designed	1	2	3	4	5	6	7
	(b) whether the purchase, hire, or lease of new EDP equipment is cost justified	1	2	3	4	5	6	7
	(c) whether the new systems are designed with the user in mind	1	2	3	4	5	6	7
	(d) whether the new systems are adequately explained to the users	1	2	3	4	5	6	7
	(e) whether the operations of new systems meets original specifications	1	2	3	4	5	6	7
	(f) other (please specify)	1	2	3	4	5	6	7

14. Please circle your degree of satisfaction with the formal management information system (MIS) now in operation.

Unsatisfied			Satisfied			Highly satisfied
1	2	3	4	5	6	7

If you are not satisfied (less than 4) would you please indicate the areas where improvements are needed.

That completes the questionnaire. Thank you very much for your co-operation. Your time, energy, and knowledge are greatly appreciated. Please put the completed questionnaire in its envelope and mail at the soonest convenient time.

The City University Business School

LIONEL DENNY HOUSE, 23 GOSWELL ROAD, LONDON EC1M 7BB 01-253 4399

Follow-up letter (1) - Pilot test

January 31, 1978

Dear

You may remember we sent you four questionnaires in December. As our method allowed for anonymous replies we cannot be absolutely sure whether we have received yours back. If we have, many thanks indeed for your participation. If not, this note is just to say that their return completed would be very valuable indeed to us. Some of the questionnaires are not easy to arrange to have completed, and it is of course those questionnaires which are most valuable to us!

We have spare copies of all questionnaires if needed.

With very best wishes,
Yours sincerely,

Andrew D. Chambers
The Leverhulme Senior Research Fellow
in Internal Auditing

The City University Business School

LIONEL DENNY HOUSE, 23 GOSWELL ROAD, LONDON EC1M 7BB 01-253 4399

Follow-up letter (2) - Pilot test

January, 1978

Dear

We were very grateful for your valuable assistance in returning the following completed questionnaires:

No. 1 Internal auditor's computer questionnaire.
No. 2 Internal auditor's questionnaire.

Will you be returning the other questionnaires in due course, viz:

No. 3 Manager's questionnaire.

No. 4 Questionnaire for the manager with special responsibility for the MIS.

I realise we are asking a lot and that it is not easy for you to arrange.

We have noted to keep you posted of our research results in due course. Many thanks for all your help.

With every good wish,

Yours sincerely,

Andrew D. Chambers
The Leverhulme Senior Research Fellow
in Internal Auditing

The City University Business School

LIONEL DENNY HOUSE, 23 GOSWELL ROAD, LONDON EC1M 7BB 01-253 4399

Dear

I would greatly value it if you could find time to arrange the completion of the enclosed. The questionnaires form an essential part of two very promising PhDs, and further details are given on the cover sheet attached to each questionnaire. Your assistance would certainly be invaluable.

Strict confidentiality will be observed.

Having met you at our Audit Managers' Seminar I hope you will find another opportunity to visit CUBS in the near future.

Yours sincerely,

Andrew D. Chambers
The Leverhulme Senior Research Fellow
in Internal Auditing

ENC.

The City University Business School

LIONEL DENNY HOUSE, 23 GOSWELL ROAD, LONDON EC1M 7BB 01-253 4399

Dear

I remember you helped me on my research into employment in internal auditing and I am bold enough to request again your assistance which was so valuable.

I would greatly value it if you could find time to arrange the completion of the enclosed. The questionnaires form an essential part of two very promising PhDs, and further details are given on the cover sheet attached to each questionnaire. Strict condifentiality will be observed.

I still have some copies of the full Research Reports on 'Employment in Internal Auditing' and on 'Graduate Job Fulfilment in Internal Auditing'. These were purchased with the intention of issuing them free of charge to those who assisted me. Please let me know if you would like a copy of either or both.

Yours sincerely,

Andrew D. Chambers
The Leverhulme Senior Research Fellow
in Internal Auditing

ENC.

The City University Business School

LIONEL DENNY HOUSE, 23 GOSWELL ROAD, LONDON EC1M 7BB 01-253 4399

Dear

It would be a great help if you could arrange for the enclosed to be completed. Further details are given on their cover sheets.

The questionnaires form an essential part of two extremely promising PhDs. I do not lightly trespass upon your time, but I feel sure this will be a very worthwhile undertaking.

Confidentiality will be strictly observed.

Please let me know if you would like to be kept in touch with these studies.

With very best wishes,
Yours sincerely,

Andrew D. Chambers
The Leverhulme Senior Research Fellow
in Internal Auditing

ENC.

The City University Business School

LIONEL DENNY HOUSE, 23 GOSWELL ROAD, LONDON EC1M 7BB 01-253 4399

Dear

I would greatly value it is you were able to find time to arrange for the enclosed questionnaires to be completed. They form an essential part of a very promising Ph.D. and more details are given on the sheet attached to each questionnaire.

I do not lightly trespass on your and your colleagues' time. I feel sure this will be a most worthwhile exercise.

Yours sincerely,

Andrew D. Chambers
The Leverhulme Senior Research Fellow
in Internal Auditing

ENC.

The City University Business School

(formerly the Graduate Business Centre)

GRESHAM COLLEGE, BASINGHALL STREET, LONDON, EC2V 5AH 01-253 4399

EXT. 574

RESEARCH QUESTIONNAIRES

1. There are two Ph.D. research studies and four questionnaires. The questionnaire attached to this sheet is the one ticked below :

   - Ph.D. topic :

     "The impact of computer based accounting systems upon the work of internal and external auditors with particular reference to computer fraud."

   ☐ Questionnaire No. 1 : Internal auditor's computer questionnaire.

   - Ph.D. topic :

     "Research into auditing management information systems (MIS)."

   ☐ Questionnaire No. 2 : Internal auditor's questionnaire. (To be completed on behalf of the Chief Internal Auditor).

   ☐ Questionnaire No. 3 : Manager's questionnaire. (This questionnaire to be completed by a manager outside the internal audit department who has experienced an internal audit).

   ☐ Questionnaire No. 4 : Questionnaire for the manager with special responsibility for the MIS.

2. Each questionnaire has been pilot tested and consequently amended.

3. Each questionnaire takes about 30 minutes to complete.

4. We would be very pleased to make available to you the results of these studies in due course. Please let us know if you would like to be kept in touch.

G. Selim
S. Abu Ghaba

The City University Business School

(formerly the Graduate Business Centre)

GRESHAM COLLEGE, BASINGHALL STREET, LONDON, EC2V 5AH 01-253 4399

EXT. 574

RESEARCH QUESTIONNAIRES

1. The Ph.D. topic is :

   "Research into auditing management information systems (MIS)".

2. There are three questionnaires. The questionnaire attached to this sheet is the one ticked below :

   Internal auditor's questionnaire ☐

   (to be completed on behalf of the Chief Internal Auditor).

   Manager's questionnaire ☐

   (to be completed by a manager outside the internal audit department who has experienced an internal audit).

   Questionnaire for the manager with special responsibility for the MIS ☐

3. Each questionnaire has been pilot tested and consequently amended.

4. Each questionnaire takes about 30 minutes to complete.

5. Confidentiality of responses will be strictly observed.

6. We would be very pleased to make available to you the results of these studies in due course. Please let me know if you would like to be kept in touch.

G. Selim.

The City University Business School

LIONEL DENNY HOUSE, 23 GOSWELL ROAD, LONDON EC1M 7BB 01-253 4399

INTERNAL AUDITORS - Questionnaire

Research into auditing management information systems

This questionnaire is designed to gather information on the benefits of auditing management information systems (MIS). Specifically we want the opinions of internal auditors on the audits of management information systems in their organizations.

By "management information systems (MIS)", we are speaking of the formal system that collects, processes and communicates data to managers for use in planning and control of the company's operations. The MIS generates reports such as forecasts, budgets, inventory status, labour efficiency, variance from standard costs, profit reports, etc.

MIS may be known in some organizations by other names, and in other organizations it may have no name at all. In all cases, however, it is, at least to some extent, formalised. Its end product is information that managers use for planning and controlling operations. Sometimes this may be a product of computerised systems, but it may be provided in a variety of other ways. It may also be provided on a decentralized basis by functional divisions.

Would you please answer the following questions:

1. Your Name: Company's name:

2. How many auditing staff are employed in your department? (U.K. only)

   Full-time _____ Part-time _____

3. Is the audit of the management information system (MIS) performed as a specific audit assignment(s)? YES/NO

   If 'NO', do you audit activities related to MIS when auditing specific functions/departments in your company? YES/NO

   N.B. An audit of the data processing department would amount to an audit of a part of your company's MIS.

4. What type of audit of your company's MIS do you perform?

   - Perform only a compliance audit. That is, review the MIS to ascertain that procedures are being followed and that reports are not erroneous.
   - Perform only an operational audit of the MIS. That is evaluate the effectiveness and efficiency of the MIS.
   - Perform both compliance and operational audits.

5. Do you feel that the benefits of an operational (efficiency and effectiveness) audit of the MIS would outweigh the costs of such an audit? (Circle the number that describes your opinion)

Greatly outweigh the costs		About equal to the costs				Much less than the costs
1	2	3	4	5	6	7

6. Do you feel that a compliance audit of such a system would provide benefits in excess of the costs? (Circle the number that describes your opinion)

Greatly outweigh the costs		About equal to the costs				Much less than the costs
1	2	3	4	5	6	7

If your company does not audit its MIS (either directly or indirectly), please skip to question 26

7. In your company, how often are MIS audits performed?

   - continuously
   - at least once a year
   - every 1-2 years
   - other (please explain)

8. What proportion of your audit department's total available time is spent on auditing the MIS?

   _____ %

9. How many auditors are usually involved in an MIS audit?

_____ auditors

10. Do you draw on personnel outside the internal audit staff to work on these audits?

- No
- Computer programmers
- System designers
- Other (please explain)
- Computer analysts
- Communication experts
- Outside consultants (please describe)

11. To the best of your knowledge, please list the backgrounds (education and experience) of the individuals performing MIS audits.

12. For each of the six categories below, please rank the items listed under those categories as to how important they are in <u>your MIS audit now.</u> For example, if (c) accuracy of data, is most important, put a (1) to the left, or if it is second, put a (2) to the left, etc. <u>Also rank, from (1) to (6), each of the six major categories</u> in the order of their importance in your MIS audit.

__ I. Data collection.

____ (a) overcollection of data
____ (b) undercollection of data
____ (c) accuracy of data
____ (d) coding of data
____ (e) errors in data entry
____ (f) efficiency of data collection and entry
____ (g) evaluation of data collection and entry personnel
____ (h) evaluation of data collection and entry management
____ (i) other? (please specify and rank)

__ II. Data processing and storage

____ (a) security
____ (b) storage of unneeded data
____ (c) destruction of needed data
____ (d) computer programs
____ (e) evaluation of data processing organization
____ (f) evaluation of data processing personnel
____ (g) efficiency of storage methods
____ (h) evaluation of data processing management
____ (i) other? (please specify and rank)

__ III. Reporting

____ (a) cost efficiency

____ (b) timeliness

____ (c) format

____ (d) understandability

____ (e) relevance to manager's needs

____ (f) accuracy

____ (g) unbiased data

____ (h) completeness

____ (i) other? (please specify and rank)

__ IV. Communication.

____ (a) relations between managers and data processing

____ (b) relations between accounting and data processing

____ (c) semantics problems in reports

____ (d) managers' opinions of the MIS

____ (e) other? (please specify and rank)

__ V. Decision-making.

____ (a) whether the reports generated lead to good decisions on the part of managers

____ (b) whether managers get too much data

____ (c) whether managers get all the data they need

____ (d) whether managers use the data they receive

____ (e) other? (please specify and rank)

__ VI. MIS design.

____ (a) whether new systems are efficiently designed

____ (b) whether the purchase, hire, or lease of new EDP equipment is cost justified

____ (c) whether the new systems are designed with the user in mind

____ (d) whether the new systems are adequately explained to the users

____ (e) whether the operation of new systems meets original specifications

____ (f) other? (please specify and rank)

13. Please rank by order of importance the benefits you feel the company has gained from the operational (efficiency and effectiveness) audits of its MIS.

- Increases MIS efficiency (uncover weaknesses and suggests improvements)
- Increases manager's understanding and utilization of MIS which leads to improved decision making.
- Improves timeliness, accuracy and formats of management reports.
- Improves new systems design (especially control features)
- Improves MIS/user interface.
- Increases internal control system reliability.
- Other (please explain and rank)

14. Please do the same as above for the compliance audits of MIS.

- Confirm compliance with internal controls.
- Improve internal controls.
- Improve accuracy and reliability of the data.
- Uncover and eliminate actions which do not conform with corporate policies and procedures.
- Improve management's utilization of the MIS.
- Increase knowledge of MIS management (act as a communication link between managers and MIS management).
- Other (please explain and rank)

15. Are there any additional benefits that you feel could be gained if the MIS audit approach were modified or expanded? (please explain)

16. In your opinion, do the auditors work closely enough with the users of management reports? (managers) - (Circle the appropriate degree of closeness).

Not at all			Moderately close			Closely enough
1	2	3	4	5	6	7

17. In your opinion, do the auditors work closely enough with the MIS personnel?

Not at all			Moderately close			Closely enough
1	2	3	4	5	6	7

18. Are the internal reports that are currently generated reviewed to determine whether they meet the needs of management? YES / NO

If 'YES' (a) Where do you audit the usefulness of the reports generated by the MIS?

- at the department issuing the report ____
- at the department receiving the report ____

(b) How do you determine what data the various managers need?

- questionnaire
- mathematical models
- other (please specify)

(c) How satisfied are you with the method used?

Unsatisfied			Satisfied		Highly satisfied	
1	2	3	4	5	6	7

19. Does anyone else (such as an MIS department) try to determine if the internal reports currently generated meet the needs of management?

YES / NO

If 'YES', (a) Who?

(b) How do they do this?

- questionnaire
- mathematical models
- other (please specify)

20. Do the internal auditors report on the overall efficiency and effectiveness of the MIS? YES / NO

If 'YES', (a) Where do you obtain the criteria by which to evaluate the MIS?

(b) How do you do this?

(c) How satisfied are you with the method used?

Unsatisfied			Satisfied		Highly satisfied	
1	2	3	4	5	6	7

21. Do the auditors point out weaknesses in the current MIS?

YES / NO

22. Do the auditors make recommendations for correcting weaknesses?

YES / NO

If 'YES', what is your policy toward avoiding these recommendations hindering the auditor's objectivity and independence in subsequent audits?

23. Is there anyone else in the company who reviews the MIS (for efficiency and effectiveness)? YES / NO

If 'YES', who?

24. Do you feel that managers:

(a) place more confidence in the reports they receive when MIS has been audited?

No			Somewhat more confidence			Much more confidence
1	2	3	4	5	6	7

(b) make better decisons when MIS has been audited?

No better			Somewhat better			Much better
1	2	3	4	5	6	7

25. Has the MIS improved because of past audits?

No			Somewhat			Very much
1	2	3	4	5	6	7

26. If you were to develop the ideal operational (efficiency and effectiveness) audit of your company's MIS, how much attention would you devote to the following MIS components and problems? (Circle the number that describes the level of attention that you attach to ALL areas below - main categories (I, II, etc.) and items (a, b, etc.))

	None			Some			A great deal
I. Data collection.	1	2	3	4	5	6	7
(a) overcollection of data	1	2	3	4	5	6	7
(b) undercollection of data	1	2	3	4	5	6	7
(c) accuracy of data	1	2	3	4	5	6	7
(d) coding of data	1	2	3	4	5	6	7
(e) errors in data entry	1	2	3	4	5	6	7
(f) efficiency of data collection and entry	1	2	3	4	5	6	7

		None			Some			A great deal
(g)	evaluation of data collection and entry personnel	1	2	3	4	5	6	7
(h)	evaluation of data collection and entry management	1	2	3	4	5	6	7
(i)	other? (please specify)	1	2	3	4	5	6	7
II.	Data processing and storage.	1	2	3	4	5	6	7
(a)	security	1	2	3	4	5	6	7
(b)	storage of unneeded data	1	2	3	4	5	6	7
(c)	destruction of needed data	1	2	3	4	5	6	7
(d)	computer programs	1	2	3	4	5	6	7
(e)	evaluation of data processing organization	1	2	3	4	5	6	7
(f)	evaluation of data processing personnel	1	2	3	4	5	6	7
(g)	efficiency of storage methods	1	2	3	4	5	6	7
(h)	evaluation of data processing management	1	2	3	4	5	6	7
(i)	other? (please specify)	1	2	3	4	5	6	7
III.	Reporting.	1	2	3	4	5	6	7
(a)	cost efficiency	1	2	3	4	5	6	7
(b)	timeliness	1	2	3	4	5	6	7
(c)	format	1	2	3	4	5	6	7
(d)	understandability	1	2	3	4	5	6	7
(e)	relevance to managers' needs	1	2	3	4	5	6	7
(f)	accuracy	1	2	3	4	5	6	7
(g)	unbiased data	1	2	3	4	5	6	7
(h)	completeness	1	2	3	4	5	6	7
(i)	other? (please specify)	1	2	3	4	5	6	7
IV.	Communication.	1	2	3	4	5	6	7
(a)	relations between managers and data processing	1	2	3	4	5	6	7
(b)	relations between accounting and data processing	1	2	3	4	5	6	7
(c)	semantics problems in reports	1	2	3	4	5	6	7
(d)	managers' opinions of the MIS	1	2	3	4	5	6	7
(e)	other? (please specify)	1	2	3	4	5	6	7

		None			Some			A great deal
V.	Decision-making.	1	2	3	4	5	6	7
	(a) whether the reports generated lead to good decisions on the part of managers	1	2	3	4	5	6	7
	(b) whether managers get too much data	1	2	3	4	5	6	7
	(c) whether managers get all the data they need	1	2	3	4	5	6	7
	(d) whether managers use the data they receive	1	2	3	4	5	6	7
	(e) other? (please specify)	1	2	3	4	5	6	7
VI.	MIS design.	1	2	3	4	5	6	7
	(a) whether new systems are efficiently designed	1	2	3	4	5	6	7
	(b) whether the purchase, hire, or lease of new EDP equipment is cost justified	1	2	3	4	5	6	7
	(c) whether the new systems are designed with the user in mind	1	2	3	4	5	6	7
	(d) whether the new systems are adequately explained to the users	1	2	3	4	5	6	7
	(e) whether the operation of new systems meets original specifications	1	2	3	4	5	6	7
	(f) other? (please specify)							

27. In your company, how is the internal audit function evaluated?

Some examples might be:-

- attainment of pre-established objectives
- number of audits
- auditees action on auditor findings
- uncovering problem areas (cost savings and fraud detected)
- top management opinions
- opinions of the company's external auditors
- no formal evaluation
- other (please explain)

28. How closely do you feel your views coincide with other auditors in your company?

Not at all			Somewhat closely			Exactly
1	2	3	4	5	6	7

That completes the questionnaire. Thank you very much for your co-operation. Your time, energy and knowledge are greatly appreciated. Please put the completed questionnaire in its envelope and mail at the soonest convenient time.

The City University Business School

LIONEL DENNY HOUSE, 23 GOSWELL ROAD, LONDON EC1M 7BB 01-253 4399

MANAGER - Questionnaire

Research into auditing management information systems

This questionnaire is designed to gather information on the benefits of additing management information systems (MIS). Specifically we want the opinions of managers on the audits of management information systems in their organisations.

By "management information system (MIS)", we are speaking of the formal system that collects, processes, and communicates data to managers for use in planning and control of the company's operations. The MIS generates reports such as forecasts, budgets, inventory status, labour efficiency, variance from standard costs, profit reports, etc.

MIS may be known in some organisations by other names, and in other organisations it may have no name at all. In all cases, however, it is, at least to some extent, formalised. Its end product is information that managers use for planning and controlling operations. Sometimes this may be a product of computerised systems, but it may be provided in a variety of other ways. It may also be provided on a decentralised basis by functional divisions.

Would you please answer the following questions:

- your name
- Company's name

1. Do you use internally generated reports in order to perform some of the tasks required by your position?

YES / NO

2. How satisfied are you with the formal MIS now in operation? (Circle the number that describes your feelings.)

Unsatisfied			Satisfied			Highly satisfied
1	2	3	4	5	6	7

3. Do you feel that the benefits of an internal audit of the MIS in the company would outweigh the costs of such an audit? (Circle the number that describes your opinion.)

Much less than the cost			About equal to the cost			Greatly exceed the cost
1	2	3	4	5	6	7

4. Do internal auditors review your company's management information system (MIS) either directly as a specific audit assignment(s) or indirectly when auditing specific functions/departments in your company?

YES / NO

If your answer is NO, please skip to question 15

5. How well do you think you understand what the internal auditors do when reviewing the MIS? (Circle the number that describes your view of your level of understanding.)

Not at all			Somewhat			Very well
1	2	3	4	5	6	7

6. Please rank by order of importance the benefits you feel the company has gained from auditing its MIS

- Uncover and eliminate actions which do not conform with corporate policies and procedures
- Increases management control of the MIS
- Increases MIS efficiency (uncover weaknesses and suggests improvements)
- Increases understanding and utilization of MIS which leads to improved decision-making
- Improves timeliness, formats, and accuracy of management reports
- Insure and improve internal controls
- Other (please explain and rank)

7. Are there any additional benefits that you feel could be gained if the MIS audit approach were modified or expanded? (please explain)

8. In your opinion, do the internal auditors work closely enough with managers such as yourself? (Circle the appropriate level of closeness.)

Not at all			Moderately close			Closely enough
1	2	3	4	5	6	7

9. Do the internal auditors review your work? yes / no

If yes, please describe your opinion about this.
Some examples might be:

- The audit is helpful to the auditee. It is a positive management tool that aids in attention directing
- Audits are accepted, conditional upon the auditor acting in a professional manner
- Audits are accepted, because they are a necessary management practice
- Audits are necessary, because objective opinions are needed
- Internal auditors are very helpful, they always provide the auditees with useful advice and information
- Other (please explain)

10. Do the internal auditors review the internal reports currently generated to determine whether they meet your needs?

yes / no

if yes,

(a) How do they do this?

- Questionnaire
- Mathematical models
- Others (please specify)

(b) How satisfied are you with the method used? (Circle the number that describes your opinion.)

Unsatisfied			Satisfied			Highly satisfied
1	2	3	4	5	6	7

11. Does anyone else (such as an MIS department) try to determine if the internal reports currently generated meet your needs?

yes / no

<u>if yes</u>,

(a) Who:

(b) How do they do this?

- Questionnaire
- Mathematical models
- Others (please specify)

(c) How satisfied are you with the method used?

Unsatisfied			Satisfied			Highly satisfied
1	2	3	4	5	6	7

12. Does the audit of the MIS allow you to make better decisions?

No better			Somewhat better			Much better
1	2	3	4	5	6	7

13. Has the MIS improved because of past audits?

No			Somewhat			Very much
1	2	3	4	5	6	7

14. Do the MIS audits allow you to place more confidence in the data you receive?

No			Somewhat more			Much more
1	2	3	4	5	6	7

15. If you were to develop a guideline for evaluating the MIS for the company, how much attention would you devote to the following MIS components and problems? (Circle the number that describes the level of attention that you attach to ALL areas below - main categories (I, II, etc.) and items (a, b, etc.))

		none			some			a great deal
I.	Data collection	1	2	3	4	5	6	7
	(a) over collection of data	1	2	3	4	5	6	7
	(b) undercollection of data	1	2	3	4	5	6	7
	(c) accuracy of data	1	2	3	4	5	6	7
	(d) coding of data	1	2	3	4	5	6	7
	(e) errors in data entry	1	2	3	4	5	6	7
	(f) efficiency in data collection and entry	1	2	3	4	5	6	7
	(g) evaluation of data collection and entry personnel	1	2	3	4	5	6	7
	(h) evaluation of data collection and entry management	1	2	3	4	5	6	7
	(i) other? (please specify)	1	2	3	4	5	6	7
II.	Data processing and storage	1	2	3	4	5	6	7
	(a) security	1	2	3	4	5	6	7
	(b) storage of unneeded data	1	2	3	4	5	6	7
	(c) destruction of needed data	1	2	3	4	5	6	7
	(d) computer programs	1	2	3	4	5	6	7
	(e) evaluation of data processing organization	1	2	3	4	5	6	7
	(f) evaluation of data processing personnel	1	2	3	4	5	6	7
	(g) efficiency of storage methods	1	2	3	4	5	6	7
	(h) evaluation of data processing management	1	2	3	4	5	6	7
	(i) other? (please specify)	1	2	3	4	5	6	7
III.	Reporting	1	2	3	4	5	6	7
	(a) cost efficiency	1	2	3	4	5	6	7
	(b) timeliness	1	2	3	4	5	6	7
	(c) format	1	2	3	4	5	6	7
	(d) understandability	1	2	3	4	5	6	7
	(e) relevance to manager's needs	1	2	3	4	5	6	7
	(f) accuracy	1	2	3	4	5	6	7
	(g) unbiased data	1	2	3	4	5	6	7
	(h) completeness	1	2	3	4	5	6	7
	(i) other? (please specify)	1	2	3	4	5	6	7

		none			some			a great deal
IV.	Communication	1	2	3	4	5	6	7
	(a) relations between managers and data processing	1	2	3	4	5	6	7
	(b) relations between accounting and data processing	1	2	3	4	5	6	7
	(c) semantic problems in reports	1	2	3	4	5	6	7
	(d) managers' opinions of the MIS	1	2	3	4	5	6	7
	(e) other? (please specify)	1	2	3	4	5	6	7
V.	Decision-making	1	2	3	4	5	6	7
	(a) whether the reports generated lead to good decisions on the part of managers	1	2	3	4	5	6	7
	(b) whether managers get too much data	1	2	3	4	5	6	7
	(c) whether managers get all the data they need	1	2	3	4	5	6	7
	(d) whether managers use the data they receive	1	2	3	4	5	6	7
	(e) other? (please specify)	1	2	3	4	5	6	7
VI.	System design	1	2	3	4	5	6	7
	(a) whether new systems are efficiently designed	1	2	3	4	5	6	7
	(b) whether the purchase, hire, or lease of new EDP equipment is cost justified	1	2	3	4	5	6	7
	(c) whether the new systems are designed with the user in mind	1	2	3	4	5	6	7
	(d) whether the new systems are adequately explained to the users	1	2	3	4	5	6	7
	(e) whether the operation of new systems meets original specifications	1	2	3	4	5	6	7
	(f) other? (please specify)	1	2	3	4	5	6	7

16. Would you think that other managers might have similar views to those expressed above?

No			Somewhat similar			Very similar
1	2	3	4	5	6	7

That completes the questionnaire. Thank you very much for your co-operation. Your time, energy, and knowledge are greatly appreciated. Please put the completed questionnaire in its envelope and mail at the soonest convenient time.

The City University Business School

LIONEL DENNY HOUSE, 23 GOSWELL ROAD, LONDON EC1M 7BB 01-253 4399

Questionnaire for the manager with special responsibility for the MIS

Research into auditing management information systems

This questionnaire is designed to gather information on the benefits of auditing management information systems (MIS). Specifically we want the opinions of those managers with special responsibilities for management information systems.

By "management information system (MIS)", we are speaking of the formal system that collects, processes, and communicates data to managers for use in planning and control of the company's operations. The MIS generates reports such as forecasts, budgets, inventory status, labour efficiency, variance from standard costs, profit reports, etc.

MIS may be known in some organizations by other names, and in other organizations it may have no name at all. In all cases, however, it is, at least to some extent, formalised. Its end product is information that managers use for planning and controlling operations. Sometimes this may be a product of computerised systems, but it may be provided in a variety of other ways. It may also be provided on a decentralized basis by functional divisions.

Would you please answer the following questions:

- your name
- Company's name

1. Do you feel that the benefits of an internal audit of the MIS in the company would outweigh the costs of such an audit? (Circle the number that describes your opinion)

Much less than the cost			About equal to the cost			Greatly exceed the cost
1	2	3	4	5	6	7

2. Do internal auditors review your company's management information system (MIS) either directly as a specific audit assignment(s) or indirectly when auditing specific functions/departments in your company?

YES / NO

If your answer is NO, please skip to question 13

3. Please rank by order of importance the benefits you feel the company has gained from auditing its MIS.

- Uncover and eliminate actions which do not conform with corporate policies and procedures.
- Increases management control of the MIS.
- Increases MIS efficiency (uncovers weaknesses and suggests improvements).
- Increases understanding and utilization of MIS which leads to improved decision-making.
- Improves timeliness, formats, and accuracy of management reports.
- Insure and improve internal controls.
- Other (please explain and rank)

4. Are there any additional benefits that you feel could be gained if the MIS audit approach were modified or expanded? (please explain)

5. In your opinion, do the internal auditors work closely enough with managers such as yourself? (Circle the appropriate level of closeness).

Not at all			Moderately close			Closely enough
1	2	3	4	5	6	7

6. Please describe your opinion about the internal auditors reviewing your work?

Some examples might be:

- The audit is helpful to the auditee. It is a positive management tool that aids in attention directing.
- Audits are accepted, conditional upon the auditor acting in a professional manner.
- Audits are accepted, because they are a necessary management practice.
- Audits are necessary, because objective opinions are needed.
- Internal auditors are very helpful, they always provide the auditees with useful advice and information.
- Other (please explain)

7. Do the internal auditors review the internal reports currently generated to determine whether they meet the manager's needs? YES / NO

If 'YES', (a) How do they do this?

- Questionnaire
- Mathematical models
- Other (please specify)

(b) How satisfied are you with the method used?
(Circle the number that describes your opinion)

Unsatisfied			Satisfied			Highly satisfied
1	2	3	4	5	6	7

8. Does your department try to determine if the internal reports currently generated meet manager's needs? YES / NO

If 'YES', (a) How do you do this?

- Questionnaire
- Mathematical models
- Other (please specify)

(b) How satisfied are you with the method used?
(Circle the number that describes your opinion)

Unsatisfied			Satisfied			Highly satisfied
1	2	3	4	5	6	7

9. Do the internal auditors report on the overall efficiency and effectiveness of the MIS? YES / NO

If 'YES', (a) Where do they obtain the criteria by which to make the evaluation?

(b) How do they do this?

(c) How satisfied are you with the method used? (Circle the number that describes your opinion)

Unsatisfied			Satisfied			Highly satisfied
1	2	3	4	5	6	7

10. Is there anyone else in the company who reviews the MIS (for efficiency and effectiveness)? YES / NO

If 'YES', Who?

11. Has the MIS improved because of past audits?

No			Somewhat			Very much
1	2	3	4	5	6	7

12. Do you feel that managers:

(a) Place more confidence in the reports they receive when MIS has been audited?

No			Somewhat more confidence			Much more confidence
1	2	3	4	5	6	7

(b) Make better decisions when MIS has been audited?

No better			Somewhat better			Much better
1	2	3	4	5	6	7

13. If you were to develop a guideline for evaluating the MIS for the company, how much attention would you devote to the following MIS components and problems? (Circle the number that describes the level of attention that you attach to ALL areas below - main categories (I, II, etc.) and items (a, b, etc.))

		None			Some			A great deal
I.	Data Collection.	1	2	3	4	5	6	7
	(a) over collection of data	1	2	3	4	5	6	7
	(b) under collection of data	1	2	2	4	5	6	7
	(c) accuracy of data	1	2	3	4	5	6	7
	(d) coding of data	1	2	3	4	5	6	7
	(e) errors in data entry	1	2	3	4	5	6	7
	(f) efficiency in data collection and entry	1	2	3	4	5	6	7
	(g) evaluation of data collection and entry personnel	1	2	3	4	5	6	7
	(h) evaluation of data collection and entry management	1	2	3	4	5	6	7
	(i) other (please specify)	1	2	3	4	5	6	7
II.	Data processing and storage.	1	2	3	4	5	6	7
	(a) security	1	2	3	4	5	6	7
	(b) storage of unneeded data	1	2	3	4	5	6	7
	(c) destruction of needed data	1	2	3	4	5	6	7
	(d) computer programs	1	2	3	4	5	6	7
	(e) evaluation of data processing organization	1	2	3	4	5	6	7
	(f) evaluation of data processing personnel	1	2	3	4	5	6	7
	(g) efficiency of storage methods	1	2	3	4	5	6	7
	(h) evaluation of data processing management	1	2	3	4	5	6	7
	(i) other (please specify)	1	2	3	4	5	6	7
III.	Reporting.	1	2	3	4	5	6	7
	(a) cost efficiency	1	2	3	4	5	6	7
	(b) timeliness	1	2	3	4	5	6	7
	(c) format	1	2	3	4	5	6	7
	(d) understandability	1	2	3	4	5	6	7
	(e) relevance to manager's needs	1	2	3	4	5	6	7
	(f) accuracy	1	2	3	4	5	6	7
	(g) unbiased data	1	2	3	4	5	6	7
	(h) completeness	1	2	3	4	5	6	7
	(i) other (please specify)	1	2	3	4	5	6	7

		None			Some			A great deal
IV.	Communication.	1	2	3	4	5	6	7
	(a) relations between managers and data processing	1	2	3	4	5	6	7
	(b) relations between accounting and data processing	1	2	3	4	5	6	7
	(c) semantic problems in reports	1	2	3	4	5	6	7
	(d) managers' opinions of the MIS	1	2	3	4	5	6	7
	(e) other (please specify)	1	2	3	4	5	6	7
V.	Decison-making.	1	2	3	4	5	6	7
	(a) whether the reports generated lead to good decisons on the part of managers	1	2	3	4	5	6	7
	(b) whether managers get too much data	1	2	3	4	5	6	7
	(c) whether managers get all the data they need	1	2	3	4	5	6	7
	(d) whether managers use the data they receive	1	2	3	4	5	6	7
	(e) other (please specify)	1	2	3	4	5	6	7
VI.	System design.	1	2	3	4	5	6	7
	(a) whether new systems are efficiently designed	1	2	3	4	5	6	7
	(b) whether the purchase, hire, or lease of new EDP equipment is cost justified	1	2	3	4	5	6	7
	(c) whether the new systems are designed with the user in mind	1	2	3	4	5	6	7
	(d) whether the new systems are adequately explained to the users	1	2	3	4	5	6	7
	(e) whether the operations of new systems meets original specifications	1	2	3	4	5	6	7
	(f) other (please specify)	1	2	3	4	5	6	7

14. Please circle your degree of satisfaction with the formal management information system (MIS) now in operation.

Unsatisfied			Satisfied			Highly satisfied
1	2	3	4	5	6	7

If you are not satisfied (less than 4) would you please indicate the areas where improvements are needed.

That completes the questionnaire. Thank you very much for your co-operation. Your time, energy, and knowledge are greatly appreciated. Please put the completed questionnaire in its envelope and mail at the soonest convenient time.

The City University Business School

LIONEL DENNY HOUSE, 23 GOSWELL ROAD, LONDON EC1M 7BB 01-253 4399

Follow-up letter (1) - Final test

May 19, 1978

Dear

I recently wrote to you enclosing some questionnaires as part of a doctoral research programme on internal auditing. Please forgive me for writing to you again but it is possible my communication went astray or is still awaiting attention.

I am taking the liberty of enclosing another copy of each of the questionnaires hoping that you can arrange their completion.

We are in particular need for the questionnaires to be completed which are addressed to (a) line manager whose activity has been audited by internal audit (involving a component of reviewing his information system), and (b) a manager with special responsibility for MIS within your organisation.

The questionnaires provide opportunities to skip questions where they cannot appropriately be answered. We beleive that, in view of this, each questionnaire can be completed by most organisations.

The reason for this follow-up letter is that we badly need more completed questionnaires in order to make the results of our studies thoroughly dependable. So we would greatly value your help if at all possible.

Yours sincerely,

Andrew D. Chambers
The Leverhulme Senior Research Fellow
in Internal Auditing

ENC.

The City University Business School

LIONEL DENNY HOUSE, 23 GOSWELL ROAD, LONDON EC1M 7BB 01-253 4399

Follow-up letter (2) - Final test

May 19, 1978

Dear

I recently wrote to you enclosing some questionnaires as part of a doctoral research programme on internal auditing, and you kindly responded by completing at least one questionnaire. Thank you very much indeed for your help.

I am taking the liberty of enclosing another copy of the questionnaires which our records show that you have not returned completed, hoping that you might be able to arrange their completion.

We are still in particular need for the questionnaires to be completed which are addressed to (a) line manager whose activity has been audited by internal audit (involving a component of reviewing his information system), and (b) a manager with special responsibility for MIS within your organisation. If either of these questionnaires is enclosed its completion is desperately needed, if at all possible.

The questionnaires provide opportunities to skip questions where they cannot appropriately be answered. We believe that, in view of this, each questionnaire can be completed by most organisations.

The reason for this follow-up letter is that we badly need more completed questionnaires in order to make the results of our studies thoroughly dependable. So we would greatly value further help from you.

Please do not hesitate to phone me (Extn.397) or my PhD research students (George Selim (Information Systems) or Samir Abo Ghaba (Fraud) - both on Extn.574) if you have any queries or protests!

Yours sincerely,

Andrew D. Chambers
The Leverhulme Senior Research Fellow in Internal Auditing

ENC.

APPENDIX B

'MIS AUDIT' TEST INSTRUMENTS

Data elements and their coding

'MIS AUDIT' QUESTIONNAIRES - DATA ELEMENT CODING

No.	Name	Code	Card Column	Missing Values	Questionnaires		
					1	2	3
1	Case Number	1-999	1-3(1)	-	✓	✓	✓
2	Company's name	1-99	5-6(1)	-1	✓	✓	✓
3	Use of internal reports (Yes/No)	1/0	8 (1)	-1		✓	
4	Satisfaction with the MIS	1-7	10 (1)	-1		✓	✓
5	Improvements needed (Yes/No)	1/0	12 (1)	-1			✓
6	Benefits outweigh costs of MIS audits	1-7	14 (1)	-1		✓	✓
7	Internal auditors reviewing MIS (Yes/No)	1/0	16 (1)	-1		✓	✓
8	Number of auditing staff (Full-time)($+\frac{1}{2}$ part-time)	1-99.0	18-21(1)	-10	✓		
9	MIS audit as a specific assignment (Yes/No)	1/0	23 (1)	-1	✓		
10	Audit of MIS indirectly	1/0	25 (1)	-1	✓		
11	Type of MIS audit	1-3	27 (1)	-1	✓		
12	Benefits of operational audit outweighing costs	1-7	29 (1)	-1	✓		
13	Benefits of a compliance audit outweighing costs	1-7	31 (1)	-1	✓		
14	How often are MIS audits performed	1-9	33 (1)	-1	✓		
15	Proportion of the department's time spent in auditing MIS (Percentage)	1-100	35-37(1)	-1	✓		
16	Number of auditors involved in MIS audit	1-99	39-40(1)	-1	✓		

* Questionnaire 1 = Internal Auditor's questionnaire
'Questionnaire 2 = Manager's questionnaire
Questionnaire 3 = MIS - Manager's questionnaire

** Card number in parentheses

'MIS AUDIT' QUESTIONNAIRES - DATA ELEMENT CODING

No.	Name	Code	Card Column	Missing Values	Questionnaires 1	2	3
17	Personnel from outside the department to help (Yes/No)	1/0	42(1)	-1	✓		
18	Who are the personnel who help in MIS audits?	1-999	44-46(1)	-1	✓		
19	Background (education and experience)	1-99	48-49(1)	-1	✓		
20	Data Collection	1-6	51(1)	-1	✓		
21	Overcollection of data	1-9	53(1)	-1	✓		
22	Undercollection of data	1-9	55(1)	-1	✓		
23	Accuracy of data	1-9	57(1)	-1	✓		
24	Coding of data	1-9	59(1)	-1	✓		
25	Errors in data entry	1-9	61(1)	-1	✓		
26	Efficiency of data collection and entry	1-9	63(1)	-1	✓		
27	Evaluation of data collection and entry - personnel	1-9	65(1)	-1	✓		
28	Evaluation of data collection and entry - management	1-9	67(1)	-1	✓		
29	Other	1-9	69(1)	-1	✓		
30	Data processing and storage	1-6	71(1)	-1	✓		
31	Security	1-9	2(2)	-1	✓		
32	Storage of unneeded data	1-9	4(2)	-1	✓		
33	Destruction of needed data	1-9	6(2)	-1	✓		
34	Computer programs	1-9	8(2)	-1	✓		
35	Evaluation of data processing organisation	1-9	10(2)	-1	✓		

* Questionnaire 1 = Internal Auditor's questionnaire
Questionnaire 2 = Manager's questionnaire
Questionnaire 3 = MIS - Manager's questionnaire

** Card number in parentheses

'MIS AUDIT' QUESTIONNAIRES - DATA ELEMENT CODING

No.	Name	Code	Card Column	Missing Values	Questionnaires 1	2	3
36	Evaluation of data processing personnel	1-9	12(2)	-1	✓		
37	Efficiency of storage methods	1-9	14(2)	-1	✓		
38	Evaluation of data processing management	1-9	16(2)	-1	✓		
39	Other	1-9	18(2)	-1	✓		
40	Reporting	1-6	20(2)	-1	✓		
41	Cost efficiency	1-9	22(2)	-1	✓		
42	Timeliness	1-9	24(2)	-1	✓		
43	Format	1-9	26(2)	-1	✓		
44	Understandability	1-9	28(2)	-1	✓		
45	Relevance to manager's needs	1-9	30(2)	-1	✓		
46	Accuracy	1-9	32(2)	-1	✓		
47	Unbiased data	1-9	34(2)	-1	✓		
48	Completeness	1-9	36(2)	-1	✓		
49	Other	1-9	38(2)	-1	✓		
50	Communication	1-6	40(2)	-1	✓		
51	Relations between managers and D.P.	1-5	42(2)	-1	✓		
52	Relations between accounting and D.P.	1-5	44(2)	-1	✓		
53	Semantic problems in reports	1-5	46(2)	-1	✓		
54	Managers' opinions of MIS	1-5	48(2)	-1	✓		
55	Other	1-5	50(2)	-1	✓		

* Questionnaire 1 = Internal Auditor's questionnaire
Questionnaire 2 = Manager's questionnaire
Questionnaire 3 = MIS - Manager's questionnaire

** Card number in parentheses

'MIS AUDIT' QUESTIONNAIRES - DATA ELEMENT CODING

No.	Name	Code	Card Column	Missing Values	Questionnaires		
					1	2	3
56	Decision-making	1-6	52(2)	-1	✓		
57	Reports leading to good decisions	1-5	54(2)	-1	✓		
58	Managers get too much data	1-5	56(2)	-1	✓		
59	Managers get all the data they need	1-5	58(2)	-1	✓		
60	Managers use the date they receive	1-5	60(2)	-1	✓		
61	Other	1-5	62(2)	-1	✓		
62	MIS design	1-6	64(2)	-1	✓		
63	New systems efficiently designed	1-6	66(2)	-1	✓		
64	Purchase, hire, lease of new equipment is cost justified	1-6	68(2)	-1	✓		
65	New systems designed with the user in mind	1-6	70(2)	-1	✓		
66	New systems adequately explained to the user	1-6	72(2)	-1	✓		
67	Operation of new systems meets original specifications	1-6	2(3)	-1	✓		
68	Other	1-6	4(3)	-1	✓		
69	How well do you understand what the internal auditors do when auditing MIS	1-7	6(3)	-1	✓		
70	Benefits - increases MIS efficiency (uncover . . .)	1-7	10(3)	-1	✓	✓	✓

* Questionnaire 1 = Internal Auditor's questionnaire
Questionnaire 2 = Manager's questionnaire
Questionnaire 3 = MIS - Manager's questionnaire

** Card number in parentheses

'MIS AUDIT' QUESTIONNAIRES - DATA ELEMENT CODING

No.	Name	Code	Card Column	Missing Values	Questionnaires 1	2	3
71	Benefits - Increases utilisation of MIS which leads to improved decision-making	1-7	12(3)	-1	✓	✓	✓
72	Benefits - Improves timeliness, accuracy, formats of the reports	1-7	14(3)	-1	✓	✓	✓
73	Benefits - Improves new systems design	1-7	16(3)	-1	✓		
74	Benefits - improves MIS/user interface	1-7	18(3)	-1	✓		
75	Benefits - increases internal control system reliability	1-7	20(3)	-1	✓		
76	Other operational audit benefits	1-7	22(3)	-1	✓		
77	Benefits - Conform compliance with internal controls	1-7	24(3)	-1	✓		
78	Benefits - Insure and improve internal controls	1-7	26(3)	-1	✓	✓	✓
79	Benefits - Improve accuracy and reliability of the data	1-7	28(3)	-1	✓		
80	Benefits - Uncover and eliminate actions which do not conform to corporate policies and procedures	1-7	30(3)	-1	✓	✓	✓
81	Benefits - Improve management's utilisation of the MIS	1-7	32(3)	-1	✓		
82	Benefits - Increase knowledge of MIS management	1-7	34(3)	-1	✓		

* Questionnaire 1 = Internal Auditor's questionnaire
'Questionnaire 2 = Manager's questionnaire
Questionnaire 3 = MIS - Manager's questionnaire

** Card number in parentheses

'MIS AUDIT' QUESTIONNAIRES - DATA ELEMENT CODING

No.	Name	Code	Card Column	Missing Values	Questionnaires 1	2	3
83	Other compliance audit benefits	1-7	36(3)	-1	✓		
84	Benefits - Increase management control of the MIS	1-7	38(3)	-1		✓	✓
85	Benefits - Other benefits from managers' and MIS managers' point of view	1-7	40(3)	-1		✓	✓
86	Additional benefits (Yes/No)	1-7	42(3)	-1	✓	✓	✓
87	Work closely with managers	1-7	44(3)	-1	✓	✓	
88	Work closely with MIS personnel	1-7	46(3)	-1	✓		✓
89	Do they review your work? (Yes/no)	1/0	48(3)	-1		✓	✓
90	How do they feel about being audited?	1-99	50-51(3)	-1		✓	✓
91	Do I.A. review management reports? (Yes/No)	1/0	53(3)	-1	✓	✓	✓
92	Where do they audit the reports? 1.- department issuing the reports 2.- department receiving the reports 3.- both	1-3	55(3)	-1	✓		
93	How do they audit and review the usefulness of the reports?	1-99	57-58(3)	-1	✓	✓	✓
94	How satisfied are they with the methods used?	1-7	60(3)	-1	✓	✓	✓
95	Does anyone else review the MIS to ensure that reports meet the needs (Yes/No)	1/0	62(3)	-1	✓	✓	

* Questionnaire 1 = Internal Auditor's questionnaire
Questionnaire 2 = Manager's questionnaire
Questionnaire 3 = MIS - Manager's questionnaire

** Card number in parentheses

'MIS AUDIT' QUESTIONNAIRES - DATA ELEMENT CODING

No.	Name	Code	Card Column	Missing Values	Questionnaires 1	2	3
96	Who does this review?	1-99	64-65(3)	-1	✓	✓	
97	How do they do this review?	1-99	67-68(3)	-1	✓	✓	
98	How satisfied are they with the methods?	1-7	70(3)	-1		✓	
99	Does the MIS dept. review the reports currently generated to determine . . . (Yes/No)	1/0	72(3)	-1			✓
100	How do they determine this?	1-99	1-2(4)	-1			✓
101	How satisfied are they with the methods used?	1-7	4(4)	-1			✓
102	Internal auditors reviewing MIS for efficiency and effectiveness (Yes/No)	1/0	6(4)	-1	✓		✓
103	Where do they obtain the criteria?	1-99	8-9(4)	-1	✓		✓
104	How do they do this review?	1-99	11-12(4)	-1	✓		✓
105	How satisfied are they with the methods used?	1-7	14(4)	-1	✓		✓
106	Do I.A. point out weaknesses in MIS?	1/0	16(4)	-1	✓		
107	Do I.A. make recommendations?	1/0	18(4)	-1	✓		
108	How do they avoid these recommendations hindering ..? (Yes/No)	1/0	20(4)	-1	✓		
109	Is there anyone else in the company who reviews MIS for efficiency and effectiveness?	1/0	22(4)	-1	✓		✓

* Questionnaire 1 = Internal Auditor's questionnaire
Questionnaire 2 = Manager's questionnaire
Questionnaire 3 = MIS - Manager's questionnaire

** Card number in parentheses

'MIS AUDIT' QUESTIONNAIRES - DATA ELEMENT CODING

No.	Name	Code	Card Column	Missing Values	Questionnaires 1	2	3
110	Who?	1-99	24-25(4)	-1	✓		✓
111	MIS audit results in managers having more confidence in the data they receive	1-7	27(4)	-1	✓	✓	✓
112	Managers make better decisions	1-7	29(4)	-1	✓	✓	✓
113	MIS improved because of past audits	1-7	31(4)	-1	✓	✓	✓
114	Data Collection - (Ideal)	1-7	33(4)	-1	✓	✓	✓
115	Over collection of data-(Ideal)	1-7	35(4)	-1	✓	✓	✓
116	Undercollection of data-(Ideal)	1-7	37(4)	-1	✓	✓	✓
117	Accuracy of data -(Ideal)	1-7	39(4)	-1	✓	✓	✓
118	Coding of data -(Ideal)	1-7	41(4)	-1	✓	✓	✓
119	Errors in data entry -(Ideal)	1-7	43(4)	-1	✓	✓	✓
120	Efficiency of data collection and entry -(Ideal)	1-7	45(4)	-1	✓	✓	✓
121	Evaluation of data collection and entry personnel -(Ideal)	1-7	47(4)	-1	✓	✓	✓
122	Evaluation of data collection and entry management -(Ideal)	1-7	49(4)	-1	✓	✓	✓
123	Other -(Ideal)	1-7	51(4)	-1	✓	✓	✓
124	Data Processing and Storage -(Ideal)	1-7	53(4)	-1	✓	✓	✓
125	Security -(Ideal)	1-7	55(4)	-1	✓	✓	✓
126	Storage of unneeded data(Ideal)	1-7	57(4)	-1	✓	✓	✓
127	Destruction of needed data (Ideal)	1-7	59(4)	-1	✓	✓	✓

* Questionnaire 1 = Internal Auditor's questionnaire
Questionnaire 2 = Manager's questionnaire
Questionnaire 3 = MIS - Manager's questionnaire

** Card number in parentheses

'MIS AUDIT' QUESTIONNAIRES - DATA ELEMENT CODING

No.	Name	Code	Card Column	Missing Values	Questionnaires		
					1	2	3
128	Computer programs -(Ideal)	1-7	61(4)	-1	✓	✓	✓
129	Evaluation of D.P. organisation -(Ideal)	1-7	63(4)	-1	✓	✓	✓
130	Evaluation of D.P. personnel -(Ideal)	1-7	65(4)	-1	✓	✓	✓
131	Efficiency of storage methods -(Ideal)	1-7	67(4)	-1	✓	✓	✓
132	Evaluation of D.P. management -(Ideal)	1-7	69(4)	-1	✓	✓	✓
133	Other -(Ideal)	1-7	71(4)	-1	✓	✓	✓
134	Reporting -(Ideal)	1-7	2(5)	-1	✓	✓	✓
135	Cost efficiency -(Ideal)	1-7	4(5)	-1	✓	✓	✓
136	Timeliness -(Ideal)	1-7	6(5)	-1	✓	✓	✓
137	Format -(Ideal)	1-7	8(5)	-1	✓	✓	✓
138	Understandability -(Ideal)	1-7	10(5)	-1	✓	✓	✓
139	Relevance to managers' needs -(Ideal)	1-7	12(5)	-1	✓	✓	✓
140	Accuracy -(Ideal)	1-7	14(5)	-1	✓	✓	✓
141	Unbiased data -(Ideal)	1-7	16(5)	-1	✓	✓	✓
142	Completeness -(Ideal)	1-7	18(5)	-1	✓	✓	✓
143	Other -(Ideal)	1-7	20(5)	-1	✓	✓	✓
144	Communication -(Ideal)	1-7	22(5)	-1	✓	✓	✓
145	Relations between managers and D.P. -(Ideal)	1-7	24(5)	-1	✓	✓	✓
146	Relations between accounting and D.P. -(Ideal)	1-7	26(5)	-1	✓	✓	✓

* Questionnaire 1 = Internal Auditor's questionnaire
Questionnaire 2 = Manager's questionnaire
Questionnaire 3 = MIS - Manager's questionnaire

** Card number in parentheses

'MIS AUDIT' QUESTIONNAIRES - DATA ELEMENT CODING

No.	Name	Code	Card Column	Missing Values	Questionnaires 1	2	3
147	Semantic problems in reports -(Ideal)	1-7	28(5)	-1	✓	✓	✓
148	Managers' opinions of the MIS -(Ideal)	1-7	30(5)	-1	✓	✓	✓
149	Other -(Ideal)	1-7	32(5)	-1	✓	✓	✓
150	Decision-making -(Ideal)	1-7	34(5)	-1	✓	✓	✓
151	Reports leading to good decisions -(Ideal)	1-7	36(5)	-1	✓	✓	✓
152	Managers getting too much data -(Ideal)	1-7	38(5)	-1	✓	✓	✓
153	Managers getting all the data they need -(Ideal)	1-7	40(5)	-1	✓	✓	✓
154	Managers use the data they get -(Ideal)	1-7	42(5)	-1	✓	✓	✓
155	Other -(Ideal)	1-7	44(5)	-1	✓	✓	✓
156	MIS design -(Ideal)	1-7	46(5)	-1	✓	✓	✓
157	New systems efficiently designed -(Ideal)	1-7	48(5)	-1	✓	✓	✓
158	Purchase, hire, lease of EDP equipment cost justified -(Ideal)	1-7	50(5)	-1	✓	✓	✓
159	New systems designed with the user in mind -(Ideal)	1-7	52(5)	-1	✓	✓	✓
160	New systems adequately explained to the users-(Ideal)	1-7	54(5)	-1	✓	✓	✓
161	Operation of new systems meets original specification-(Ideal)	1-7	56(5)	-1	✓	✓	✓

* Questionnaire 1 = Internal Auditor's questionnaire
Questionnaire 2 = Manager's questionnaire
Questionnaire 3 = MIS - Manager's questionnaire

** Card number in parentheses

'MIS AUDIT' QUESTIONNAIRES - DATA ELEMENT CODING

No.	Name	Code	Card Column	Missing Values	Questionnaires 1	2	3
162	Other (Ideal)	1-7	58(5)	-1	✓	✓	✓
163	Internal audit department evaluated and how	1-999	60-62(5)	-1	✓		
164	How closely do you feel that your views coincide with ...	1-7	64(5)	-1	✓	✓	
165	Subfiles	1-3	2(6)		✓	✓	✓
166	Turnover last year (in 000 pounds)	1.000-9000000.000	4-14(6)	-10	✓	✓	✓
167	Number of employees last year (in 000 employees)	1.000-900.000	16-22(6)	-10	✓	✓	✓
168	Profit before tax and interest first year (in 000 pounds)	(+)(-)1.000 to (+)(-)100000.000	24-34(6)	-10	✓	✓	✓
169	Net assets first year (in 000 pounds)	1.000 to 100000.000	36-46(6)	-10	✓	✓	✓
170	Profit . . . second year (in 000 pounds)	11 columns	48-58(6)	-10	✓	✓	✓
171	Net assets second year (in 000 pounds)	11 columns	60-70(6)	-10	✓	✓	✓
172	Profit . . . third year (in 000 pounds)	11 columns	1-11(7)	-10	✓	✓	✓
173	Net Assets third year (in 000 pounds)	11 columns	13-23(7)	-10	✓	✓	✓

* Questionnaire 1 = Internal Auditor's questionnaire
Questionnaire 2 = Manager's questionnaire
Questionnaire 3 = MIS - Manager's questionnaire

** Card number in parentheses

'MIS AUDIT' QUESTIONNAIRES -
DATA ELEMENT CODING

No.	Name	Code	Card Column	Missing Values	Questionnaires 1	2	3
174	Profit . . . fourth year (in 000 pounds)	11 columns	25-35(7)	-10	✓	✓	✓
175	Net Assets fourth year (in 000 pounds)	11 columns	37-47(7)	-10	✓	✓	✓

* Questionnaire 1 = Internal Auditor's questionnaire
Questionnaire 2 = Manager's questionnaire
Questionnaire 3 = MIS - Manager's questionnaire

** Card number in parentheses

APPENDIX C

"M.I. EVALUATION" TEST INSTRUMENT

Intuitive construction of SD scales

Pilot test questionnaire

Final test questionnaire

Intuitive Construction of SD Scales

Please judge the following bi-polar adjectives for their relevance in reflecting the attributes of a report (internally generated in a company, used by managers for planning and controlling their operations).

The attributes in question are:

1. Quantity of data contained in the report.
2. Format of the report.
3. Reliability (or accuracy) of the data contained in the report.
4. Timeliness of the report, refers to the period covered by the report and the time needed for processing and distributing the report.
5. Cost (to the user), refers to the non-economic cost, i.e. the user's time and effort expended in extracting information from the report.

The procedure to be followed for each bi-polar adjective is as follows:

- Put a (✓) under the attribute you think is most reflected by the adjective.
- If you consider the adjective unrelated to any of the attributes, please put (✓) under the N/A (not applicable).
- If you cannot decide, make no entry.

Bi-polar adjective	Quantity	Format	Reliability (accuracy)	Timeliness	Cost	N/A
Adequate - Inadequate						
Obscure - Precise						
Descriptive - Non-descriptive						
Clear - Unclear						
Opportune - Inopportune						
Readable - Unreadable						
Efficient - Inefficient						
Complete - Incomplete						
Accurate - Inaccurate						
Reliable - Unreliable						
Current - Outdated						
Concise - Redundant						
Enough - Insufficient						
Logical - Illogical						
Ordered - Disordered						
Valid - Invalid						
Timely - Untimely						

Bi-polar adjective	Quantity	Format	Reliability (accuracy)	Timeliness	Cost	N/A
Full - Sparse						
Appropriate - Inappropriate						
Simple - Complex						
Detailed - General						
True - False						
Concise - Rambling						
Organized - Disorganized						
Coherent - Incoherent						
Ambiguous - Unambiguous						
Up-to-date - Out-dated						
Sufficient - Insufficient						
Structured - Unstructured						
Consistent - Inconsistent						
Trustworthy - Untrustworthy						
Recent - Past						
Enough - Not enough						
Methodical - Unmethodical						
Systematic - Unsystematic						

Bi-polar adjective	Quantity	Format	Reliability (accuracy)	Timeliness	Cost	N/A
Precise - Vague (imprecise)						
Well timed - Ill timed						
Workable - Unworkable						
Superficial - In depth						
Specific - General						
Lucid - Opaque						
Confirmed - Unconfirmed						
Authentic - Unauthentic						
New - Old						
Productive - Unproductive						
Detailed - Sketchy						
Exact - Inexact						
Slight - Weighty						
Well-constructed - Ill-constructed						
Certain - Uncertain						

Bi-polar adjective	Quantity	Format	Reliability (accuracy)	Timeliness	Cost	N/A
Correct - Incorrect						
Fluent - Hesitant						
Right - Wrong						

That completes the questionnaire. Thank you very much for your co-operation. Your time, energy, and knowledge are greatly appreciated.

The City University Business School

(formerly the Graduate Business Centre)

LIONEL DENNY HOUSE, 23 GOSWELL ROAD, LONDON EC1M 7BB 01-253 4399

Branch title:

About your job

1. Present job title:

2. Length of time in your present appointment: ..... years

3. What is the staff establishment of your branch? ..... people

4. How long since you were first appointed to a grade 11 position, or equivalent: ..... years

5. In your working career, have you ever had any formal involvement in the design and development of an information system? Yes/No

About the objectives of the and reports

6. In relation to your area of responsibility, please use the scale below to indicate how well you think the two series of reports meet the following objectives (circle the number that describes your opinion):

   (a) provide information to monitor performance
   (b) provide information for planning future operations

	Not at all			Somewhat			Very well
reports	1	2	3	4	5	6	7
reports	1	2	3	4	5	6	7

About the reports

Assume, that in future you would receive these reports only if you contracted on a commercial basis with the Management Information Department for the continued provision of the reports.

(Of course, no such plans exist and you are asked to make this assumption purely as a basis for answering the questions that follow)

7. What is the maximum amount you would be ready to pay annually for each series of reports for your use (e.g. £0, £50, £100, £200, £500, £1,000 £10,000 or more)?

reports £ ..... per year

reports £ ..... per year

8. Having established a value of each of these series of reports for your annual use, please check which basis you used for establishing your estimate of value.

	reports	reports
(a) Based on the cost of adding personnel in your department to collect and compile the data in report form for your use:	....	....
(b) Based on the value of time saved toward preparedness for taking decisions and implementing them:	....	....
(c) Based on a percentage of the gross revenue of your branch (including interest):	....	....
(d) Based on a percentage of the gross costs of your branch (including interest):	....	....
(e) Based on the cost of lack of preparedness or poor performance of your operations:	....	....
(f) Based on a percentage of your annual salary (i.e. the monetary value of your organizational position). Implied is that current information assists you in maintaining or improving your organizational position:	....	....
(g) Based on other factors (please specify)		

How you feel about these reports

9. The following section contains a list of scales. You are asked to judge the reports on each of the scales by placing an (X) in the appropriate space.

For example, if you consider that a series of reports is very closely related to either end of the scale, place your (X) in the space adjacent to that end, e.g.:

Here or Here

relevant (X) ( ) ( ) ( ) ( ) ( ) (X) irrelevant

If you consider that it is quite closely related to either end of the scale, place an (X) in the second space adjacent to the end, e.g.:

Here or Here

relevant ( ) (X) ( ) ( ) ( ) (X) ( ) irrelevant

If you consider that it is slightly related to either end of the scale, place your (X) in the third space adjacent to the end, e.g.:

Here or Here

relevant ( ) ( ) (X) ( ) (X) ( ) ( ) irrelevant

If you consider it to be neutral on the scale, or the descriptive word or phrase is completely unrelated to the reports, then check the centre space on the scale, e.g.:

relevant ( ) ( ) ( ) (X) ( ) ( ) ( ) irrelevant

General instructions

- MARK EVERY SCALE
- FOR EACH SCALE, PLEASE PUT THE (X) IN ONE OF THE ALLOWED SPACES
- WORK QUICKLY, (your first impression is what is wanted)
- MAKE EACH ITEM A SEPARATE AND INDEPENDENT JUDGMENT
- WATCH IT! (good answers are not always on the left)

How you feel about reports ____:

	very	quite	slightly	neutral	slightly	quite	very	
Important	( )	( )	( )	( )	( )	( )	( )	Unimportant
Worthless	( )	( )	( )	( )	( )	( )	( )	Valuable
Accurate	( )	( )	( )	( )	( )	( )	( )	Inaccurate
Ordered	( )	( )	( )	( )	( )	( )	( )	Disordered
Outdated	( )	( )	( )	( )	( )	( )	( )	Current
Meaningful	( )	( )	( )	( )	( )	( )	( )	Meaningless
Inefficient	( )	( )	( )	( )	( )	( )	( )	Efficient
Immaterial	( )	( )	( )	( )	( )	( )	( )	Material
Complete	( )	( )	( )	( )	( )	( )	( )	Incomplete
Disorganized	( )	( )	( )	( )	( )	( )	( )	Organized
Desirable	( )	( )	( )	( )	( )	( )	( )	Undesirable
Effective	( )	( )	( )	( )	( )	( )	( )	Ineffective
Unreliable	( )	( )	( )	( )	( )	( )	( )	Reliable
Appropriate	( )	( )	( )	( )	( )	( )	( )	Inappropriate
Insufficient	( )	( )	( )	( )	( )	( )	( )	Sufficient
Applicable	( )	( )	( )	( )	( )	( )	( )	Inapplicable
Ill-timed	( )	( )	( )	( )	( )	( )	( )	Well-timed
Unproductive	( )	( )	( )	( )	( )	( )	( )	Productive
Incorrect	( )	( )	( )	( )	( )	( )	( )	Correct
Simple	( )	( )	( )	( )	( )	( )	( )	Complex
Relevant	( )	( )	( )	( )	( )	( )	( )	Irrelevant
Well-constructed	( )	( )	( )	( )	( )	( )	( )	Ill-constructed
Unconfirmed	( )	( )	( )	( )	( )	( )	( )	Confirmed
Uninformative	( )	( )	( )	( )	( )	( )	( )	Informative
Trustworthy	( )	( )	( )	( )	( )	( )	( )	Untrustworthy
Inopportune	( )	( )	( )	( )	( )	( )	( )	Opportune
Necessary	( )	( )	( )	( )	( )	( )	( )	Unnecessary
Workable	( )	( )	( )	( )	( )	( )	( )	Unworkable
Non-beneficial	( )	( )	( )	( )	( )	( )	( )	Beneficial
Timely	( )	( )	( )	( )	( )	( )	( )	Untimely
Inadequate	( )	( )	( )	( )	( )	( )	( )	Adequate
General	( )	( )	( )	( )	( )	( )	( )	Detailed
Supportive	( )	( )	( )	( )	( )	( )	( )	Non-supportive
Not enough	( )	( )	( )	( )	( )	( )	( )	Enough

How you feel about reports _____:

10. Now, please judge these reports in the same manner as described for the previous question.

	very	quite	slightly	neutral	slightly	quite	very	
Meaningless	( )	( )	( )	( )	( )	( )	( )	Meaningful
Material	( )	( )	( )	( )	( )	( )	( )	Immaterial
Undesirable	( )	( )	( )	( )	( )	( )	( )	Desirable
Outdated	( )	( )	( )	( )	( )	( )	( )	Current
Ordered	( )	( )	( )	( )	( )	( )	( )	Disordered
Accurate	( )	( )	( )	( )	( )	( )	( )	Inaccurate
Worthless	( )	( )	( )	( )	( )	( )	( )	Valuable
Important	( )	( )	( )	( )	( )	( )	( )	Unimportant
Productive	( )	( )	( )	( )	( )	( )	( )	Unproductive
Ill-constructed	( )	( )	( )	( )	( )	( )	( )	Well-constructe
Untrustworthy	( )	( )	( )	( )	( )	( )	( )	Trustworthy
Informative	( )	( )	( )	( )	( )	( )	( )	Uninformative
Unworkable	( )	( )	( )	( )	( )	( )	( )	Workable
Adequate	( )	( )	( )	( )	( )	( )	( )	Inadequate
Detailed	( )	( )	( )	( )	( )	( )	( )	General
Non-supportive	( )	( )	( )	( )	( )	( )	( )	Supportive
Enough	( )	( )	( )	( )	( )	( )	( )	Not enough
Untimely	( )	( )	( )	( )	( )	( )	( )	Timely
Incomplete	( )	( )	( )	( )	( )	( )	( )	Complete
Efficient	( )	( )	( )	( )	( )	( )	( )	Inefficient
Organized	( )	( )	( )	( )	( )	( )	( )	Disorganized
Ineffective	( )	( )	( )	( )	( )	( )	( )	Effective
Reliable	( )	( )	( )	( )	( )	( )	( )	Unreliable
Inappropriate	( )	( )	( )	( )	( )	( )	( )	Appropriate
Sufficient	( )	( )	( )	( )	( )	( )	( )	Insufficient
Inapplicable	( )	( )	( )	( )	( )	( )	( )	Applicable
Well-timed	( )	( )	( )	( )	( )	( )	( )	Ill-timed
Correct	( )	( )	( )	( )	( )	( )	( )	Incorrect
Complex	( )	( )	( )	( )	( )	( )	( )	Simple
Irrelevant	( )	( )	( )	( )	( )	( )	( )	Relevant
Confirmed	( )	( )	( )	( )	( )	( )	( )	Unconfirmed
Opportune	( )	( )	( )	( )	( )	( )	( )	Inopportune
Unnecessary	( )	( )	( )	( )	( )	( )	( )	Necessary
Beneficial	( )	( )	( )	( )	( )	( )	( )	Non-Beneficial

About custom-tailored reports

The following assumptions apply to this section only:

(a) Assume, that you could have the reports exactly as you would like them. In other words, their format, quantity of data, timeliness, and reliability would be tailored to meet your needs.

(b) Next, assume that plans exist for you to contract commercially with the Management Information Department on an annual subscription basis for these custom-tailored reports.

11. What would be the maximum amount you would be ready to pay annually for each series of reports for your use?

reports £ .... per year

reports £ .... per year

12. Maintaining the above assumptions, mark the scales below, in the manner described in the previous section, to evaluate the new custom-tailored reports.

For reports ____:

	very	quite	slightly	neutral	slightly	quite	very	
Unimportant	( )	( )	( )	( )	( )	( )	( )	Important
Valuable	( )	( )	( )	( )	( )	( )	( )	Worthless
Meaningless	( )	( )	( )	( )	( )	( )	( )	Meaningful
Material	( )	( )	( )	( )	( )	( )	( )	Immaterial
Desirable	( )	( )	( )	( )	( )	( )	( )	Undesirable
Ineffective	( )	( )	( )	( )	( )	( )	( )	Effective
Applicable	( )	( )	( )	( )	( )	( )	( )	Inapplicable
Irrelevant	( )	( )	( )	( )	( )	( )	( )	Relevant
Informative	( )	( )	( )	( )	( )	( )	( )	Uninformative
Necessary	( )	( )	( )	( )	( )	( )	( )	Unnecessary
Non-beneficial	( )	( )	( )	( )	( )	( )	( )	Beneficial
Supportive	( )	( )	( )	( )	( )	( )	( )	Non-supportive

For reports ____:

	very	quite	slightly	neutral	slightly	quite	very	
Inapplicable	( )	( )	( )	( )	( )	( )	( )	Applicable
Unnecessary	( )	( )	( )	( )	( )	( )	( )	Necessary
Beneficial	( )	( )	( )	( )	( )	( )	( )	Non-beneficial
Immaterial	( )	( )	( )	( )	( )	( )	( )	Material
Meaningful	( )	( )	( )	( )	( )	( )	( )	Meaningless
Relevant	( )	( )	( )	( )	( )	( )	( )	Irrelevant
Uninformative	( )	( )	( )	( )	( )	( )	( )	Informative
Undesirable	( )	( )	( )	( )	( )	( )	( )	Desirable
Important	( )	( )	( )	( )	( )	( )	( )	Unimportant
Effective	( )	( )	( )	( )	( )	( )	( )	Ineffective
Non-supportive	( )	( )	( )	( )	( )	( )	( )	Supportive
Valuable	( )	( )	( )	( )	( )	( )	( )	Worthless

About you and the reports

13. Were you consulted in any way about the design of the reports prior to their implementation?

reports yes / no

reports yes / no

14. Would you like to continue to receive the reports?

reports yes / no

reports yes / no

15. With respect to reports _____:

(a) Use the scale below to indicate your opinion about the amount of detail in the reports (circle the number that describes your opinion).

Too little			About right			Too much
1	2	3	4	5	6	7

(b) Are there any changes you would like to see to these reports? (Please use a separate sheet if required)

(c) If your answer is above (4) would you prefer a summary of controllable expenses only for your use?

yes / no

16. Which parts of the reports do you regularly review?

17. With respect to reports _____:

(a) Use the scale below to indicate your opinion about the amount of detail in these reports (circle the number that describes your opinion).

Too little			About right			Too much
1	2	3	4	5	6	7

(b) Are there any changes you would like to see to these reports? (Please use a separate sheet if required)

18. Which parts of reports do you regularly review?

19. Please make any additional comments or suggestions you have about the reports in the space below - use additional sheets if necessary. (Please remember, all specific comments will be confined to the MI Department and The City University Business School.)

That completes the questionnaire. Thank you very much for your co-operation. Your time, energy, and knowledge are greatly appreciated. Please put the completed questionnaire in its envelope and mail at the soonest convenient time.

The City University Business School

LIONEL DENNY HOUSE, 23 GOSWELL ROAD, LONDON EC1M 7BB 01-253 4399

Branch title :

About your job

1. Present job title :

2. Length of time in your present appointment : ..... years

3. (For branches and large offices only) What is the staff establishment of your branch(es) ? ..... people

4. How long since you were first appointed to a grade 11 position,or equivalent ? (For those holding grade 5-10 appointment): Please instead say how long you have held an appointment as an assistant manager in charge of a branch) ..... years

5. In your working career, have you ever had any formal involvement in the design and development of an information system ? Yes/No

About the objectives of the and reports

6. In relation to your area of responsibility, please use the scales below to indicate how well you think the two series of reports meet the following objectives (Circle the number that describes your opinion):

(a) provide information to monitor performance

	Not at all			Somewhat			Very Well
reports	1	2	3	4	5	6	7
reports	1	2	3	4	5	6	7

(b) provide information for planning future operations

reports	1	2	3	4	5	6	7
reports	1	2	3	4	5	6	7

About the reports

Assume, that in future you would receive these reports only if you contracted on a commercial basis with the Management Information Department for the continued provision of the reports,

(Of course, no such plans exist and you are asked to make this assumption purely as a basis for answering the questions that follow)

7. What is the maximum amount you would be ready to pay annually for each series of reports for your use (e.g. £0, £50, £100, £200, £500 £1000, £10,000 or more) ?

reports £ .... per year

reports £ .... per year

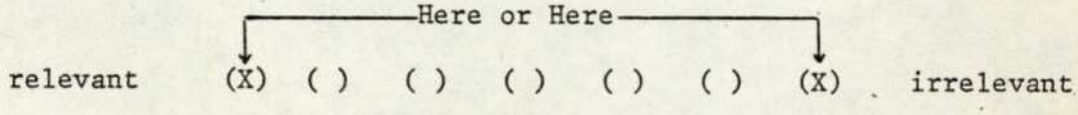
8. Having established a value of each of these series of reports for your annual use, please check one or more of the following to describe the basis you used for establishing your estimate of value.

	reports	reports
(a) Based on the cost of adding personnel in your department to collect and compile the data in report form for your use:	....	....
(b) Based on the value of time saved toward preparedness for taking decisions and implementing them:	....	....
(c) Based on a percentage of the gross revenue of your branch (including interest) :	....	....
(d) Based on a percentage of the gross costs of your branch (including interest) :	....	....
(e) Based on the cost of lack of preparedness or poor performance of your operations :	....	....
(f) Based on a percentage of your annual salary (i.e. the monetary value of your organizational position). Implied is that current information assists you in maintaining or improving your organizational position:	....	....
(g) Based on other factors (please specify)	....	....

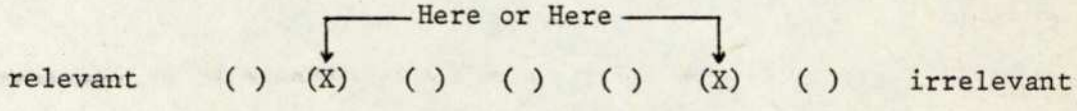
How you feel about these reports

9. The following section contains a list of scales. You are asked to judge the reports on each of the scales by placing an (X) in the appropriate space.

For example, if you consider that a series of reports is very closely related to either end of the scale, place your (X) in the space adjacent to that end, e.g. :



If you consider that it is quite closely related to either end of the scale, place an (X) in the second space adjacent to the end, e.g. :



If you consider that it is slightly related to either end of the scale, place your (X) in the third space adjacent to the end, e.g.:

Here or Here

relevant ( ) ( ) (X) ( ) (X) ( ) ( ) irrelevant

If you consider it to be neutral on the scale, or the descriptive word or phrase is completely unrelated to the reports, then check the centre space on the scale, e.g.:

relevant ( ) ( ) ( ) (X) ( ) ( ) ( ) irrelevant

General instructions

- MARK EVERY SCALE
- FOR EACH SCALE, PLEASE PUT THE (X) IN ONE OF THE ALLOWED SPACES
- WORK QUICKLY, (your first impression is what is wanted)
- MAKE EACH ITEM A SEPARATE AND INDEPENDENT JUDGMENT
- WATCH IT! (good answers are not always on the left)

How you feel about reports _____:

	very	quite	slightly	neutral	slightly	quite	very	
Important	( )	( )	( )	( )	( )	( )	( )	Unimportant
Worthless	( )	( )	( )	( )	( )	( )	( )	Valuable
Accurate	( )	( )	( )	( )	( )	( )	( )	Inaccurate
Ordered	( )	( )	( )	( )	( )	( )	( )	Disordered
Outdated	( )	( )	( )	( )	( )	( )	( )	Current
Meaningful	( )	( )	( )	( )	( )	( )	( )	Meaningless
Inefficient	( )	( )	( )	( )	( )	( )	( )	Efficient
Immaterial	( )	( )	( )	( )	( )	( )	( )	Material
Complete	( )	( )	( )	( )	( )	( )	( )	Incomplete
Disorganized	( )	( )	( )	( )	( )	( )	( )	Organized
Desirable	( )	( )	( )	( )	( )	( )	( )	Undesirable
Effective	( )	( )	( )	( )	( )	( )	( )	Ineffective
Unreliable	( )	( )	( )	( )	( )	( )	( )	Reliable
Appropriate	( )	( )	( )	( )	( )	( )	( )	Inappropriate
Insufficient	( )	( )	( )	( )	( )	( )	( )	Sufficient
Applicable	( )	( )	( )	( )	( )	( )	( )	Inapplicable
Ill-timed	( )	( )	( )	( )	( )	( )	( )	Well-timed
Unproductive	( )	( )	( )	( )	( )	( )	( )	Productive
Incorrect	( )	( )	( )	( )	( )	( )	( )	Correct
Simple	( )	( )	( )	( )	( )	( )	( )	Complex
Relevant	( )	( )	( )	( )	( )	( )	( )	Irrelevant
Well-constructed	( )	( )	( )	( )	( )	( )	( )	Ill-constructed
Unconfirmed	( )	( )	( )	( )	( )	( )	( )	Confirmed
Uninformative	( )	( )	( )	( )	( )	( )	( )	Informative
Trustworthy	( )	( )	( )	( )	( )	( )	( )	Untrustworthy
Inopportune	( )	( )	( )	( )	( )	( )	( )	Opportune
Necessary	( )	( )	( )	( )	( )	( )	( )	Unnecessary
Workable	( )	( )	( )	( )	( )	( )	( )	Unworkable
Non-beneficial	( )	( )	( )	( )	( )	( )	( )	Beneficial
Timely	( )	( )	( )	( )	( )	( )	( )	Untimely
Inadequate	( )	( )	( )	( )	( )	( )	( )	Adequate
General	( )	( )	( )	( )	( )	( )	( )	Detailed
Supportive	( )	( )	( )	( )	( )	( )	( )	Non-supportive
Not enough	( )	( )	( )	( )	( )	( )	( )	Enough

How you feel about reports _____:

10. Now, please judge these reports in the same manner as described for the previous question.

	very	quite	slightly	neutral	slightly	quite	very	
Meaningless	( )	( )	( )	( )	( )	( )	( )	Meaningful
Material	( )	( )	( )	( )	( )	( )	( )	Immaterial
Undesirable	( )	( )	( )	( )	( )	( )	( )	Desirable
Outdated	( )	( )	( )	( )	( )	( )	( )	Current
Ordered	( )	( )	( )	( )	( )	( )	( )	Disordered
Accurate	( )	( )	( )	( )	( )	( )	( )	Inaccurate
Worthless	( )	( )	( )	( )	( )	( )	( )	Valuable
Important	( )	( )	( )	( )	( )	( )	( )	Unimportant
Productive	( )	( )	( )	( )	( )	( )	( )	Unproductive
Ill-constructed	( )	( )	( )	( )	( )	( )	( )	Well-constructed
Untrustworthy	( )	( )	( )	( )	( )	( )	( )	Trustworthy
Informative	( )	( )	( )	( )	( )	( )	( )	Uninformative
Unworkable	( )	( )	( )	( )	( )	( )	( )	Workable
Adequate	( )	( )	( )	( )	( )	( )	( )	Inadequate
Detailed	( )	( )	( )	( )	( )	( )	( )	General
Non-supportive	( )	( )	( )	( )	( )	( )	( )	Supportive
Enough	( )	( )	( )	( )	( )	( )	( )	Not enough
Untimely	( )	( )	( )	( )	( )	( )	( )	Timely
Incomplete	( )	( )	( )	( )	( )	( )	( )	Complete
Efficient	( )	( )	( )	( )	( )	( )	( )	Inefficient
Organized	( )	( )	( )	( )	( )	( )	( )	Disorganized
Ineffective	( )	( )	( )	( )	( )	( )	( )	Effective
Reliable	( )	( )	( )	( )	( )	( )	( )	Unreliable
Inappropriate	( )	( )	( )	( )	( )	( )	( )	Appropriate
Sufficient	( )	( )	( )	( )	( )	( )	( )	Insufficient
Inapplicable	( )	( )	( )	( )	( )	( )	( )	Applicable
Well-timed	( )	( )	( )	( )	( )	( )	( )	Ill-timed
Correct	( )	( )	( )	( )	( )	( )	( )	Incorrect
Complex	( )	( )	( )	( )	( )	( )	( )	Simple
Irrelevant	( )	( )	( )	( )	( )	( )	( )	Relevant
Confirmed	( )	( )	( )	( )	( )	( )	( )	Unconfirmed
Opportune	( )	( )	( )	( )	( )	( )	( )	Inopportune
Unnecessary	( )	( )	( )	( )	( )	( )	( )	Necessary
Beneficial	( )	( )	( )	( )	( )	( )	( )	Non-Beneficial

About custom-tailored reports

The following assumptions apply to this section only:

(a) Assume, that you could have the reports exactly as you would like them. In other words, their format, quantity of data, timeliness, and reliability would be tailored to meet your needs.

(b) Next, assume that plans exist for you to contract commercially with the Management Information Department on an annual subscription basis for these custom-tailored reports.

11. What would be the maximum amount you would be ready to pay annually for each series of reports for your use?

reports £ .... per year

reports £ .... per year

12. Maintaining the above assumptions, mark the scales below, in the manner described in the previous section, to evaluate the new custom-tailored reports.

For reports :

	very	quite	slightly	neutral	slightly	quite	very	
Unimportant	( )	( )	( )	( )	( )	( )	( )	Important
Valuable	( )	( )	( )	( )	( )	( )	( )	Worthless
Meaningless	( )	( )	( )	( )	( )	( )	( )	Meaningful
Material	( )	( )	( )	( )	( )	( )	( )	Immaterial
Desirable	( )	( )	( )	( )	( )	( )	( )	Undesirable
Ineffective	( )	( )	( )	( )	( )	( )	( )	Effective
Applicable	( )	( )	( )	( )	( )	( )	( )	Inapplicable
Irrelevant	( )	( )	( )	( )	( )	( )	( )	Relevant
Informative	( )	( )	( )	( )	( )	( )	( )	Uninformative
Necessary	( )	( )	( )	( )	( )	( )	( )	Unnecessary
Non-beneficial	( )	( )	( )	( )	( )	( )	( )	Beneficial
Supportive	( )	( )	( )	( )	( )	( )	( )	Non-supportive

For reports :

	very	quite	slightly	neutral	slightly	quite	very	
Inapplicable	( )	( )	( )	( )	( )	( )	( )	Applicable
Unnecessary	( )	( )	( )	( )	( )	( )	( )	Necessary
Beneficial	( )	( )	( )	( )	( )	( )	( )	Non-beneficial
Immaterial	( )	( )	( )	( )	( )	( )	( )	Material
Meaningful	( )	( )	( )	( )	( )	( )	( )	Meaningless
Relevant	( )	( )	( )	( )	( )	( )	( )	Irrelevant
Uninformative	( )	( )	( )	( )	( )	( )	( )	Informative
Undesirable	( )	( )	( )	( )	( )	( )	( )	Desirable
Important	( )	( )	( )	( )	( )	( )	( )	Unimportant
Effective	( )	( )	( )	( )	( )	( )	( )	Ineffective
Non-supportive	( )	( )	( )	( )	( )	( )	( )	Supportive
Valuable	( )	( )	( )	( )	( )	( )	( )	Worthless

About you and the reports

13. Were you consulted in any way about the design of the reports prior to their implementation?

reports yes / no

reports yes / no

14. Would you like to continue to receive the reports?

reports yes / no

reports yes / no

15. With respect to reports :

(a) Use the scale below to indicate your opinion about the amount of detail in the reports (circle the number that describes your opinion).

Too little			About right			Too much
1	2	3	4	5	6	7

(b) Are there any changes you would like to see to these reports? (Please use a separate sheet if required)

(c) If your answer is above (4) would you prefer a summary of controllable expenses only for your use?

yes / no

16. Which parts of the reports do you regularly review?

17. With respect to reports :

(a) Use the scale below to indicate your opinion about the amount of detail in these reports (circle the number that describes your opinion).

Too little			About right			Too much
1	2	3	4	5	6	7

(b) Are there any changes you would like to see to these reports? (Please use a separate sheet if required)

18. Which parts of reports do you regularly review?

19. Please make any additional comments or suggestions you have about the reports in the space below - use additional sheets if necessary. (Please remember, all specific comments will be confined to the MI Department and The City University Business School.)

That completes the questionnaire. Thank you very much for your co-operation. Your time, energy, and knowledge are greatly appreciated. Please put the completed questionnaire in its envelope and mail at the soonest convenient time.

APPENDIX D

"M.I. EVALUATION" TEST INSTRUMENT

Data elements and their coding

'EVALUATION OF M.I.'QUESTIONNAIRE

DATA ELEMENT CODING

Data Element No	Name	Code	Card Column	Missing Values
1	Case number	1-90	1-2 (1)*	
2	Organisational level of managers:			
	Department type "A"	4	4 (1)	
	Departments type "B" & "C"	3		
	Departments type "D" & "E"	2		
	Department type "F"	1		
3	Time in present position	1.00-45.00	6-10 (1)	-1.00
4	Number of staff establishment	1- 500.00	12-17(1)	-1.00
5	Length of time in present positions (grade 11)	1.00-45.00	19-23(1)	-1.00
6	Participation in I.S. design	1/0	25 (1)	9
7	Meeting the objectives - first reports (control)	1-7	27 (1)	9
8	Meeting the objectives - second reports (control)	1-7	29 (1)	9
9	Meeting the objectives - first reports (planning)	1-7	31 (1)	9
10	Meeting the objectives - second reports (planning)	1-7	33 (1)	9
11	First reports - monetary value	0-10000	35-39(1)	-1
12	Second reports - monetary value	0-10000	41-45(1)	-1
13	Basis for monetary value - first reports:		47-49(1)	-1
	Adding personnel	1		
	Time saved	2		
	Percentage of gross revenue	4		
	Percentage of gross costs	8		
	Cost of poor performance	16		
	Percentage of salary	32		
	Other factors	64		
14	Adding personnel - first reports	1/0	51 (1)	9
15	Time saved - first reports	1/0	53 (1)	9
16	Percentage of gross revenue - first reports	1/0	55 (1)	9

* Card number in parentheses

Data Element No	Name	Code	Card Column	Missing Values
17	Percentage of gross costs - first reports	1/0	57 (1)*	9
18	Cost of poor performance - first reports	1/0	59 (1)	9
19	Percentage of salary - first reports	1/0	61 (1)	9
20	Other factors - first reports	1/0	63 (1)	9
21	Total number of bases - first reports	1-7	65 (1)	9
22	Basis for monetary value - second reports:		67-69(1)	-1
	Adding personnel	1		
	Time saved	2		
	Percentage of gross revenue	4		
	Percentage of gross costs	8		
	Cost of poor performance	16		
	Percentage of salary	32		
	Other factors	64		
23	Adding personnel - second reports.	1/0	71 (1)	9
24	Time saved - second reports	1/0	1 (2)	9
25	Percentage of gross revenue- second reports	1/0	3 (2)	9
26	Percentage of gross costs - second reports	1/0	5 (2)	9
27	Cost of poor performance - second reports	1/0	7 (2)	9
28	Percentage of salary - second reports	1/0	9 (2)	9
29	Other factors - second factors	1/0	11 (2)	9
30	Total number of bases - second factors	1-7	13 (2)	9
31	SDI - Important	1-7	15 (2)	9
32	SDI - Valuable	1-7	17 (2)	9
33	SDI - Meaningful	1-7	19 (2)	9
34	SDI - Material	1-7	21 (2)	9
35	SDI - Desirable	1-7	23 (2)	9
36	SDI - Effective	1-7	25 (2)	9
37	SDI - Applicable	1-7	27 (2)	9

* Card number in parentheses

No.	Data Element Name	Code	Card Column	Missing Values
38	SDI - Relevant	1-7	29 (2)*	9
39	SDI - Informative	1-7	31 (2)	9
40	SDI - Necessary	1-7	33 (2)	9
41	SDI - Beneficial	1-7	35 (2)	9
42	SDI - Supportive	1-7	37 (2)	9
43	SDI - Complete	1-7	39 (2)	9
44	SDI - Sufficient	1-7	41 (2)	9
45	SDI - Adequate	1-7	43 (2)	9
46	SDI - Enough	1-7	45 (2)	9
47	SDI - Ordered	1-7	47 (2)	9
48	SDI - Organised	1-7	49 (2)	9
49	SDI - Simple	1-7	51 (2)	9
50	SDI - Well-constructed	1-7	53 (2)	9
51	SDI - Detailed	1-7	55 (2)	9
52	SDI - Accurate	1-7	57 (2)	9
53	SDI - Reliable	1-7	59 (2)	9
54	SDI - Correct	1-7	61 (2)	9
55	SDI - Confirmed	1-7	63 (2)	9
56	SDI - Trustworthy	1-7	65 (2)	9
57	SDI - Current	1-7	67 (2)	9
58	SDI - Well-timed	1-7	69 (2)	9
59	SDI - Opportune	1-7	71 (2)	9
60	SDI - Timely	1-7	1 (3)	9
61	SDI - Efficient	1-7	3 (3)	9
62	SDI - Appropriate	1-7	5 (3)	9
63	SDI - Productive	1-7	7 (3)	9
64	SDI - Workable	1-7	9 (3)	9
65	Median - ALL first reports	1.00-7.00	11-14(3)	-1.00
66	Mean - ALL first reports	1.00-7.00	16-19(3)	-1.00
67	Standard deviation - ALL first reports	1.00-7.00	21-24(3)	-1.00
68	Median - Value first reports	1.00-7.00	26-29(3)	-1.00
69	Mean - Value first reports	1.00-7.00	31-34(3)	-1.00
70	Standard deviation - Value first reports	1.00-7.00	36-39(3)	-1.00

* Card number in parentheses

Data Element No	Name	Code	Card Column	Missing Values
71	Median - Attributes first reports	1.00-7.00	41-44(3)*	-1.00
72	Mean - Attributes first reports	1.00-7.00	46-49(3)	-1.00
73	Standard Deviation - Attributes - first reports	1.00-7.00	51-54(3)	-1.00
74	Median - Quantity first reports	1.00-7.00	56-59(3)	-1.00
75	Mean - Quantity first reports	1.00-7.00	61-64(3)	-1.00
76	Standard Deviation - Quantity first reports	1.00-7.00	66-69(3)	-1.00
77	Median - Format first reports	1.00-7.00	1-4 (4)	-1.00
78	Mean - Format first reports	1.00-7.00	6-9 (4)	-1.00
79	Standard Deviation - Format first reports	1.00-7.00	11-14(4)	-1.00
80	Median - Reliability first reports	1.00-7.00	16-19(4)	-1.00
81	Mean - Reliability first reports	1.00-7.00	21-24(4)	-1.00
82	Standard Deviation - Reliability - first reports	1.00-7.00	26-29(4)	-1.00
83	Median - Timeliness first reports	1.00-7.00	31-34(4)	-1.00
84	Mean - Timeliness first reports	1.00-7.00	36-39(4)	-1.00
85	Standard Deviation - Timeliness - first reports	1.00-7.00	41-44(4)	-1.00
86	Median - Cost first reports	1.00-7.00	46-49(4)	-1.00
87	Mean - Cost - first reports	1.00-7.00	51-54(4)	-1.00
88	Standard Deviation - Cost first reports	1.00-7.00	56-59(4)	-1.00
89	SD2 - Important	1-7	61 (4)	9
90	SD2 - Valuable	1-7	63 (4)	9
91	SD2 - Meaningful	1-7	65 (4)	9
92	SD2 - Material	1-7	67 (4)	9
93	SD2 - Desirable	1-7	69 (4)	9

* Card Number in parentheses

Data Element No	Name	Code	Card Column *	Missing Values
94	SD2 - Effective	1-7	71 (4)	9
95	SD2 - Applicable	1-7	1 (5)	9
96	SD2 - Relevant	1-7	3 (5)	9
97	SD2 - Informative	1-7	5 (5)	9
98	SD2 - Necessary	1-7	7 (5)	9
99	SD2 - Beneficial	1-7	9 (5)	9
100	SD2 - Supportive	1-7	11 (5)	9
101	SD2 - Complete	1-7	13 (5)	9
102	SD2 - Sufficient	1-7	15 (5)	9
103	SD2 - Adequate	1-7	17 (5)	9
104	SD2 - Enough	1-7	19 (5)	9
105	SD2 - Ordered	1-7	21 (5)	9
106	SD2 - Organised	1-7	23 (5)	9
107	SD2 - Simple	1-7	25 (5)	9
108	SD2 - Well-constructed	1-7	27 (5)	9
109	SD2 - Detailed	1-7	29 (5)	9
110	SD2 - Accurate	1-7	31 (5)	9
111	SD2 - Reliable	1-7	33 (5)	9
112	SD2 - Correct	1-7	35 (5)	9
113	SD2 - Confirned	1-7	37 (5)	9
114	SD2 - Trustworthy	1-7	39 (5)	9
115	SD2 - Current	1-7	41 (5)	9
116	SD2 - Well-timed	1-7	43 (5)	9
117	SD2 - Opportune	1-7	45 (5)	9
118	SD2 - Timely	1-7	47 (5)	9
119	SD2 - Efficient	1-7	49 (5)	9
120	SD2 - Appropriate	1-7	51 (5)	9
121	SD2 - Productive	1-7	53 (5)	9
122	SD2 - Workable	1-7	55 (5)	9
123	Median - ALL - Second reports	1.00-7.00	57-60(5)	-1.00
124	Mean - ALL - second reports	1.00-7.00	62-65(5)	-1.00
125	Standard deviation - ALL-second reports	1.00-7.00	67-70(5)	-1.00
126	Median - Value - second reports	1.00-7.00	1-4 (6)	-1.00

* Card number in parentheses

Data Element No	Name	Code	Card Column	Missing Values
127	Mean - Value - second reports	1.00-7.00	6-9 (6)*	-1.00
128	Standard deviation - Value - second reports	1.00-7.00	11-14 (6)	-1.00
129	Median - Attributes - second reports	1.00-7.00	16-19 (6)	-1.00
130	Mean - Attributes - second reports	1.00-7.00	21-24 (6)	-1.00
131	Standard deviation - Attributes - second reports	1.00-7.00	26-29 (6)	-1.00
132	Median - Quantity - second reports	1.00-7.00	31-34 (6)	-1.00
133	Mean - Quantity - second reports	1.00-7.00	36-39 (6)	-1.00
134	Standard deviation - Quantity - second reports	1.00-7.00	41-44 (6)	-1.00
135	Median - Format - second reports	1.00-7.00	46-49 (6)	-1.00
136	Mean - Format - second reports	1.00-7.00	51-54 (6)	-1.00
137	Standard deviation - Format - second reports	1.00-7.00	56-59 (6)	-1.00
138	Median - Reliability - second reports	1.00-7.00	61-64 (6)	-1.00
139	Mean - Reliability - second reports	1.00-7.00	66-69 (6)	-1.00
140	Standard deviation - Reliability - second reports	1.00-7.00	1-4 (7)	-1.00
141	Median -Timeliness - second reports	1.00-7.00	6-9 (7)	-1.00
142	Mean - Timeliness - second reports	1.00-7.00	11-14 (7)	-1.00
143	Standard deviation - Timeliness - second reports	1.00-7.00	16-19 (7)	-1.00
144	Median - Cost - second reports	1.00-7.00	21-24 (7)	-1.00
145	Mean - Cost - second reports	1.00-7.00	26-29 (7)	-1.00
146	Standard deviation - Cost - second reports	1.00-7.00	31-34 (7)	-1.00
147	Hypothetical - monetary value first reports	0-25000	36-40 (7)	-1
148	Hypothetical - monetary value second reports	0-20000	42-46 (7)	-1

* Card number in parentheses

DATA ELEMENT No	Name	Code	Card Column	Missing Values
149	Hyp. - SD1 Important	1-7	48 (7)*	9
150	Hyp. - SD1 Valuable	1-7	50 (7)	9
151	Hyp. - SD1 Meaningful	1-7	52 (7)	9
152	Hyp. - SD1 Material	1-7	54 (7)	9
153	Hyp. - SD1 Desirable	1-7	56 (7)	9
154	Hyp. - SD1 Effective	1-7	58 (7)	9
155	Hyp. - SD1 Applicable	1-7	60 (7)	9
156	Hyp. - SD1 Relevant	1-7	62 (7)	9
157	Hyp. - SD1 Informative	1-7	64 (7)	9
158	Hyp. - SD1 Necessary	1-7	66 (7)	9
159	Hyp. - SD1 Beneficial	1-7	68 (7)	9
160	Hyp. - SD1 Supportive	1-7	70 (7)	9
161	Median - Hyp. - SD1 (Value)	1.00-7.00	1-4(8)	-1.00
162	Mean - Hyp. - SD1 (Value)	1.00-7.00	6-9(8)	-1.00
163	Standard deviation - Hyp. - SD1 (Value)	1.00-7.00	11-14(8)	-1.00
164	Hyp. - SD2 Important	1-7*	16 (8)	9
165	Hyp. - SD2 Valuable	1-7	18 (8)	9
166	Hyp. - SD2 Meaningful	1-7	20 (8)	9
167	Hyp. - SD2 Material	1-7	22 (8)	9
168	Hyp. - SD2 Desirable	1-7	24 (8)	9
169	Hyp. - SD2 Effective	1-7	26 (8)	9
170	Hyp. - SD2 Applicable	1-7	28 (8)	9
171	Hyp. - SD2 Relevant	1-7	30 (8)	9
172	Hyp. - SD2 Informative	1-7	32 (8)	9
173	Hyp. - SD2 Necessary	1-7	34 (8)	9
174	Hyp. - SD2 Beneficial	1-7	36 (8)	9
175	Hyp. - SD2 Supportive	1-7	38 (8)	9
176	Median - Hyp.-SD2 (Value)	1.00-7.00	40-43(8)	-1.00
177	Mean - Hyp.-SD2 (Value)	1.00-7.00	45-48(8)	-1.00
178	Standard deviation - Hyp. - SD2 - (Value)	1.00-7.00	50-53(8)	-1.00
179	Consulted about first reports	1/0	55 (8)	9
180	Consulted about second reports	1/0	57 (8)	9

* Card number in parentheses

Data Element			Card	Missing
No	Name	Code	Column	Values
181	Continue receiving first reports	1/0	59 (8)*	9
182	Continue receiving second reports	1/0	61 (8)	9
183	Amount of detail in first reports	1-7	63 (8)	9
184	Any changes in first reports	1/0	65 (8)	9
185	Preferring a summary of expenses (first reports)	1/0	67 (8)	9
186	Parts review in first reports		69 (8)	9
	ALL reports	4		
	ALL expenses	3		
	ALL income	3		
	Significant items	2		
	A specific item	1		
	None	0		
187	Amount of detail in second reports	1-7	71 (8)	9
188	Any changes in second reports	1/0	1 (9)	9
189	Parts reviewed in second reports		3 (9)	9
	ALL reports	4		
	ALL advances	3		
	ALL except budget	2		
	Significant items	1		
	NONE	0		
190	Additional comments		5 (9)	9
	Comments about the questionnaire	1		
	Comments about the reports	2		
	Comments about the questionnaire/reports	3		
191	Subfiles	1-5	7 (9)	9
192	Budget (ranked)	1-6	9 (9)	9

* Card number in parentheses

BIBLIOGRAPHY

BOOKS

Anthony, R.N., Planning and control systems: A framework for analysis, Harvard University, Division of Research, Boston, 1965

Batty, J., Management Accountancy, Macdonald and Evans Ltd., London, Fourth Edition, 1975

Brink, V.Z., Cashin, J.A., and Witt, H., Modern Internal Auditing - An operational approach, The Ronald Press Co., N.Y., Third Edition, 1973

Burch, J.G., and Strater, F.R., Information Systems: Theory and Practice, Hamilton Publishing Co., Santa Barbara, California, 1974

Cadmus, B., Operational Auditing Handbook, The Institute of Internal Auditors, Florida, U.S.A., 1964

Cashin, J.A.., and Owens, G.C., Auditing, The Ronald Press Co., N.Y., Second Edition, 1963

Cattell, R.B., Factor Analysis: An Introduction and Manual for the Psychologist and Social Scientist, Greenwool Press Publishers, Connecticut, 1952

Cattell R.B., Personality and Motivation: Structure and Measurement, World Book Co., N.Y., 1957

Chambers, A.D., and Hanson, O. (Eds.), Keeping Computers under Control, Gee & Co. (Publishers) Ltd., London, 1975

Child, D., The essentials of factor analysis, Holt, Rinehart, and Winston, London, 1976

Coleman, R.J., and Riley, M.J. (Eds.) MIS: Management Dimensions, Holden-Day Inc., San Francisco, 1973

Cowan, J.L., (Ed.) Studies in Thought and Language, The University of Arizona Press, Arizona, 1970

Cushing, B.E., Accounting Information Systems and Business Organizations, Addison-Wesley Publishing Co., Massachusetts, 1978

Davis, G.B., Management Information Systems: Conceptual foundations, Structure and Development, McGraw-Hill Inc., N.Y., 1974

Dawes, R.M., Fundamentals of Attitude Measurement, John Wiley & Sons Ltd., N.Y. 1972

Emery, J.C., Organizational Planning and Control Systems: Theory and Technology, The Macmillan Co., Collier-Macmillan Ltd., London, 1969

Gibbons, J.D., Non parametric methods for quantitative analysis, Holt, Rinehart, and Winston, N.Y., 1976

Good, C.V., and Scotes, D.E., Methods of Research: Educational, Psychological and Social, Appleton-Century Craft, Inc., N.Y., 1954

Green, P.E., Robinson, P.J., and Fitzroy, P.T., Experiments on Value of Information in simulated marketing environment, Allyn and Bacon, Inc., Boston, 1967

Gregory, R.H., and Van Horn, R.L., Automatic data-processing systems: Principles and Procedures, Wandsworth Publishing Co. Inc., San Francisco, 1960

Gregory, R.H., and Van Horn, R.L., Automatic Data Processing Systems - Principles & Procedures, Wandsworth Publishing Co. Inc., California, Second Edition, 1963

Handscombe, R., (Ed.) Bankers' Management Handbook, McGraw-Hill Co. London, 1976

Harman, H.H., Modern factor analysis, The University of Chicago Press, Third Edition Revised, 1976

Hays, W.L., Statistics for the Social Sciences, Holt, Rinehart & Winston, London, 1973

Holmes, A.W., and Overmyer, W.S., Basic Auditing Principles, Richard D. Irwin, Inc., Fourth Edition, 1972

Hutchinson, J.G., Organizations: Theory and Classical concepts, Holt, Rinehart and Winston, N.Y., 1967

Jancura, E.G., and Berger, A.H., Computers - auditing & control, Auerbach Publishers Inc., Philadelphia, 1973

Johnson, J.T., and Brasseaux, J.H., (Eds.), Readings in Auditing, South-Western Publishing Co., Cincinnati, Second Edition, 1965

Lamperti, F.A., and Thurston, J.B., Internal Auditing for Management, Prentice-Hall Inc., N.Y., 1953

Lebrenton, P.P., Administrative Intelligence Information Systems, Houghton Miffin Co., Boston, 1969

Lindberg, R.A., and Cohn, T., Operations Auditing, AMACOM,1972

Littleton, A.C., Essays in Accountancy, University of Illinois Press, Urbana, Illinois, 1961

Littleton, A.C., Accounting evolution to 1900, Russell & Russell, N.Y., 1966

Littleton, A.C., and Zimmerman, V.K., Accounting Theory: Continuity and Change, Prentice-Hall Inc., N.J., 1962

McDonough, A.M., Information economics and Management Systems, McGraw-Hill Book Co., N.Y., 1963

McRae, T.W., Computers and Accounting, John Wiley & Sons, London, 1976

Mehrens, W.A., and Ebel, R.L.,(Eds.), Principles of Educational and Psychological measurement - A book of selected readings, Rand Mcnally & Co., Chicago, Illinois, 1967

Meigs, W.B., Larsen, E.J., and Meigs, R.F., Principles of Auditing, Richard D. Irwin, Inc., Illinois, Fifth Edition, 1973

Moser, C.A., and Kalton, G., Survey methods in social investigation, Heinemann Educational Books, London, Second Edition, 1977

Murphy, M.E., Advanced public accounting practice, Richard D. Irwin Inc., Illinois, 1966

Norbeck, E.F., and others (Eds.), Operational Auditing for Management Control, American Management Association, 1969

Nunnally, J.C., Psychometric Theory, McGraw-Hill Book Co., N.Y., 1967

Nunnally, J.C., Jnr., Introduction to Psychological Measurement, McGraw-Hill Book Co., N.Y., 1970

Oppenheim, A.N., Questionnaire design and attitude measurement, Heinemann Educational Books, London, First Edition, 1970

Osgood, C.E., Suci, G.J., and Tannenbaum, P.H., The measurement of meaning, University of Illinois Press, Urbana, 1957

Osgood, C.E., May, W.H., and Mirron, M.S., Cross-cultural Universals of Affective Meaning, University of Illinois Press, Chicago, 1975

Roget's Thesaurus of English Words and Phrases, Penguin Books Ltd., Middlesex, England, 1977

Roscoe, J.T., Fundamental Research Statistics; for the behavioral sciences, Holt, Rinehart and Winston, Inc.,N.Y.,1969

Rummel, R.J., Applied factor analysis, Northwestern University Press, Evanston, 1970

Samuelson, R.A., Economics: An introductory analysis, McGraw-Hill Book Co., N.Y., 1967

Sawyer, L.B., The practice of modern internal auditing, The Institute of Internal Auditors, N.Y., 1973

Schultz, R.L., and Slevin, D.P., Implementing Operations Research/Management Science, American Elsevier Publishing Co. Inc., N.Y., 1975

Shannon, C.E., and Weaver, W., The mathematical theory of communication, The University of Illinois Press, Urbana, 1962

The Shorter Oxford English Dictionary: on historical principles, prepared by Little, W., Fowler, H.W., & Coulson, J., Revised and edited by: Onions, C.T., Oxford University Press, London, 1966

Siegel, S., Nonparametric statistics for the behavioral sciences, McGraw-Hill Co. Inc., N.Y., 1956

Silvoso, J.A., and Bauer, R.D.M., Auditing, South-Western Publishing Co., Chicago, Second Edition, 1965

Simon, H.A., The New Science of Management Decisions, Harper & Row, N.Y., 1960

Snider, J.G., and Osgood, C.E. (Eds.), Semantic Differential Technique: A Source Book, Aldine Publishing Co., Chicago, 1969

Stettler, H.F., Auditing Principles, Prentice-Hall Inc., N.J., Second Edition, 1961

Summers, G.F., (Ed.), Attitude Measurement, Rand McNally & Co., Chicago, 1970

Voich, D. Jr., Mottice, H.J. and Shrode, W.A., Information Systems for Operations and Management, South-Western Publishing Co., Cincinnatti, 1975

Waldron, R.S., Spicer and Pegler's Practical Auditing, HFL (Publishers) Ltd., Sixteenth Edition, 1978

Webster's New Collegiate Dictionary, A Meriam-Webster, London, G. Bell & Sons Ltd., 1974

Yamane, T., Statistics: An Introductory Analysis, Harper & Row Publishers Inc., N.Y., Third Edition, 1973

ARTICLES

Ackoff, R.L., Towards a behavioral theory of communication, Management Sciences,Vol. IV, April 1958, Pp 218-231

Ackoff, R., Management misinformation systems, Management Sciences, December 1967, Pp B147-156

Adelberg, A.H., Auditing on the march: Ancient times to the twentieth century, The Internal Auditor, November/December 1975, Pp 35-47

Agrawal, S.P., Accounting's new role in computer-based information systems, Management Adviser, July-August 1974, Pp 40-45

Allen, J.R., The auditor's relationship to the development of data processing controls, Management Accounting, Vol. LIX, No.5, November 1977, Pp 39-42

Anderson, J.A., Information interactions and accounting information user reactions, The Accounting Review, Vol. L, No.3, July 1975, Pp 509-511

Andrus , R.R., Approaches to information evaluation, MSU Business Topics, Summer 1971, Pp 40-46

Baiman, S., The evaluation and choice of internal information systems within a multiperson world, Journal of Accounting Research, Vol. 13, No. 1, Spring 1975, Pp 1-15

Barefield, R.M., The effect of aggregation on decision-making success: A laboratory study, Journal of Accounting Research, Vol.10, No.2, Autumn 1972, Pp 229-242

Bedford, N.M., and Onsi, M., Measuring the value of information - An information theory approach, Management Services, January-February 1966, Pp 15-22

Bentley, T.J., Designing an information system that meets needs of management, Management Accounting, Vol.52, No.10, November 1974, Pp 299-303

Berdine, W.R., and Brickner, W.H., Strategic planning and attributes of external information, Managerial planning, January/February 1976, Pp 17-21

Binberg, J.G., and Nath, R., Laboratory experimentation in Accounting Research, The Accounting Review, January 1968 Pp 38-45

Bishop, E.B., Information for corporate planning, Management Accounting, Vol. 48, No.8, August 1970, Pp 295-298

Boer, G., Information science and relevant accounting reports, Management Accounting, Vol. LVII, No.10, April 1976, Pp 33-39

Bomar, S.H., Management looks to the internal auditor, The Internal Auditors Vol. XIX, Spring 1962, Pp 18-24

Bostwick, C.L., The use of information theory in accounting, Management Accounting, Section 1, Vol. XLIX, No.10, June 1968, Pp 11-17

Boulding, K.E., The Economics of knowledge and the knowledge of economics, American Economic Review, Vol. 56, No.2, 1966, Pp 1-13

Brown, J.C., Internal auditing in the seventies, The Internal Auditor, Winter 1966 Pp 10-16

Burns, W., What top management expects of internal audit now! The Internal Auditor, Vol. 32, No.3, May/June 1975, Pp 16-24

Burton, J.C., Management auditing, The Journal of Accountancy, May 1968, Pp 41-46

Butterworth, J.E., The accounting system as an information function, Journal of Accounting Research, Vol.10, No.1, Spring 1972, Pp 1-27

Bynner, J., and Coxhead, P., Some problems in the analysis of semantic differential data, Human Relations, Vol. 32, No.5, 1979, Pp 367-385

Campfield, W.L., Trends in auditing - Management plans and operations, The Journal of Accountancy, July 1967, Pp 41-46

Carlson, A., Changing role of the auditor, Journal of Systems Management, Vol. 29, No.11, November 1978, Pp 30-35

Caspari, J.A., Fundamental concepts of information theory, Management Accounting, Section 1, Vol. XLIX, No.10, June 1968, Pp 8-10

Cattell, R.F., Factor analysis: An introduction to essentials, I. The purpose and underlying models, Biometrics, Vol.21, March 1965, Pp 190-215

Cerullo, M.J., Determining post-implementation audit success, Journal of Systems Management, March 1979, Pp 27-31

Chambers, A.D., The structure of internal auditing, Accountancy, October 1974, PP 40-42

Churchill, N.C., Audit Recommendations in management audit: A case study and some remarks, Empirical Research in Accounting: Selected studies, 1967, Supplement to Vol.4 of the Journal of Accounting Research, Pp 128-151

Churchill, N.C., and Cyert, R.M., An experiment in management auditing, The Journal of Accountancy, February 1966, Pp 39-43

Cleland, D.I., and King, W.R., Competitive business intelligence systems, Business Horizons, December 1975, Pp 19-28

Cleland, D.I., and King, W.R., Information for more effective strategic planning, Long Range Planning, Vol.10, No.1, January 1977, Pp 59-64

Crandall, R.H., Information economics and its implications for the further development of accounting theory, The Accounting Review, Vol. XLIV, No.3, July 1969, Pp 457-466

Cushing, B.E., Pricing internal computer services; The basic issue, Management Accounting, Vol. LVII, No.10, April 1976, Pp 47-50

Davidson, H.J., and Truebold, R., Accounting for decision-making, The Accounting Review, October 1961, Pp 577-582

Dearden, J., Myth of real-time management information, Harvard Business Review, Vol. XLIV, No.3, May-June 1966, Pp 123-132

Dearden, J., MIS is a mirage, Harvard Business Review, Vol. 50, No.1, January-February 1972, Pp 90-99

Demski, J., Information improvement bounds, Journal of Accounting Research, Vol.10, No.1, Spring 1972, Pp 58-76

Dew, R.B., and Gee, K.P., Control information needs of middle management, Management Accounting, Vol. 50, No.4, April 1972, Pp 89-91

Dickhaut, J.W., Livingstone, J.L., and Watson, D.J.H., On the use of surrogates in behavioural experimentation, Supplement to Volume XLII of the Accounting Review, 1972 Pp 455-471

Dickson, G.W., Seun, J.A., and Chervany, N.L., Research in management information systems: The minnesota experiments, Management Science, Vol. 29, No.9, May 1977, Pp 913-923

Didis, S.K., Value analysis of information systems, Journal of Systems Management, Vol.XX, November 1969, Pp 9-11

Dodwell, J.W., Operational auditing: A part of the basic audit, The Journal of Accountancy, June 1966, Pp 31-39

Dooley, D.E., Internal auditing, The Internal Auditor, Vol. XIX, Summer 1962, Pp 12-20

Downs, P.E., Testing the upgraded semantic differential, Journal of The Market Research Society, Vol. 20, No.2, Pp 99-103

Driver, M.J., and Mock, T.J., Human information processing, decision style theory and accounting information systems, The Accounting Review, Vol. L, No.3, July 1975, Pp 490-508

Eason, K.D., Understanding the naive computer user, The computer journal, Vol. 19, No.1, February 1976, Pp 3-7

Ein-Dor, P., and Segev, E., Information-System Responsibility, MSU Business Topics, Autumn 1977, Pp 33-40

Ein-Dor, P., and Segev, E., Organizational context and the success of management information systems, Management Science, Vol. 24, No.10, June 1978, Pp 1064-1077

Elam, P.G., User-defined information system quality, Journal of Systems Management, Vol. 30, No.8, August 1979, Pp 30-33

Feltham, G.A., The Value of information, The Accounting Review, Vol.42, October 1968, Pp 684-696

Feltham, G.A., The Value of Information Systems, Journal of Systems Management, Vol. XX, November 1969, Pp 9-16

Feltham, G.A., Cost aggregation: An information economic analysis, Journal of Accounting research, Vol.15, No.1, Spring 1977, Pp 42-70

Flamholtz, E., and Cook, E., Connotative meaning and its role in accounting change: A field study, Accounting, Organizations and Society, Vol. 3, No.2, Pp 115-139

Gallagher, C.A., Perceptions of the value of MIS, Academy of Management Journal, Vol.17, No.1, March 1974, Pp 46-55

Gartenberg, M., and Randall, R.F., From EDP to MIS and beyond, Management Accounting, April 1979, Pp 13-16

Gifford, M.B.G., and James, D., Providing management with information: A methodology, Management Accounting, Vol.54, No.2, February 1976, Pp 55-58

Golembiewski, R.T., Billingsley, K., and Yeager, S., The congruence of factor-analytic structures: Comparisons of four procedures and their solutions, Academy of Management Review, Vol.1, No.3, July 1976, Pp 27-35

Green, P.E., Halbert, M.H., and Minas, J.S., An experiment in information buying, Journal of Advertising Research, Vol. 4, No.2, September 1964, Pp 17-23

Grinyer, P.H., and Norburn, D., Planning for existing markets: perceptions of executives and financial performance, Journal of The Royal Statistical Society, A, Vol.138, 1975 Pp 70-97

Hamilton, R.E., The effect of aggregation on decision-making success: A laboratory study: A comment, Journal of Accounting Research, Vol.12, No.2, Autumn 1974 Pp 355-361

Haried, A.A., The semantic dimensions of financial statements, Journal of Accounting Research, Vol.10 No.2, Autumn 1972, pp.376-391.

Haried, A.A., Measurement of meaning in financial reports, Journal of Accounting Research, Vol. 11, No.1, Spring 1973, Pp 117-145

Havlicek, L.L., and Peterson, N.L., Effect of the violation of assumptions upon significance levels of the Pearson r, Psychological Bulletin, Vol.84, No.2, 1977 Pp 373-377

Hay, L.E., What is an information system? The legal, conventional and logical constraints, Business Horizons, February 1971, Pp 65-72

Head, R.V., The elusive MIS, Data mation, September 1970, Pp 22-27

Helbreigel, D., and Slocum, J.W., Jr., Managerial problem-solving styles, Business Horizons, December 1975, PP 29-37

Henkel, R.E., Part-whole correlations and the treatment of ordinal and quasi-interval data as interval data, Pacific Sociological Review, Vol.18, No.1, January 1975, Pp 3-26

Henry, H., Information: the under-utilized asset, Accountancy Vol. 83, No.949, September 1972, Pp 18-21

Herzog, J.P., Operational audit, Journal of Systems Management, Vol. 28, No.10, October 1977, Pp 34-39

Hibbert, G., and Graham, M., The boundaries of internal auditing, Accountancy, September 1979, Pp 95-100

Higgins, J.C., The value of accuracy in information for planning and control, Long Range Planning, Vol.7, No.4, August 1974, Pp 67-72

Hilton, R.W., The determinants of cost information value: An illustrative analysis, Journal of Accounting Research, Vol.17, No.2, Autumn 1979, Pp 411-435

Hirsch, R.E., The value of information, Journal of Accounting, June 1968, Pp 41-45

Hughes, G.D., Upgrading the semantic differential, Journal of The Market Research Society, Vol.17, No.1, Pp 41-44

Hughes, J.S., Optimal timing of cost information, Journal of the Market Research Society, Vol. 13, No.2, Pp 344-349

Hutchings, T.D., Profitability through organizational effectiveness, Cost and Management, July-August 1970, Pp 5-8

Kanuk, L., and Bercuson, C., Mail surveys and response rates: A literature review, Journal of Marketing Research, Vol.X11, November 1975, Pp 440-453

Kaufman , F. Effects of EDP on internal control, The Journal of Accountancy, June 1961, Pp 47-59

King, W.R., and Cleland, D., The design of MIS: An information analysis approach, Management Science, Vol. 22, No.3, November 1975, Pp 286-297

King, W.R., and Rodriguez, J.I., Evaluating management information systems, MIS quarterly, September 1978, Pp 43-51

Kleijnen, J.P.C., Evaluation of management information systems, Omega, Vol.7, No.6, 1979, Pp 539-543

Labovitz, S., The assignment of numbers to rank order categories, American Sociological Review, Vol. 35, No.3, June 1970, Pp 515-524

Labovitz, S., Statistical usage in sociology; Sacred cows and ritual, Sociological methods & research, Vol.1, No.1, August 1972, Pp 13-37

Langenderfer, H.Q., and Robertson, J.C., A theoretical structure for independent audits of management, The Accounting Review, October 1969, Pp 777-787

Lavalle, I.H., and Rappaport, A., On the economics of acquiring information of imperfect reliability, The Accounting Review, Vol. XLIII, April 1968, Pp 225-230

Lemon, F.W., Where are we going as a profession, The Internal Auditor, Summer 1966, Pp 89-96

Libby, R., The use of simulated decision makers in information evaluation, The Accounting Review, Vol. L., No.3, July 1975, Pp 475-489

Littauer, S.B., Yegulalp, T.M., and Zahariev, G.K., A framework for optimizing managerial decision, Omega, Vol. 4, No.1, February 1976, Pp 35-48

Lorange, P., and Vancil, R.F., How to design a strategic planning system, Harvard Business Review, Vol. 54, No.5, September/October 1976, Pp 75-81

Lucas, H.C., Jr., Performance and the use of an information system, Management Science, Vol.21, No.8, April 1975, Pp 908-919

Lucas, H.C., Jr., The use of an accounting information system, action, and organizational performance, The Accounting Review, Vol. L, No.4, October 1975, Pp 735-746

McFarlan, F.W., Management audit of the EDP Department, Harvard Business Review, Vol.51, No.3, May-June 1973, Pp 131-142

McGhee, W., Shields, M.D., and Birnberg, J.G., The effects of personality on a subject's information processing, The Accounting Review, Vol. LIII, No.3, July 1978, Pp 681-697

Mancinelli, T.B., Management information systems: The trouble with them, Computers and Automation, July 1972, Pp 11-13

Marschack, J., Economics of inquiring, communicating, deciding, American Economic Review, Vol. 58, No.2, 1968, Pp 1-18

Marschack, J., Economics of Information Systems, Journal of American Statistical Association, Vol.66, March 1971, Pp 192-219

Marshall, R.M., Determining an optimal accounting information system for an unidentified user, Journal of Accounting Research, Vol. 10 No.2, Autumn 1972, Pp 286-307

Mason, J.O., Jr., Management information system - The auditor's role, The Internal Auditor, Vol. 32, No.5, September/October 1975, Pp 40-48

Mason, R.O., and Mitroff, I.I., A program for research on management information systems, Management Science, Vol.19, No.5, January 1973, Pp 475-487

Mathis, R.L., and Sutton, R.H., Performance appraisal - Part 1, Journal of Systems Management, Vol. 30, No.6, June 1979, Pp 16-18

Mathis, R.L., and Sutton, R.H., Performance appraisal - Part 2, Journal of Systems Management, Vol.30, No.7, July 1979, pp.9-1

Mathusz, D.V., The value of information concept applied to data systems, Omega, Vol.5, No.5, 1977, Pp 593-604

Mautz, R.K., and White, B.J., Internal control - a management view, Financial Executive, June 1979, Pp 12-18

Meigs, W.B., The development and role of internal auditing, The Accounting Review, Vol. XXVI, October 1951, Pp 518-523

Methven, P., Operational efficiency, Data Processing, Vol.19, No.4, April 1977, Pp 15, 19-20

Meyers, E.B., Operational auditing, The Internal Auditor, Vol. XXIII, Winter 1966, Pp 17-24

Milutinavich, J., Management information systems, 1: the factors which detsrmine the cost, Data Systems, April 1978, Pp 22-24

Milutinavich, J., Management information systems, 2: Cost benefits, Data Systems, May 1978, Pp 20-22

Mock, T.J., Concepts of information value and accounting, The Accounting Review, Vol. XLVI, No.4, October 1971, Pp 765-778

Mock, T.J., Estin, T.L., and Vasarhelyi, M.A., Learning patterns, decision approach and value of information, Journal of Accounting Research, Vol.10, No.1, Spring 1972, Pp 129-153

Morse, H.E., Jr., Performance and operational auditing, The Journal of Accountancy, June 1971, Pp 41-46

Moskowitz, H., and Miller, J.G., Information and decision systems for production planning, Management Science, Vol. 22, No.3, November 1975, Pp 359-370

Moskowitz, H., Schaefer, R.E. and Borcherding, K., 'Irrationality' of managerial judgments: Implications for information systems, The International Journal of Management Science, Vol. 4, No.2, 1976, Pp 125-140

Mueller, G.E., Blueprinting a workable MIS, Administrative Management, September 1978, Pp 24-25, 79-82

Neuschel, R.P., Unleashing computer power, Business Horizons, February 1971, Pp 81-86

Neuschel, R.P., Strengthening management information systems, The Mckinsey Quarterly, Winter 1976, Pp 46-57

Novick, M.R., and Lewis, C., Coefficient alpha and the reliability of composite measurements, Psychometrika, Vol.32, No.1, March 1967, Pp 1-13

Oliver, B.L., The Semantic Differential: A device for measuring the interprofessional communication of selected accounting concepts, Journal of Accounting Research, Vol.12, No.2, Autumn 1974, Pp 299-316

Osgood, C.E., Studies on the generality of effective meaning systems, American Psychologist, Vol.17, 1962, Pp 10-28

Panameswarau, R., Greenberg, B.A., Bellenger, D.N. and Robertson, D.H., Measuring Reliability: A comparison of alternative techniques, Journal of Marketing Research, Vol.XVI, February 1979, Pp 18-25

Paretta, R.L., The frequency of information flows: A misunderstood management variable, Management Adviser, July-August 1974, Pp 46-49

Perry, W.E., Auditability: A management concern, Financial Executive, June 1977, Pp 24-26

Peterson, R.E., The components of information, Interfaces, Vol.7, No.4, August 1977, Pp 87-91

Philip, W.G., The auditor's role in the evaluation of management performance (management audit), The Chartered Accountant in Australia, January 1971, Pp 4-11

Rao, C.R., Estimation and tests of significance in factor analysis, Psychometrika, Vol. 20, No.2, June 1955, Pp 98-111

Ricker, R.R., Data and information are they synonymous? Journal of Systems Management, September 1979, Pp 22-23

Rittenberg, L.E., and Davis, G.B., The roles of internal and external auditors in auditing EDP systems, The Journal of Accountancy, December 1977, Pp 51-58

Rittenberg, L.E., and Purdy, C.R., The internal auditor's role in MIS developments, MIS Quarterly, December 1978, Pp 47-57

Robey, D., User attitudes and management information system user, Academy of management journal, Vol.22, No.3, September 1979, Pp 527-538

Rolefson, J.F., The DP check-up, Journal of Systems Management Vol 29 No.11, November 1978, Pp 38-48

Rummel, R.J., Understanding factor analysis, Conflict Resolution, Vol. XI, No.4, 1967, Pp 444-480

Safford, H.B., Measuring cost and potential benefits of computer projects, Data management, September 1975, Pp 39-42

San Miguel, J.G., Information processing in managerial decision-making: A preliminary study, Omega, Vol.4, No.5, 1976, Pp 577-582

Scantelbury, D.L., The essential ingredient of auditing, The Internal Auditor, July/August 1970, Pp 24-32

Schewe, C.D., The management information system user: An exploratory behavioral analysis, Academy of Management Journal, Vol.19, No.4, December 1976, Pp 577-590

Schmitt, N. and Levine, R.L., Statistical and Subjective Weights: Some problems and proposals, Organizational Behavior and Human Performance, Vol.20, No.1, October 1977, Pp 15-30

Scott, G.M. and Ward, B.H., The internal audit - A tool for management control, Financial Executive, March 1978, Pp 32-37

Seppala, Y., The relative value of a management information system, a simulation study, Omega, Vol.8, No.1, 1980, Pp 39-45

Shaw, M.K., Internal auditing our promotable product, The Internal Auditor, Vol.XIX, Spring 1962, Pp 8-17

Sijthoff, J.T., The computer and marketing information systems, European Marketing Research Review, Vol.6, 1971, Pp 39-58

Smith, H.S., Cost control for computers, Business Horizons, February 1973, Pp 73-82

Sollenberger, H.M., A cost accounting framework for EDP management, Management Accounting, Vol.LIX, No.4, Pp 48-56

Stewart, D., The internal auditor of the future, The Internal Auditor, March/April 1970, Pp 46-56

Strassman, P.A., Managing the costs of information, Harvard Business Review, Vol.54, No.5, September/October 1976, Pp 133-142

Taylor, P.J., Appraising a corporate organization, The Internal Auditor, Vol.XIV, Winter 1962, Pp 28-40

Thurston, J.B., 1941 - Modern Internal Auditing has just been born, The Internal Auditor, Summer 1966, Pp 57-60

Tricker, R.I., Ten myths of management information, Management Accounting, Vol.49, No.8, August 1971, P.231

Tweedie, D.P., The psychological background to financial reporting, The Accountant's Magazine, December 1976, Pp 470-474

Vaulommel, E., and De Brabauder, B., The organization of Electronic Data Processing (EDP) activities and computer use, The Journal of Business, Vol.48, No.3, July 1975, Pp 391-410

Vazsonyi, A., The decision to inquire, Interfaces, Vol.7, No.1, November 1976, Pp 73-80

Vidali, J.J., Jr, Single-anchor stapel scales versus double-anchor semantic differential scales, Psychological reports, Vol.33, 1973, Pp 373-374

Vidali, J.J. Jr, and Holeway, R.E., Stapel scales versus semantic differential scales: further evidence, Psychological reports, Vol.36, 1975, Pp 165-166

Will, H.J., Auditing in systems perspective, The Accounting Review, Vol.XLIX, No.4, October 1974, Pp 690-706

Woolf, E., How to audit operations, Management Today, April 1975, Pp 74-75, 126

MISCELLANEOUS

Agami, A.M., An inquiry into the cost and value of management accounting information, Unpublished Ph.D. dissertation, University of Illinois, 1970.

Alexander, M.J., Information systems analysis: theory and applications, Science Research Associates, USA, 1974.

Bomeli, E.C., The audit of management performance, Unpublished Ph.D. dissertation, Michigan State University, 1963.

Chambers, A.D., Current trends in internal auditing, Proceedings of the fourth annual conference on recent developments in internal auditing, The City University Business School, London, 1979, pp.167-210.

Delaney, P.R., A field study concerning the role of internal auditors, Unpublished Ph.D. dissertation, University of Illinois, 1971.

Emery, J.C., Cost/Benefit analysis of information systems, Working Paper, Wharton School of Finance and Commerce, University of Pennsylvania, 1971.

Feltham, G.A., A theoretical framework for evaluating changes in accounting information for managerial decisions, Unpublished Ph.D. dissertation, University of California, 1967.

Feltham, G.A., & Mock, T.J., Concepts of information and information systems and their impact on information system design, AIS Research paper 7001, University of California, Los Angeles, September 1970.

Gallagher, C.A., Measurement and analysis of managers' perceptions of the value of selected management information, Unpublished DBA dissertation, Florida State University, 1971.

Greenridge, C.D., The effect of improved information on profitability in smaller retail firms, Unpublished Ph.D. dissertation, Ohio State University, 1967.

Haried, A.A., An inquiry into the semantic problems of external accounting communication: a comparative study of research techniques, Unpublished Ph.D. dissertation, University of Illinois, 1969.

Haseley, A.F., Information and decision-making in a management game, Unpublished Ph.D. dissertation, Purdue University, 1966.

The Institute of Internal Auditors, Statement of the Responsibilities of the Internal Auditor, The Institute of Internal Auditors, N.Y., 1947.

The Institute of Internal Auditors, Statement of the Responsibilities of the Internal Auditor, The Institute of Internal Auditors, N.Y., 1957.

The Institute of Internal Auditors, Internal auditing of EDP systems, The Institute of Internal Auditors, N.Y., 1967.

The Institute of Internal Auditors, Survey of Internal Auditing, Research report No.15, The Institute of Internal Auditors, N.Y., 1969.

The Institute of Internal Auditors, Statement of the Responsibilities of the Internal Auditor, The Institute of Internal Auditors, N.Y., 1971.

The Institute of Internal Auditors, Establishing the internal audit function in EDP - job descriptions, The Institute of Internal Auditors, N.Y., 1974.

The Institute of Internal Auditors, Modern concepts of internal auditing . . . Auditing computer centers, The Institute of Internal Auditors, N.Y., 1974.

The Institute of Internal Auditors, Survey of Internal Auditing, The Institute of Internal Auditors, Florida, USA, 1975.

The Institute of Internal Auditors, An evaluation of selected current internal auditing terms, Research report No.19, The Institute of Internal Auditors, Florida, USA, 1975.

The Institute of Internal Auditors, A survey of internal auditing in the UK, Research report No.1, The Institute of Internal Auditors, UK chapter, London, 1976.

The Institute of Internal Auditors, Standards for the professional practice of internal auditing, The Institute of Internal Auditors, Florida, USA, 1978.

Kelly, J.A., The analysis and measurement of value of selected non-financial project management information, Unpublished DBA dissertation, Florida State University, 1974.

King, W.R., Strategies for success in MIS, Working paper, Graduate School of Business, University of Pittsburgh, February 1979.

Kirkpatrick, D.C., General systems theory as a framework for management information systems, unpublished DBA dissertation, University of Colorado, 1976.

Mather, J.H., Measurement of attitudes in banking by means of the Semantic Differential, Unpublished Ph.D. dissertation, The University of Arizona, 1975.

Miguel, J.G., Shank, J.K., & Govimdarajan, V., Extending the audit function: a survey and framework for analysis, Working Paper 76-39, Graduate School of Business Administration, Harvard University, Nov. 1976.

Mints, F.E., The effects of the internal auditor's behavioural patterns on his relationships with operating personnel, Unpublished Ph.D. dissertation, University of Southern California, 1972.

Mock. T.J., The evaluation of alternative information structures, Unpublished Ph.D. dissertation, University of California, 1969.

Munro, M.C., A comparison of the decision analysis and data analysis methods for determining management's information needs, Unpublished Ph.D. dissertation, University of Minnesota, 1975.

Ratchford, B.T., The value of information for selected appliances, Working paper 87-5, European Institute for Advanced Studies in Management, February, 1978.

Ratchford, B.T., A normative model for assessing the effectiveness of consumer choice and information seeking behaviour, Working paper 78-8, European Institute for Advanced Studies in Management, February 1978.

Rodriguez, J.I., & King, W.R., An empirical assessment of participative MIS design, Working paper, Graduate School of Business, University of Pittsburgh, December 1977.

Rodriguez, J.I., & King, W.R., Evaluating management information systems, Working paper, Graduate School of Business, University of Pittsburgh, December, 1977.

San Miguel, J.G., Goals, information and psychological variables in decision-making: an empirical study, Unpublished Ph.D. dissertation, The University of Texas at Austin, 1973

Schaeberle, F.W., The role of the internal auditor in relation to information systems, Unpublished Ph.D. dissertation, University of Missouri, 1973.

Schwarzbach, H.R., Auditing management information systems: an empirical investigation on the impact of management information system's audits, Unpublished DBA dissertation, The University of Colorado, 1976.

Seward, H.H., Measuring user satisfaction to evaluate information systems, Unpublished Ph.D. dissertation, Harvard University, 1973.

Shahine, I.O., The impact of internal audit on middle managers' personal bias in the budgeting system, Unpublished Ph.D. dissertation, University of Sheffield, 1976.

Smith, J.H., An investigation of the concept of management auditing, Unpublished Ph.D. dissertation, University of Illinois, 1967.

Uretsky, M., Audit implications of a postulated MIS, Unpublished Ph.D. dissertation, The Ohio State University, 1965.