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The Impact of the
Internal Organisational Environment
on
NSD Knowledge Management
& NSD Performance

*A Thesis submitted to City University for the degree of
Doctor of Philosophy in the Faculty of Business Management*

29th July, 2000

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Abstract

Building on a diverse stream of literature, knowledge strategy and NSD in particular, the theory investigated in this research is that service firms can use knowledge strategy to improve the innovation performance of their business. Although scholars are now beginning to organise their research agendas around a set of explicit hypotheses concerning the causes and effects of knowledge-intensive environments, knowledge management has only recently emerged as an explicit area of pursuit for managing firms. This research empirically investigated knowledge management activity in the context of NSD, and as such provides insight into a subject area previously lacking in rigorous empirical studies. Previous research in the field of NSD has tended to concentrate its focus on the financial services market. In contrast, this research drew its sample from a wider population and identified that many of the findings appear to be generalisable across a number of business markets, both in a consumer and business context.

In adopting a knowledge-based view of a service business, this research conceptualised a notion of NSD Knowledge Environment (NKE) to represent the way in which knowledge supports the business' ability to develop new services across a NSD programme. The nine unique bundles of resources which comprise the NKE (knowledge depth; knowledge dispersion; NSD memory; personal interaction; climate of learning; creative climate; entrepreneurial climate; collaborative climate; goal climate) were found to be capable of yielding sustainable, above-normal business performance. The NKE was discovered to have a significant impact on the service business' overall NSD programme performance across four distinct measures: financial; new opportunities; customer responsiveness; innovation. Whilst service firms were found to be aware of the importance of knowledge resources to their business, few had embraced a business-wide framework for managing particular knowledge assets. This research therefore indicates the importance of addressing the need for a knowledge management framework targeted specifically at NSD success.

Whilst the NKE was discovered to have a significant impact on the service business' overall ability to develop innovative new products supports the findings of previous research, interestingly, this research identified a multi-dimensional concept of innovativeness, comprising both measures of innovative outcomes and innovative processes. The more innovative NSD programmes were found to be more successful on many other performance dimensions (financial and non-financial) than their counterparts, i.e. innovative NSD programmes were more successful than their competition on all dimensions, as well as having a very high percentage of sales and profits originating from new services introduced in the last three years.

The overall implication of this research is that if a firm's scarce resources are the source of improved economic performance, it follows that supportive knowledge practices and a supportive internal knowledge environment must be created to ensure these assets are leveraged successfully.

Declaration

The author hereby declares that no portion of the work referred to in this thesis has been submitted in support of an application for another degree or qualification of this or any other university or other institute of learning.

Mr. D. T. Kelly

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Dedication

I dedicate this work to Bina Gandhi, without whose support I would not have been able to allocate the time necessary to complete this PhD.

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Research Title

"The Impact of the Internal Organisational Environment on NSD Knowledge Management and NSD Performance".

1 INTRODUCTION

Why are some service firms able to build competitive advantage by using their repository of organisational knowledge during new service development programmes, while others are not? What strategies, programmes, initiatives or actions can service firms institute that would enable them to create, and then profit, from the knowledge that they have striven to acquire? How can service firms establish policies which enable their new service teams to draw on the firm's knowledge base, augment it, and then develop the kind of breakthroughs that can create entirely new markets and industries?

1.1 The Theoretical Foundations

The underlying theory being tested in this thesis is that knowledge strategy impacts overall business performance (Grant 1996b). The model defined by this research represents a set of empirical relationships that test one aspect of that theory empirically – i.e. the model operationalises the theory that a knowledge strategy impacts innovation performance in services firms. Specifically, does the social process of creating and managing organisational knowledge produce differences in the performance of new service programmes.

In order to assess how knowledge is retained and leveraged in a NSD programme the research seeks to combine the ideas from two diverse stream of literature: (i) NSD (e.g. Easingwood 1986; Hart 1996); knowledge management (e.g. Grant 1996a; 1996b; Nonaka 1994).

1.2 The Role of Knowledge in Business Strategy

In 1975, more than half the value of all the Fortune 500 firms was attributable to tangible assets. By 1995, that figure had dropped to near 25 per cent, putting intangible assets firmly in the driving seat - and almost half of those intangible

1 INTRODUCTION

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assets were some form of intellectual property¹. It is widely agreed that the society in which we live in has been gradually turning into the "knowledge society" (Drucker 1990), and researchers and theorists are now beginning to pay attention to the idea of the business as a body of knowledge, rather than as a traditional portfolio of physical assets (Pisano 1994). The emergence of the knowledge-based view of the business, representing a confluence of a number of streams of research, contains a number of contributing literatures (Grant & Baden-Fuller 1995): resource-based theory (Grant 1991); epistemology (Polanyi 1966); organisational learning (Huber 1991); evolutionary economics (Nelson & Winter 1982); organisational capabilities and competences (Prahalad & Hamel 1990); and NPD (Nonaka 1984).

In the business literature, the meaning of the term "knowledge" remains a highly contentious concept. Knowledge has been defined as "information that changes something or somebody – either by becoming grounds for action, or by making an individual or an institution capable of different and more effective action" (Drucker 1990, p. 242). There is some agreement that knowledge is constructed from data and information, and is stored in individual cognition (Kim 1993) or in an organisational memory (Moorman & Miner 1997). Knowledge can be 'explicit' or 'tacit'² (Polanyi 1962; 1967); it can be a skill; a routine³ (Quinn 1996); a mental model, a motivation/mission, a spiritual value (Whitehall 1997); or it can be a particular business competence (Teece et al. 1997).

Such diversity suggests that to form the basis of a theory of the business, as some researchers seek, knowledge must be defined precisely enough to facilitate a determination of which firms have the more significant knowledge, and to explain how that knowledge leads to competitive advantage. The task is currently being addressed by strategy researchers (Grant 1996a; 1996b; Spender 1996a; 1996b).

¹ Financial Times, 11th November 1998.

² Tacit knowledge is learned largely by experience. It is communicated only indirectly, e.g. through metaphor and analogy. Explicit knowledge is the knowledge contained in manuals, procedures, and systems. It is easily communicated and shared.

³ For example, the know-how and know-why required to execute the NSD process.

Similarly, because many different classifications of knowledge are perceived to exist, it has been posited that the business may need to develop a strategy for each classification of knowledge in order to promote its efficient and effective dissemination, measurement, growth and protection (Wiig 1997a).

1.3 Knowledge Management in NSD

Product development processes have been characterised as "total information systems" that are driven by firm-level processes (Clark & Fujimoto 1991). One may regard the development of a new service as generally starting with a coarse, information-poor format (e.g. an idea for a new service) and gradually evolves, generally via a NSD process, to a detailed, information-rich format (e.g. charts, blueprints, new services & systems). At each stage of the process, new or modified knowledge (e.g. market, process, commercial, or technical) is added with the help of the business' know what, know how & know why, i.e. tools, methods, models, and architectural knowledge (Quinn 1996). However, Dougherty (1990; 1992) has posited that functional departments comprise "thought worlds", each with its own "fund of knowledge" (*what* staff and management know) and "system of meaning" (*how* staff and management know). The importance of the observation is that in NSD, individuals from different areas of the business may well understand discrete aspects of the business, and the common understandings they share may be grasped in different ways. The dissimilarities then lead to difficulties in applying knowledge in a group context. It is posited by Dougherty that what distinguishes successful NSD projects is how the barriers are overcome, not the presence of them.

Similarly, it has been observed that within any business a "core knowledge set" helps to define the most basic of the repertoire of organisationally-relevant knowledge structures that describe the events and behaviours appropriate to the particular business and the people within it (Lyles & Schwenk 1992). In a services context, the knowledge set may be hypothesised to form the internal environment which either supports or hinders NSD activity and drives the NSD process. In this research, the New Service Development Environment (NKE) is

conceptualised to reflect the characteristics of that core knowledge set which supports knowledge management activity in NSD.

The challenge of exploring the issues surrounding the management of knowledge in product innovation – be it technical innovation, product innovation, process innovation, strategic or organisational innovation - has been accepted by a number of management theorists (e.g. Nonaka 1990; Clark & Fujimoto 1991; Wheelwright & Clark 1992). Their contribution has been to develop theories which explain the value of different types of knowledge during the process of product innovation. However, the immediate research challenge is to produce empirical research data to support the underlying theories, and to develop a understanding of the management of knowledge in service firms in particular.

The practical reality is that management of knowledge has only recently emerged as an *explicit* issue for firms, and even more recently as a topic of serious academic study (Wiig 1997a). It is generally agreed that our understanding of the business processes surrounding knowledge management remain rather limited (Inkpen 1996).

1.4 New Services Development

The development of new services is the lifeblood of a service business (John & Storey 1998). Even for traditional tangible good manufacturers, the creation of new services is vital to augment the core product offering (Mathur 1988), for example, the strategies of virtually all pharmaceutical companies are critically dependent on service functions. Without the introduction of new services, it is generally agreed that firms will struggle to grow, and will gradually fall into decline. Similarly, many large companies like Apple and IBM reformed themselves to become essentially “intellectual holding companies” purposely manufacturing or producing as little product internally as possible (Quinn 1990a).

There has been a considerable amount of research into NSD and, more specifically, a number of studies which investigate the key factors which impact or determine success and failure (de Brentani 1995b; Storey 1994).

Success/failure studies in NSD may be characterised in a number of different ways. Some studies may be distinguished by the unit of measurement, e.g. product (de Brentani 1991) vs. programme (Martin & Horne 1993), and others by the nature of the business activity addressed, e.g. business (Johne & Harborne 1985) vs. consumer markets (Edgett & Parkinson 1992). Other differentiation may exist in the nature of the industries or sub-sets of industries researched, e.g. financial services (Edgett 1993) vs. professional services (de Brentani & Ragot 1996). Increasingly, NSD success/failure studies have been differentiated by the breadth of the variables explored, e.g. seeking many variables which impact performance (Storey & Easingwood 1996) vs. the importance of particular variables, e.g. communication (Lievens et al. 1997a; 1997b).

That service firms are highly reliant upon their knowledge assets, e.g. 'human capital' and 'structural capital' for sustainable competitive advantage has been reported previously (Roos & Roos 1997). An individual new service, and new services in general, are largely intangible. Employee knowledge, expertise, motivation, and self-management therefore perform a much more critical role in the success of new services than new tangible goods (Atuahene-Gima 1996a). The processes used to develop new services are also less amenable to the 'checks and balances' used by the manufacturers of tangible goods. Emphasis is therefore being given by firms to the development of a supportive internal environment, i.e. the culture, climate and management practices which will leverage the knowledge and skills of staff during the course of a single service innovation (Johne & Storey 1998; de Brentani 1993a).

Management theorists have long attempted to prove the link between culture, climate and performance (e.g. Peters & Waterman 1982), and within the NPD literature, the internal setting within which development takes place has been found to be an important influence on both NPD performance (Dwyer & Mellor 1991; Cooper & Kleinschmidt 1987a; 1987b; John & Snelson 1988) and NSD performance (Storey & Easingwood 1996a; Thwaites 1992; de Brentani 1993a). Thwaites (1992) posits that the only way for a service business to achieve long-term competitive advantage is through the development of "an organisational

climate that is responsive to change and supportive of new product initiatives" (p. 303). Similarly, de Brentani (1993a) suggests that the primary factor in the development of successful new services is the creation of an innovative NSD environment where ideas and open communication are encouraged by supportive management. A business must therefore strive to establish the appropriate culture, structure, incentives, systems, and processes that somehow allow innovation to happen as part of daily business (Markides 1997).

While the successful development of a single new service is important in meeting short-term business objectives, a continuous flow of new services is vital if a service business is to remain competitive in the long-term. In firms where annual employee and supervisor turnover rates could reach 25% or more, the challenge faced is to capture, disseminate and store the knowledge and experience gained during individual NSD projects, and leverage it to the advantage of the business' NSD programmes (McKee 1992; Cahill 1995). Service firms which fail to address this issue satisfactorily are likely to be outperformed by those firms which have identified intangible knowledge assets as key competitive resources which drive better market performance.

1.5 Performance Measurement

There is an extensive body of literature on the factors which affect new service (and new product) success. Contemporary reviews of this research have observed that whilst financial and sales-based criteria are the most frequently used measures of new service success, these studies tend to report and adopt a plethora of other performance criteria (e.g. Montoya-Weiss & Calantone 1994). The agreement on an appropriate definition of success is important for research because without a clearly understood conceptualisation of business performance there can be no effective commentary on which factors contribute most to outstanding NSD achievement.

There have been a number of studies which have attempted to categorise the possible measures of success (e.g. Craig & Hart 1993; Griffin & Page 1993; Hart 1996; Voss 1992). These reviews of performance measurement have distinguished two levels at

which analysis can take place: (i) the project level (i.e. the success of an individual new product); (ii) the programme level (i.e. the success of new product development over a period of time). NPD performance can also be measured at the *corporate* level. However, "the use of indicators of corporate financial performance is only appropriate for measuring new product success given an adequate time lapse from the launch of the new product" (Hart 1996, p2).

Griffin and Page (1993) classified five measures of NPD performance. Three of these groups were at the project level (measures of financial performance, consumer-based measures and project-level measures) and the remaining two at the firm level (measures of firm benefits and programme-level measures). While Griffin & Page group market share and sales-based measures with consumer-based measures of performance, Craig and Hart (1993) combine them with profit-based measures. In a related literature, Kaplan and Norton (1993; 1996) introduce the concept of a *balanced scorecard* when discussing the measurement of firm performance. They argue that performance should be measured with a mind to four perspectives: (i) financial, (ii) customer, (iii) internal business process, and (iv) learning and growth.

This research uses the programme-level as the measure of NSD performance because programme success indicates the business' capability to develop a procession of project successes, rather than one-off success. Determination of the success factors at the programme level therefore attest to the business' ability to survive in the long-term.

1.6 Research Aims

The research in this thesis uses a cross-sectional sample of UK service firms. It explores the underlying characteristics of the internal environment existing in service firms, and investigates the impact that the internal environment has upon the management of knowledge in a NSD programme, and upon NSD performance at the programme level.

Building on a diverse stream of literature, this research specifically seeks to advance the body of academic knowledge in four main areas: (i) to identify the

characteristics of the internal organisational environment which influence the management of knowledge in a NSD programme; (ii) to determine whether these factors influence the success of a service business' NSD programme and the proficiency with which its NSD process is executed; (iii) to identify whether the proficiency with which the NSD process is executed influences the performance of the NSD programme; (iv) to explore whether NSD innovativeness is associated with NSD commercial success. Two primary and four secondary research questions are posed. These are summarised below:

Main Research Questions

- Q1a: Which internal organisational factors comprise the NSD Knowledge Environment (NKE)?
- Q1b: What is the impact of the NKE on the performance of the NSD programme?

Supporting Research Questions

- Q1c: What is the impact of the NKE on the innovativeness of the NSD programme?
- Q2: Are innovative NSD programmes more successful on other performance measures than less innovative programmes?
- Q3: What is the impact of NSD process proficiency on the performance of the NSD programme?
- Q4: What is the impact of the NKE on the proficiency with which the NSD process is executed?
- Q5: Does external environmental turbulence affect the performance of the NSD programme, the NKE, or the proficiency with which the NSD process is executed?

1.6.1 Comparisons with Previous Research

This research can be compared with previous research in the knowledge management and service development areas.

Researchers have previously demonstrated the importance of knowledge to firms, but what has been written is largely theoretical (Fiol & Lyles 1985, Huber 1991; Nonaka & Takeuchi 1995), and beyond small-sample, in-depth studies of a few firms, there has been little empirical work in this area. Although the theories reflect an intuitive understanding of the effects of learning and knowledge-based resources on performance, there is clear need for hypotheses development and testing (Fiol 1994; Simonin 1997).

Researchers have also previously identified the importance of organisational factors in the success of NSD and NPD outcomes. Three types of study exist:

- General success/failure studies, e.g. De Brentani (1993a) who examined a number of success/failures factors in a study of the NSD processes of financial services business.
- Specific studies of the organisational influences on the NSD process in one industry, e.g. Thwaites (1992) who explored the organisational characteristics that affected the NSD process in the UK building societies sector.
- The examination of organisational influences on both NSD activities and project outcomes, e.g. Dwyer & Mellor (1991)⁴ who examined the organisational environment, NPD process activities and project outcomes of 75 Australian manufacturing firms.

The service literature has also explored, in varying degrees, a number of related themes to those explored in this research:

⁴ Building on the work of Johnes & Snelson (1988), the authors also used the McKinsey 7-s framework.

- The importance of cross-functional communication as one of the underlying organisational dimensions influencing organisational success⁵ (Thwaites 1992; de Brentani 1989; 1993b; 1995; Cooper et al. 1994; Easingwood & Storey 1991).
- The importance of the NSD process (Shostack 1984a; b).
- The skills and knowledge required to execute the activities constituting the NSD process (Edgett 1996).
- The emerging knowledge-based service enterprise (Quinn 1991).

In comparison, this research seeks to combine aspects of each of the above studies: (i) it seeks to identify the organisational factors which specifically affect the way in which one form of knowledge is managed during NSD; (ii) it seeks to determine whether these factors influence project proficiency and programme success; (iii) it is an empirical cross-sectional study of service firms in the UK. In doing so, this research seeks to more fully present an understanding of the factors implicit in successfully developing a supportive internal environment.

1.7 Implications of Research for Management

This research contributes to knowledge in two ways: (i) it reviews the factors which comprise the NSD Knowledge Environment (NKE), i.e. the factors which impact the way in which knowledge is managed across a number of NSD projects; (ii) it explores the extent to which those internal factors impact upon the performance of the NSD programme level.

In contributing to knowledge, this thesis has a number of significant implications for management involved in the development of new services; (i) in identifying those internal factors which comprise the NKE and which impact the way in

⁵ The importance of internal communication in NSD (Lievens, Moenaert & S'Jegers 1994; de Brentani 1989; 1993b; 1995); the importance of external communication in NSD (Cooper et al. 1994; Easingwood & Storey 1991); constructing internal marketing networks (Ballantyne 1997); the influence of internal and external communication on the commercial success of financial service innovations (Lievens, Moenaert & S'Jegers 1997a; 1997b).

which knowledge is managed during the NSD programme, and which are under the influence of management, the research will highlight particular areas of focus for management; (ii) in identifying the impact of the NKE upon different types of NSD programme performance, the research will provide management with the ability to influence the nature of NSD success.

1.8 Summary of Findings

This research has raised important findings which have important implications for both managers in charge of NSD, and for researchers investigating the performance of NSD programmes.

1.8.1 New Service Development Knowledge Environment (NKE)

The fundamental question in the field of strategic management is how firms achieve and sustain competitive advantage. This research emphasises that the knowledge of a service firms' staff and management is critical, and considers these unique bundles of resources capable of yielding sustainable above-normal profits (Grant 1991). However, if these scarce resources are the source of economic profits, it follows that supportive knowledge practices and a supportive internal knowledge environment must be created to ensure these assets are leveraged successfully.

In adopting a knowledge-based view of a service business, this research conceptualised a notion of NSD Knowledge Environment (NKE) to represent the way in which knowledge is managed to support the business' ability to develop new services across a NSD programme.

1.8.2 New Service Development Activities

Management in service firms are under pressure to search for higher quality and greater numbers of new services. This research has given important insights into service development practices across a range of firms. Most significantly, there

are a small number of service firms that have achieved outstanding performance across a wide range of measures.

Interestingly, the research also identified a multi-dimensional concept of innovativeness, comprising both measures of innovative outcomes and innovative processes. Significantly, it was identified that the more innovative NSD programmes were more successful on many other performance dimensions (financial and non-financial) than their counterparts, i.e. innovative NSD programmes were more successful than their competition on all dimensions, as well as having a very high percentage of sales and profits originating from new services introduced in the last three years.

1.8.3 NSD Performance

The NKE was discovered to have a significant impact on the service business' overall NSD programme performance. While service firms would be aware of the importance of knowledge assets to their business, few have yet to embrace a business-wide framework for managing particular knowledge assets. This research indicates the importance of addressing the need for a knowledge management framework targeted specifically at NSD programme success.

Similarly, the NKE was discovered to have a significant impact on the service business' overall ability to develop innovative new products. This supports the findings of previous research which has suggested that firms need to demonstrate an innovative capability to gain a competitive edge in order to survive and grow.

2 LITERATURE REVIEW

This chapter reviews the services marketing, NSD, knowledge management, organisational learning literatures.

2.1 Introduction to Literature Review

This research explores the impact of the internal environment upon knowledge management activity in new service development (NSD). Therefore, it is appropriate that a number of relevant literatures are reviewed.

Firstly, the services and NSD literature is examined. In the past two decades, the world economy has been marked by a steady shift away from the production of goods, and towards a greater emphasis on services. It has been posited that the services sector contributes two-thirds to 80% of national and global economies, depending upon the measure used (Quinn, Doorley & Paquette 1990a). Marketing academics established services as an important, and unique, area of research during the 1980s. Early and significant contributions came particularly from Parasuraman et al. (1985) and Shostack (1977). The development of new services is therefore likely to be the lifeblood of the service business, if not all firms (Johne & Storey 1998). While there has been a considerable amount of research into NSD and, more specifically, into the key factors which impact or determine success and failure, the area remains under-researched.

The knowledge literature is also explored. Researchers and theorists have only recently begun paying attention to the idea of the business as a body of knowledge, rather than as a traditional portfolio of physical assets (Pisano 1994), and much new research has recently appeared, and is currently appearing, in leading academic journals. It is anticipated that this literature holds valuable theoretical insights which can be applied to the NSD arena.

This research uses the NSD programme as the unit of measurement. The organisational learning literature is examined because it is anticipated that useful insights will be gained from understanding how firms effectively share

organisational knowledge across individual NSD projects. Once again, much new research has appeared in the last five years.

Reviews of the creativity management, integration, and information processing literatures are included in Appendices A-C. The three streams of academic contribution form complementary inputs into the development of the conceptual model. However, while particular authors are sometimes referenced in the chapters related to the development of the conceptual model and the research results to highlight a relevant historical finding, such activity is less frequent than is found within the services management, knowledge strategy and organisational learning literatures. Therefore, while important lessons exist in the research, the three literature reviews are relegated to the appendix.

2.2 Services Literature

This chapter explores a number of aspects of the services marketing literature which were used in the development of the conceptual model; (i) new service development (NSD); (ii) success/failure in NSD; (iii) performance measurement in NSD; (iv) communications theory in services.

2.2.1 Introduction

In the past two decades, the world economy has been marked by a steady shift away from the production of goods, and towards a greater emphasis on services. The importance of services to the economy has been largely driven by the forces of deregulation, industry restructuring, privatisation, technology development, and increased competition (Iacobucci 1998).

It is acknowledged that knowledge bases, skill sets, and service activities are the things that generally can create continuing added value and competitive advantage, irrespective of the industrial setting, and the reality is that most firms - product manufacturers and service providers alike - are heavily dependent upon their service operations. For example, although only 6% of IBM staff world-wide are directly engaged in industrial manufacturing, the business continues to be classified as *industrial* in the Standard Industrial Classification (SIC) scheme. In fact, it has been posited that up to 65% - 75% of most manufacturing business' costs are in overhead categories, and that most of those are merely services which the company began buying internally. The use of new technologies now makes it possible to achieve major economies of scale by purchasing these crucial services externally, and potentially doing so on a global basis (Quinn, Doorley & Paquette 1990a).

Similarly, the distinctions between services firms themselves are gradually vanishing (Quinn, Doorley & Paquette 1990b). This is very much in evidence in the UK where the boundaries between transportation, communications, and travel-service industries are disappearing: Airline carriers are beginning to provide

direct reservations, business conferences, inclusive holidays, financial services (including insurance) and car hire; advertising agencies fear emerging competition from the increasingly ambitious and powerful management consulting firms; retailers (e.g. Virgin Group PLC) are becoming train operators; bookshops are becoming Internet Service Providers (e.g. W.H.Smith); telecommunication firms are becoming media enterprises (e.g. BT), and media enterprises are becoming telecommunications firms (e.g. BSkyB and Carlton television). The implication is, therefore, that services research is likely to provide important guidance to managers in today's volatile marketplace.

Marketing academics established the services literature as an important, and unique, area of research during the 1980s. Early and significant contributions came particularly from Parasuraman et al. (1985) and Shostack (1977). Two major literature reviews have since been produced by Frisk et al. (1993) and Iacobucci (1998). Using an evolutionary metaphor as the framework, the literature review by Frisk et al. (1993) traced services marketing literature through three stages, covering the period 1953-1992: (i) *crawling out* (1953-79); *scurrying about* (1980-85); (iii) *walking erect* (1986 - onwards). Subject areas addressed included: (i) characteristics of services; (ii) service design and delivery; (iii) service encounters and service experiences; (iv) service quality and customer satisfaction; (v) service recovery; (vi) reverse marketing; (vii) internal marketing and support services; (viii) modelling and measurement; (ix) technology infusion; (x) customer retention and customer value. Using the four key dimensions of services ("SHIP") and the services marketing "7 Ps", Iacobucci (1998) built on the work of Frisk et al. and colleagues by researching the literature from 1986 onwards, via an on-line library search and a manual search of 865 articles.

2.2.2 Classifying Services

The traditional view of researchers of services marketing literature has been that the heterogeneity of services means that little communication or learning can take place between service firms in different industrial settings. Lovelock (1983) posits that service industries therefore remain dominated by an operations

orientation that insists each industry is different. Better classification of services and the services sector into categories is consequentially useful in cross-fertilising ideas and predicting future behaviour of firms that fall into each category. A review of the literature on classifying services suggests that a wide diversity of characteristics can be useful in describing service firms (Lovelock 1983; Wemmerlov 1990; Zeithaml et al. 1985). Although many classification schemes have been proposed, no categorisation has become pervasive or pre-eminently useful (Silverstro et al. 1992).

Appendix D reviews some of the major classifications of services identified by researchers and academics. No one clear definition of services exists which would be insightful in indicating the generalisability of the results from this research.

2.2.3 Characteristics of Services

A number of authors have suggested that the differences between goods and services exist as a matter of degree only (Middleton 1983), i.e. whilst goods and services lie on a continuum of tangibility, all goods have intangible elements and all services have tangible elements. The consensus is that "the differences between goods and services appear to be assumed, and researchers have begun to focus on substantive business issues and problems stemming from the implications of these basic service differences" (Frisk et al. 1993).

Once it was recognised that the characteristics of services and service firms differed from that of tangible goods, it was acknowledged that while the basic principles of 'product' marketing still apply, specific marketing strategies and tactics needed to be developed for use in services industries, reflecting the unique characteristics of the services they provide (e.g. Shostack 1977; Berry 1980). For example, the traditional marketing mix for tangible goods (i.e. product, place, price and promotion) was been expanded to include "people", "process", and "physical evidence" (Booms & Bitner 1981; Ennew & Watkins 1992). The "people" aspect represents all the actors involved in the service delivery process, i.e. the service production personnel, the customer and other business' customers.

"Physical evidence" includes the environment in which the service is delivered, tangible cues of the service, as well as facilitating goods. "Process" involves the procedures, mechanisms, and flow of activities by which the service is delivered.

2.2.4 Communication in Services⁶

Thwaites (1992) identified communication as one of the underlying organisational dimensions which influences new service success. de Brentani (1989) wrote that "new service development projects which are characterised by inadequate internal communications, and which do not receive the attention they require from the different functional areas, perform poorly on most of the success measures" (p.251). The effectiveness of internal (de Brentani 1989; 1993a; 1995a; 1995b) and external communications (Cooper et al. 1994; Easingwood & Storey 1991) has been identified as a critical component in new service success by a number of authors. Each of these is now discussed in more detail.

2.2.4.1 INTERNAL COMMUNICATION

The importance of internal communication in a service business has been widely acknowledged (Gronroos 1990). The need for internal (marketing) communication in services firms stems from the inseparability of production and consumption of services (Lievens, Moenaert & S'Jegers 1997a). The difficulty in decoupling the operations and marketing functions means that for work and information flows to occur it is even more important that the two functions interact (Lievens, Moenaert & S'Jegers 1997a; Mahajan et al. 1994). These activities are functionally interdependent and Gronroos (1990) has referred to front-line personnel as the "interactive marketing function" and Gummesson (1991b) called them "part-time marketers".

The quality of the internal communication flows has been posited to influence the organisational climate, that is the level of trust, harmony, and the quality of the

⁶ See Appendix B & C for a literature review of the integration, communication and information processing in NPD.

relationships between team members (Souder & Moenaert 1992; Lievens, Moenaert & S'Jegers 1997b). Similar to the manufacture of tangible goods, Lievens, Moenaert & S'Jegers (1997b) found that internal communication is an essential mechanism to stimulate the cross-functional co-operation of innovation team members, thus guiding internal marketing efforts and empowering service staff and frontline personnel. The quality of communication during the planning stage of a service innovation project greatly influences the quality of communication during subsequent development and launch activities (Lievens, Moenaert & S'Jegers 1997b; Easingwood 1986).

2.2.4.2 INTERNAL MARKETING

Firms have begun to regard internal marketing as a strategic weapon to help achieve high-quality service delivery, and thereby achieve greater customer satisfaction (George & Gronroos 1989). Although the concept of internal marketing has been addressed by a number of researchers over the last 20 years (Berry 1981; Gronroos 1981a, 1981b, 1985), the subject has only recently been placed at the heart of the new approach to services marketing (Cahill 1995). To date, much of the research concerning internal marketing has been focused on service providers, particularly health care, financial and professional services (Gronroos 1983; Gummesson 1991b; Joseph 1996). The service element of what manufacturing firms do for their customers has yet to be fully addressed as a strategic issue (Varey 1995b).

Much of the research into internal marketing has been embryonic and descriptive or prescriptive. There is as yet some confusion over what internal marketing actually is, its role, and how it can be implemented (Varey 1995b). Whether broadly or narrowly defined, there is little empirically-based evidence in the literature to suggest how internal marketing develops or motivates customer-conscious staff, or contributes to external market performance (Ballantyne 1997).

The establishment of internal marketing programmes can deliver many benefits to the business. It can be used to achieve an externally oriented "strategic service vision" to direct marketing and operations as one function (Heskett 1987), to

establish a set of common shared values among a core group of staff which will facilitate the maintenance of that strategic vision over the long-term (George 1990), and to introduce new products, services and marketing initiatives (George & Gronroos 1989). Particular emphasis has been given to the impact of internal marketing on external market place performance (Gronroos 1994; Ballantyne et al. 1995; Rafiq & Ahmed 1995).

More details on the characteristics of internal marketing research can be found in Appendix D.

2.2.4.3 EXTERNAL COMMUNICATION

In contrast to tangible product providers, service firms must assist the customer to conceptualise and evaluate the service, e.g. by providing tangible clues. This makes the effectiveness of the communication between buyer and seller even more critical (Gronroos 1990). The more intangible or non-standardised the object of communication, the more difficult the communication about such objects becomes, and the higher the customer's perception of risk (March & Simon 1958; Moenaert & Souder 1990b). Thus, in order to be successful, the service business must use effective communication mechanisms to reduce that risk perception (Lievens, Moenaert & S'Jegers 1997a).

Considering the simultaneity of production and consumption for service firms, boundary spanning roles are likely to be an important predictor of organisational effectiveness at the customer-employee interface, for example, the participation of front-line staff in the innovation process is vital if the business wishes to gain access to customer information (Lievens, Moenaert & S'Jegers 1997a; 1997b; Schneider & Bowen 1984). These gatekeepers have been shown to mediate customer information from areas external into the organisation and the project team, akin to the technological gatekeeper reported by Allen (1985).

Generating awareness among potential customers is essential to the successful diffusion of new products or services (Rogers & Shoemaker 1971; Easingwood & Storey 1991). However, any gap between the quality of actual service delivery

and the customer expectations created needs to be reduced. The accuracy of the information message communicated is therefore important.

The effect of external communication on business performance is identified in the findings of Lievens, Moenaert & S'Jegers (1997b). The authors report that the least successful projects exhibit characteristics of low information transfer between supplier and customer.

2.2.5 Conclusions

This chapter has reviewed the services marketing literature.

In the past two decades, UK and world economies have been marked by a steady shift away from the production of tangible goods toward a greater emphasis on services. The increasing importance of services has been driven by deregulation, industry restructuring, privatisation, technology development, and increased competition (Iacobucci 1998). The management literature widely agrees that the service sector contributes two-thirds to 80% of national and global economies, depending upon the measure used (Quinn, Doorley & Paquette 1990a), although this figure varies by geographical region. In the UK, the FTSE100 index's weighting in services tops 30%, compared with only 14% for the German market⁷. The probability, therefore, is that the development of services, and the service element in supplying products – not the management of physical resources – will be the key to growth for most firms, as well as industries and nations. For these reasons it is a subject worthy of research.

The commonly cited characteristics of services that distinguish them from tangible goods are intangibility, separability, heterogeneity and perishability. These features of services have important implications for the way in which they are developed and marketed to customers (Shostack 1977; Lovelock 1984a; 1984b; Zeithaml et al. 1985; Edgett & Jones 1991).

⁷ Financial Times, 1998 (August)

The traditional view of the services marketing literature has been that the heterogeneity of services means that little communication or learning can take place between service firms in different industrial settings. Lovelock (1983) posits that service industries remain dominated by an operations orientation and insists each industry is different. However, many researchers have sought to develop classifications which are useful in cross-fertilising ideas and predicting future behaviour of firms that fall into each category (Lovelock 1983; Wemmerlov 1990; Zeithaml et al. 1985). Although many classification schemes have been proposed, no categorisation has become pervasive or pre-eminently useful (Silverstro et al. 1992).

Firms have begun to regard internal marketing as a strategic weapon to help achieve high-quality service delivery and thereby achieve greater customer satisfaction, particularly in service firms (George & Gronroos 1989). Much of the research has been embryonic and descriptive or prescriptive. There is as yet some confusion over what internal marketing actually is, its role, and how it can be implemented (Varey 1995b). Whether broadly or narrowly defined, there is little empirically based evidence in the literature to suggest how internal marketing develops or motivates customer-conscious staff, or contributes to external market performance (Ballantyne 1997). An understanding of employee capabilities and how individual knowledge transfer is facilitated is vital if service firms are to improve the range and quality of services it offers to its customers.

2.3 New Services Development (NSD) Literature⁸

Without the introduction of successful new services and products, it is likely that firms will not be able to sustain long-term growth, and are therefore likely to fall into steady decline.

2.3.1 Themes in NPD & NSD Research

Researchers have recently attempted to more closely analyse existing NPD and NSD research. For example, Griffin (1997) identifies three streams in the literature: (i) profiles and compensation of NPD & NSD professionals (e.g. Feldman 1991); (ii) measuring NPD & NSD success (e.g. Griffin & Page 1993; 1996); (iii) tracking the *practices* of managing product development (e.g. Page 1993). A summary of the NPD best practice research can be found in Appendix F.

Acknowledging that the literature on product development continues to grow, Brown & Eisenhardt (1995) identify three streams of literature. Product development as: (i) a rational plan; (ii) a communication web; (iii) disciplined problem-solving. Appendix E provides for a more detailed description of the contributing literatures to these themes. The rational plan perspective emphasises that successful product development is the result of: (i) careful planning of a superior product in an attractive market; (ii) the execution of the plan by a competent and well co-ordinated cross-functional team, that operates with the blessing of; (iii) senior management. The communication web perspective focuses on one independent variable - communication. These studies emphasise the depth, not breadth, as in the rational plan, by looking inside the 'black box' of product development. In disciplined problem-solving, product development is regarded as a balancing act between relatively autonomous problem-solving by

⁸ A distinction between new product development (NPD) and new service development (NSD) is made. See glossary for details.

the project team and the discipline of a heavyweight leader, strong top management, and an overarching product vision.

2.3.2 Distinctions in NPD & NSD Research

Before drawing a distinction between the findings of the NPD & NSD research, the characteristics of the NPD literature are briefly explored.

Similar pressures are faced by both tangible and intangible product innovators: (i) increased levels of competition, reflected in more firms competing for the same markets; (ii) rapidly changing market environments; (iii) higher rates of technical obsolescence; (iv) shorter life cycles (Griffin 1997).

Research into why new service products fail or succeed, in contrast to manufactured products, is still in its infancy (Cooper & de Brentani 1991). Appendix G offers a review of the major new product success & failure studies. Only recently has research begun to identify the characteristics of successful new product developments in the service sector settings (Edgett 1996). In comparison to NPD, Sundbo (1997) found that some systematic organisation of product innovation exists in service firms, but he also reported much of it is based on trial and error or a search process.

Services differ from manufactured goods in several unique ways (de Brentani 1989). However, the marketing literature seems to suggest that the process of developing, and the factors influencing, development of new products or new services are very *similar* (Mitchell Madison 1995): (i) strategies are always important; (ii) leaders are generally project managers appointed by senior management or the functional area; (iii) the presence of a process to guide development is paramount; (iv) multi-functional teams are used; (v) determining appropriate rewards is extremely difficult.

Conversely, the differences are posited to lie in a number of areas:

- A market-driven NSD process is the dominant ingredient for achieving new service success (Cooper et al. 1994).

- Service processes which more completely define the charter or strategy for projects, and more completely test services prior to commercialisation, are correlated with higher success (de Brentani 1989).
- Service processes are regarded as simpler than those used by tangible goods manufacturers (Shostack 1994b).
- The front-end of the process is the focus for service firms.
- Responsibility for managing development is more likely to reside in the marketing function (Griffin 1997).
- Many core team members in service firms are dedicated to the team, rather than being temporary assignments (Mitchell Madison Group 1995).
- Manufactured goods producers are statistically more likely than service providers to have, and use, a formal process (Griffin 1997).

However, the NSD field remains rather under-researched. Most development research has been focused on understanding the needs of, and establishing methods for, manufactured goods producers (Terrill 1992). Much of the development processes and methods created have been targeted at the goods-producing firms (Cooper & Kleinschmidt 1991). Indeed, Griffin (1997) asserts that more research on the development "needs of service firms should be done, and practices specific to meeting those needs should be developed, starting with better delineation of best practice processes and organisational structures for service development" (p.453).

2.3.3 New Service Development in Context

A single definition of innovation is yet to be agreed (Bantel & Jackson 1989). Kimberly (1981) describes three uses of the term *innovation*: (i) innovation as a process; (ii) innovation as discrete items, e.g. service product or programme; (iii) innovation as an attribute of firms, i.e. innovativeness.

It has also been suggested that a business will grow its total business organically by pursuing a number of types of supporting developments, e.g. product development, market development, product augmentation development, process development (Chan, Go & Pine 1998; Johne 1996; Johne & Storey 1998; Johne & Davies 1998a: 1998b). In practice, each of these four activities are likely to be undertaken in parallel, with differing emphases being placed on each. In predominantly technology-driven firms heavy emphasis is frequently placed on product development. In predominantly marketing-driven firms heavy emphasis is frequently placed on market development and product augmentation development. In many service firms, heavy emphasis is placed on process development. Each of these is now discussed.

2.3.3.1 PROCESS INNOVATION

All product developments can benefit from process development in the form of reductions in costs achieved through what is now widely referred to as “re-engineering” efforts. For example, an efficient supplier who keeps working on productivity can expect, over time, to develop products that offer the same, or even improved performance, at a lower cost (Johne & Storey 1998). Rarely does a supplier not have to concern itself with cost reductions. For example, American Airlines developed the IdeAAs in Action programme to align the business towards opportunities for cost savings (Robinson & Stern 1997).

Process development may involve a fundamental rethink, and redesign, of business processes, and could comprise changing existing working practices within the business. Drew (1995a) has asserted that the chief driving force behind such re-engineering efforts in service firms is not cost reductions *per se*, but improved customer service.

2.3.3.2 PRODUCT INNOVATION

Product development may be regarded as an umbrella term embracing improvements to existing products as well as radical alterations to product or service performance attributes. The characteristics of a NSD project may be

determined, for example, by the degree of risk, size, complexity, novelty, technological innovation and specialist knowledge required. The radical nature of projects may also be influenced by the degree to which multi-site offices or channel partners are involved (Drew 1995b). Booz, Allen and Hamilton (1982) have suggested six main types of product development efforts may be distinguished in the market. The following four are typified by varying forms of newness in terms of their operational newness to the supplier; and also, in part, in terms of their newness to customers: (i) *product improvement* (includes revisions to existing products); (ii) *new product lines* (frequently "me-too" products); (iii) *product line extensions* (of existing product lines); (iv) *new-to-the-world products* (which are new to the market and new to the supplier). The authors additionally posit two further types of developments, although Johnes (1996) observes that these may not be distinct types of development as it is possible for such categories to appear in each of the first four types: (i) cost reductions; (ii) repositioning.

In the services innovation literature, Lovelock (1984a) has stressed that the word "new" is one of the most overused in the marketing world. Drawing on the work of Heany (1983), Lovelock posits different categories of service development, ranging from style changes - right through to major innovations. Adapting the work of Meyers (1984), Chan, Go & Pine (1998) identify three styles of service innovations, based on two dimensions. Their schema is presented in Exhibit 2-6.

Incremental innovations represent the most common type of service innovation, involve small improvements, and rarely require new technology or changes in customer behaviours. *Distinctive* innovations represent major improvements and involve some degree of behavioural change on part of the customer. In contrast, *breakthrough* innovations require both major improvements in technology or approaches and customer behaviours. Anderson & Tushman (1990) suggest that the core technology of a product (i.e. service) or process "evolves through long periods of incremental change punctuated by technological discontinuities". The authors view discontinuities as either competence enhancing (small improvements in performance) or competence destroying (order-of-magnitude improvements in performance).

		CONSUMPTION PATTERNS	
		Old	New
TECHNOLOGY OR APPROACH	Old	Incremental Innovation	Distinctive Innovations
	New	Distinctive Innovations	Breakthrough Innovations

Exhibit 2-1: Styles of Innovation (Chan, Go & Pine, 1998)

The term 'architectural innovation' has been proposed to refer to "those innovations that change the way in which components of a product are linked together, while leaving the core design concepts (and thus basic knowledge underlying the components) untouched" (Henderson & Clark 1990). Thus, architectural variations often lead to new concepts, that is, underlying components and the links in between them can be a source of innovation.

2.3.3.3 PRODUCT AUGMENTATION

Repositioning a service from the perception of the market involves making changes to the way core product features are promoted and made available to customers. It has been referred to as "product augmentation development" (Johne 1996). This term describes the support given by suppliers to customers to help them evaluate, buy, and use a core product (Kotler 1994; Storey & Easingwood 1996b).

In researching manufactured product development, Cooper & Kleinschmidt (1987a) have shown that the provision of appropriate support is important in achieving product superiority in the eyes of customers, and they identified support as a key factor determining development success. Similarly, in studies of

successful consumer financial services, it has been found that it is not product advantage, on its own, which differentiates between success and failure, rather it is the variations in the service experience which explain most differences between development success and failure (Easingwood & Storey 1993; Storey & Easingwood 1994). In a study of successful corporate banking service developments, John and Pavlidis (1996) observed augmentation to be essential.

Product augmentation development is important to service firms because it is possible that the same basic product attributes can be supplied in many different ways, and at many different prices to separate customer groups. A premium price can normally be charged when support is provided, which can lead to higher profit margins. On the other hand, offering a basic service with little or no support enables a service business to make considerable cost savings which can then be passed on to the customer (John & Storey 1998). Product augmentation development relies on the supplier being able to accurately interpret and act upon customers' preferences for promotional and distribution support. Mathur (1992) argues that customer service and promotional support can be provided on the basis of expertise or personalisation (or both).

Product augmentation does not necessarily mean offering more or less direct support. It may involve changing the nature of the delivery process so that customers find it more convenient. For example, process change was followed by First Direct, a subsidiary of Midland Bank (John & Storey 1998), to offer their target group of customers 24-hour service availability. This more than compensated for the lack of traditional face-to-face contact traditionally offered by banking firms.

It is with the help of augmentation that an appropriate "offer" is placed on the market. Grönroos (1990) and Storey & Easingwood (1994) refer to this wider output as the "augmented service offer". The concept of offer development is now reviewed in more detail.

2.3.3.4 OFFER DEVELOPMENT

The term "offer development" has been coined to embrace both service development aimed at improving core performance attributes as well as service augmentation development. Most empirical research has so far focused on the type of service development aimed at improving core performance attributes. Notable exceptions are contained in the work of Easingwood & Storey (1993) and Storey & Easingwood (1994).

Although the relationship between core service advantage and success has been demonstrated to be important, the level of importance has not been shown to be as high in relation to a number of the other factors measured. The majority of new services are almost certainly not highly innovative⁹, rather they are copies of existing services, and therefore any service advantage is likely to be short lived. Core service advantage has been found to be necessary, but in itself an insufficient factor, for competitive success (Johne & Storey 1998).

It may be difficult for many customers to fully understand core service attributes. This means that, in general, it is advantageous to develop services that are familiar to customers, less complex, and relatively easy for customers to understand. This is particularly true for services which require a high degree of customer participation (Lievens & Moenaert 1994). Nevertheless, highly innovative services can give a business a significant competitive advantage, as is illustrated through "new style product development" (Johne 1994). The trick would appear to be to make it hard for the competition to copy all the facets of the new service offer (MacMillan, McCaffrey & Wijk 1985; John 1994b).

Many consumers cannot evaluate technical aspects of services, and therefore rely on functional aspects when judging performance. An important influencing factor in this evaluation is the expertise and enthusiasm of front-line staff. Expertise not just in terms of technical skills, e.g. service knowledge etc., but also customer service skills.

In professional services, customer participation in service delivery is an integral element of the offering (Johne & Storey 1998). To produce a successful professional service, co-operation is needed. How this co-operation is operationalised is a quality dimension of the service. The most important characteristic is knowledge - the customer has to have knowledge about service to be able to contribute to the delivery process.

One of the major elements of the support that firms give to a new service is through its communication strategy. Communication strategy needs to raise customer awareness of the new service - explicitly communicating its benefits and creating a clear image for the new service (Johne & Storey 1998). An extensive distribution system may also help in this respect by making target markets more accessible. Not surprisingly, empirical research has stressed the benefits of a multi-channel distribution strategy (Lievens & Moenaert 1994; Easingwood & Storey 1996).

2.3.3.5 MARKET DEVELOPMENT

Market development, often undertaken in parallel with other forms of development, is concerned with improving the mix of target markets into which newly developed offers can be placed, thus enhancing the mix of customers served by the business. Lack of skill in market development will almost certainly result in an unwise mix of target markets being selected. It has been observed that even the skilled efforts at product development and product augmentation development, as well as any efforts at process development, are unlikely to ensure the business will achieve its full potential if market development is not executed effectively (Johne & Storey 1998).

⁹ In NPD, researchers have maintained that product innovativeness does not have a major impact on the rate of success in the market-place. However, Kleinschmidt & Cooper (1991) have demonstrated that the relationship between product innovativeness and commercial success is U-shaped.

2.3.4 The New Service Development Process

One of the main conclusions to be drawn from studies into NSD is the importance of the quality of the development process (Johnes & Storey 1998). A formal process is widely advocated, backed by experienced staff and adequate resourcing. However, it is the effectiveness and proficiency of execution which has an effect on performance, not merely the existence of a formal development process (Cooper 1996a). Issues surrounding the NSD process are now reviewed.

2.3.4.1 NPD PROCESS MODELS

A development process identifies the major activities required to produce a new product or service. Generally conceptualised to consist of stages, the process usually begins with identifying the new product strategy.

Most *tangible* product firms have been found to use a formal process (Booz, Allen, Hamilton 1992). Researchers have identified many examples of stage-wise approaches to NPD, (e.g. Cooper 1979; 1997b; Cooper & Kleinschmidt 1986). The results from empirical research suggest that failing to perform a stage in the process may have an effect on new product performance, and that certain functions or stages may have a more critical impact than others on the success of a new product (Cooper & Kleinschmidt 1986). Research indicates that the stage-wise new product process model is representative of the activities that take place during NPD, although the phasing of each activity has been criticised as unrealistic by some researchers because many of the activities are thought to overlap and some iterative (Moore 1987).

In identifying the importance of the NPD process in tangible product development, Cooper (1996a) found that the better performers had quality processes where: there was an emphasis on up-front homework; the process included sharp, early product definition; the voice of the customer is evident throughout; there are tough go/kill decision points in the process; there was a focus on quality of execution; the process was complete or thorough; the process was flexible, where stages and decision points could be skipped or combined, as dictated by the nature and risk of the project.

2.3.4.2 EMERGENCE OF SPECIFIC NSD PROCESS MODELS

In general, the levels of sophistication demonstrated in the development of tangible goods has yet to be attained in many fields of service development. Shostack (1984a; 1984b) identified four essential characteristics of an effective development *process* for new service products. In the area of services, where product development can often be copied quickly, and frequently involves very minor investments in terms of time and money, current activity is described as failing to meet Shostack's essential characteristics of: (i) objectivity; (ii) precision; (iii) fact-driven; (iv) methodologically based.

A number of researchers (Bowers 1989; Scheuing & Johnson 1989a; Martin & Horne 1993) have all shown that service suppliers do not, in general, use sophisticated and formal development procedures. In finding that only 60% of the service firms responding to her research possessed a formal NSD process, Griffin (1997) asserted that manufactured goods suppliers are statistically more likely than service providers to have and use a formal NSD process. The degree of sophistication in the use of the process is also different. Reidenbach & Moak (1986) observed that the average length of the development process for banks was surprisingly long at six months, and that new product failures tended to be from firms that skipped certain stages of the process or carried them out haphazardly.

2.3.4.3 INFLUENTIAL MODELS OF NSD PROCESSES

Three types of development have been distinguished in the context of NSD (Edvardsson & Olsson 1996): (i) the development of the *service concept*; (ii) the development of the *service system*; (iii) the development of the *service process*. The service business must develop and offer a service concept which is appropriate to the customer's needs and which contains attractive added-value and a 'customer-friendly' and generic service process. The service system provides the required resources for the service process.

It is surprising that there have not been more attempts made to identify or develop specific service development models. Of those developed, one of the most influential models is that produced by Scheuing & Johnson (1989a), which

highlights the important distinction between the design of the service and the design of the delivery process itself (see Exhibit 2-7). Because services are, by their very nature processes, delivery systems assume a high degree of importance in the development of successful new services (Lovelock 1984a; Langeard & Eiglier 1983). The model presented by Scheuing & Johnston also illustrates the importance of involving customer-contact staff and customers in the process.

Activity / Source	NSD Stage
Marketing objectives	Formulation of new service objectives and strategy
Internal sources	Idea generation
	Idea screening
Customer contact personnel	Concept development
	Concept testing
Budget development	Business analysis
	Project authorisation
Operations personnel	Service design and testing
	Process and systems design and testing
	Marketing and programme design and testing
	Personnel training
All personnel	Service testing and pilot run
	Market testing (test marketing)
	Full-scale launch
	Post-launch

Exhibit 2-2: New Service Development Model (Scheuing & Johnson 1989a)

A similarly influential model is that identified by Shostack (1984a; b). She reported on the development process employed by a discount brokerage service (see Exhibit 2-8). The development process observed was complex, highly verbal and iterative, with each stage aimed at further specifying the service and its process. The model addresses much of the criticism that a detailed, formalised planning system stifles the creativity needed to develop really successful new services (Edvardsson, Haglund & Mattsson 1995).

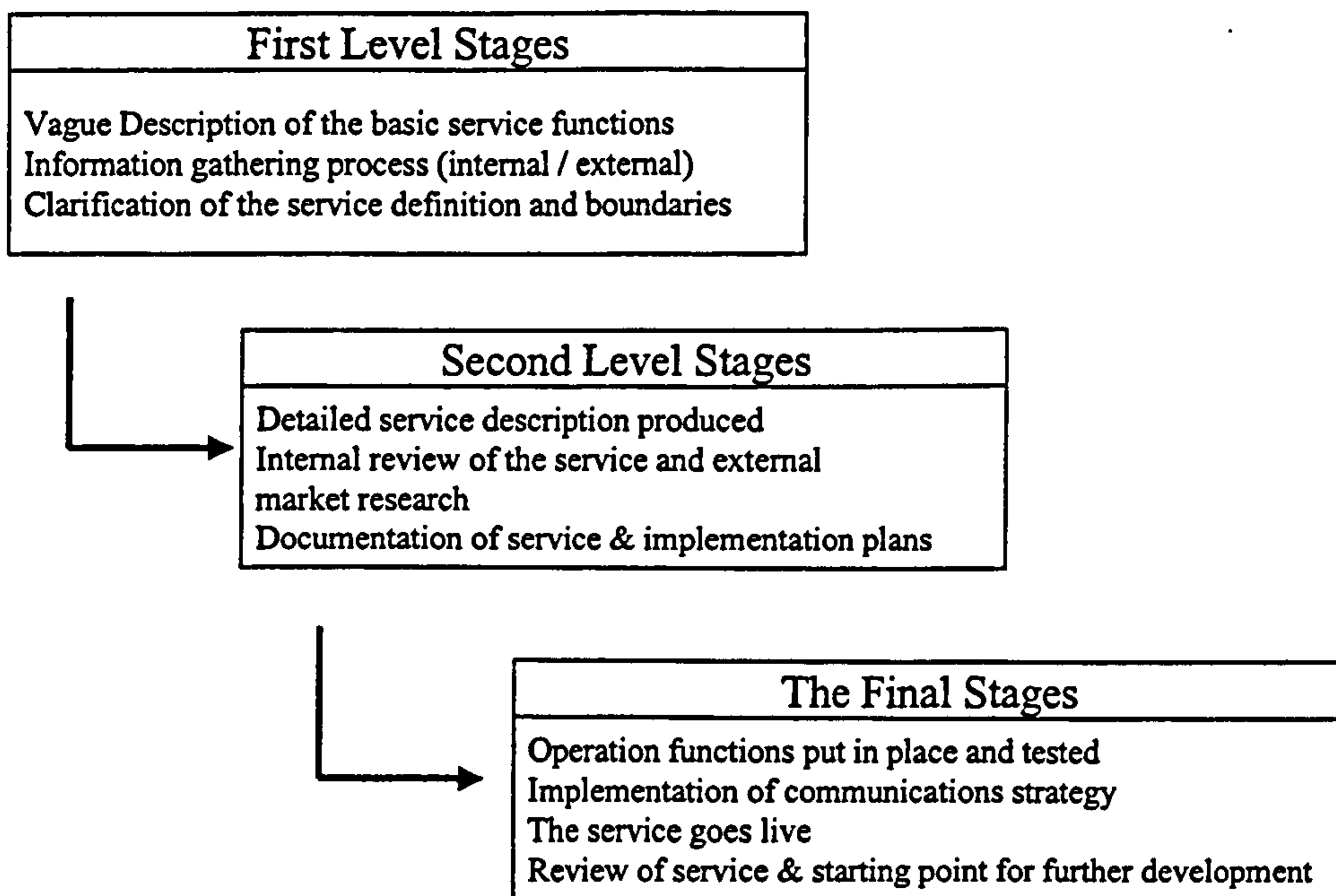


Exhibit 2-3: NSD Model from a Brokerage Firm (Shostack 1984b)

Specific process models proposed for NSD have also emerged from the research of Bowers (1986a; 1986b), Johnson, Scheuing & Gaida (1986), and Donnelly, Berry & Thompson (1985).

In contrast, Scarborough & Lannon (1989) observed that the applicability of the staged-development paradigm in financial services is debatable. At the general level, they observed that the generation of financial service innovations frequently has more to do with inter-organisational relationships than any logic of development process.

In summary, it may be suggested that further research into specific models of NSD process need to be instigated. Much of the previous NSD research has adopted and applied the principles and findings of NPD research, and little additional insight has emerged as a consequence.

2.3.5 The People Involved in NSD

Communication during a new service project is characterised by a continuous interaction between the business and its environment, through which uncertainty is reduced. The relationship between communication and innovation performance will also depend upon the four characteristics of the new service, i.e. intangibility, perishability, simultaneity and heterogeneity. As the four elements increase work-related uncertainty, the required level of communication and information sharing required among team members will also need to increase (Lievens, Moenaert & S'Jegers 1997b).

People involvement is crucial in NSD. From the NPD research, three groups of individuals can be identified as contributing significantly to the success of development projects (Johne & Storey 1998): (i) development staff; (ii) customer-contact staff; (iii) customers. One may also suggest that important contributions will be made by back-office or internal staff (Bitran & Pedrosa 1998), top management, contact staff and non-contact staff (Martin & Horne 1995).

2.3.5.1 DEVELOPMENT STAFF

A number of different roles will be adopted by development staff during the creation of a new service. An absence of skilled and experienced development staff to fill these roles has been identified as one of the key barriers to successful development in service firms (Johne & Harborne 1985; Drew 1995a).

During a development project, staff with specialised knowledge and an understanding of the possibilities and limitations of the new service, not just at a general level but also in detail, should be involved in service development (Edvardsson & Olsson 1996). It is therefore important that a particular departmental function, e.g. marketing or operations, does not dominate NSD. Successful approaches have been found to be truly cross-functional (Langeard, Reffait & Eiglier 1986; John & Harborne 1985; John & Pavlidis 1996). The most significant roles found in the NSD literature were the product champion and the project leader.

Champions & Project Leaders

Many service firms adopt a project-team approach and employ product champions. The role of a powerful product champion has been found to be especially important in pushing the project through the development process (Dover 1987; Edgett 1994; Edgett & Parkinson 1994).

Similarly, although the cross-functional team is at the heart of efficient NSD, a project leader (or project development manager) may well be a pivotal figure in the development process, as it is in NPD (Clark & Fujimoto 1991). The project leader is the linking mechanism who bridges between the project team and senior management (or the champion). The project leader will therefore impact upon the proficiency and effectiveness of the NSD process. The project leader is likely to: (i) possess significant decision-making responsibility; (ii) be able to leverage resources; (iii) develop the vision to mesh together the competencies and strategies with the needs of the market to create an effective service concept.

2.3.5.2 TOP MANAGEMENT INVOLVEMENT

A consistent finding in most success/failure studies is the need for tangible and visible top management support, especially in terms of providing adequate funding and resources, communicating explicit and consistent strategies, and establishing globalised teams (Griffin 1997; Atuahene-Gima 1995; 1996a; 1996b; de Brentani & Ragot 1996). Management action is also important in delegating to project teams such that they have enough autonomy to feel motivated and creative.

2.3.5.3 FRONT-LINE STAFF

Most managers recognise that good service, e.g. quality of core product and delivery, is a consequence of having effective and productive people in customer contact positions. However, Schlesinger & Heskett (1991) suggest that most service firms perpetuate a 'cycle of failure' by tolerating high turnover and expecting employee dissatisfaction. The authors suggest an appropriate course of action for firms would be: careful selection; realistic previews of job &

organisation; focus on quality of early experiences; employee empowerment; awareness of employee role in customer satisfaction; scorekeeping and feedback; integration of employees into 'a winning team'; focus on aggregate labour cost and not individual wage levels; concentration on quality at the service core.

Front-line staff are those who have direct contact with customers, either personally or through other communication media. Bowen & Schneider (1985) refer to front-line staff's 'boundary-panning' roles because they act as the interface between the service organisation and its customers, and as a consequence have a considerable impact on the customer's perception of the quality of service delivery (i.e. the production of the service). In fact, many studies have found that customer's perception of the quality of the service delivered depends significantly upon how they perceive the staff's knowledge and commitment. Business leaders such as Percy Barnevik, CEO and President of ABB, have called upon firms to engage more of the knowledge, skills and capabilities of their front-line staff.

"firms are constructed so that most of our employees are asked to use only 5% to 10% of their capacity at work, it is only when those same individuals go home that they can engage the other 90% to 95% - to run their households, lead a Boy Scout troop, or to build a summer home. We have to be able to recognise and employ that untapped ability that each individual brings to work every day" (Bartlett & Ghoshal 1995).

If front-line staff are vital strategic resources, instead of mere factors of production, corporate executives can no longer afford to become isolated from staff in their firms. Roles and responsibilities must be re-allocated, with those deeper in the business taking on many of the tasks formerly reserved for those at the top (Bartlett & Ghoshal 1995).

Greater and more effective participation of front-line staff in the business is critical because they are the actual deliverers of the service. Their feedback on customer impressions and satisfaction levels can indicate where potential changes to the service can be made, and where the process by which it was developed may be improved. They are also an excellent source of ideas for new services (Martin & Horne 1994). Effective management of that knowledge after capture is vital.

Schneider & Bowen (1984) identify four distinct benefits of encouraging frontline employee involvement in NSD: (i) it helps better identify customer requirements; (ii) staff involvement increases the likelihood of positive implementation; (iii) it helps stop process efficiency considerations overwhelming the needs of customers; (iv) it can lead to staff treating customers better.

It has also been observed that there is a significant difference in the degree of staff participation for more successful service innovations, and indeed non-contact personnel (Martin & Horne 1994), e.g. the involvement of customer contact staff throughout the process is regarded as important indicator of NSD success (Atuahene-Gima 1995, 1996a, 1996b; Edgett 1994; Edgett & Parkinson 1994).

The quality of the customer relationship has been found to be a function of contact personnel expertise and knowledge (Cooper & de Brentani 1991). This suggests the need for new service design to offer flexibility in allowing customisation by frontline personnel (Schneider & Bowen 1994). However, knowledge and expertise may be insufficient for high performance. Motivation and enjoyment are also necessary (Edvardsson & Olsson 1996).

Many researchers have found that frontline staff are often reluctant to get involved in development activities because new services may increase their workload (Easingwood 1986; Scheuing & Johnson 1989a; Davison, Watkins & Wright 1989). Therefore, job design, team-working, choice of staff, training, and the reward system all become even more important (Edvardsson & Olsson 1996).

A related issue is the role played by the process of internal marketing. Research by both Lovelock (1984a) and Langeard Reffait & Eiglier (1986) has highlighted the need for a business to sell the service idea to the internal customer as they will be the ones most immediately affected by the new service introduction. The successful internal marketing of a new service in-house, especially to front-line personnel, is a critical success factor in service innovation (de Brentani & Cooper 1992; Storey & Easingwood 1993). Internal marketing and communication influences behaviour as it triggers the active involvement and co-operation of the involved personnel (Lievens, Moenaert & S'Jegers 1997b).

Compared with NPD, it has been found that in NSD a greater need exists for managerial actions that enhance the involvement of frontline personnel, particularly in the stages of idea generation, design, and project launch process (Johne & Storey 1998).

2.3.5.4 CUSTOMERS

It has been posited that success in NSD is more likely if there is extensive customer involvement in the development process, especially in the area of idea generation (Martin & Horne 1995).

Seeing customers as co-producers of services has far-reaching implications for service development practice. The behaviour of the customer, their knowledge, potential involvement, equipment, and administrative routines must be taken into account as the service is developed. The customer may be regarded as either an asset or a 'disruptive factor', and designing the service to make it easy for the customer to take part is therefore vital (Edvardsson & Olsson 1996).

The fundamental importance of involving the customer in NSD has been noted in the services literature (Gronroos 1982, 1983; Martin & Horne 1994). In reality, the extent of customer involvement has been found to be relatively low (Martin & Horne 1994; Chan, Go & Pine 1998).

The service process, involving multiple interactions with customers, needs to be customer-friendly and adapted to human logic. The best people to judge this are the customers themselves (Edvardsson and Olson 1996; Bostrom 1995; Winch & Schneider 1993). It has been argued that customers are so important in the development process that they ultimately become 'partial employees' (Schneider and Bowen 1984) or "part-time marketers" (Gummesson 1991b). Only by helping customers articulate their needs during the development process can firms gain most value (Johne & Storey 1998).

2.3.5.5 SUPPORT STAFF

Support staff are those who do not interact with customers directly, but are required to implement core or peripheral functions and service delivery. As with any other design component, the attributes and functions of all support staff are determined at the system design stage. Support staff can be particularly helpful in the design of technology for new services, eliciting the attributes of tools or equipment that they will need to use to implement the service. Their implementation of those systems can have a significant impact on the success of the interaction with the customer.

2.3.6 Stages of the NSD Process

This section explores the importance of a business establishing a formal NSD process. It then reviews the impact of each individual stage of the process.

Many service firms do not, as yet, possess a strategic focus on NSD, and in general they have been found to lack development competences and appropriate organisational structures (Easingwood 1986; Scheuing & Johnson 1989a; Edgett 1993; Martin & Horne 1993). For example, top performing banks have more formalised and better structured NSD programmes than lesser performing ones (Reidenbach & Moak 1986; Johne & Harborne 1985; Johne & Pavlidis 1996; Johne 1993).

Two factors describe the business' proficiency in developing new services: (i) a detailed/formal NSD process describes the quality of the total activities used for creating and launching new services; (ii) effectiveness in carrying out the NSD process. New services which relate highly on this second dimension successfully exploit the different types of expertise and knowledge available within the business (de Brentani 1991).

Whilst NSD has tended to follow the same generic process as NPD, the relative importance of each stage, and how each stage is carried out, is affected by the unique characteristics of services. Griffin (1997) found that a service business' process consists of fewer steps than would be used by manufactured goods

suppliers (3.8 steps vs. 5.4 steps). Product screening, concept testing, product testing and market testing techniques have found to be little used in NSD (Easingwood 1986; Bowers 1989; Scheuing & Johnson 1989a; Davison, Watkins & Wright 1989; Edgett 1993; Bowers 1986). Where they are carried out, they are done less than proficiently, even though evidence suggests they have a high impact on the project outcome (Reidenbach & Moak 1986; Mohammed-Salleh & Easingwood 1993). Similarly, Edgett (1996) found that financial service firms are still skipping large parts of the process and, even when stages are carried out, they are being done so less than proficiently. Martin & Horne (1994) seek more research into the efficiency of the activities in the process because of "competitive pressures and the quest for quickness in the process".

How well various activities of the NSD process are carried out has been found to separate the winners from the losers (Edgett 1996). In a survey of commercial financial services firms, Edgett (1996) discovered a strong link between the quality of execution of the stages of the NSD process and the overall performance of NSD projects. In particular, the author noted that the NSD activities which strongly distinguished the high performers were the "pre-development" stages of the NSD process. While Edgett's (1996) findings, i.e. that top performers do indeed score more highly on the quality of execution of the stages of the NSD process, these were arrived at by aggregating scores for all respondents' NSD projects. Few research projects have tested this assertion on a cross-sector sample of individual firms NSD programmes.

The way in which the NSD process is executed is dependent upon the knowledge, skills and expertise of a service business' staff and management, i.e. its technical and marketing knowledge. The development of a new service generally starts with a coarse, information-poor format (e.g. an idea for a new service) and gradually evolves, generally via a NSD process, to a detailed, information-rich format (e.g. charts, blueprints, new services & systems). At each stage of the process, knowledge is added to the design with the help of the know what, know

how & know why¹⁰ (i.e. tools, methods, models, and architectural knowledge). Inter-organisational interfaces must therefore be engineered such that communication is facilitated (Montoya-Weiss & Calantone 1992).

The most common stages referred to in the literature as constituting the NSD process are now discussed; NSD strategy; idea generation; market assessment; screening; concept stage; service design; market testing; implementation; launch; post-launch review.

2.3.6.1 NSD STRATEGY

A constant theme running throughout NPD best practice reports is the need for a development strategy to direct the overall programme and each individual project undertaken (Little 1991; Booz et al. 1968; 1982; EPO Group 1995; Kuczmarski 1994; Mercer Management 1994). It is recognised that these strategies could be either formal or emergent (Mintzberg 1987).

What is the role of a NSD strategy? Some researchers observe that strategic issues in NPD only intrude or act to the extent that they provide a framework for innovation (Twiss 1980), act as a screening device (Cooper 1988a) or are affected by the economic outcomes of innovation. Scarborough & Lannon (1989) observed that in reality, "not only are fundamental strategic factors often hard to quantify in strict economic terms, but they may play an active role in driving and not simply filtering innovation projects" (p. 54).

Cooper (1996a) indicates that a new product strategy should: (i) identify the goals or objectives of the business unit's total new product effort; (ii) communicate the goals to of new products in achieving the business' goals; (iii) specify specific areas of strategic product, market and technology focus; (iv) provide a long-term thrust.

The type of new product strategy adopted by firms has been found to be closely related to the performance results achieved (Cooper 1984a, 1984b; 1984c). The

¹⁰ In: "The Professional Intellect" (Quinn et al. 1996)

implication, therefore, is that the performance of a business' NPD is determined by top management action, i.e. by the development of an appropriate strategy. The strategy elected can achieve different types of performance, e.g. high success rates, high impact on the business as a whole, or high relative performance against the competition faced in the market (Cooper 1984a, 1984b; 1984c). Achieving high performance in all three areas is a very difficult objective to attain.

Booz, Allen and Hamilton (1982) reported that 75% of its surveyed firms possessed a new product strategy as part of their new product process. Most employed a formal new product process usually beginning with identifying the new product strategy. Similarly, Page (1993) reported that 56.4%, and Griffin (1997) 62.7%, used a NPD strategy. Conversely, Feldman & Page (1984), and Moore (1987), found the use of formal new product strategies to be lacking in most of the firms they examined (11% and 33% respectively). Mercer (1994) found that having a strategy for NPD was a key differentiation between success and failure. Griffin (1997) identified that a statistically higher percentage of the best performing respondents (i.e. 75.9%) had specific strategies, while only 58.8% of the lower performers did. Interestingly, Griffin found no statistical differences in having an overall strategy between service and manufactured goods producers.

Freeman (1974, p. 255) and Parker (1978, p. 98) discussed six broad types of innovation strategies available to firms: (i) offensive; (ii) defensive; (iii) imitative; (iv) dependent; (v) traditional; (vi) opportunistic. A more comprehensive and parsimonious typology for understanding organisational strategy has been developed by Miles & Snow (1978). They categorised the firms employing organisational strategy as prospectors, analysers, defenders, and reactors. What differentiates one strategy from another are the business' goals and the degree of familiarity with its new products, markets, and technologies (Cooper 1983a; Crawford 1980). A business that ventures into totally new and unfamiliar products, markets, and technologies is posited to have greater need for information and knowledge about the market and technology to reduce the risk of new product failure (Gupta, Raj & Wilemon 1986a). It should be noted that the Miles & Snow typology has been criticised for being too prescriptive, and

divorced from the actual strategies being implemented by firms to guide their NPD activities.

Researchers have also referred to the existence of proactive, as opposed to reactive, marketing strategies. Kotler (1994) wrote about attacker and defender market and product strategies. Such strategies refer to strategic intent - whether a supplier wants to lead product change or to follow the lead of others. Johnes (1994) has referred to a reactive "rule-breaking" type of strategy as "new style product development". 'New style' product development describes an approach which is output-orientated, rather than input-orientated. Its aim is to exploit market potentials as fully as possible. Success is judged against market potentials, not against past internal performance measures. In a discussion of learning in product development, Lynn et al. (1998) assert that their review of the innovation literature identifies four types of strategy: (i) customer-driven (von Hippel 1978); (ii) process-driven (Calantone & di Benedetto 1988); (iii) pioneer-driven (Lambkin 1992); (iv) learning-driven (Lynn et al. 1996). McKee (1992) identified that a mismatch between the NPD strategy adopted and learning style sought can lead to failure.

No recognisable research theme has investigated the existence of development strategies specifically for services firms.

2.3.6.2 IDEA GENERATION

Interestingly, although Easingwood (1986) identified that service firms find it relatively easy to generate new service ideas, many services markets are characteristic of an overall lack of radical innovation (Chan, Go & Pine 1998). Historically, there is often a dangerous focus on 'me-too' products, with most developments being reactive and defensive in nature (Piercy & Morgan 1989). Cowell (1988) cites the difficulty in patenting services as a reason for the low R&D expenditures which exist, as well as the concentration on *improvement* rather than innovation. In the past, much technological innovation has been driven by cost requirements (Langeard et al. 1981). Bowers (1986) reports that service firms do not tend to engage in a formal process of idea generation, and

recommends they should “routinely search for new product ideas outside of the organisation” as a way of getting closer to the market (p.70).

Whilst many service firms find it relatively easy to generate new service ideas, they tend not to engage in formal idea generation (Easingwood 1986). However, it has been found that successful firms establish systems and procedures for stimulating idea generation on a long-term basis (Robinson & Stern 1997; Felberg & DeMarco 1992).

In identifying that few ideas for new products come from the formal strategic planning system, Moore (1987) raised the question as to whether a new product strategy actually constrains the search for new ideas. In directing search activities, it is important that the idea generation activity is viewed not as an isolated activity in the new product development process, but as a continuous and integrated feature of the development process which requires close management attention. Crawford (1994) noted that techniques for stimulating ideas for new services must be created and maintained on an on-going basis to keep generating innovations. Since ideas for new products can arise almost anywhere (Robinson & Stern 1997), it has been argued that idea search systems should embrace the whole business (Vandermerwe 1987).

Ideas for new service products have been shown to be generated in many ways. They can arise inside the business and outside it; they can result from formal or informal search procedures, they may involve the business in creating the means of delivering the new service product, or they may involve the business in obtaining the rights to the service product, e.g. through a franchise agreement (Cowell 1988). *Employees* have long been identified as an important source of winning new product ideas (MacMillan & McCaffrey 1984). In service firms, given the physical and psychological proximity of customer contact personnel to customers, steps should be taken to establish a mechanism to solicit and reward new service ideas from contact personnel (Bowers 1989). However, the operations and customer service functions of service firms, in spite of their opportunity to do so, are the source of relatively few ideas. De Brentani (1991) found front-line personnel did not appear to play a significant role in the early

stages of the NSD process. One explanation for the failure of operations personnel to contribute new product ideas could be the lack of a formal NSD process or, as suggested by Easingwood (1986), "there is a tendency for operations people to perceive new products as creating increased workload" (p272). Some service firms, recognising the potential for new ideas, are increasingly tapping their employee's knowledge and creativity, e.g. Schneider & Bowen (1984) reported that National Car Rental used to conduct monthly focus groups among employees to uncover ideas for improving existing services as well as developing new dimensions to these services, and Kodak and American Airlines have established innovation systems to facilitate connections between employees (Robinson & Stern 1997).

UK Insurance firms are guilty of making little use of *customers*, perhaps as a result of seeing the intermediary as the first-line customer (Davison, Watkins & Wright 1989).

Due to the ease of copying, *competitors* are often the single most important source of ideas for new services (Easingwood 1986; Hooley & Mann 1988; Scheuing & Johnson 1989a). In research by Teixeira and Ziskin (1993), it was found that approximately 80% of banks viewed their competitors as the main source of new product ideas. Other sources of ideas included: (i) technology forecasting (Chan, Go & Pine 1998); (ii) suppliers (Chan, Go & Pine 1998); (iii) statistical techniques, e.g. conjoint analysis, perceptual mapping, and attribute analysis (Chan, Go & Pine 1998); (iv) staff (McGuire 1973); (v) regulatory changes (Kelly & Storey 1998a).

2.3.6.3 MARKET RESEARCH/ASSESSMENT

Market research can be applied in both internal and external situations. External analysis identifies trends, threats and opportunities in the market by gathering data about suppliers, customers, competitors, substitutes, regulations, and other relevant aspects, e.g. in the case of a major innovation, market research should help appraise the business of potential demand. The internal analysis determines how the new service fits with the business' current offering, how it will impact the

business' current operations and what skills, resources, and capabilities are needed in the development effort.

Implicit in the strategic planning stage - and probably deserving the status of clearly stated first step in the process (Mullins & Sutherland 1998) - is effort directed toward the understanding and identification of customer wants and needs, particularly those hidden from immediate view, in gaps between currently available product and service categories. The use of market research in NSD has been examined in several empirical studies. Most of the studies observed a widespread lack of sophistication (Davison et al. 1989; Gupta et al 1990; Edgett & Thwaites 1990; Edgett 1993). This may, in part, be due to: lack of a marketing culture; a large number of new service products are copies; many service firms have not formed formal marketing research units, or they have been in existence for a limited amount of time (Morgan 1989).

Ennew & Watkins (1992) and Langeard et al. (1981) found that management's perceptions of consumer preferences and intentions were frequently wrong, indicating a need to invest in quality research.

Quantitative research is generally not recognised as being a reliable means of assessing consumer acceptance of new service products (Langeard, Reffait & Eiglier 1986) because of the general absence of a physical prototype and the difficulty of reproducing market conditions. Methods used to develop 'new-to-the-world' services include prototyping and qualitative research methods like focus groups (Mullins & Sutherland 1998). Similarly, Edgett & Jones (1991) found in their study of the launch of a successful financial services product, that the development process adopted by the institution made extensive use of qualitative research techniques, rather than quantitative methods, at different stages of the development process.

Much of the market research conducted by firms during NSD would appear to consist of 'off the shelf' reports (Davison, Watkins & Wright 1989). Such syndicated market data quantifies existing market and brand shares, identifies socio-economic characteristics of existing customers, and can to a limited extent

be used to identify market opportunities. However, it gives little insight into consumer behaviour.

2.3.6.4 SCREENING

The objective of screening new service ideas is to allocate resources between those projects which have the most likelihood of helping the business meet its objectives. Applying a systematic and formal management decision approach has been closely linked to improved success in the development and launch of new products (de Brentani 1986). The screening process can be a single activity or a multi-stage procedure, and it can utilise quantitative or qualitative screening criteria. As screening is likely to be carried out during the early stages of the NSD process, there may be a shortage of "hard facts", and the only information available on which to make a decision may be the subjective opinions of the management team. Some researchers have argued that firms operate in a company-specific mode, and therefore the screening criteria chosen should be refined to reflect the characteristics of the particular type of business (Choffray & Lillien 1980). Others observe that a fairly universal set of new product screening criteria appears to be relevant for most firms (de Brentani 1986). Although efforts are being made to develop greater numerical accuracy, Cooper (1981a) has posited that screening decision will always be plagued by a high degree of uncertainty and subjectivity.

Most service firms have been found to use informal screening procedures (Easingwood 1986, Edgett 1993). While profit; sales, revenues and market share estimates are all used in analysing the potential of projects (Scheuing & Johnson 1989, Martin & Horne 1993), specific screening criteria used in service firms include the potential impact on the image of the service organisation (Langeard & Eiglier 1983). However, it has been recognised that a wider range of issues needs to be accounted for, e.g. the link between the image of the new service and the image of the service business as a whole (Thomas 1978; Langeard & Eiglier 1983; Easingwood 1986).

In the evaluation of service developments, managers face the problems of allocating costs across shared delivery systems and estimating the cannibalisation of existing products. It has been argued that because of the use of shared delivery and management systems, the actual financial loss from product failure can be low (Davison, Watkins & Wright 1989). There are, however, considerable hidden costs to failure. Notably the cost of managerial effort wasted on weak products, the adverse affect a poor service has on the corporate image and missed opportunities in terms of alternative new products that could have been developed. However, a wider range of issues needs to be taken into account. The literature with respect to NSD project success and failure offers guidance to practising managers in the selection of criteria when evaluating new service ideas. There have been several large scale empirical investigations, e.g. Easingwood and Storey (1991), de Brentani (1991), Edgett and Parkinson (1994), Cooper et al. (1994), Storey and Easingwood (1998), Attuanhene-Gima (1996), and de Brentani & Ragot (1996). The key success factors for new services which may be used in screening new service ideas include:

- Synergy between the new service and the organisation.
- Understanding the marketplace.
- A customer centred orientation.
- A large, growing need for the service.
- A formal and well resourced development process.
- A culture that supports innovation.
- Extensive research and testing.
- The relative advantage of the augmented service offering.
- The expertise and enthusiasm of the customer contact staff.
- The quality of the service experience.

2.3.6.5 CONCEPT DEVELOPMENT & TESTING

Concept development starts with the identification of customer requirements (e.g. Griffin & Hauser's voice of the customer 1993). These requirements are then combined with other requirements (e.g. regulation) and translated into attributes for the new service. These are then tested (Bitran & Pedrosa 1998). Murphy & Robinson (1981) was one of the earliest papers to have discussed the application of the concept test to NSD.

Concept testing is often carried out imperfectly in NSD because it is both difficult to develop accurate concept descriptions and customers often have difficulties in articulating which precise benefits they prefer, which then increases the uncertainty as to the accuracy of the research results (Langeard, Reffait & Eiglier 1986; Mohammed-Salleh & Easingwood 1993; Edvardsson, Haglund & Mattsson 1995).

Concept testing involves taking the 'design blueprints' and building pilot operations (similar to prototypes for tangible products), measuring their performance, comparing with expected performance, and refining the design so that the product or service displays the expected behaviour (Bitran & Pedrosa 1998). A number of methods and procedures have been proposed which are likely to assist service firms to develop the initial service concept. Simulations and prototypes have been employed successfully, e.g. in the hotel sector (Davis 1988). It has also been posited that new technology in the form of virtual reality is likely to be used in future (Rosenberger & de Chernatony 1995). Firms can speed up the adoption process by lowering the degree of service newness to customers, i.e. new services should not have concepts customers find difficult to understand, require major learning effort and time for effective use, or require considerable advance planning for adoption (Atuahene-Gima 1996b; Lievens, Moenaert & S'Jegers 1997b).

2.3.6.6 DESIGNING NEW SERVICES

It has been observed that there are two main elements to designing a new service (Cowell 1984): (i) defining the core service attributes; (ii) defining the service

delivery system, i.e. bringing together people, processes and facilities. Similarly, Lovelock (1996) separates the service marketing concept (its benefits and costs) from the service operations concept which defines the operational requirements. Edvardsson and Olsson (1996) argue that service development can be broken down into three activities:

- *Service concept* development (the description of customer's needs and how these are to be satisfied).
- *Service system* development (represents the static resources required for the service. These resources consist of the service business' staff; the physical/technical environment; the business in terms of its structure and administrative support systems, and also customers themselves, as they can be considered "co-producers").
- *Service process* development (the chain of activities which must occur for the service to function).

Any variation in the quality of the service delivery network alters what the customer receives. Therefore, in a service business operations and frontline staff play a critical role in the development process (Easingwood 1986; de Brentani 1989). Indeed, one of the main problems faced in achieving NSD success is balancing the needs of new service operations and processes with those of existing business activities (Langeard, Reffait & Eiglier 1986). Careful co-ordination is needed because of the interdependency of many development projects and service technologies (Edvardsson, Haglund & Mattsson 1995). Although marketing frequently has responsibility for NSD, it often does not have overall responsibility for all associated activities, such as training or service testing (Scheuing & Johnson 1989a; Gupta et al 1990). Close co-ordination between all the functions involved in service delivery is therefore needed (Langeard et al 1981; Shostack 1984a; 1984b). Customers also need to be involved in the design, for any new service must fit in with their systems (Edvardsson & Olsson 1996).

There have been few empirical findings to show how to go about designing both core attributes and the supporting process of delivery. One exception is the work

of Shostack (1982; 1984a; 1984b) who proposed the use of “molecular modelling” and “blueprinting” to bring order to the process. The molecular model shows the way in which tangible and intangible elements of the service are incorporated into the final offer. Importantly, different models can be produced for different segments, based on preferences for individual elements. Shostack (1982) stresses the advantages of “blueprinting” the operational process in diagrammatic form. The service blueprint is based on time and motion theory, PERT project programming, and on system design techniques, and it shows time in diagrammatic form, all the main functions of the service, all possible fail points and processes to correct these, and the relationships between the front and back offices.

Behara & Chase (1981) propose the use of the “house of quality” (a component of QFD) for service design, or “service quality deployment”. In the “house of service” service components are divided into planning, procedures, and personnel. Architectural knowledge is particularly important at this stage to map the overall system design to its component parts. This knowledge is likely to be held by a number of people and departments.

Gronroos (1990, p.58) identified the root cause of the failure in the service design process to be the failure to place service design process “in the hands of people who have a thorough understanding of the needs and wishes of the market and of the consumers of services to be designed”. If staff are to be effective in anticipating and meeting customer needs, they must understand the processes comprising the service offering. It is this knowledge that leads to the high level of employee know-how and know-why found in service firms successful at NSD (Kim 1993).

2.3.6.7 MARKET TESTING

Market testing is designed to evaluate whether a prospective user: (i) understands the idea of the proposed service; (ii) reacts favourably to it; (iii) feels it offers benefits and satisfies unmet needs. Market testing attempts to test the product

performance among a limited of test-set of customers and to gauge potential market reaction and acceptance.

Prior to market introduction, the use of market testing is widely advocated because it is easier and cheaper to correct mistakes in the design of a service and in the service support systems at this stage than after a formal launch (Johne & Storey 1998). Langeard, Reffait and Eiglier (1986) even consider market testing, and test marketing in general, to be more important than market research, as the latter is often not a reliable means of assessing consumer acceptance of new services. Although market research can provide broad customer reactions to a new service concepts, it is important to create a service experience that the consumer can evaluate, thus enabling the business to make sure the service is operating correctly.

However, it has been observed that market testing, of all the steps in the NSD process, is by far the most omitted of all NSD stages and, on those infrequent occasions when it is performed, it is not done well (Mohammed-Salleh & Easingwood 1993). Banks, building societies and insurance firms, in particular, frequently introduce a new service with limited promotion. A number of other factors have been cited as reasons for the widespread lack of market testing by services firms (Easingwood 1986; Reidenbach & Moak 1986; Davison, Watkins & Wright 1989; Mohammed-Salleh & Easingwood 1993). These include:

- Financial loss from service failure is low in comparison to the cost of market testing.
- The ease of copying of the service by competitors who could benefit from information derived from the test.
- Lack of time, as many new services are copied
- Importance of the speed of launch
- Market reaction to "copies" can be easily estimated
- There is little difference between the cost of testing and the cost of going 'live'.

- Many new services are introduced to complete the product line rather than purely for profit.
- Offering new services at only limited sites restricts the perceived overall value (Johne & Storey 1998), e.g. the benefits of an ATM service is influenced by the number of available locations.

Mullins & Sutherland (1998) observed the desire of a telecommunications business to get the new service into the hands of customers quickly, and then to continue a dialogue with them in order to modify the product to better meet their needs. Such an approach, while not new to manufacturing firms, has not been widely discussed as suitable approach for service firms, in spite of its apparent advantages given their absence of tooling and other impediments found in manufacturing firms.

2.3.6.8 IMPLEMENTING NEW SERVICES

Generally, the implementation stage involves translating strategic intentions into action steps. It involves assigning relevant tasks and actions to people, ensuring that the tasks are executed, and accomplishing predetermined objectives. Some authors regard the implementation stage as the most critical stage in NSD (Schneider & Bowen 1984). It is where the plans regarding the service concept and the service process are put into action. Shostack (1984a; 1984b) regards the service implementation as comprising three distinct phases: (i) implementation of the operations plan; (ii) implementation of the communication strategy; (iii) market introduction.

During the implementation of a new service, marketing communications can play a vital role in controlling customer expectations about the characteristics and value of the new service (Schneider & Bowen 1984; Edvardsson & Olsson 1996). It can be important in keeping all employees up to date with development activities. Extensive testing and training is also required (Scheuing & Johnson 1989a). This should not just be confined to service personnel, as customers may need to be taught how to use elements of the service offering (Johne & Storey 1998).

2.3.6.9 LAUNCH

There are three reasons why the launch of a new service should be executed rapidly and smoothly by firms: (i) it maximises the time in which profits can be achieved; (ii) it assures a large volume of business can be built up to spread fixed costs over a large base; (iii) particularly for radical new services, it is important that customers continue to have faith in the business' ability to deliver the product (MacMillan & McCaffrey 1984).

However, a highly visible launch can lead to faster competitive response (MacMillan, McCaffrey & Wijk. 1985). Therefore, it is important that the customer contact staff are prepared adequately. They must not only have the necessary expertise, but should also be enthusiastic for the project. This can be cultivated by internal communications and "internal marketing", supported by staff training (Johne & Storey 1998).

2.3.6.10 POST-LAUNCH REVIEW AND LEARNING

Feedback as an organisational learning principle is needed to detect and correct error and reinforce particular responses. Some key monitor indicators should be established to measure the progress made, i.e. in deciding what to change and how to change it, the progress of the NSD process should be evaluated (Day 1994a). A business that does not use the knowledge that is generated in the development of a new service loses many of the benefits that a NSD process brings. In a NPD context, Wheelwright & Clark (1992) assert that learning for product development goes beyond changing procedures, methods, or models, and requires careful systematic effort. The authors report that using a "project audit" - a formal review conducted by a cross-functional team appears to be of great help to organise the learning process.

As with tangible product development, many service firms recognise the importance of post-launch assessments and on-going monitoring programmes (Easingwood 1986, Grden-Ellson et al. 1986). Owing to the inseparable nature of many services (i.e. the service is produced and delivered in parallel), service firms do have an advantage over firms developing new tangible products during

implementation. In particular, immediate feedback can be obtained from customers which can assist firms in quickly identifying and correcting potential problems.

2.3.7 Factors Impacting Success & Failure NSD

Of the comprehensive reviews of the success/failure literature published (Johne & Snelson 1988; Barclay & Benson 1990; Hart 1993; Montoya-Weiss & Calantone 1994), the majority investigate tangible products only. The development of insights and useful knowledge in the service sector has been slower in coming. In general, there is no one single factor which impacts success, nor a simple answer as to how to spot a winning product. Success depends on many characteristics and variables. In particular, the studies of NSD success indicate the need for:

- A clear corporate vision concerning the role NSD is to play in organic business development
- Top management commitment
- Clear goals for the NSD programme
- Supportive culture, with no fear of failure or overarching bureaucracy
- Internal systems to support innovation and enhance communication
- High quality and experienced development staff
- Job descriptions and reward systems linked to innovation
- The presence of intrapreneurs to pursue aggressive product innovation.

Factors affecting NSD success can be identified at the project, programme, and organisational level. The project task is concerned with getting a single NSD right, and the programme task is concerned with getting a series of service developments right, usually over a longer time span.

With respect to NSD *project* success and failure, Johnes & Storey (1998) report that there have been seven large scale empirical investigations (Easingwood &

Storey 1991; de Brentani 1991; Edgett & Parkinson 1994; Cooper et al. 1994; Storey & Easingwood 1994; Attuanhene-Gima 1996a; de Brentani 1996; de Brentani & Ragot 1996). In these studies of individual NSD projects, managers are asked to rate a specific recent development project in terms of a large number of descriptive variables. Factor analysis is then used to simplify the data. Managers also self-rate the performance of their service on a number of dimensions. Correlation and regression analysis are then used to explore the relationships between the factors and the performance.

Research has shown that explanations of project success are multi-factored. A host of important supporting activities need to be managed competently and in a balanced and well co-ordinated manner. Supporting activities have been summarised by John & Storey (1998) under three broad sub-tasks which underpin effective and efficient project development: opportunity analysis; project development; and offer formulation (see Appendix G).

As well as studies into successful NSD projects, there has been research into service development *programmes* (e.g. John & Harborne 1985; Hodgson 1986b; Reidenbach & Moak 1986; Martin & Horne 1993; Drew 1995a; John & Pavlidis 1996). These studies examine factors affecting firms that, on the whole, are successful at developing new services over a period of time, rather than one-off project successes. Programme findings mirror work on individual project success and failure. Firms tend to have a commitment to service development, with systems and a culture which support innovation. For example, job descriptions and reward systems are linked to the NSD process. NSD programmes are more formalised, proactive and the whole process is better structured. One of the reasons for this is that they have higher quality and more experienced development staff. They have a clear strategy for new products and on the whole aim beyond short-term financial objectives. Such innovative firms concentrate on their existing strengths, have better market knowledge (keeping one eye on the market and one eye on the competition); fit new services with the current portfolio, and accept the limitations of available resources (John & Storey 1998).

Although the literature indicates that the success/failure factors in NPD and NSD are quite similar, there are some fundamental differences which need to be understood. Unlike business that produce tangible goods, service firms may typically not rely on product advantage as a means for ensuring the success of a new service. Developing a competitive response to a tangible product may require significant investments of time and resources. Service firms can more easily duplicate the core elements of a new service (Easingwood & Storey 1998). Research investigating success and/or failure factors have tended to support the notion of a generic approach to product development, e.g. there is an assumption that success factors apply to all product, market and technological scenarios (Poolton & Barclay 1998). In reality, the relative intensity and applicability of each factor may vary considerably.

In order to explore the factors which explain success and failure and competitive advantage in NSD, this research makes use of the McKinsey 7-s framework (Johne & Snelson 1990). It has the advantage of parsimony: efficiency factors are incorporated in only 7 headings which are meaningful to managers. The 7 headings are explained in Appendix H.

2.3.7.1 THE IMPACT OF STRATEGY ON NSD SUCCESS

The importance of strategy was reviewed in the previous section. However, a couple of further comments are offered.

It is widely recognised that competitive advantage can result from: (i) the implementation of a value-creating strategy which is not simultaneously being implemented by any current or potential competitors (Barney 1991); (ii) through superior execution of the same strategy as competitors. In the NSD and NPD literature there is much evidence to highlight the importance of establishing synergy between a new service and the business (Johne & Storey 1998). One may argue that the new service should fit in with the existing products of the business, the image the business it has, and with the overall strategy of the business. The resources and expertise required for the new service should already be available in the business in all major functional areas. At best, new services should be

developed for markets that the business understands. Research has also demonstrated that sustainable advantage can be gained if a new service builds on the strengths of the business to form barriers to entry, in terms of business reputation, access to users, learning barriers, distribution networks and operating systems (Easingwood 1990).

2.3.7.2 THE IMPACT OF STRUCTURE ON NSD SUCCESS

Structure can refer to both the physical structure of the business as defined in the organisation chart, and the particular structures adopted to manage development projects.

The traditional role of formal structure in service firms has been to control through rules and procedures. However, Johnes & Davies (1998a; 1998b) observe that this is being gradually replaced by a system of control through shared values, leadership style and systems that allow top management to monitor the outcome of decisions made at the business level. Much of the management research investigating organisational structure has taken place in the context of manufactured goods suppliers. Damanpour (1991), in making a comparison of the differences between the two, observed lower levels of formalisation in service firms but higher levels of direct supervision.

Edvardsson & Olsson (1996) note the need for the organisation structure to perform four key roles in a service business: (i) to clearly define responsibility and authority; (ii) to support planning and administration; (iii) to facilitate easy dialogue with customers; (iv) to organise and control the various activities connected with marketing.

In the service sector, many management theorists (Carlzon 1987) have long argued for flattening the organisation chart and turning it upside down, thereby placing customer contact personnel on the higher level of an inverted pyramid. In inverting the structure, managers support staff in their tasks, and act as coaches and role models to help staff provide better service to customers, thus ensuring their ideas for future service development are valued. The pyramid structure is particularly in evidence in professional services firms. Quinn et al. (1996a) assert

that the structures adopted by service firms should be finely tuned to the particular innovation strategy being emphasised (also Lovelock 1996). The authors report the use of different organisational forms to ensure the business is both more responsive to customer needs and captures and disseminates internal and external knowledge (e.g. inverted organisation, networks, spider's web, starburst). It has been found that firms which adhere to traditional hierarchies, and which foster 'segmentation' within the business are likely to inhibit innovation (Kanter 1983; 29 - 30).

The impact of particular project structures on project performance has been reported in the literature. In investigating the issue of tangible product development, Larson & Gobeli (1989) found that the success of development projects varies according to the project management structure used, and that project structure does have a significant effect on success, even when other determinants are considered (functional organisation, functional matrix were found to perform less well against a balanced matrix, a project matrix, and project teams).

In their research, Martin & Horne (1993) discovered that firms with the most successful service innovations were characterised as having significantly more internal participation than those which were relatively less successful. Functional co-ordination during development can be achieved via good internal communications or through the use of formal multi-functional development teams (Edgett 1994; Edgett & Parkinson 1994; Atuahene-Gima 1995, 1996a, 1996b).

Scarborough & Lannon (1989) observed that there are significant constraints placed upon the management of innovation projects in service firms in terms of both skills and location within the organisational structure. Lovelock (1984a) suggests the creation of a 'task-force' which is insulated from day-to-day functional pressures. However, Gronroos (1994) highlights a potential danger:

Marketing management cannot be separated from the management of other business functions in the same way in service firms as in the consumer goods sector, and that strategic management, therefore, cannot be treated in isolation, from strategic management and strategic planning'.

It has been noted that one way to achieve effective integration is through the use of an internal marketing mechanism (Varey 1995). Such mechanisms seek to ensure that internal customers, irrespective of their functional affiliations, get the resources and support they need in order to best serve their employees, and ultimately their customers. Indeed, successful NSD projects have been found to be enhanced by high levels of interfunctional co-operation, even to the extent of co-locating teams (Mullins & Sutherland 1998). While Edgett (1993) asserts that the development of new services may require different organisational forms to make it easier for conflict-free co-ordination to take place, Drew (1995b) calls for the development of new work styles which are designed around processes rather than functions. Thwaites (1992) identifies four structural goals which firms must seek in order to achieve NSD success: (i) high levels of communication in all directions of the business; (ii) problem-solving through teams; (iii) high levels of co-operation; (iv) a simple, well-documented structure which is understood and only has the number of tiers necessary to be effective and allow rapid adjustments to changed circumstances.

In their research, Chan, Go & Pine (1998) observed that 31% of a service business' NSD activities were controlled by marketing managers, only 27% used a team approach, and the remaining firms employed either project managers or general managers. There is also evidence in the literature that successful NSD project teams are being run on a committee basis (Edgett 1993; John & Davies 1993). Griffin (1997) identified that service firms are statistically less likely to have development organised at the SBU level. Permanent staffs and process owners were found to be the most frequent reporting structures for service firms. Service development was, asserted Griffin, most likely to be found reporting to the marketing function, and least likely to an engineering function. The author distinguished no organisational development differences between service and product-producing firms, i.e. both use cross-functional teams extensively.

2.3.7.3 THE IMPACT OF SYSTEMS ON NSD SUCCESS

A number of business systems are identified in the literature as having a big impact on NSD success. The role of information technology in achieving strategic competitive advantage is beginning to attract the attention of academic researchers (Colgate 1998). The most basic organisational systems - from accounting to billing to incentives to information systems - can play a key role in facilitating or obstructing efforts to bring new services to market. Solutions to revamping inflexible and out-dated systems are likely to be as much cultural as structural in nature (Mullins & Sutherland 1998).

Quinn & Paquette (1990) assert that in the same way that technology can offer standardisation, it can also be employed as an entry barrier for competitive imitation, a particular problem for service firms. In the UK multi-channel television market, BSkyB has used technology to both improve distribution and to heighten the barrier to firms wishing to compete in terms of customer service quality.

Scheuing & Johnson (1989a) and Atuahene-Gima (1996a) found that it is important to adequately reward development activities.

In terms of communication strategy, an extensive distribution system can help by making target markets more accessible. Not surprisingly, empirical research has therefore stressed the benefits of a multi-channel distribution strategy in achieving NSD success (Easingwood & Storey 1996).

2.3.7.4 THE IMPACT OF STYLE & SHARED VALUES ON NSD SUCCESS

The literature on cultural change in firms suggests that, although playing a central role in the success and failure of new services, the development of a supportive organisational culture is a real challenge and difficult for firms to achieve (Mullins & Sutherland 1998; de Brentani 1989). The NSD literature indicates a number of styles and cultures impact NSD success.

The importance of developing a culture which minimises the fear of failure has been observed in the literature (Lievens, Moenaert & S'Jegers 1997b).

Many NSD projects have been found to possess poor “ownership” which results in intra-organisational conflicts, co-ordination problems, and a lack of information about specifications and goals at the start of the development process (Edvardsson, Haglund & Mattsson 1995).

The role of top management in the success of NSD has been noted by Bantel & Jackson (1989). They identified that few top insurance managers provide the sort of support that could be described as “envisioning, energising and enabling” an innovation programme. In the banking sector, Bantel & Jackson (1981) observed that the characteristics of the top management team are more predictive of organisational innovation than are CEO characteristics.

Ideally, service development should be market-driven. Technically, or intuitively-driven development, often results in services which lack relevance to the customer (Berry & Hensal 1973). Hence, the importance of identifying the precise needs of the market. Firms with a strong market-orientation have often been found to develop more successful products (Johne 1996).

See Appendix I for more detail on organisational cultures and climates.

2.3.7.5 THE IMPACT OF SKILLS & STAFF ON NSD SUCCESS

The development of appropriate skills, knowledge or expertise is vital for the effective and proficient development of a new service. The NSD process has been observed to be a very complex, knowledge-intensive activity, incorporating many embedded 'loops of learning', and the creation and maintenance of these skills, particularly over the lifetime of a NSD programme, is likely to be integral to the success of NSD. Bitran & Pedrosa (1998) note:

The development of a new product or service generally starts with a coarse, information-poor format (e.g. an idea) and gradually evolves to a detailed, information-rich format (e.g. charts, blueprints). At each stage of the process, knowledge is added to the design with the help of tools, methods, models, and architectural knowledge. Starting from the identification of a need or opportunity, designers seek to understand desirable attributes of the

prospective product and generate an initial concept...When a product or service is the first of its kind, no previous architectural knowledge exists to help in its design. Thus, an initial architecture is proposed and evolves over time until a dominant design emerges. At this point, the architectural knowledge becomes part of the methodology to develop other similar products or services (p. 172).

However, although many service firms learn new skills from their own experiences, they do not always do so systematically or very efficiently (Sundbo's 1997). With the rapid rise in NSD activity, Ennew & Wright (1990) found that service firms, i.e. building societies, were not hiring enough specialists and people with experience from other industries to acquire the breadth of expertise required, and had set about recruiting more specialists and developing more flexible organisational structures.

From the NSD literature, three groups of individuals can be identified as contributing significantly to the success of development projects (Johne & Storey 1998): development staff; customer-contact staff; customers. One may also add back-office or internal staff (Bitran & Pedrosa 1998). This is expanded in a later section.

Project managers and product champions are the two most likely leadership styles to be encountered in both NSD and NPD. A product champion is defined as 'a person who takes an inordinate interest in seeing that a particular process or product is fully developed and marketed. The role varies from situations calling for little more than stimulating awareness of the opportunity to extreme cases where the champion tries to force a project past the strongly entrenched internal resistance of company policy or that of objecting parties' (Crawford 1991). While Griffin (1997) found no statistical differences in who was responsible for leading successful and unsuccessful projects, the Mercer study¹¹ (1994) identified that 63% of the higher-performing firms used product champions. Similarly,

¹¹ This was a cross-functional study, and there are no reference in Griffin (1997) as to how many of these were service businesses.

(Edgett & Jones 1991) identified that the presence of product champions was associated with NSD success.

2.3.8 Measuring Development Performance

It is important that a business which has established objectives for its NSD efforts is in a position to determine the extent to which the objectives have been achieved. As a consequence, a small literature has emerged around the measurement of NSD performance, incorporating both NPD and NSD (although mainly NPD). For example, Booz, Allen, Hamilton (1982) found that two-thirds of all the firms they studied measured new product performance and, of those, nearly two-thirds used more than one measure of success. In 1993, Griffin & Page identified 75 measures of NPD performance.

2.3.8.1 METHODOLOGICAL APPROACH TO MEASUREMENT¹²

Two methods have traditionally been employed to collect data on NPD success measures. These are to ask the respondent to:

- Categorise success themselves, e.g. "select a product which was a success" and/or "was the product selected a success?".
- Supply the data which indicates whether the product was a success or a failure, e.g. profit and sales levels during the analysis period.

However, surprisingly, very little consensus exists within the product innovation literature as to the way success should be defined and measured. Hart (1993) suggests that much of the literature to date has side-stepped the issue. It has been suggested that many of the published empirical NPD studies are not replicable in a truly scientific way because researchers have failed to state clearly the controls used with respect to the initial purpose, the context within which development

¹² Due to the similarity in measures employed, in this section references to 'products' and 'NPD' pertains to both services and tangible products, unless services are explicitly discussed.

was attempted, and the precise criteria which was used to assess the results of the project or programme (Johne & Storey 1998).

2.3.8.2 THE CONTEXT OF MEASUREMENT

Performance can be measured at a number of different levels within the business. At each level, factors may operate which discourage the business from implementing any form of measurement system. These issues are now reviewed.

A business' tendency to innovate, and its continued market prosperity underpins much of the performance literature. Although product and service innovation is but one aspect of a business' overall performance, often the underlying assumption of the positive relationship between NPD success and overall business success has meant the latter is used by researchers to detect the former. For example, many of the measures used to evaluate competitive and corporate performance used by strategy researchers have also become used to measure the success of NPD programmes.

Griffin & Page (1993) identified a number of reasons why firms do not measure development success & failure. These included:

- Lack of systems in place to measure
- Company culture does not support measuring
- No-one is held accountable for results
- The development process is not understood
- Short-term orientation exists
- Lack of time to measure results
- Measurement is unimportant

One of the key factors to be addressed in NPD performance measurement studies is the level at which the analysis of success is performed. Three levels are often suggested: (i) project; (ii) programme; (iii) business. Programme-level studies have been reported by a number of researchers (e.g. John & Harborne 1985;

Hodgson 1986b, Reidenbach & Moak 1986; Martin & Horne 1993; Drew 1995a; John & Pavlidis 1996). However, most research has been focused at the product level, despite the reluctance of firms to divulge sensitive performance information (Ayal & Raban 1990; Hart & Service 1988; Cooper & Kleinschmidt 1987a; Maidique & Zirger 1985; Nystrom 1985). In their review of the performance literature, Griffin & Page (1993) grouped measures of successful performance into five categories. Two of these were at the business level (measures of business benefits and programme-level measures) and three were at the product level (product-level measures, measures of financial performance and measures of customer acceptance).

It is important that the measures used to evaluate the success of the product outcome directly relate to the objectives initially established, rather than measure fortuitous happenstance (Hart 1993). The objectives established at the programme level are likely to be somewhat different to those established for individual projects. Performance of a NPD programme can be viewed in at least three different ways. To speak of a 'high performance' programme is simplistic: (i) what type of performance, e.g. high success rate, high impact or high relative performance?; (ii) success measures may be independent of each other, e.g. a NSD programme may generate high profits and sales, but may fail to leverage the business into new markets; (iii) the strategies which lead to high performance on each of the performance dimensions may be different, i.e. it may be impossible to find a strategy which is strong in all performance dimensions (Cooper 1986).

Exhibit 2-9 illustrates some of the performance dimensions which have been adopted by firms, or delineated by researchers, in the studies of NPD or NSD performance at the programme level.

Measurement Adopted	Study
Program Impact	Cooper (1986)
Success Rate	Cooper (1986)
Relative Performance	Cooper (1986)
Strategic fit	Griffin & Page (1993)
Leads to future opportunities	Griffin & Page (1993)
NPD as percentage of sales	Griffin & Page (1993)
NPD as percentage of profits	Griffin & Page (1993)
Overall business performance, e.g. ROA, operating profit.	Reidenbach & Moak (1986)
Self-reported	Drew 1996a; Martin & Horne 1993
Sum of seven self-reported measures	Drew 1996a;
Combined Index. Index consisted of three measures: (i) percentage of this year's revenues from new product introductions in the last two years; (ii) percentage of next year's revenues from new products introduced this year and last; (iii) percentage of revenues in five years from new products introduced over next five years.	Drew (1996a)

Exhibit 2-4: Programme Level Measures

Many managers and academics acknowledge that long-term survival of firms requires the balancing of short-term and long-term oriented objectives and activities (Kerssens-van Drongelen & de Weerd-Nederhof 1998). The inclusion of time considerations is therefore of critical importance in determining the true success of a NSD product or programme. For example, Biggadike's (1976) research showed that the successfully launched product is unlikely to be profitable for at least the first four years. Therefore, a newly developed product could be classified successful in the short-term or as a failure in the long-term, and vice versa (Hultink & Robben 1995). Measures providing timeframes include, "products launched within the last five years" (Cooper & Kleinschmidt 1987a; 1987b).

2.3.8.3 IMPORTANT PERFORMANCE STUDIES

In an empirical study of types of NPD success and failure in new industrial services, de Brentani (1989) prescribed 16 different measures from which were deduced (through factor analysis) four measures of performance: (i) sales and market share; (ii) competitive; (iii) "other booster"; (iv) cost. Similarly, Cooper et

al. (1994) prescribed 14 measures of performance from which were deduced three measures of performance: (i) financial; (ii) relationship enhancement; (iii) market development. In an analytical study of NPD success factors, Cordero (1990) identified three performance measures: (i) overall business performance; (ii) technical performance; (iii) commercial performance.

In identifying 75 different performance measures Griffin and Page (1993) found that neither practitioners or academics use single measures of performance. Having sought subsequent expert opinion by group consensus and factor analysis, the authors distinguished five categories of performance measures: (i) overall business benefits; (ii) programme-level benefits; (iii) product level benefits; (iv) financial benefits; (v) customer acceptance benefits.

In their literature review and meta-analysis, Montoya, Weiss & Calantone (1994) identified three types of measures: (i) financial; (ii) market share; (iii) technical.

2.3.8.4 PERFORMANCE MEASURES

Hart (1993) observes that studies into corporate performance can be grouped into financial and non-financial measures, and this distinction is a helpful one when assessing success in NPD. The financial and non-financial dimensions of success identified by Hart (1993) illustrate the existence of competitive thinking in measures used by managers.

Financial Measures

At the business level, financial measures of performance predominate, e.g. percentage of products launched with the last five years (Cooper & Kleinschmidt 1987a; 1987b). Financial measures of performance at the programme-level tend to focus on profit, sales, market share and market share growth (Storey 1994). The grouping of market share measures with financial criteria is regularly found in the literature (Hart 1993).

Hart (1993) suggests that financial measures of performance can be grouped under a number of headings which refer to the base of the measurement. The author

distinguishes five measures based upon: (i) profit; (ii) assets; (iii) sales; (iv) capital; (v) equity.

Direct financial measures can ask respondents to supply actual performance figures, e.g.:

- Average return on assets (Peters & Waterman 1982; Reidenbach & Moak 1986)
- The extent to which profits for the new product exceed the cost of the product development programme (Cooper, 1984a; 1984b; 1984c).
- Profitability of the product over its life cycle (Nystrom 1979)
- Direct monetary gain (Rothwell et al. 1974)
- Time to breakeven (Cooper & Kleinschmidt 1987a; 1987b)
- Profit margin and profit growth (Walsh et al. 1988)
- Percentage of sales and/or profits achieved by new services launched in the last three years¹³.

Indirect financial measures involve asking whether or not breakeven was achieved, whether profits reached “objectives set” or “acceptable levels” (Cooper 1979; Calantone & Cooper 1981; Cooper & Kleinschmidt 1987a; Cooper & Kleinschmidt 1987b; Link 1987).

The criticisms levelled at using indirect financial measures are that firstly, they rely on the accuracy of the respondent’s memory and, secondly, they are reliant upon the responses being validated by the researcher. Similarly, validity checks on measures such as “sales related to objectives”, “sales growth compared to the industry average” (Cooper & Kleinschmidt 1987a; Hart & Service 1988) are rarely used.

¹³ The average goal of both manufactured goods and service businesses is reported to be 45% of sales to come from products commercialised in the last three years (Griffin 1997).

However, preliminary research by Hart (1993) indicates that when looking at sales growth only, indirect measures offer similar results as direct measures.

Non-Financial Measures

In response to the criticism levied at using purely financial performance measures, researchers have begun to introduce a number of other non-financial measures. Drew (1995a) identified retaining customers and improving a business' reputation as being two distinct, non-financial, measurements of NSD success. Similarly, Easingwood & Storey (1991) identified a number of potential extra benefits from developing new financial services, which they termed "non-direct" benefits. These were: improved business reputation; an improved NSD capability; enhanced customer loyalty; moving the business in a new direction; increased consumption of existing products by current customers and by new customers.

Non-financial measures of performance have been classified under a number of headings (Hart 1995): (i) technological; (ii) market; (iii) design; (iv) activity; (iv) commercial. These are explored below.

Technological Measures

Nystrom (1985) refers to the main measure of technological outcome as being the degree of novelty which firms have to employ to solve the critical technical problems when developing new products. However, both of these measures fail to relate success to the objectives established.

McGrath & Romeri (1994) introduced the R&D effectiveness index as an overall measure of product development success. The authors posit that the index can measure, and reflect, the dynamics of the product development process, i.e. decreased time-to-market, improved product profitability, increased development productivity, and reduced development waster.

Market Measures

Nystrom (1985) measured market performance by using the uniqueness or the interchangeability of the product from the buyers point of view at the time it is introduced into the market. Cooper & Kleinschmidt's (1987a, 1987b, 1986) measure of market success was the opening up of new markets. Griffin & Page (1993) treat sales-related measures as measures of customer-acceptance, rather than financial measures, along with purchase trial rate, repeat purchase rate, customer retention rate, customer satisfaction and customer acceptance.

Commercial Measures

Commercially-based measures used in research have tended to be a little vague. For example, in their research Ayal & Raban (1990) asked respondents to make subjective evaluations as to whether the product was a success or failure. Hise et al. (1989) relate product performance to the original expectations for the product but do not report those expectations. As a consequence, Hart (1993) suggests that failure to refer to the guidance that was given on the dimensions of success makes it difficult for meaningful aggregate comparisons to be made and used in later research.

Design Measures

Design-based measures have been used by Walsh, Roy & Bruce (1988) to classify design success according to the "number of design awards" received and "the number of citations by The Design Council". Similarly, Ughanwa & Baker (1989) selected firms winning The Queen's Award for Design as their sample of firms with successful products.

Activity Measures

Activity-based measures tend to relate to either the extent of product development activities or the proficiency with which those product development activities were performed.

Measures which examine the proficiency of development activities are either indirect relative measures, e.g. "the success of the NSD programme in relation to its objectives" and on "a global rating" (Cooper 1984a; 1984b; 1984c) or they are direct measures, e.g. "the number of successful launches" (Hart & Service 1988), "the rate of successes"¹⁴, failures and kills over a five year period" (Cooper 1984a; 1984b; 1984c). Johnes & Snelson (1988) apply an indirect measurement system by assessing "the regularity of updated products in the relation to the competitive nature of the market". This measure indirectly measures experience because firms which introduce or update products regularly will be more experienced at the NPD process than those that do not.

An important distinction has also been drawn between measuring success of the development outcome and measuring the performance of the development process (Voss 1992). While success measures are likely to be related to the specific objectives, the performance of the development process is the facilitating mechanism for achieving success, e.g. a well-executed project is likely to provide a better chance of achieving a successful product outcome. Innovation process measures include (Chiesa et al. 1996): (i) Concept development (e.g. average product lifecycle length, planning horizon, effectiveness (e.g. satisfaction), meeting customer needs, product variety, product range); (ii) product development speed (Cordero 1990), product performance, engineering/design); (iii) production process innovation (e.g. continuous improvement); (iv) technology acquisition; (v) leadership; (vi) resourcing; (vi) systems and tools.

In some situations, e.g. in a high-contact services context, a number of additional operational performance measures may be useful. These external (e.g. customer satisfaction) and internal (quantitative) measures should be sampled frequently and regularly. Exhibit 2-10 reviews some of the data sources which might be important inputs into the development of process measures.

¹⁴ Griffin (1997) found no statistical difference between the success rate for services and tangible products. The author indicates a range between 55% and 60%.

	Data Sources	
Performance Measure	Management Review	Customers
Quantitative	Operational data (e.g. productivity, lost customers rework, timeliness)	<ul style="list-style-type: none"> ▪ Customer satisfaction surveys ▪ Market share ▪ Repurchase rates ▪ Complaint frequency ▪ Customer comments ▪ Written complaints ▪ Customer interviews
Qualitative	Evaluation of server skill, effort and attitude based on: mystery shopping, monitoring, interviews of customer contact personnel)	

Exhibit 2-5: High Contact Services Performance Measurers (Bitran & Hoech 1990)

Criticism of Financial & Non-Financial Measures

The use of both financial and non-financial measures of NPD performance have been criticised for a number of reasons. These are reviewed below.

Criticisms of Financial Measures

Financial measures of performance have been criticised on the grounds that while one of the most easily quantifiable industrial performance yardsticks, they are far from the only important ones. For example, product failure in financial terms can also result in important organisational, technical and market developments, anticipated or unanticipated (Maidique & Zirger 1985).

Another criticism of financial measures of success is that they are often packaged together, irrespective of their common influence upon product performance. For example, the grouping of sales growth and profits measures in one category has been posited to be flawed as it may well be possible to have sales growth without realising any profit at all. Indeed, results of research from Hart (1993) indicate that sales and profits measures can not be assumed to be alternative measures of success.

Criticisms of Non-Financial Measures

The main criticism of non-financial performance measures has been that few of them are empirically-based and little work is carried out in the research to establish the nature and extent of the link between the measures and the dimensions they seek to capture. Few studies investigate the link between the objectives established by the managers responsible and the non-financial performance achieved by the product (Hart 1996).

The nature of the link between financial measures and non-financial measures is rarely explored. In her research, Hart (1993) found too few significant associations between non-financial and financial measures to provide any insights into the existence of a relationship.

Need for Further Research

Johne and Storey (1997) look to academic researchers to make more strenuous efforts to understand managers' detailed motivations before applying general performance measures to their research. The authors provide an example from the research of Griffin and Page (1993) who identified that managers in the U.S. continue to regard NPD as successful if it does not fail, and Baker (1975) suggests that we must accept that "a new product has failed when its originator comes to this conclusion based on his own criteria" (p.16).

2.3.8.5 PERFORMANCE AND INNOVATIVENESS

The relationship between product innovativeness and performance has been of interest to some researchers. The nature of the relationship is potentially insightful to practising managers. In understanding the nature of the relationship, managers could determine the extent to which the business needs to be "different" in the market, and the rewards which are to be anticipated from differentiation. Cooper (1996b) noted that a myth exists that highly innovative products are much more risky, whereas more ordinary new products - modifications, tweaks, extensions - are more successful. The myth remains because it has rarely been tested - particularly in the services arena.

Chan, Go & Pine (1998) observed that managers of service firms seem to confine their development to incremental or distinctive innovations and do not attempt to develop breakthrough innovations (i.e. those where major technology or behavioural changes are required). Similarly, Sanchez & Elola (1991) found that firms are more actively involved in incremental innovation, i.e. improvements on existing products and new products in an existing family (42.8% of the cases were a totally new product).

In a survey of 125 Industrial product firms, Kleinschmidt & Cooper (1991) found a U-shaped relationship between product innovativeness and product performance. New-to-the-world products and innovative product lines were observed to perform particularly well in terms of measures such as success rate, overall profitability, market shares, new windows of opportunities and meeting sales and profit objectives. Non-innovative products, namely modifications, revisions, cost reductions and repositionings, also perform well in terms of ROI and domestic market share, and they were found to be a close second to innovative products on most other measures. In comparison, moderately innovative products, fared poorly. These included less innovative new lines to the business and new items in existing lines. No subsequent studies seem to have built upon this knowledge and investigated the relationship between innovativeness and performance in the services sector.

Link (1987) found that highly innovative firms generally felt their success was dependent upon the existence of a dedicated and strong advocate, a rapidly growing market, product uniqueness. More innovative firms also blamed their failures on poor promotion or poor quality when compared to firms concentrating on line-extensions or me-too products.

2.3.9 Conclusions

This chapter has reviewed the new services development and performance measurement literatures. They are summarised here.

The development of new services is the lifeblood of a service business. Even for traditional tangible good manufacturers, the creation of new services is vital to augment the core product offering (Mathur 1988), e.g., the strategies of virtually all pharmaceutical firms are critically dependent on service functions. Without the introduction of new services, it is generally agreed that firms will struggle to grow, and will gradually fall into decline. Similarly, many large firms like Apple and IBM reformed themselves to become essentially "intellectual holding companies" purposely manufacturing or producing as little product internally as possible (Quinn & Paquette 1990a).

There has been a considerable amount of research into NSD and, more specifically, into the key factors which impact or determine success and failure. Success/failure studies in NSD may be characterised in a number of different ways. Some studies may be classified by the unit of measurement, e.g. product (de Brentani 1991) vs. programme (Martin & Horne 1993). Other studies may be classified by the extent of the business activity addressed, e.g. business (John & Harborne 1985) vs. consumer markets (Edgett & Parkinson 1992). Others suggest that differentiation may exist in the nature of the industries or sub-sets of industries researched, e.g. financial services (Edgett 1993) vs. professional services (de Brentani & Ragot 1996). Increasingly, NSD success/failure studies have been differentiated by the breadth of the variables explored, e.g. seeking all variables which impact performance (Storey & Easingwood 1996) vs. the importance of communication (Lievens, Moenaert & S'Jegers 1997a; 1997b).

The relationship between product innovativeness and performance has been of interest only to some researchers. The nature of the relationship is potentially insightful to practising managers, i.e. in understanding the nature of the relationship managers could determine the extent to which the business needs to be "different" in the market, and the rewards which are to be anticipated from such differentiation. Cooper (1996b) has noted that a myth exists that highly innovative products are much more risky, whereas more ordinary new products - modifications, tweaks, extensions - are more successful. The myth remains because it has rarely been tested - particularly in the services arena.

That service firms are highly reliant upon their knowledge assets, e.g. 'human capital' and 'structural capital' for sustainable competitive advantage has been reported previously (Roos & Roos 1997). An individual new service, and new services in general, are largely intangible. Employee knowledge, expertise, motivation, and self-management therefore perform a much more critical role in the success of new services than new tangible goods (Atuahene-Gima 1996a). The processes used to develop those new services are also less amenable to the 'checks and balances' used by the manufacturers of tangible goods.

While the successful development of a single new service is important in meeting short-term business objectives, a continuous flow of new services is vital if a service business is to remain competitive in the long-term. In firms where annual employee and supervisor turnover rates could reach 25% or more, the challenge faced is to capture, disseminate and store the knowledge and experience gained during individual NSD projects, and leverage it to the advantage of the business' NSD programmes (McKee 1992; Cahill 1995). Service firms which fail to address this issue satisfactorily are likely to be outperformed by those firms which have identified intangible knowledge assets as key competitive resources which drive better market performance.

There is an extensive body of literature on the factors which affect new service (and product) success. Contemporary reviews of this research have observed that whilst financial and sales-based measures are the most frequently used measures of new service success, these studies tend to utilise a plethora of other performance criteria (e.g. Montoya-Weiss & Calantone 1994). The agreement on an appropriate definition of success is important for research, because without a clearly understood conceptualisation of success there can be no effective commentary on which factors contribute most to NSD performance. There have been a number of studies which have attempted to categorise the possible measures of success (e.g. Craig & Hart 1993; Griffin & Page 1993; Hart 1996; Voss 1992). These reviews of performance measurement have distinguished two levels at which analysis can take place: (i) the project level (i.e. the success of an individual new product); (ii) the programme level (i.e. the success of new product development over a period of

time). Programme success relies on a procession of project successes, rather than one-off success. NPD performance can also be measured at the *corporate* level.

2.4 The Knowledge Literature

The business is a repository of knowledge - knowledge embedded in routines and processes. It is therefore important the business is able to create, transfer, assemble, integrate, exploit and measure its knowledge assets. Knowledge assets are important to a service business because they underpin its competences, and its competences, in turn, underpin the success of its offerings in the market (Teece 1998). A broad review of the knowledge literature is therefore required to explore the underlying factors which may impact the efficiency and proficiency of a business' NSD programme.

2.4.1 The Emergence of Knowledge Theory

The fundamental question in the field of strategic management is how firms achieve and sustain competitive advantage (Teece et al. 1997). The dominant paradigm in the field of management strategy during the 1980s was the 'competitive forces' approach developed by Porter (1980). This approach emphasises the actions a business can take to create defensible positions against competitive forces. The 'strategic conflict' approach (e.g. Shapiro 1989), closely related to the 'competitive forces' model, focuses on product/market imperfections, entry deterrence, and strategic interaction. It uses the tools of game theory, and implicitly views competitive outcomes as a function of the effectiveness with which firms keep their rivals off balance through strategic investments, pricing strategies, signalling, and the control of information.

Another approach, emphasises building competitive advantage through capturing entrepreneurial rents stemming from fundamental business-level efficiency advantages. One strand of this literature, often referred to as the 'resource-based perspective', emphasises business-specific capabilities and assets, and the existence of isolating mechanisms which are fundamental determinants of business performance (Teece 1984). The resource-based theory of the business suggests that hidden assets are critical, and considers firms as unique bundles of resources yielding sustainable, above normal profits (Grant 1991). Adopting a

resource-based perspective, Baden-Fuller & Pitt (1996) posit that the opportunities available to a business are: (i) exploit existing resources more effectively; (ii) bring in or borrow resources from others; (iii) or create resources from within. The resource-based perspective focuses on strategies for exploiting existing business-specific assets (Teece et al. 1997). If control over these scarce resources is the source of economic profits, it follows that issues such as skill acquisition, the management of knowledge and know-how (Schuen 1994), and organisational learning become fundamental strategic issues.

As a consequence, researchers and theorists have begun paying attention to the idea of the business as a body of knowledge, rather than as a traditional portfolio of physical assets (Pisano 1994). The knowledge-based view of the business, representing a confluence of a number of streams of research, has a number of contributing literatures:

- Resource-based theory (Grant 1991).
- Epistemology (Polanyi 1962; von Krogh et al. 1994).
- Organisational learning (Levitt & March 1988; Huber 1991).
- Evolutionary economics (Nelson & Winter 1982).
- Organisational capabilities and competences (Prahalad & Hamel 1990).
- NPD (Nonaka 1991; Clark & Fujimoto 1991).

These streams have come together in a number of recent papers which have explicitly addressed the strategic and managerial aspects of knowledge within firms (Grant & Baden-Fuller 1995). Some of the key papers are presented in Exhibit 2-11.

Authors	Research Focus
Kogut & Zander (1992)	The transformation of personal into organisational knowledge.
Zander & Kogut (1995)	The transfer of organisational capability.
Kogut & Zander (1993)	A knowledge-based theory of the multinational corporation.
Spender (1992)	The managerial implications of the distinction between knowledge generation and knowledge application.
Spender (1994)	The strategic implication of "organisational knowledge".
Demsetz (1991), Grant (1995)	The role of the business in knowledge integration.
Jensen & Meckling (1992)	How imperfections of knowledge transfer influence the relative efficiencies of firms and markets and the allocation of decision rights within the business.
Hedlund (1994)	The features of the knowledge-based "n-form" business.
Quinn (1992)	The emerging knowledge-based service enterprise.
Nonaka (1994)	The creation of organisational knowledge through the interplay between tacit and explicit knowledge and between individual and organisational knowledge.

Exhibit 2-6: Knowledge-Based Theory of the Firm (Grant & Baden-Fuller 1995)

It has been posited that the knowledge-based view of the business is not yet a theory because it represents a only confluence of long-established interests in uncertainty and information, with several streams of newer thinking about the business – not new theory which has been established to satisfactorily explain the behaviour of the business (Grant 1996). The challenge over the next few years is to bring together these theoretical and practical developments in a fuller specification of the implications of the knowledge-based view for business strategies (Grant 1997).

By identifying existing knowledge and core competences, the business can seek to leverage them, e.g. by extending the scope beyond the existing product/market and identifying where the various combinations of these resources and capabilities can be used in other markets or industries. In effect, the business can identify the knowledge it possesses, and which the customer has or may be prepared to pay a premium for, and apply it to other markets, technologies, and product domains. The characteristics of the knowledge strategies adopted by firms have therefore become an important area of interest in the strategy literature. Because of the many different types of knowledge which exist, it has been suggested that the

business needs to develop a strategy for each type of knowledge to ensure its effective dissemination, growth and protection. However, most firms have yet to formally define explicit knowledge-based practices (Wiig 1997a), and many others have been observed to be confusing the value and importance of information and knowledge to the business (Clarke 1998).

In implementing a strategy to leverage core knowledge, it has been observed that the planning process needs to address a number of key issues (Whitehall 1997). It needs to: (i) leverage the existing knowledge valued by the customer; (ii) create new knowledge that will be valued by the customer; (iii) recognise the competitive advantage of the different types of knowledge that are inimitable and focus upon them; (iv) identify knowledge blockers and enablers; (v) identify the different organisational structures and different supporting infrastructures required to support the widely different processes of knowledge leveraging and knowledge creating, as well as the different types of knowledge being addressed (i.e. technological, process or cultural); (vi) drive out resources and costs not adding value perceived by the key stakeholders.

Focusing on the Pharmaceutical industry, Bierly & Chakrabarti (1996) identified four generic knowledge strategy groups: “innovators”; “explorers”; “loners”; and “exploiters”. The innovator and explorer strategies were found to be linked to higher profits and *loner* and *exploiters* strategies were linked to lower profits. Those in the low profit category either do not desire to, or are unable to, change their strategies. The American Productivity and Quality Centre (APQC), in researching 11 US firms efforts in the area of knowledge management, identified six key strategies that firms use to compete more effectively. They were: (i) knowledge management as a *business strategy*; (ii) *transfer* of knowledge and best practice; (iii) *customer-focused* knowledge; (iv) *personal* responsibility for knowledge; (v) *intellectual asset* management; (vi) *innovation* and knowledge creation. Similarly, in identifying five knowledge-based strategies pursued by enterprises, Wiig (1997b) found that firms undertake specific programs and activities, provide supporting infrastructure capabilities, and sometimes create incentives to motivate individual staff, teams, and even departments and business

units to co-operate with the new objectives. The strategies identified, which are similar to those of the APQC, are described more fully in Exhibit 2-12:

Knowledge Strategy	Strategy Description
Knowledge Strategy as Business Strategy	Emphasises knowledge creation, capture, organisation, sharing and use in <u>all</u> plans, operations and detailed activities to provide the best possible knowledge available at each point of action.
Intellectual Asset Management Strategy	Emphasises enterprise-level management of specific <u>intellectual assets</u> such as patents, technologies, operational and management practices, customer relations, organisational arrangements, and other structural knowledge assets. Management's task is to renew, organise, evaluate, protect and increase the availability and marketing of these assets.
Personal Knowledge Strategy	Emphasises <u>personal responsibility</u> for knowledge-related investments, innovations and competitiveness, renewal, effective use and availability to others of knowledge assets within each staff area of accountability. The objectives are continually to build knowledge and to apply the most competitive knowledge to the enterprise's work.
Knowledge Creation Strategy	Emphasises organisational learning, basic and applied research and development, and motivation of staff to innovate and capture <u>lessons</u> to obtain new and better knowledge which will provide improved competitiveness.
Knowledge Transfer Strategy	Emphasises systematic approaches to transfer (i.e. obtain, organise, restructure, warehouse or memorise, repackage for deployment and distribute) knowledge to points of action where it will be used to perform work. This strategy includes knowledge sharing and adopting best practices.

Exhibit 2-7: Knowledge-Based Strategies (Wiig 1997b)

It is likely that more than one generic knowledge strategy can be successful in an industry, depending upon the industry characteristics and the characteristics of the knowledge managed (Spender 1996a; 1996b). Indeed, it is evident that more than one strategy will be required to achieve particular organisational goals, e.g. the development of innovative capability may well combine elements of all five strategies. The benefits of adopting a knowledge-based strategy include: faster learning; no need to re-engineer, and therefore lose vital knowledge; lower organisational costs; and growth in competitive knowledge (Whitehall 1997).

2.4.2 What is Knowledge?

If it is agreed that a business will pursue a knowledge strategy, and that the success of that strategy will be determined by the nature of the knowledge managed, it is vital that the knowledge object is defined precisely enough. However, it is evident that the meaning of “knowledge” is a highly contentious concept (Spender 1996a; 1996b). Therefore, a number of the pertinent issues raised in the literature are reviewed in the subsequent text.

2.4.2.1 DATA, INFORMATION¹⁵ AND KNOWLEDGE

To be the basis of a theory of the business, as some researchers seek, knowledge must be defined precisely enough to facilitate a determination of which business has the more significant knowledge, and to explain how that knowledge leads to competitive advantage (Spender 1996a; 1996b). Authors often illustrate the characteristics of knowledge by examining the relationship between data, information and knowledge.

Literally, information means 'to put' data 'in form' (lat. *in* = in, *form* = form, *are* = doing), and it is often viewed as a flow of messages, while knowledge is created by that very flow of information. Information is a commodity capable of yielding knowledge, and what information a signal carries is what we learn from it. It has been observed that “knowledge is information that changes something or somebody – either by becoming grounds for action, or by making an individual or an institution capable of different and more effective action” (Drucker 1990, p. 242). Knowledge, unlike information, is about beliefs and commitment. It is a function of a particular stance, perspective, or intention taken as a result of interpreting information, i.e. knowledge is a subset of information whose *validity* has been *established* through *tests of proof*. In this way, knowledge can be distinguished from opinion, speculation, beliefs, or other types of unproven

¹⁵ Nonaka (1988b) initially wrote about semantic and syntactic information. Syntactic information is the *physical* information measured in bits in which there is no attention given to any inherent meaning, e.g. the routine information stored in a computer. In contrast, semantic information examines the actual *meaning* of the information.

information (Liebeskind 1996; Nonaka & Takeuchi 1995). It is possible for a business to be knowledge-intensive but not information intensive (Starbuck 1992). For example, some activities draw on extensive knowledge without processing large amounts of current information –management consulting, for example. Conversely, a business can process a great deal of information without using much knowledge, e.g. firms may decide to outsource payroll production because the process is largely an information process which adds little value or knowledge in the form of organisational capabilities. In a societal context, Boisot (1995b) illustrates the distinction between data, information and knowledge when he writes.

In effect, knowledge might be represented as a set of probability distributions that we deploy with respect to the phenomena that we encounter: distributions on sets of expectations shaped by the repeated encounters with information. The latter by contrast constitutes an extraction from data that acts upon our probability distributions and either modifies or reinforces them – i.e. information makes a difference to the way we think about things or to our disposition to act. Data that does not bring about this modification to the knowledge that we possess carries no information; it is uninformative...Knowledge describes our internal dispositional states as knowing and acting subjects; these are modified by acts of information extraction that we ourselves perform on data that reaches us through our senses. Data itself can then be thought of as an energetic phenomenon that links us in our capacity as knowing subjects to an external physical world.

2.4.2.2 TACIT & EXPLICIT KNOWLEDGE

The literature indicates that there are two major views on the nature of knowledge. Firstly, the "cognitive perspective", the most well known, is based on formal models of cognitive systems as machines for information processing and logical reasoning, and was advanced through the work of authors like Herbert Simon. To the cognitivist, the world is pre-given, knowledge is explicit, capable of being encoded and stored, and is easy to transmit to others. Conversely, the

"constructionist perspective", advanced in the work of Humberto Maturana and Fransesco Varela (two Chilean biologists), views cognition as an act of construction or creation. To the constructionist, some knowledge is explicit, but some is also tacit.

Grant (1996b, p. 377), in arriving at a definition useful to the development of a knowledge-based theory of the business, adopts a constructionist perspective, and classifies knowledge to include "both explicit knowledge which can be written down, and tacit knowledge which cannot". Grant's observation follows the explicit/tacit duality initially posited by Polanyi (1962; 1967), and developed further by Nelson & Winter (1982): explicit knowledge, contained in manuals and procedures; and tacit knowledge, learned only by experience, and communicated only indirectly, through metaphor and analogy. However, the boundary between the explicit and tacit types of knowledge is both porous and flexible, so there is a constant traffic between the two domains. Most knowledge has tacit dimensions. It exists on a spectrum. At one end of the spectrum it is completely tacit, at the other it is completely explicit. Exhibit 2-13 compares the two knowledge types.

Nonaka & Takeuchi (1995) regard the origin of all knowledge in individual intuition, i.e. the transformation and communication of what is already known tacitly by staff. They make the interaction of the explicit and the tacit modes of knowing central to their theory of organisational knowledge creation. The challenge for the business occurs when staff are unaware of the tacit dimensions of their knowledge or are unable to articulate them adequately.

Tacit Knowledge (Subjective)	Explicit Knowledge (Objective)
Knowledge of existence (body)	Knowledge of rationality (mind)
Simultaneous knowledge (here and now)	Sequential knowledge (there and then)
Analog knowledge (practice)	Digital knowledge (theory)

Exhibit 2-8: Two Types of Knowledge (Nonaka & Takeuchi 1995)

Nelson & Winter (1982) suggest firms embed tacit knowledge in "organisational routines" (i.e. distinct ways of doing things). In their research, the assumption is made that the business provides the special context in which the explicit and implicit bodies of knowledge are both selected by interaction with the external economic reality, and then stored in the routines available to future generations of staff. Over time, the quality of the interaction of the explicit and evolving implicit types of knowledge may lead to further improvements and, thence, to superior business performance. Hiebeler (1996) suggests that knowledge is "the useful, actionable, and meaningful information retained in a formal *system*, despite the comings and goings of the individuals who collectively make up the system".

The relationship between tacit and explicit knowledge may also be explored in terms of organic innovation. During the process of market, process or product innovation (Johne & Davies 1998a: 1998b), individuals from various educational, social, economic and cultural backgrounds will draw upon their tacit (and explicit) knowledge bases to contribute to the various stages, tasks or activities of the NSD process. Although the innovation process is often presented in the literature as a linear set of activities, a circular process of knowledge divergence and convergence is likely to occur at each stage. Leonard-Barton & Sensiper (1998) observe that staff's' tacit knowledge, in particular, may be potentially exercised through the mechanisms of problem-solving, problem finding, and prediction and anticipation. This is illustrated in Exhibit 2-14. While divergence results in highly creative behaviour (i.e. new ideas), the authors note that convergence is demonstrated in overlapping specific knowledge (i.e. knowledge of specific steps in the NPD process), collective system knowledge (i.e. knowledge of the overall NPD process), and guiding tacit knowledge (i.e. the guiding metaphor).

Leonard-Barton and Sensiper's depiction of the innovation cycle build upon the work of Wheelwright & Clark (1992) and Cooper (1990a), to indicate that at any one point in an innovation process managers need to manage both the expansion of thought that gives rise to potentially creative alternatives and the honing in on a viable option.

Diverge

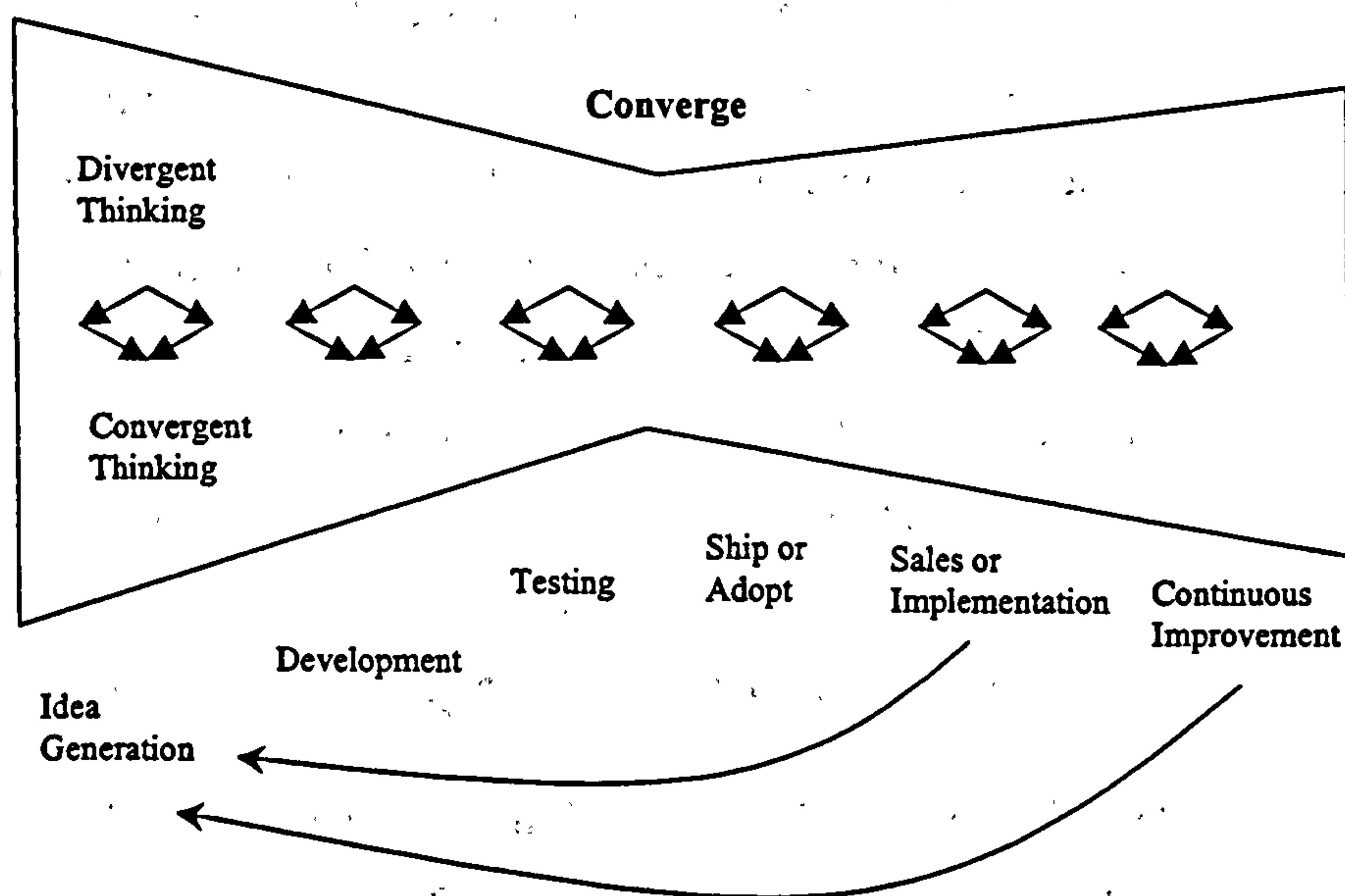


Exhibit 2-9: The Innovation Tunnel (Leonard-Barton & Sensiper 1998)

Although one may wish to capture all knowledge explicitly, the faster the innovation cycle, the more likely that some knowledge will remain in tacit form. The challenge for the business is therefore to develop strategies for managing both knowledge types effectively, recognising that it may not be possible to make all tacit knowledge explicit.

2.4.2.3 FURTHER TAXONOMIES

Positing that knowledge is the understanding that enables the intelligent user to predict, Clarke (1998) classifies knowledge as either advantaged, base, or trivial. *Advantaged* knowledge provides a competitive advantage, *base* knowledge is knowledge which is integral to a business and which may provide short-term advantage (e.g. best practice), and *trivial* knowledge offers no major impact.

Some authors have made the distinction between *knowing what* is done, *knowing how* things are done and *knowing why* they occur (Garvin 1993; Brown & Duguid 1998; Chew et al. 1991). Know-what, the explicit knowledge which may be shared by several people, circulates with relative ease and therefore is difficult to

protect, e.g. documented procedures. Know-how, rooted in norms, behaviour and standards of practice, is more tacit and therefore more difficult to spread, co-ordinate, benchmark or change. Know-how embraces the ability to put know-what into practice. Know-why is more fundamental, it captures underlying cause-and-effect relationships and accommodates exceptions, adaptations, and unforeseen events. In researching the professional intellect of service firms, Quinn et al. (1996) develops this conceptualisation further by observing that knowledge (or intellect) operates at four levels (see Exhibit 2-15).

	Knowledge Type	Classification	Description
1	Know-what	Cognitive Knowledge	The basic mastery of a discipline that professionals achieve through extensive <u>training</u> and certification. This knowledge is essential, but far from sufficient for commercial success.
2	Know-how	Advanced Skills	The <u>application</u> of the rules of a discipline to complex real-world problems. It is the most widespread value-creating professional skill level.
3	Know-why	Systems Understanding	The deep <u>knowledge</u> of the web of cause-and-effect relationships underlying a discipline.
4	Care why	Self-motivated Creativity	Consists of will, <u>motivation</u> , and adaptability for success. Highly motivated and creative groups often outperform groups with greater physical or financial resources.

Exhibit 2-10: Managing The Professional Intellect (Quinn et al. 1996)

The first three levels of Quinn's model can exist in a business' systems, databases, or operating technologies. However, the fourth is most often found in the business' culture. Quinn observed that most firms focus virtually all their training attention on developing basic (rather than advanced) skills, and little or none on systems or creative skills. Professional know-how is developed most rapidly through repeated exposure to the complexity of real problems. Thus, for most professionals, the learning curve depends heavily on interactions. On the job training, mentoring, and peer pressure can force professionals to the top of their knowledge "ziggurat".

In a NSD context, the know-how required to execute one development project may not be enough to sustain long-term business performance. The business also needs to develop the know-why which enables know-how to be applied to NSD programmes, which will be of longer duration and span many different technologies and markets.

Quinn’s classification system has been adopted by other researchers. For example, Whitehall (1997) has argued that the definition of knowledge as know-how and know-why is too broad a classification in which to analyse actual business processes for their knowledge content. He offers an alternative and extended typology, which includes *know when and where* and *know who*. Exhibit 2-16, reproduced by Whitehall and adopted from the work of Robert Dilts, suggests that the knowledge shared by the business at the higher levels, e.g. values and beliefs will be far more powerful and difficult to replicate than those of the lower levels - capabilities, behaviour, and is therefore an important goal for many business seeking sustainable long-term advantage.

Knowledge Definition	Description
Spiritual	Shapes our lives and has a profound affect on all other levels.
Mission and values	Sense of self, core values and mission in life.
Beliefs and assumptions	The ideas we think are true
Capabilities	The general skill sets
Behaviour	The specific actions we carry out
Environment	What we react to

Exhibit 2-11: Knowledge, Learning and Change (Whitehall 1997)

Although not discussed here, further taxonomies have been developed to describe knowledge in a business context. These include distinctions between:

- Observable/non-observable in use (e.g. product vs. process).
- Positive/negative knowledge (success stories vs. failure stories).
- Autonomous/systematic knowledge (i.e. technological knowledge necessitating the modification to other systems or sub-systems).

- Architectural/non architectural knowledge.
- Competency enhancing/competency destroying.

2.4.2.4 USING KNOWLEDGE TO CREATE CORE COMPETENCES

Previously, it was suggested that the business' knowledge assets underpin its competences, and its competences in turn underpin its offerings in the market (Teece 1998). However, organisational competence is a term liberally employed by researchers and management theorists despite its vague definition (Piret 1997). While knowledge assets are grounded in the experience and expertise of individuals, firms provide the physical, social, and resource allocation structure so that knowledge can be shaped into competences. How these competences and knowledge assets are configured and deployed will significantly fashion competitive outcomes and the commercial success of the enterprise. The organisational knowledge that constitutes competences is more than "know-what". It also requires the "know-how" which puts know-what into practice.

The theory of competence-based competition considers three similar but distinctly different components of core competence (Gorman & Thomas 1997): (i) resources; (ii) capabilities; (iii) competences. Resources have been defined as business-specific assets that are difficult if not impossible to imitate, e.g. production facilities. Resources may be hard to transfer because of transaction and transfer costs, and because they may also contain an element of tacit knowledge (Teece et al. 1997). When resources are assembled so they enable distinctive activities to be performed, i.e. clusters of know-how assets, they may be termed organisational competences. Competences include discrete business-level organisational processes which are fundamental to running the business, e.g. the development of new services, but they also include generalised organisational skills such as miniaturisation. Competences are typically supported by routines, not dependent upon a single individual, e.g. the activities constituting the NSD process. A core competence are those competences which define a business' fundamental business as core, i.e. "the collective learning in the business, especially the knowledge of how to co-ordinate diverse production skills and

integrated multiple streams of technologies" (Prahalad & Hamel 1990). Birkett (1995) has observed:

"core competences refer to a form of knowledge in firms. Such knowledge may be located in the minds of individuals, in the collective understandings of groups or teams, or in the business culture. It may be manifested in work methods, structures and systems, physical artefacts, modes of communication, and language patterns. It may be shared, more or less; acted out rather than articulated; tacit rather than explicit; a reservoir or a stream. It may need to be found or created – brought to the surface or consolidated" (Birkett 1995).

In defining a core competence as "a combination of complementary skills and knowledge bases embedded in a group or team that results in the ability to execute one or more critical processes to a world-class standard", Coyne et al. (1997) subdivide the a competence into two: (i) an *insight/foresight* competence enables a business to discover or learn facts or patterns that create first-mover advantages, e.g. technical knowledge; (ii) a *frontline execution* competence arises when the quality of an end product or service can vary appreciably according to the activities of the frontline personnel, e.g. skills of an individual underwriter.

A capability, a competence, and an organisational process are closely interrelated. It is the business' capability which enables the activities in a business process to be carried out, e.g. development of new products¹⁶ (Day 1994a). A capability may be defined as the knowledge set that distinguishes and provides a competitive advantage...i.e. a set of differentiated skills, complementary assets, and routines that provide the basis of a business' competitive capacities and sustainable advantage in a particular business. Teece et al. (1997) develop the concept of a **dynamic capability**, i.e. the "business' ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments"

¹⁶ For example, NSD. On the one hand capability-generating activities will facilitate creating a product. In other cases, the activities refer to the handling and combining of market and technical information into knowledge about the development process; monitoring the organisational and market environment; reporting and telling other participants; forming the information into ideas, product concepts, prototypes, launch activities etc. On the other hand, these capability-generating activities give knowledge about how to perform these activities (the quality of performance), that is how to develop a new service.

(p.516). Dynamic capabilities are most likely to be found in firms with flat hierarchies, a clear vision, high-powered incentives, and high autonomy. Leonard-Barton (1992a) identifies four dimensions of a capability knowledge set, which to be considered *core* all dimensions must be addressed by the business:

- Content of the knowledge set is embodied in employee knowledge and skills.
- These knowledge and skills are embedded in technical systems (in addition to explicit information this also includes information which has been converted from tacit to explicit information).
- The processes of knowledge creation and control are guided by managerial systems, which represents formal and informal ways of creating knowledge, e.g. through sabbaticals and incentives.
- Infused with the previous three dimensions is the value assigned within the culture of the business to the content and structure of the knowledge, e.g. chemical engineering vs. marketing expertise.

The extent to which competences are difficult to replicate, imitate, and appropriate determines the degree to which they can offer the business competitive advantage. Replication involves transferring competences from one economic setting to another, imitation is simply replication by a competitor, and appropriation is the ease with which imitation can take place (Teece 1998). For example, whilst the NSD process relies upon both tacit and explicit knowledge, it is the tacit element to the process which makes it difficult for competition to copy. However, the tacit element to the process can also make it difficult for the business itself to understand, and failure to understand will restrict its ability to learn.

2.4.3 The Management of Knowledge

Having identified the importance of particular knowledge assets, and the opportunity available to the business to leverage those assets, the business will need to establish a supportive internal environment to manage them effectively. *Knowledge management* is the term generally applied to the approach of adding or

creating value by more actively leveraging the know-how, experience; and judgement resident within, and in many cases outside, the business. However, our understanding of the organisational practices surrounding knowledge management in the business remain rather limited (Inkpen 1996). Until recently there has been little significant support from academic and management research, and no general approach to managing knowledge has been commonly accepted. Although scholars are now beginning to organise their research agendas around a set of explicit hypotheses concerning the causes and effects of knowledge-intensive environments (Glazer 1998), knowledge management has only recently emerged as an explicit area of pursuit for managing firms, and even more recently as a topic of serious academic study (Wiig 1997a). Previously, each business tends to be regarded as unique, and options for managing knowledge are legion. Furthermore, since knowledge management is still relatively new, the availability of standardised or "off-the-shelf" approaches is limited. Consequently, firms have been observed to devise customised approaches to provide the enterprise with the best and most applicable solutions, and this adds further to the complexity of managing knowledge (Wiig 1997a).

Kerssens-Van Drongelen et al. (1996) define knowledge management as the explicit influencing of knowledge accumulation and dissemination, and refer to it as "the systematic underpinning, observation, instrumentation and optimisation of the business' knowledge economies". Quintas et al. (1997) adopts a more market-oriented approach and refer to knowledge management as "the process of continually managing knowledge of all kinds to meet existing and emerging needs, to identify and exploit existing and acquired knowledge assets and to develop new opportunities" (pp. 387). A number of researchers have identified key activities which must be executed as part of a knowledge management initiative. Marshall et al. (1996) argue that, at the business level, knowledge will be: generated from internal operations; accessed from sources inside or outside the business; transferred formally (training), or informally (on-the-job), before it is utilised; represented in the form of reports, graphs and presentations; embedded in processes, systems, and controls; facilitated by the steady development of a culture based on incentives and management leadership. From a managerial

perspective, Wiig (1997a) identifies activities according to four areas of emphasis for a business managing its knowledge base (p.3). See Exhibit 2-17.

Function	Description
Governance functions	Monitor & facilitate knowledge-related activities (survey and map the knowledge landscape; oversee knowledge asset management; manage intellectual assets; implement incentives to motivate knowledge creation, sharing, and use; pursue knowledge-focused strategy; restructure operations and organisation).
Staff functions	Establish and update knowledge infrastructure (enterprise-wide lessons learned programme; knowledge bases with organised ontologies; knowledge professional resource pools; knowledge inventories; comprehensive multi-path knowledge transfer development capability; corporate university).
Operational functions	Create, renew, build and organise knowledge assets (discover and innovate constantly; acquire knowledge; educate and train; maintain knowledge bases; automate knowledge transfers; conduct research and development; transform and embed knowledge)
Realise the value of knowledge	Distribute and apply knowledge assets effectively (always use best knowledge; share knowledge throughout enterprise; collaborate to pool appropriate knowledge; adopt best practice; sell products with high knowledge content).

Exhibit 2-12: Emphases in Knowledge Management (Wiig 1997a)

Ruggles III (1997) simplifies the framework for analysing knowledge management activities when he posits that the topic encompasses three main knowledge activities. Alongside measurement, these classifications are used to explore the relevant literature: (i) generation; (ii) codification; (iii) transfer & integration; (iv) storage.

Enabling Conditions and Barriers

von Krogh (1998) posits that the key challenge for researchers is to find enabling conditions for the fragile processes of knowledge creation. Nonaka (1994) identified a number of business-wide enabling conditions that promote a more favourable climate for effective knowledge creation. These include: (i) a creative chaos; (ii) redundancy of information; (iii) requisite variety.

The values guiding relationships in firms have been found to be of importance (von Krogh, Nonaka & Ichijo 1998), e.g. the value of *care* in organisational relationships is recognised to be a particular enabler. When there is "care" in organisational relationships, there will be a mutual trust, active empathy, access to help among team members, lenient judgement towards participation in the team, and courage. To cultivate care the author proposes the use of: (i) incentive systems to reward knowledge creation; (ii) mentoring programmes which give senior managers clear responsibility for helping staff grow and actualise their full potential; (iii) trust, openness and courage as explicitly stated values by top management; (iv) training programmes; (v) debriefings and post-project reviews to share experience; (vi) the provision of social events to stimulate good relations.

Dumas (1997) also identified that a different way to build knowledge requires time and commitment. It also requires a degree of open-mindedness to new approaches which can be difficult to achieve.

In creating new knowledge, von Krogh (1998) suggests that four barriers are faced, each of which makes knowledge creation a fragile process: (i) the absence of a legitimate language which is acceptable to all members; (ii) the existence of stories and habits, e.g. which detail past failures; (iii) formal procedures which may at once embed experiences and *over-control* the creation process; (iv) business paradigms which guide individuals away from pursuing justified true beliefs which are not in accordance.

2.4.3.1 KNOWLEDGE CREATION

The process of creating knowledge based on information and data requires that organisational members acknowledge the existence of the data and store it in some way for future use. For example, a report may be written by one organisational domain and then passed to team members in another. In discussing the data and information within the report, new organisational knowledge may be created. The more latent the data, the more discussion may be required to create new knowledge. Sense emerges out of a new situation. An individual will hold particular beliefs, will commit themselves to the new situation and, most

importantly, will enhance their potential to act in a new situation¹⁷. The creation of new organisational knowledge has been identified as providing the basis for organisational renewal and sustainable competitive advantage (Inkpen 1996; Grant 1996). The most typical process of creating new knowledge is the act of developing new strategies, products and services. A failure to create new knowledge and manage it as a critical organisational asset may therefore account for the declining performance of many well-established firms.

A number of researchers have been seeking a knowledge-based theory in which firms are enduring alliances between independent knowledge-creating entities, be they individuals, teams or other firms (e.g. Nonaka 1994, and Spender 1996). For example, Nonaka (1994) suggests that the knowledge held by individuals, firms, and societies can be enlarged and enriched through an interactive amplification of the tacit and explicit knowledge held by individuals, firms, and societies. In Nonaka's terms, the "spiral of knowledge" creation occurs through the processes of: (i) socialisation; (ii) combination; (iii) externalisation; (iv) internalisation. These *conversion modes* interact in a dynamic and continuous "entanglement" to drive the knowledge creation process (see Exhibit 2-18).

Socialisation involves the sharing of tacit knowledge between individuals, and largely involves capturing knowledge through physical proximity. *Externalisation* requires the expression of tacit knowledge and its translation into comprehensible forms that can be understood by others and, in practice, is often supported by the development of dialogue with customers or experts. *Combination* involves the conversion of explicit knowledge into more complex sets of explicit knowledge, and is largely an issue of systemisation of knowledge (i.e. capturing, dissemination and processing). *Internalisation* of newly created knowledge is the conversion of explicit knowledge into the organisation's tacit knowledge, and relies upon the embodiment of explicit knowledge in practice and by using simulations or experiments to trigger *learning by doing* processes.

¹⁷ The first steps, that of "sharing tacit knowledge" and "creating concepts" are believed to hinge on the individual being able to share their personal true beliefs about a situation with others (von Krogh 1998).

Nonaka & Konno (1998) identify "Ba" as the source of the knowledge creation process. "Ba" is the *shared space* that serves as a foundation for knowledge creation. Knowledge is embedded in "Ba" (i.e. the shared spaces), where it is then acquired through one's own experience or reflections on the experiences of others. It can emerge in individuals, working groups, project teams, informal circles, temporary meetings, email groups, and at the front-line contact with the customer. The four types of "Ba" correspond to the four modes of knowledge conversion described above (see Exhibit 2-18)¹⁸.

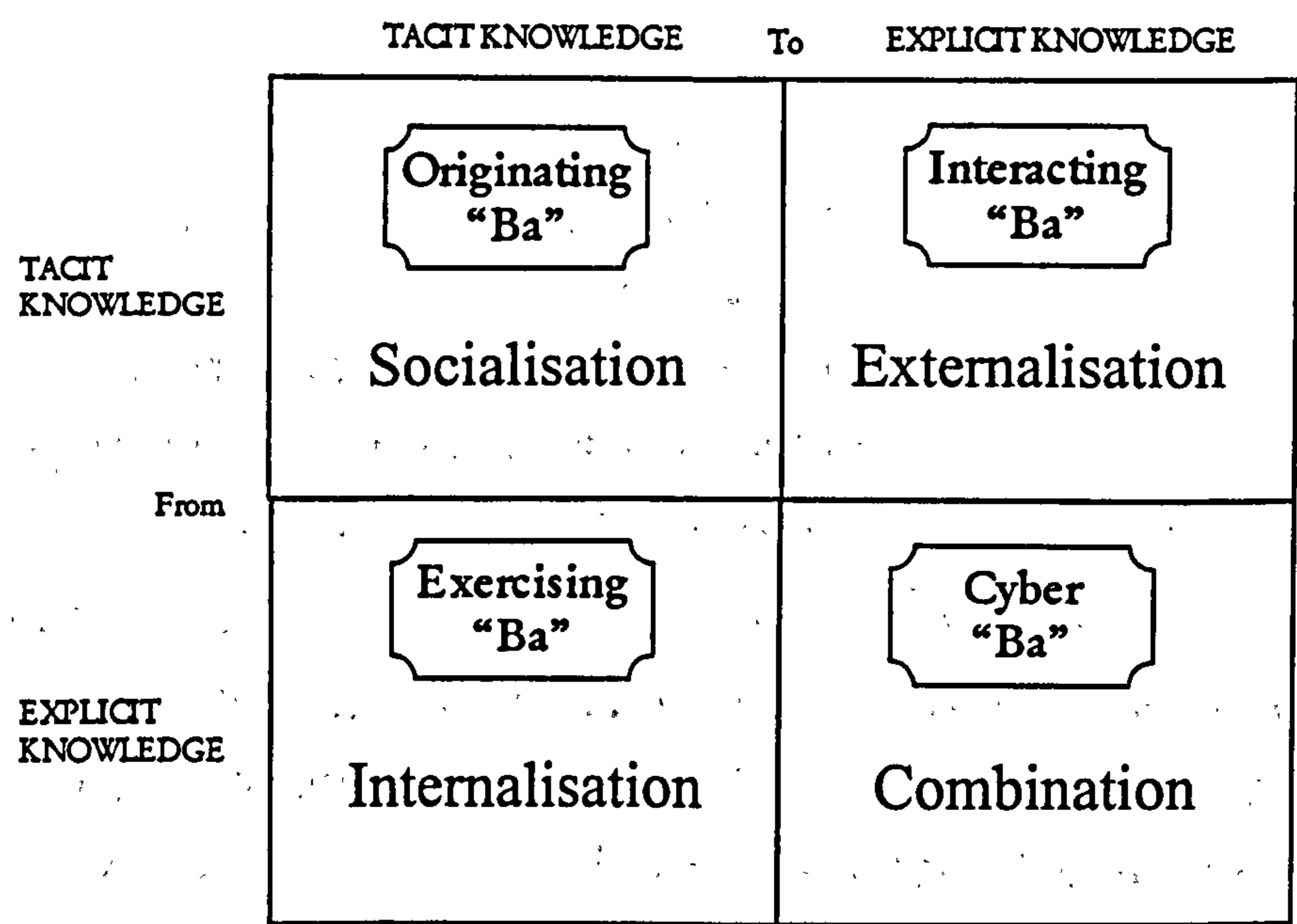


Exhibit 2-13: Organisational Knowledge Creation (Nonaka 1994)

Building upon the work of Nonaka, von Krogh (1998) identifies five phases to knowledge creation as it relates to the process of innovation: (i) the *initial sharing* of knowledge, experience, and practices among team members; (ii) the effective *creation* of new service and product concepts based on this shared knowledge; (iii) the *justification* of those concepts deeply rooted in, for example,

¹⁸ The authors offer three examples for clarification and elucidation. Sharp employs teams as "Ba", Toshiba institutionalises a platform of cross-functional knowledge creation, and Maekawa Seisakusho grounds the business culture, the organisation structure and success in the "Ba" for knowledge creation.

business strategy or market studies; (iv) the building of a prototype product or initial service *offering*; (v) the global *leveraging* of knowledge, concepts, prototypes, and offerings through the business.

2.4.3.2 KNOWLEDGE CODIFICATION & SCANNING

As knowledge gains in complexity, so its diffusion becomes more limited (Polanyi 1958). It is only as complexity is mastered and reduced – this often calls for capacity to “abstract” – that the knowledge that one carries in one’s head can be structured and either set down on paper or embedded in objects – i.e. it can be codified. Once information has been transposed from individual brains into documents or physical objects it can be diffused quite rapidly (Boisot 1995b). The higher the degree of coding, the less the amount of data required to describe the object. Exhibit 2-19 illustrates this concept in the form of Boisot’s C-Space, or Culture-Space.

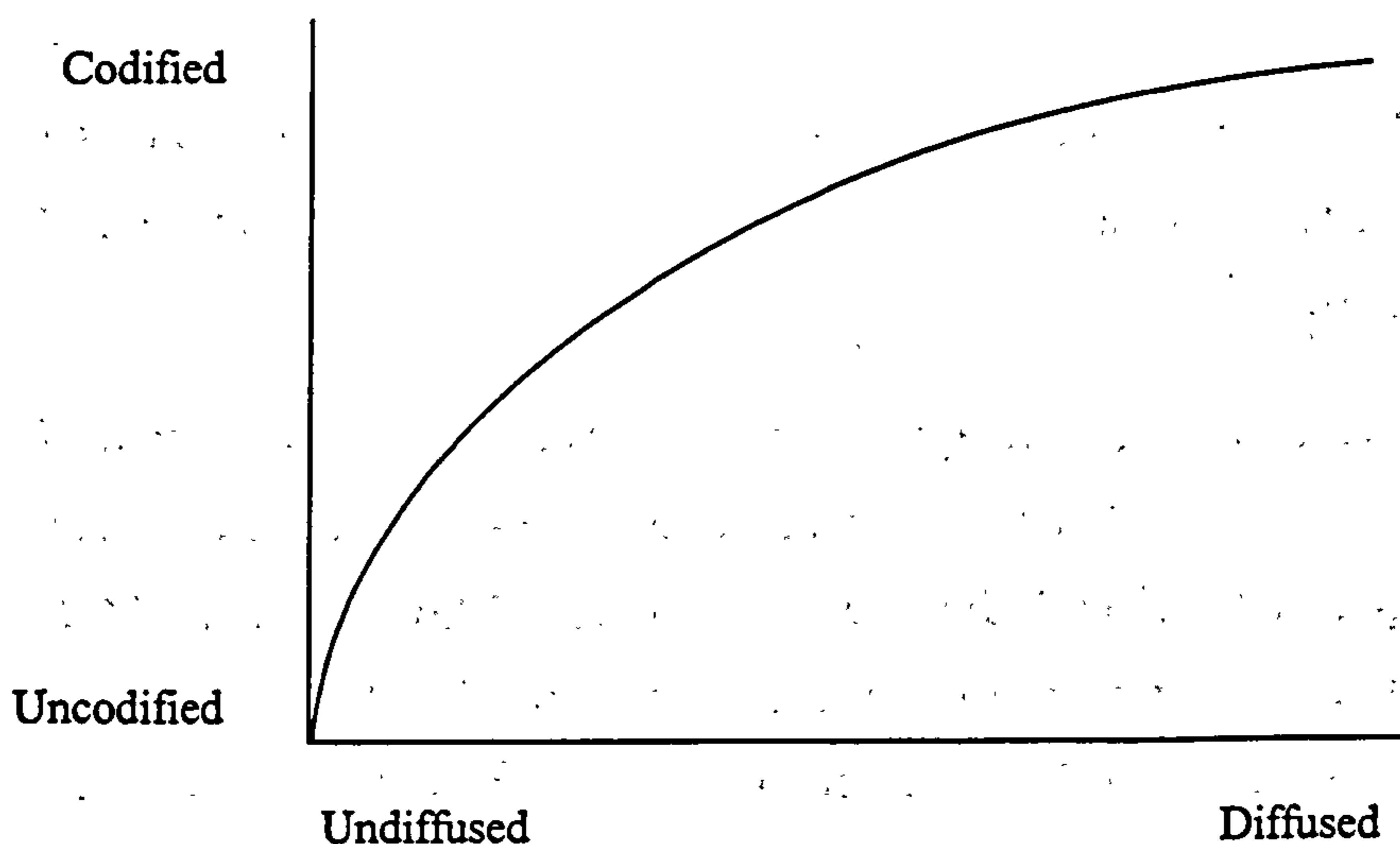


Exhibit 2-14: The Knowledge C-Space (Boisot 1995b)

When the complexity of a knowledge phenomena outruns the capacity of an individual’s perceptual apparatus to code for them, another coding strategy, scanning, may be adopted. With scanning, all data are in effect treated as equiprobable: no prior coding scheme, therefore, is available to guide the

processing effort and coding efficiency is hard to achieve (Boisot 1995b). Code creation is one of the ways in which new knowledge can be created. Different ways of knowing a phenomenon can be expressed as a continuum on a coding continuum scale, along which one is free to move providing that the codes defining the phenomenon have been created and mastered. Code creation may be termed efficient to the extent that moves up or down the coding scale, whether they involve shedding or gaining data, remain information preserving so that ultimately the same quantity of information can be extracted from a code, whatever its position of the coding scale (Boisot 1995b).

2.4.3.3 INTEGRATION OF KNOWLEDGE

Until quite recently, the study of innovation and knowledge transfer has not been a major object of academic research. However, theorists have recently begun to recognise the importance of developing an appropriate literature (Teece 1998).

Uncovering the mechanisms through which knowledge is integrated helps the business understand the challenges inherent in building new competences, e.g. 3Ms ability to develop new products and foster market development rests on a set of routines, practices and attitudes that are built into business culture and operating procedures.

Much of the research into the management issues concerning the integration of different types of specialised knowledge has been within the context of new product development (Nonaka 1990; Clark & Fujimoto 1991; Wheelwright & Clark 1992). It has been observed that while some innovations are the result of the application of new knowledge, others result from reconfiguring existing knowledge to create "architectural innovations" (Henderson & Clark 1990, Henderson & Cockburn 1994). Many individuals within a business specialise in acquiring knowledge to perform their functional role, and if producing goods and services requires the application of many types of knowledge, processes like NPD must be organised to integrate these different types of knowledge while enabling individuals to maintain their functional specialisation. Grant (1996) recognises the importance of integrating knowledge in the business when he writes:

"If knowledge is a critical input into all production processes, if efficiency requires that it is created and stored by individuals in specialised form, and if production requires the application of many different types of specialised knowledge, then the primary role of the business is the integration of knowledge" (Grant 1996, p. 377).

Methods of Integrating Knowledge

In his research, Grant (1996) identifies four mechanisms which may be used to integrate specialised knowledge within the business: (i) rules & directives; (ii) sequencing; (iii) routines; (iv) group problem-solving and decision-making. These mechanisms are particularly relevant to the activity of knowledge integration in NSD.

- Rules & directives. Approaches to co-ordination involves 'plans, schedules, forecasts, rules, policies and procedures, and standardised information and communication systems' (Van de Ven et al. 1976). Such rules and directives provide a means by which tacit knowledge can be converted into readily comprehensive explicit knowledge.
- Sequencing. Probably the simplest means by which individuals can integrate their specialist knowledge while minimising communication. Continuous co-ordination can be achieved by organising production activities in a time-patterned manner sequence such that each specialist's input occurs independently through being assigned a separate time slot. In most production activities there is discretion over the extent of sequencing, e.g. new product design can be fully sequential, overlapping sequences, or concurrent (Nonaka 1990; Clark & Fujimoto 1992).
- Routines. An organisational routine is a 'relatively complex pattern of behaviour... triggered by a relatively small number of initiating signals or choices and functioning as recognisable unit in a relatively automatic fashion' (Winter 1987), e.g. the operations of a fast-food restaurant.

- Group Problem-Solving & Decision-Making. Reliance upon high-interaction, non-standardised co-ordination mechanisms increases with task complexity and task uncertainty. Therefore, group problem-solving and decision-making by teams is usually reserved for unusual, complex and important tasks.

Jain & Triandis (1990) observed three general approaches to transferring knowledge: (i) a *personnel* approach results in the temporary/permanent transfer of the owner(s) of knowledge to the user group that has to apply the knowledge; (ii) an *organisational link-pins* approach results in specialised transfer agencies being used as intermediaries, bringing together and supporting owners and seekers of knowledge; (iii) a *procedural* approach results in early use involvement by means of procedures, e.g. multifunctional (lifecycle) project teams.

Factors Influencing the Successful Integration of Knowledge

Contrary to conventional wisdom that blames primarily motivational factors, e.g. lack of incentives, interdivisional jealousy, low priority, lack of buy-in, recipient's refusal to do what they are told, resistance to change, lack of commitment, turf protection, NIH syndrome (Chew et al. 1991), Szulanski (1996) found the major barriers to internal knowledge transfer to be knowledge-related factors. The author's findings indicate that it is not that firms do not want to integrate knowledge, rather they do not know how to. This would suggest that management should dedicate resources to developing the learning capacity of organisational units, and systematically understanding and communicating practices and knowledge. The knowledge-related factors posited to be likely to influence the difficulty of integrating knowledge assets into and across the business (Szulanski 1996) may be conceptualised as consisting of:

- Characteristics of the knowledge transferred, e.g. tacit or explicit (Winter 1987; Nonaka 1994; Polanyi 1962; 1967).
- Characteristics of the source, e.g. lack of motivation, perception of unreliability.

- Characteristics of the recipient, e.g. lack of motivation, lack of absorptive capacity, lack of retentive capacity (Cohen & Levinthal 1990), presence of gatekeepers (MacDonald & Williams 1993), poor transformative capacity (Garud & Nayyar 1994).
- Characteristics of the context in which transfer takes place, e.g. barren organisational context, arduous relationship, absence of rewards (Nonaka 1994; Ghoshal & Bartlett 1994; O'Dell & Grayson 1998).

Each of these four issues are now explored in more detail in the following text.

Characteristics of the Knowledge Transferred

The complexities of knowledge integration mean that the co-ordination of knowledge across the business is not a trivial issue. Nelson & Winter (1982) identified five criteria to comprehend the difficulty which may exist in transferring knowledge. The position of a unit of knowledge on one of these continuum scales is an indicator of its difficulty in being transferred, and therefore calls into question its value as a formal asset. The five categories are:

- Tacit vs. articulable (e.g. tacit knowledge is not generally easy to transfer and explicit knowledge suffers from two key problems of appropriability. First, as a public good, anyone who acquires it can resell it without losing it and, secondly, the mere act of marketing it makes it available to potential buyers (Grant 1996).
- Non-teachable vs. teachable.
- Not observable in use vs. observable in use.
- Complex vs. simple.
- An element of a system vs. independent.

The way in which knowledge is structured will also have an impact on the success a business achieves in integrating it. In fact, Hedlund (1994) believes that one of the reasons for the innovation problems of the large, Western organisation lies in the inflexibility of tightly specified and articulated systems of knowledge, which

makes it difficult to be inconsistent and to engage in projects not perceived to fit 'what the company is all about'.

The knowledge integrated into organisational capabilities may also be viewed as a hierarchy (see Exhibit 2-20).

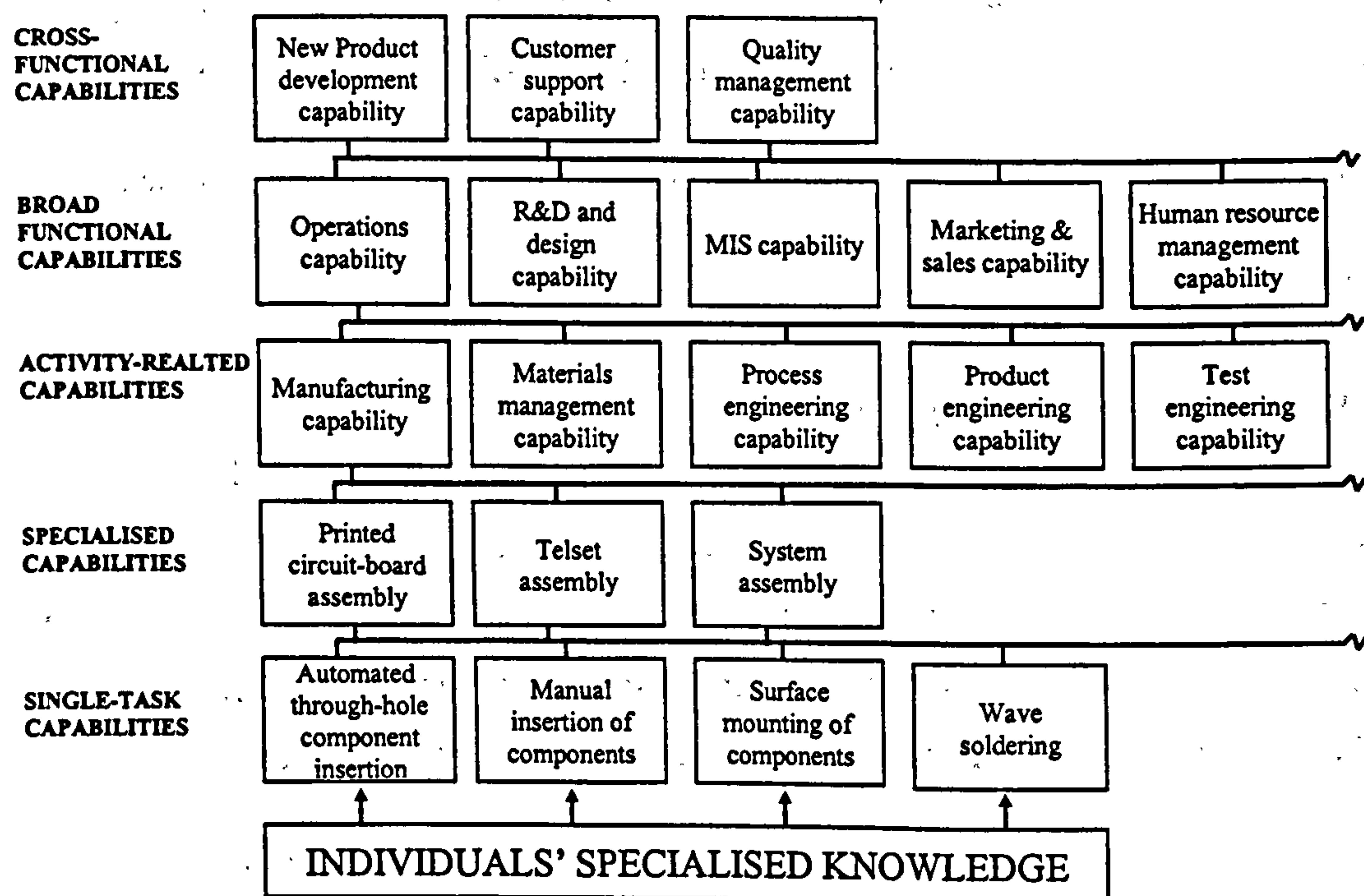


Exhibit 2-15: Organisational Capabilities of a PBX Producer: A Partial Vertical Segment (Source: Grant 1996)

At the base of the hierarchy is the specialised knowledge held by individual organisational members. At the first level of integration are capabilities which deal with specialised tasks. Moving up the hierarchy of capabilities, the span of specialised knowledge being integrated broadens; task-specific capabilities are integrated into broader functional capabilities - marketing, manufacturing, R&D, and financial. At the higher levels of integration are capabilities which require wide-ranging cross-functional integration, e.g. new product development (Clark & Fujimoto 1991). The wider the span of knowledge being integrated, the more complex are the problems of creating and managing organisational capability.

Characteristics of the Recipient

It has been recognised that a necessary condition for successful exploitation of knowledge assets is the ability of the business to absorb knowledge generated both from *within* the business, and *outside* of its organisational boundaries (Mowery, Oxley, Silverman 1996; Cohen & Levinthal 1990).

A business can seek to effectively absorb *external knowledge*. In fact, the ability of a business to recognise the value of new, external information, assimilate it, and apply it to commercial ends is critical to its innovative capabilities. Cohen & Levinthal (1990) have labelled this as "absorptive capacity", and suggest that it is largely dependent upon the level of the business' prior-related knowledge. Absorptive capacity is related to the concept of 'complexity', which is based upon the assumption that as a business gains more in experience and learns from it, it will become more expert at what it is doing (Lyles & Schwenk 1992). Absorptive capacity is not a passive endeavour. Rather, through awareness, strong leadership, commitment, and continual dialogue (Levinson & Asahi 1995) a business, or alliance, can shape and enhance absorptive capacity. It has been found that absorptive capacity is more likely to be developed and maintained as a by-product of routine activity when the knowledge domain that the business wishes to exploit is closely related to its current knowledge base (Cohen & Levinthal 1990). For example, absorptive capacity can be generated by firms conducting their own R&D, or as a by-product of a business' manufacturing operations (Abernathy 1978; Rosenberg 1982). When a business wishes to acquire and use knowledge that is unrelated to its on-going activity, then it must dedicate effort *exclusively* to creating absorptive capacity (i.e. absorptive capacity is not a by-product), e.g. Samsung's acquisition of technology through the development of prior knowledge and high intensity of effort (Kim 1997).

In an alliance context, the practice of comparing one's own activities to those of other firms, and then identifying and implementing best practices, constitutes an essential component in the absorptive capacity requisite for learning (Levinson & Asahi 1995). When there is no perfect congruence between a business' product domain and its knowledge domain, where there is uncertainty over future

knowledge requirements, and where new products offer early-mover advantages, then inter-business collaboration is advantageous (Grant & Baden-Fuller 1995). Management research has particularly sought to examine the transfer of best practices, i.e. organisational capabilities, between firms because such practices are regarded to be important drivers of business performance (Prahalad & Hamel 1990; Grant 1991). The extent to which firms enter alliance relationships with the '*intent to learn*' will impact the effectiveness of the knowledge transfer and the learning taking place (Hamel 1991; Slocum, McGill & Lei 1994).

A business can also seek to effectively absorb *internal knowledge*. Research by Pavitt (1984) demonstrated that nearly 59% of 3,013 significant innovations in the UK (from 1945 to 1979) were based on knowledge generated from within innovating firms. In some industries, it was estimated that internal sources could account for 70%. This then places a greater emphasis upon assimilating knowledge generated from within the business. Exploiting internal knowledge may require a business to transfer knowledge across time in readiness for use as it may be generated in periods where it is unable to exploit it immediately. Garud & Nayyar (1994) label this ability, *transformative capacity*. In contrast to absorptive capacity, transformative capacity is the ability of a business to continually redefine a product portfolio based on technological opportunities created within a business.

If a business is to reuse the knowledge created over time to allow for greater demand or availability of complementary technologies, it must select the technology vectors (Porac & Thomas 1990) to focus upon, maintain them appropriately, and be able to reactive them when required (Garud & Nayyar 1994). The dimensions affecting this inter-temporal transfer of knowledge are similar to those affecting transfer of knowledge across space. The decision of a business to store *easy to transfer* knowledge depends on two other factors: (i) to benefit, the business must be able to prevent other firms from appropriating the stored knowledge; (ii) if the knowledge is business-specific, the business must also store those complementary resources necessary to leverage the value of the stored knowledge.

Characteristics of the Context

Transferring capabilities and knowledge has proven to be problematic and von Hippel (1994) coined the term '*sticky*' to refer to the level of difficulty experienced when transferring knowledge and information between business units within a business, or between firms. He defines the stickiness of a given unit of information in a given instance as the incremental expenditure required to transfer that unit of information to a specified locus in a form usable by a given information seeker.

The nature of the organisational *structure* can make integration of knowledge problematic. Because of the inherent complexity of knowledge assets, classic organisational designs may not work in a knowledge-intensive environment. For example, the need to manage tacit knowledge may impose a natural limit on the size of the operating units¹⁹. In complex systems, hierarchy, specialisation, and centralisation have been found to be major sources of distortion and blockage of intelligence (Harold Wilensky 1967).

It has been observed that organisation structures need to be designed with a view to organising activities such as to reduce the extent and intensity of communication needed to achieve knowledge integration Grant (1996b). Nonaka (1988a) proposes the use of "compressive" management approaches, where top management creates a vision or dream, and middle management creates and implements concrete concepts to solve and transcend the contradictions arising from the gaps between what exists at the moment and what top management hopes will exist in the future. Middle management close the gap and create and share new knowledge by having the ability to combine strategic (context free) information with hands-on (context-specific) information.

Nonaka (1994) proposed the concept of a *hypertext organisation* which aims to provide the business with a strategic ability to acquire, create, exploit and accumulate new knowledge continuously and repeatedly. Hypertext design

¹⁹ IDEO, an industrial design business, and WM-Data, a manufacturer of hearing aids, both posit that there must be no more than 50 staff per unit (The McKinsey Quarterly, 1, 1998).

distinguishes between the normal routine operation conducted by a hierarchical organisation and the knowledge-creating activities carried out by self-organising teams. The hypertext organisation combines the efficiency and stability of a hierarchical bureaucratic organisation with the dynamism of the flat, cross-functional task-force organisation. The hypertext organisation can be visualised as a multi-layered organisation comprised of three layers: (i) the *knowledge-base* embraces tacit knowledge associated with organisational culture and procedures, as well as explicit knowledge in the form of documents, filing systems, computerised databases, etc.; (ii) the *business-system* layer is where normal routine operation is carried out by a formal, hierarchical, bureaucratic organisation; (iii) the *project team* layer relates to the area where multiple self-organising project teams create knowledge.

Romme & Dillen (1997) note the emergence of the *circular* organisational structure to overcome the restrictions placed on learning by traditional top-down structures. A circular organisation is created by superimposing a hierarchy of circles on the existing administrative hierarchy. Many professional firms have abandoned hierarchical structures, organising themselves in patterns specifically tailored to the particular way intellect creates value. Such reorganisation often involves breaking away from the traditional thinking about the role of the centre as a directing force. The consequent *inverted business* makes sense when individual experts embody most of the business' knowledge, when they do not have to interact with one another to solve problems, and when they customise their knowledge at the point of contact with customers.

A number of large-scale studies on knowledge management have identified adequate *rewards* as a significant factor in determining the success of transferring knowledge within and outside the organisational boundaries. If the process of sharing and transferring knowledge is not inherently rewarding, celebrated, and supported by the culture of the business, then artificial rewards, e.g. financial payments, won't necessarily have an effect. In particular, it has been observed that while financial rewards may be successful in the early stages of building enthusiasm, a good reward system should provide intrinsic rewards to achieve the

required behavioural trait, e.g. staff must find the activity rewarding or beneficial in its own right (O'Dell & Grayson 1998).

Information technology (IT) has been observed to help a business access, organise, store, search, retrieve and navigate information. It is also being used in the creation, dissemination and storage of organisational knowledge (see Ruggles III 1997). Technologies often seen to be used, in some cases effectively, include: navigation tools; full-text search engines; intelligent agents; document management; data warehouses; data mining; collaborative work group tools; e-mail; broadcast technology.

2.4.3.4 STORING KNOWLEDGE IN THE BUSINESS

A related issue to that of absorptive capacity, and equally as important - particularly in the field of innovation - is the role of organisational/corporate memory, or stored knowledge (Starbuck 1992; Kerssens-Van Drongelen et al. 1996; Moorman & Miner 1997). The notion of a corporate memory has been around for over a quarter of a century, and many definitions have been proposed. These definitions focus on the persistence of knowledge in a business, often independently of how this persistence is achieved (van Heijst et al. 1997). Envisioning memory as a formal phenomenon is consistent with the recent literature (Cohen & Levinthal 1990; 1994; Huber 1991) which suggests that firms process, use, and store information, and these collective activities are distinct from the activities of individual managers. Organisational memory has been defined as the collective beliefs, behavioural routines, or physical artefacts that vary in their content, level, dispersion, and accessibility (Moorman & Miner 1997). This view of memory is also consistent with that of Day (1994c) who views it as "a repository for collective insights contained within policies, procedures, routines, and rules that can be retrieved when needed".

It is essential that important knowledge be *codified* (Boisot 1995b) or recorded in information systems, operating procedures, white papers, mission statements, organisational stories or routines. Information technology such as shared data

bases, communications networks, and decision-support systems may well have a role to play in facilitating the storage of organisational memory (Day 1994c).

Garud & Nayyar (1994) suggest that the process of creating memory for knowledge varies with the dimensions of knowledge. For example, as knowledge becomes more articulable, it need only be codified to be available for future use. In contrast, the more tacit the knowledge, the richer the media required to maintain it. In choosing which knowledge to store, the business has to address a number of issues:

- Ambiguity, due to multiple and conflicting views about the future strategic value of that knowledge (Daft & Lengel 1986) and decision-maker's divergent preferences (March 1978). Firms may often deal with ambiguity by using rich media to exchange views and opinions among managers about the future of technologies.
- Uncertainty, due to the existence of incomplete information about future demands and supply conditions, competitors' actions, and other externalities (Daft, Sormunen & Parks 1988). Firms may often deal with uncertainty by collecting more information.

A business' memory base can consist of many media/sources, which Kerssens-Van Drongelen et al. (1996) group into four categories. The most prominent of these is the least traceable and accessible, *brainware*. Such knowledge makes a business very dependent upon its staff.

- **Brainware** - knowledge in the mind of people, such as experience, intuition, a person's educational background.
- **Hardware** - touchable things incorporating knowledge, such as solid prototypes, products, R&D equipment, production processes.
- **GroupWare** - unwritten knowledge shared by people, such as rules of thumb, procedures, stories.

- Documentware - knowledge documented on paper or in databases/information systems, such as CAD/CAM models, parts database, patents, lab reports, handbooks.

Davenport, Long & Beers (1998) identified three basic types of knowledge stored in organisational memory: (i) external knowledge, e.g. competitive intelligence; (ii) structured internal knowledge, e.g. research reports; (iii) informal internal knowledge, e.g. discussion databases full of know-how and lessons learned. Walsh & Ungson (1991) posits that organisational memory is composed of: (i) the structure of its retention facility; (ii) the information contained in it; (iii) its effects; (iv) the information acquisition and retrieval processes.

Maintaining knowledge for future use is costly because resources must be assigned to keep it "alive" (Levitt & March 1988). The complexity of the knowledge stored will also affect the amount of information required to maintain it, and this in turn will be determined by the amount of information required to successfully reconstruct an entire knowledge vector and the speed at which it must be reactivated (e.g. Xerox's attempt to re-enter the personal computer market). Once the potential for exploiting a maintained knowledge vector is recognised, the next task is to reactivate it and ensure availability through some form of catalogue, otherwise the business will be unaware of its knowledge stores. Just as knowledge transferred across space and culture requires social, political and economic modification, so knowledge retrieved across time requires modification to suit current needs. At this point it is important to assess the reliability of the knowledge (Levitt & March 1988) and internalise it once again through experience (Nonaka 1988). Wilson & Hlavacek (1984) note that some firms keep knowledge alive by maintaining an active core group of people who had previous experience in the knowledge area.

2.4.4 Measuring Knowledge Impact

Knowledge and ideas, unlike physical assets, are not scarce, they are not subject to diminishing returns and they can create substantive growth. It has been argued that "intangibility" is central to the theory of defining future wealth creation and

competitive advantage. Wealth creation in manufacturing is increasingly derived from intellectual assets such as R&D, process and product design, marketing and management systems. For this reason, Bradley (1997a) posits that the traditional divisions between manufacturing and service activities is disappearing.

Knowledge is found in the minds of individuals, it exists in capital such as plants, equipment, or financial instruments, firms' routines and cultures, and professional cultures. However, if knowledge is to be viewed as an asset, the business needs to understand which knowledge or competence should be developed, and how value can be derived from it. The issue of knowledge measurement is especially pressing as the decisions concerning the deployment of knowledge in a business will depend heavily on its true or perceived value. Glazer (1998) therefore declares: "if academics are serious about developing a comprehensive theory of knowledge, and if managers are serious about developing their knowledge assets, then it is time for us all to get serious about developing reliable and valid measures of knowledge". Similarly, Miles et al (1998) suggest that given the attention now focused on this area, the time is appropriate for the development of frameworks that attempt to clearly define alternative forms of capital.

There have been various efforts made to capitalise the value of income streams earned by certain intangible assets, most notably technological know-how, brands, and customer relationships. However, despite the increasing importance of knowledge, current management theory and practice remains predicated on physical assets, and existing frameworks for thinking about knowledge assets remain inadequate (Wilkins et al. 1997; Bradley 1997a). For example, it may be argued that financial statements do not yet reflect the new realities of the information age (Toffler 1990).

Depending on the particular knowledge management focus, the scope and goal of knowledge management measurement can vary considerably. The measurement process can assess: individual knowledge elements; tasks; processes; firms; an enterprise; a nation. The scope of the activities at each of these levels is illustrated in Exhibit 2-21.

Focus of Knowledge Measurement	Description
Detailed knowledge focus	To address the <u>individual knowledge elements</u> , e.g. case histories, concept hierarchies, relationships between entities, etc. The goal is to maximise task performance by treating knowledge with best available methods and technology.
Work function focus	To identify knowledge requirements for competent execution of complex <u>tasks</u> and methods of knowledge transfers. The goal is to maximise intelligent behaviour by placing the most appropriate knowledge wherever it is needed.
Process and practices focus	To implement specific activities and platforms for managing knowledge, e.g. capturing, organising, sharing, inciting. The goal is to achieve effective and comprehensive knowledge management by adopting the best practices and <u>processes</u> .
Value chain focus	To determine priorities for knowledge management based on knowledge-related opportunities and bottlenecks. The focus is to pursue the most valuable opportunities by supporting enterprise <u>value disciplines</u> and operations with knowledge.
Enterprise-wide focus	To pursue building, applying, and deriving value from knowledge assets to maximise viability and profits. The goal is to rely on knowledge and knowledge assets to maximise enterprise success.
Nation-wide focus	

Exhibit 2-16: Scope of Knowledge Management Measurement (Wiig 1997a)

2.4.4.1 VALUE OF KNOWLEDGE TO THE ECONOMY

Economists, led by Paul Romer, have written about "economics of ideas" and the almost unlimited potential for economic growth and success that new innovations and knowledge-based products make possible (Romer 1993; Kelly 1996). In contrast to earlier theories, the economics of ideas explains much of the increased quality of life and wealth creation of the last decades, and points squarely to the vital role that knowledge plays. Making people knowledgeable brings innovation, and continued ability to create and deliver products and service of the highest quality. It also requires effective knowledge capture, reuse, and building upon prior knowledge (Wiig 1997a). Romer's model for the economics of ideas indicates some of the economic perspective and motivations behind the

progressive manager's desire to focus on knowledge-dependent opportunities and strategies. The model also explains why firms that do not pursue knowledge-dependent strategies have problems. Their products, services, and internal operations become limited compared to innovative firms.

2.4.4.2 MEASURING KNOWLEDGE AT THE FIRM LEVEL

Most firms would be aware of the importance of knowledge assets to their business, but few have yet to embrace a business-wide framework for managing knowledge assets. The traditional approaches used for measuring knowledge assets, where used by firms, incorporate human resources, organisational learning or intellectual property-based approaches to identifying and estimating the level of business-level know-how.

Human resource-based measures include: (i) training days per employee; (ii) total training spend; (iii) number of personnel development plans completed; (iv) number of performance appraisals completed; (v) assessment against competency framework.

While the human resources based measures place a greater emphasis upon the individual level, *organisational learning* approaches address the synergies which might arise at the organisational level, e.g. the research surrounding the 'experience curve' (the relationship between cost and experience) identifies how economic activity is structured to achieve higher performance. Although much of the research in this area has focused upon the effects on manufacturing activity, the concept can also be applied to non-manufacturing activities. One advantage of the experience curve is that the cost savings attributable to learning can be measured, and conceivably capitalised as a knowledge asset.

A business can also seek to measure its intellectual property. *Intellectual property* refers to any product of the human intellect which has some value in the marketplace, e.g. idea, invention, expression, unique name, business method, or industrial process. Intellectual property law attempts to determine when and how a person can capitalise on a creation. Depending upon the type of property,

different intellectual property law may be relevant, e.g. patent law, copyright law, trademark law, trade secret law and unfair competition law.

However, the use of these three distinct types of measure is far from satisfactory when evaluating the knowledge capabilities of the business. Increasingly, firms are looking to build knowledge-related measures into business performance measures (Davenport, Long & Beers 1998). For example, Demarest (1997) asserts:

“all knowledge management programs ought to be targeted directly at the income statement: at revenue enhancement, cost reduction, or the management of risk associated with marketplace and financial performance...implying a formal understanding at a strategic level within the business, of the role knowledge plays in the business' quest to add value” (p. 380).

A number of new metrics have been proposed to measure the overall value of knowledge assets at the business level.

Tobin's q, originally used to analyse why firms make capital investment, is defined as the ratio between a business' market value (stock price x shares outstanding) and the replacement value of its physical assets. It reflects the value the market places on items not on the balance sheet, part of which are knowledge assets.²⁰ The problems associated with *Tobin's q* include: (i) it does not differentiate between the value of non-intellectual and intellectual capital factors; (ii) the value of knowledge assets can be less than 1 (i.e. business is being undervalued); (iii) it is assumed that the knowledge assets can be accurately reflected in the business' market price, even though they might not be apparent to management; (iv) general market swings can significantly affect the value of the knowledge assets; (v) the valuation is subject to easy manipulation by firms, e.g. through reducing the value of the physical assets. Comparing the value of a

²⁰ The average for U.S. businesses in 1996 was 1.7 (New York Times 16 March 1996).

business' Tobin's q to that achieved by other firms in the same, or different, industries may go some way to reducing these influences.

Another method of valuing knowledge assets uses estimates of knowledge assets in relation to *net R&D spending*, plus net training expenditures. Although offering the advantage of simplicity, the approach has a number of disadvantages: (i) in focusing upon training and R&D, the value of the business' total stock of knowledge assets is ignored; (ii) the approach also conflates what is spent on R&D/training with the knowledge assets that such expenditures create. Another broad R&D-based method calculates the net present value of patents using discounted cash flows tied to the cost of capital. Product life cycles are then factored into this to provide a measure of intellectual capital (Bradley 1997a).

In innovation terms, measuring knowledge flows through R&D has proved very difficult. While corporate R&D intensity is often used as a measure, it is generally agreed that this provides a measure of knowledge input rather than knowledge output. Citation patterns in a business' patent portfolio (Mowery, Oxley, Silverman 1996) and changes in one partner's technology portfolio in relation to the other during the course of an alliance relationship (Almeida 1996) have been used as output measures. For example, research by Henderson (1994) suggested that over a 30-year period the most successful pharmaceutical firms obtained more than twice the number of patents per research dollar, and that firms that take advantage of knowledge generated from all areas of the business are significantly more productive than their rivals.

Building upon the work of Kaplan & Norton (1996), Skandia, one of Sweden's leading insurance business, has developed a systematic way of visualising and measuring *intellectual capital*, and have added it as an appendix to its traditional financial report (see Exhibit 2-22). Skandia views intellectual capital as both what is in the heads of staff ('human capital') and what is left in the business when people go home in the evening ('structural capital'). The latter is further subdivided into: customer focus; process focus and renewal; development focus.

Skandia's initiative has been followed by other firms including Hewlett-Packard, Dow Chemicals, CIBC and Canon (Roos & Roos 1997)²¹.

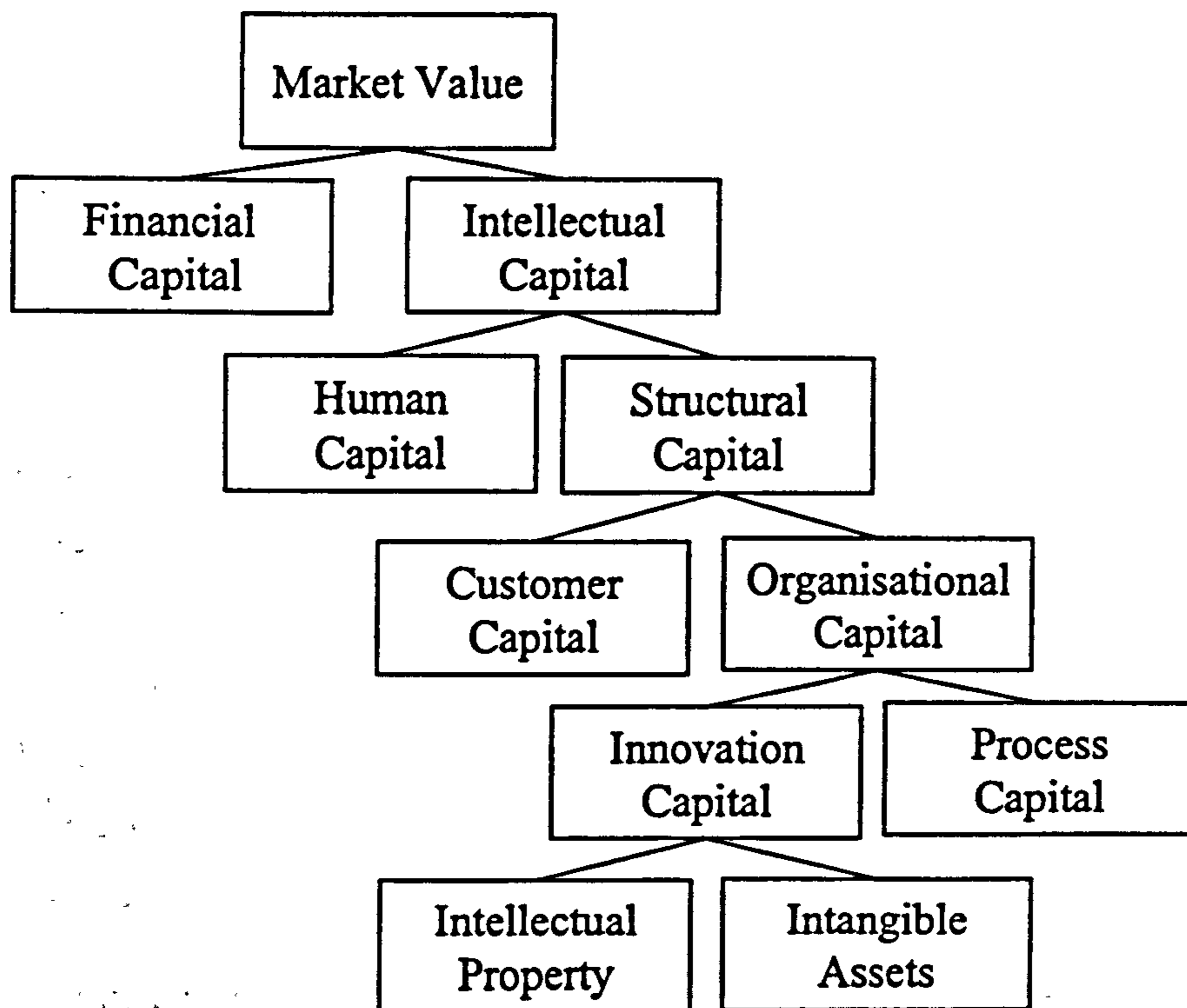


Exhibit 2-17: The Skandia Value Scheme (Edvinsson 1997)

In the future, to support enterprise-level monitoring and strategy setting, it is possible that something akin to systematic Intellectual Asset accounting (IAA) will be developed to become established as a common practice within business (e.g. maybe based on the categorisation of assets used by Skandia). Such accounting will provide formalised approaches to describe the state of the enterprise's knowledge assets - the "knowledge landscape" - and their potentials (Wiig 1997a). However, Davenport, Long & Beers (1998) warn that efforts to measure knowledge assets, while laudable, will eventually require major changes

²¹ For example, detailed knowledge on how to launch and operationalise a Skandia office in a new market is shared by all Skandia staff. This has significantly enhanced the business' ability to take advantage of the deregulation of financial markets in North America and Europe and thereby extend its global reach and penetration (Bradley 1997a).

in world-wide accounting systems if they are to become institutionalised. Measuring intellectual capital is different to measuring just knowledge management activities. The goal of knowledge management is to improve the business' value chain creation capability through more effective use of knowledge. The goal of intellectual capital management is to improve the business' value generating capabilities through identifying, capturing, leveraging, and recycling intellectual capital. This includes both value creation and value extraction (Edvinsson 1997).

In reality, it is important for a business to monitor and measure and number of different knowledge variables in the business. For example, WM-data monitors the utilisation of its consulting personnel, the profit and value added per revenue-earning staff member, the stability of the workforce, the average age of its personnel, the stability and longevity of the customer base, and the development of competence in its knowledge workers (The McKinsey Quarterly, 1, 1998).

2.4.4.3 MEASURING INDIVIDUAL KNOWLEDGE ASSETS

In computing the value of the business' knowledge assets solely at the business level, metrics ignore the need to identify and value individual knowledge assets associated with the individual, the process and the business. While strategists and researchers will continue to seek quantification of the value contribution made by knowledge to overall business performance, it has been observed that the more common type of success in knowledge management involves operational improvements limited to a particular process or function, e.g. to improve product innovation, customer support, education and training, software development (Davenport, Long & Beers 1998).

A framework of five superordinate categories or modes for measuring a business' approach to knowledge management has been proposed by Quintas et al. (1997). It is hypothesised that each category can be used as a guiding "scorecard" with which to measure the contribution made by individual knowledge assets: (i) knowledge acquisition - focus and search; (ii) problem-solving - location,

procedures, activity, scope; (iii) dissemination - processes and breadth; (iv) ownership - identity and resource; (v) representation of storage/memory.

2.4.4.4 MEASUREMENT AT THE PROCESS/ACTIVITY LEVEL

In the future, it has been observed that management teams and staff at all levels can be expected to be cognisant, and analyse the impacts, of their action in terms of the expected value-added contributions and resulting "bottom line" end-value of their own work. Wiig (1997a) proposes one such model in Exhibit 2-23. An illustration might be: the transfer of high-value expert strategies to practitioners (the knowledge management activity), might lower operating costs (internal benefits), which might offer higher quality products and services (improved deliverables), which might increase customer satisfaction (external benefits), which might result in greater profitability (bottom-line benefits). For example, the Hughes Space and Communications Company (Ward & Leo 1996) measure their success in managing knowledge by using metrics at the work level, e.g. one of the measures is repeated mistakes. "If knowledge is really spreading, we should begin to eliminate repeated mistakes...for example, we identified two incidences where lessons learned within the work groups have avoided a half a million dollars of re-work and saved about a week of cycle time" (p.18).

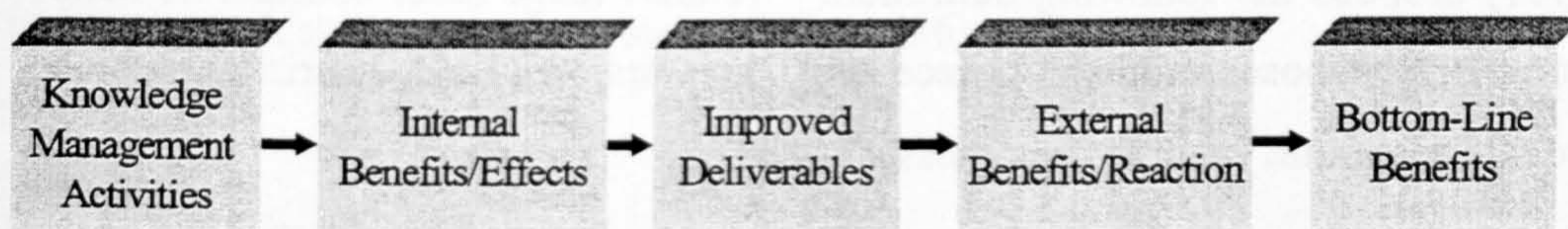


Exhibit 2-18: Translating Value-Added from Initial Actions to Bottom-Line Benefits (Wiig 1997a)

Wilkins et al. (1997) propose the use of a valuation framework which employs the added value and the cost of a knowledge asset as the main contributors to value. The stepped approach involves determining: (i) all activities that seem to be knowledge intensive; (ii) the set of resources that are consumed in production (for each activity); (iii) what resources possess knowledge assets, and listing those

knowledge assets; (iv) the set of products that is produced in production (for each activity); (v) the cost of each resource (per product). The advantage of such an approach is that the method focuses on the way products and services are produced. The disadvantage is that it will work mainly in an environment where production processes are the most important form of organisation, exceptions would include sectors like pharmaceuticals where the value of the knowledge asset is largely determined by duration of patent protection. The method also values only current knowledge assets and not the opportunity to deploy knowledge assets in the future to increase their value.

Benchmarking is the process of identifying, understanding, and adapting outstanding practices from firms anywhere in the world. O'Dell & Grayson (1998) observe that such benchmarking can be carried out via benchmarking teams, best practice teams, knowledge and practice networks and internal audits. In reality, benchmarking can take place at the individual, process and business level.

2.4.4.5 BARRIERS TO MEASUREMENT

The vagueness of many definitions of knowledge assets makes them difficult to use in practice, and for the purposes of measurement and valuation, Wilkins et al. (1997) propose the following definition: "A knowledge asset consists of facts (statements whose validity is accepted), assumptions, and heuristics which provide economic value to its possessor" (p.63).

It has been suggested that the tacit nature of knowledge makes it difficult to measure the development of knowledge, although the strategic management literature is beginning to report the positive experiences of a number of firms who are developing effective knowledge measurement systems to drive their knowledge strategy forward. Firms often cannot assess what they know because of forces of specialisation or departmentalisation and, when they can, they may still not be able to anticipate future needs for particular information that may, as a result, get discarded (Huber 1991). Traditionally, managers have been comfortable with things that are easily measured and accountable. As such,

extensive systems have been developed that allow managers to track the use of economic capital, such as money and physical assets, and measure the economic returns accruing to it. Knowledge, however, is not so easily accounted.

2.4.4.6 PROTECTING KNOWLEDGE ASSETS

Because the flow of knowledge is so uncertain, it is unlikely that new knowledge created will be evenly distributed across industries. Therefore, possibility exists that Ricardian and monopoly rents will be earned (Winter 1987). However, for a particular business to earn such rents it must be able to protect its assets from appropriation or imitation by its competitors (Liebeskind 1996). Although, legal protection for the business is afforded by copyright, patents and trade secrets processes, the business will also need to protect knowledge 'leakage' as a consequence of employee action. In protecting its knowledge assets, options open to the business include: (i) unifying ownership through incentives schemes within the business; (ii) employment contracts to restrict the actions of staff in ways that would not be permitted in market contracts for human capital (Marsten 1988); (iii) the business can reorder rewards over time, the so-called "golden hand-cuffs" (Milgrom & Roberts 1992). For example, Bain & Company, the US consulting business, motivates its people to use the BRAVA system (Bain Resource Access for Value Added) by basing a portion of their compensation on staff willingness to input case histories into the system (Cerny 1996).

2.4.5 Conclusions

In 1975, more than half the value of all the Fortune 500 firms was attributable to tangible assets. By 1995, that figure had dropped to near 25 per cent, putting intangible assets firmly in the driving seat - and almost half of those intangible assets were some form of intellectual property²². It is widely agreed that the society in which we live in has been gradually turning into the "knowledge society" identified by Drucker (1990), and researchers and theorists are now

²² Financial Times, 11th November 1998.

beginning to pay attention to the idea of the business as a body of knowledge, rather than as a traditional portfolio of physical assets (Pisano 1994). The emergence of the knowledge-based view of the business, representing a confluence of a number of streams of research, contains a number of contributing literatures (Grant & Baden-Fuller 1995): resource-based theory (Grant 1991); epistemology (Polanyi 1966); organisational learning (Huber 1991); evolutionary economics (Nelson & Winter 1982); organisational capabilities and competences (Prahalad & Hamel 1990); and NPD (Nonaka 1984).

In the business literature, the meaning of the term “knowledge” remains a highly contentious concept. Knowledge has been defined as “information that changes something or somebody – either by becoming grounds for action, or by making an individual or an institution capable of different and more effective action” (Drucker 1990, p. 242). There is some agreement agreed that knowledge is constructed from data and information, and is stored in individual cognition (Kim 1993) or in an organisational memory (Moorman & Miner 1997). Knowledge can be ‘explicit’ or ‘tacit’ (Polanyi 1962; 1967); it can be a skill; a routine (Quinn et al. 1996); a mental model, a motivation/mission, a spiritual value (Whitehall 1997); or it can be a particular business competence (Teece et al. 1997).

Such diversity suggests that to form the basis of a theory of the business, as some researchers seek, knowledge must be defined precisely enough to facilitate a determination of which firms have the more significant knowledge, and to explain how that knowledge leads to competitive advantage – a task currently being addressed by strategy researchers (Grant 1996; 1996b; Spender 1996a; 1996b). Similarly, because many different classifications of knowledge are perceived to exist, it has been posited that the business may need to develop a strategy for each classification of knowledge in order to promote its efficient and effective dissemination, measurement, growth and protection (Wiig 1997a).

Much of the research into the management issues concerning the integration and management of different types of specialised knowledge has been within the context of new product development (Nonaka 1990; Clark & Fujimoto 1991; Wheelwright & Clark 1992). It has been observed that while some innovations

are the result of the application of new knowledge, others result from reconfiguring existing knowledge to create "architectural innovations" (Henderson & Clark 1990, Henderson & Cockburn 1995). However, there has been little exploration of the issues surrounding the integration of knowledge in the context of services, and NSD, in particular.

This literature review has identified a number of areas as being in need of further research and experimentation. In particular: (i) how tacit knowledge can be captured and utilised; (ii) how to optimally structure the flow of knowledge between seekers and providers to maximise impact; (iii) how to make knowledge more visible and concrete (Holtshouse 1998). As research advances, it has been observed that research will need to be more sensitive to preserving, and building upon, the already significant literatures on the management of technology, entrepreneurship, innovation and business strategy (Teece 1998b).

2.5 Organisational Learning Literature

Solving a problem, introducing a product, or re-engineering a process all require creating and integrating new and existing knowledge, and acting accordingly. In the absence of learning, firms and individuals will simply repeat old practices. The need for firms to learn has become intensified by the competitive challenges of the 1990s, which threaten many established management practices. Among these challenges are the globalisation of competition, shorter product life cycle, fragmentation of end-user markets, advances in technology, and more demanding customer expectations.

The concepts around organisational learning were formally introduced by Simon (1953/1976) over forty years ago in his description of the birth of a public agency. The first publications specifically on organisational learning appeared in the 1960s (Cangelosi & Dill 1965) but research in the field gained momentum through the work of Argyris (1976), the publication of *The Fifth Discipline* by Peter Senge (1990a), and the special edition on organisational learning in *Organisation Science* (1991). There remains, however, even greater need to improve our knowledge of organisational learning so that firms can more effectively respond to the rapidly changing environment (Rahim 1995). To this extent, one may suggest that the present organisational learning literature currently refines and restates the concepts and principles which have emerged from previous research streams, rather than offering any new insights into the way in which firms can leverage learning to improve business performance.

2.5.1 What is Organisational Learning?

Many management theorists view organisational learning as a process, a cognitive enterprise that unfolds over time: some believe that behavioural change is required (Fiol & Lyles 1985; Kok 1998²³); that new ways of thinking are enough

²³ Acquiring new knowledge is one thing, but acting appropriately as a consequence is often required.

(Huber 1991); some emphasise concrete market information processing systems (i.e. information generation and dissemination) as the mechanism through which learning should take place (Sinkula 1994); others stress the need for shared mental models, shared organisational visions, and open-minded approaches to problem-solving (Senge 1990a; 1992). Some link organisational learning to knowledge acquisition and others to value creation.

The literature on organisational learning still has a strongly theoretical nature (Romme & Dillen 1997) and may be regarded as being excessively broad (Cohen & Sproull 1991), fragmented (Shrivastava 1983), without direction (Fiol & Lyles 1985), and lacking in cumulative and integrative work (Huber 1991). Many discussions on learning in firms is on high philosophy and grand themes, sweeping metaphors rather than the gritty details of practice. Garvin (1993) suggests three critical issues remain unresolved in the literature: (i) the need for a plausible, well-grounded definition of learning firms; (ii) the need for clearer guidelines for practical management of learning; (iii) the need for better tools for assessing a business' rate and level of learning. Once these issues have been addressed, managers may have a firmer foundation for launching learning firms.

Glynn et al. (1994) proposed two approaches to studying learning organisations. The *behavioural* approach focuses on the "hows" at the organisational level, and the *cognitive* approach focuses on the "whats" at the individual level. The behavioural perspective assumes firms are routine-based systems which respond to experience by repeating and experimenting with behaviours which have been successful and avoiding those which have not (e.g. Levinthal & March 1981). The approach focuses on changes in structures, technologies, routines, and systems as the organisation responds to its own experience. The cognitive perspective emphasises the pattern of cause-effect relationships (i.e. cognitive associations) produced by the learning process, as well as the processes by which these beliefs are communicated and institutionalised within and among firms. Cognitive learning perspectives are understood to be changes in belief systems which may or may not be reflected in immediately observable behaviours or organisational performance.

Although highlighting the overlap, Romme & Dillen (1997) explain organisational learning in terms of four dominant theories: (i) contingency theory; (ii) psychology; (iii) information theory; (iv) system dynamics. In *contingency theory*, firms are viewed as open systems which continually adapt themselves to their surroundings (Cangelosi & Dill 1965; Cyert & March 1963). In *psychology theory*, the assumption is that firms translate their internal and external environments in terms of their own frames of reference (Weick 1979; Argyris & Schon 1978; Argyris 1982; 1990; 1991; 1992). In *information theory*, firms are primarily considered as processes of acquisition, distribution, interpretation and storage of information; organisational learning is a continually evolving process that results in the expansion and improvement of knowledge (Walsh & Ungson 1991; Huber 1991; Nonaka 1991). In the theory of *system dynamics*, the principles of system dynamics are used to show that social reality consists of circles of causality. Research, therefore, suggests that organisational learning must be understood as a cohesive, holistic process before more detailed theorising can take place (de Guess 1988; Kim 1993; Stata 1989; Senge 1990a).

Although theorists have studied learning for many years, there is still no universally agreed definition of organisational learning. Exhibit 2-24 presents those definitions proposed by leading researchers in the area. Although employing different perspectives, the commonality among the definitions is that they agree that learning in, and by, firms is an institutionalised process by which firms and their members identify, interpret, and manage their experience.

Source	Description
Argyris & Schon (1978)	Organisational learning is “experience-based improvement in organisational task-performance”.
Ray Stata (1989)	“Organisational learning occurs through shared insights, knowledge, and mental models...[and] builds on past knowledge and experience – that is, on memory”.
Fiol & Lyles (1985)	Learning is the development of insights, knowledge, and associations between past actions, the effectiveness of those actions, and future actions.
Huber (1991)	Learning is the “development of insights which results in a change in states of knowledge that expands the range of potential behaviours”.
Kim (1993)	Learning is the “process whereby knowledge is created through the transformation of experience”
Ulrich, Todd & von Glinow (1993).	“Learning capability represents the capacity of managers within an organisation to generate and generalise <i>ideas</i> with impact”.
Day (1994c)	“Learning is simply taking in information. The learning process must include the ability of managers to ask the right questions at the right time, absorb the answers into their mental model...share the new understanding with others...and then act decisively”.
Shrivastava & Grant (1985)	“The autonomous capacity of firms to create, share and use strategic information about themselves and their environment for decision-making”.

Exhibit 2-19: Definitions of Organisational Learning in the Literature

In their research, McGill & Slocum (1993) sought to differentiate organisational learning from other knowledge-related theories by describing the associated policies, practices, and possibilities for action of four types of organisational experience: (i) knowledge; (ii) understanding; (iii) thinking; (iv) learning. Exhibit 2-25 presents a summary of their findings.

Category	Knowledge (e.g. McDonalds)	Understanding (e.g. Sears)	Thinking (e.g. Foley's)	Learning (e.g. Honda)
Philosophy	Dedication to one best way (predictable, controlled, efficient).	Dedication to strong cultural values which guide strategy/action.	A view of business as a series of problems.	Examine, enhance & improve every business experience.
Mgmt. Practice	Maintain control through rules & regulations.	Clarify, communicate, reinforce the business culture.	Identify problems, collect data & implement solutions.	Experimentation, model learning, acknowledge failures.
Staff	Follow the rules...don't ask why.	Use corporate values as behavioural guides.	Embrace & enact programmed solutions.	Gather, use info, and constructively dissent.
Customers	Must believe the business knows best.	Believe that business' values ensure positive experiences.	Are considered a problem to be solved.	Are part of a learning relationship with open & continuous dialogue.
Change	Incremental...must be a fine tuning of "the best way".	Only within the "ruling myth".	Implemented through problem-solving programmes.	Part of the continuous process of experience-examine-hypothesise-experiment-experience.

Exhibit 2-20: Organisational Approaches to Experience (McGill & Slocum 1993)

It has been argued that a high capacity for learning is a crucial factor distinguishing between successful and unsuccessful firms (Senge 1990; Ulrich et al. 1993). For example, the capacity of a business to learn has been linked to corporate renewal (Brown 1991), entrepreneurship (Lant & Mezias 1990), and innovation (McKee 1992; Brown & Duguid 1991). Learning's importance as a key strategic variable (Cosier 1981) is further evidenced by scholars and practitioners who indicate that the rate at which individuals and firms learn may become the only sustainable competitive advantage in knowledge-intensive industries (Stata 1989). It has also been observed that there are two features of organisational learning which are important to competitive advantage (Levinthal & March 1993). Firstly, learning generally increases average performance. More experienced staff will generally fair better than less experienced staff. Secondly, learning generally increases reliability, i.e. more experienced staff produce fewer surprises. While competitive advantage is clearly helped by achieving increases in average performance, improved reliability is a mixed blessing. In increasing reliability, there is a danger that individuals, and therefore firms, may lose pre-eminence in their competitive sector, leading to poorer performance.

2.5.2 Taxonomies of Organisational Learning

A number of types of learning are referenced in the literature. Each type is associated with particular characteristics and results. The following text introduces the main taxonomies in use.

Organisational learning has been classified as a three-tier framework - single-loop, double-loop and meta-learning. These learning capabilities can be regarded as being hierarchical, i.e. meta-learning includes double-loop and single-loop learning. *Single-loop* learning, that required for incremental innovation to take place, occurs when the decision network utilises information inputs to modify products without changing existing organisational norms and technologies. It occurs when members of firms respond to environmental changes by detecting errors and taking corrective action to maintain the status quo. *Double-loop learning*, that required for discontinuous innovation, involves change in organisational norms and technologies as well (Fiol & Lyles 1985). In double-loop learning, systems thinking disciplines the business to focus on interrelationships and dynamic processes of change rather than on linear cause-effect chains (Senge 1990a; Argyris 1977). Sustained periods of double-loop learning can provide a window of competitive advantage for the business, but eventually that window will be closed as knowledge diffuses to competitors (Slater & Narver 1995). Exhibit 2-28 explores the main characteristics between single and double-loop learning, and the differing results anticipated to be achieved by each category.

	Single Loop Learning	Double Loop Learning
Characteristics	1. Based on repetition 2. Routine 3. Within existing structures	1. Based on cognitive processes & understanding 2. Non-routine 3. Aims at changing rules & structures
Results	1. Simple context 2. Problem solving capacity 3. Change of behaviour or performance level	1. Complex context 2. Development of new myths, stories and cultures 3. Change of mental frameworks

Exhibit 2-21: Single Loop/ Double Loop Learning (Romme & Dillen 1997)

In addition to identifying the presence of single-loop and double-loop learning, Kok (1998) writes of a 'deutero' learning process: where firms learn how to learn, i.e. by inventing strategies for learning (Argyris & Schon 1978, p.4). Deutero learning is "organisational when it is embedded in maps and images which guide organisational decision, control and instruction" (p. 86).

Senge identifies two types of organisational learning: (i) adaptive, i.e. copying and accommodating; (ii) generative, i.e. creative and innovative. Unlike adaptive learning, generative learning, requires the expansion of capabilities and new ways of looking at things. At the heart of Senge's learning organisation is the breaking of "mental models" and challenging pre-dispositions. Adaptive learning corresponds to single-loop learning and generative with double-loop learning.

Analogous to Senge's adaptive and generative learning, Fiol & Lyles (1985) draw distinctions between lower-level (incremental) and higher-level (transformational) learning. They observe that "lower-level learning occurs within a given organisational structure, a given set of rules...It is a result of repetition and routines and involves association building. Higher-level learning, on the other hand, aims at adjusting overall rules and norms rather than specific activities or behaviours...This type of learning occurs through the use of heuristics, skill development, and insights. It is therefore a more cognitive process than is lower-level learning, which often is the result of repetitive behaviour" (pp.807 - 808).

Another classification of organisational learning also centres on the aspect of behavioural change, i.e. the link between organisational learning and its ultimate objective, performance improvement. From this perspective, there are three ways that learning can influence organisational behaviour, and therefore business performance (Menon & Varadarajan 1992). These three types of *knowledge-use* form a continuum, from direct to indirect, of the effects of organisational learning on behavioural change (Slater & Narver 1995): (i) *action-oriented* use involves the direct application of knowledge to solve problems; (ii) *knowledge-enhancing* use influences management perspectives of problems, but is less likely to change behaviour; (iii) *affective-use* increases satisfaction or decreases dissonance with a change that already has been made.

A distinction in types of learning has also been proposed on the basis of the learning subject being examined, i.e. *task-specific* learning (e.g. technical, marketing etc) and *managerial learning* (e.g. learning about the functioning of the R&D/NPD process as a whole). Wheelwright & Clark (1992) consider managerial learning in innovation to be especially difficult, and often neglected. Staff are often pressed into the next project with little time to consider the learning points from the project or activity completed. In services development, it has been found that the post-launch review is not employed as much as the other stages are (Easingwood 1986).

In innovation terms, the three learning processes (single-loop, double-loop & meta) are often juxtaposed with three types of innovation - incremental, discontinuous and institutional, or programme (McKee 1992; Slater & Narver 1995; Osland & Yaprak 1995; Romme & Dillen 1997). Each level of learning is supported by different organisational learning processes (McKee 1992).

- *Incremental innovation* requires expertise focused close to operational levels with a great deal of highly specific information on a particular aspect of the business. Incremental innovation emphasises the integration of functions, e.g. R&D and marketing (Gupta, Wilemon 1990; Saghafi et al. 1990).
- *Discontinuous innovation* requires learning to relate the business to its environment in a new way. This often requires the use of high level skills which often may originate outside the business.
- *Programme-level innovation* requires the business to generalise innovation skills across projects (Takeuchi and Nonaka 1986). One aspect of this learning is, as Schrage (1989) notes, "firms that learn how to fail intelligently outperform firms that seek to minimise the frequency of failure" (p. 46).

Lynn et al. (1998) also identified three types of learning in the product development literature: (i) *within-team* learning (Project-based learning is the learning that occurs within the context of the team itself); (ii) *cross-team* learning;

(iii) *market learning*. The author found that firms do not need to excel at all three forms of learning. Infact, some learning strategies can actually be detrimental to a new product development effort. Team learning strategies must be tailored to a given innovation. Their ideas are presented in Exhibit 2-27.

Dimension	Within-Team Learning	Cross-Team Learning	Market Learning
Incremental Innovation ¹ Cost Reduction Strategy ²	Extensive	Extensive	Moderate
Evolutionary Technical Innovation Technology Entrepreneur Strategy	*	Extensive	Extensive
Evolutionary Market Innovation New Market Model Strategy	Extensive	Restricted	Extensive
Discontinuous Innovation New Venture Unit Strategy	Extensive	Extensive	Moderate
* Not enough data to determine; ¹ Innovation environment; ² Learning strategy;			

Exhibit 2-22: New Product Team Learning Strategies (Lynn et al. 1998)

2.5.3 The Learning Organisation

Distinctions are often drawn between organisational learning and the learning organisation. While Nonaka (1988b) writes of a learning organisation transforming "the flow of information into a stock of knowledge and, at the same time, spreads it to other departments and stimulates the systematic self-organising of information" (p. 70), Kofman & Senge (1993) assert that there is no such thing as a learning organisation. They posit it is a category which we create in language. Like every linguistic creation, this category is a double-edged sword that can be empowering or tranquillising. Exhibit 2-26 offers some further definitions of the learning organisation proffered in the literature.

Source	Description of a Learning Organisation
Watkins & Marsick (1993)	"The learning organisation has <i>embedded systems</i> or mechanisms to capture and share learning"
Senge (1990a)	"an organisation that is continually expanding its capacity to <i>create its future</i> "
Garvin (1993)	"a business skilled at <i>creating</i> , acquiring, and transferring knowledge, and at <i>modifying</i> its behaviour to reflect new knowledge and insights" (p.80).

Exhibit 2-23: The Learning Organisation in the Literature

Characteristics of the learning organisation have emerged from both academic and practitioner-oriented journals. Exhibit 2-27, although not exhaustive, presents three broad dimensions as identified by Luthans et al. (1995) in their review of the literature: (i) presence of tension; (ii) presence of systems thinking; (iii) a culture which facilitates learning. The authors note the absence of empirically-based research.

Category & Authors	Characteristics
<i>Presence of Tension</i>	
Cangelosi & Dill (1965)	Discomfort stress; Disjunctive stress; Performance stress
Morgan & Ramirez (1983)	System monitors & questions the context in which it is operating System monitors & questions the rules which underlie its own operation
Sullivan & Nonaka (1986)	Variety amplification by senior managers Variety reduction by junior managers Some tension or feeling of crisis within the organisation
Pascale (1990)	Continual questioning, inquiry Internal variety; Constructive level of debate
Weick (1979)	Values arguments Encourages doubt and contradiction
Senge (1990a; 1990b)	Creative tension; Gap between vision & reality
Leonard-Barton (1992b)	Challenging status quo
Argyris (1993)	Critical reflection

<i>Presence of Systems Thinking</i>	
Morgan & Ramirez (1983)	Systems that learn from their own experience Systems that are multi-skilled and interchangeable
Sullivan & Nonaka (1986)	All members learn and apply the "theory of action" Integration of all knowledge into one coherent picture
Senge (1990a; 1990b)	Shared vision; Systems thinking
Dimancescu (1991)	Holistic principles of management
Leonard-Barton (1992b)	Totally integrated systems Systems tremendously dependent on each other R&D is merged with production Holistic systems thinking
McGill et al. (1992)	Openness to the widest possible range of perspectives

<i>A Culture Which Facilitates Learning</i>	
Sullivan & Nonaka (1986)	High level of shared knowledge; Job rotation Openness to the suggestions of subordinates Elaborate education system built into business career paths
Stata (1989)	Value teamwork, openness, objectivity Tie pay and promotion to intangible factors
Senge (1990a; 1990b)	Leaders are designers, teachers, stewards
Leonard-Barton (1992b)	Constant experimentation on the factory floor Innovation is everyone's business Design your own equipment and processes
McGill et al. (1992)	Creativity; personal flexibility; Willingness to take risks Empathy; sensitivity & concern for human nature
Weick (1979)	Values improvisation; Dwells on opportunities

Exhibit 2-24: Characteristics of a Learning Organisation

2.5.4 Organisational Learning Processes

Although much has been written about the nature of organisational learning in both academic and practitioner journals, understanding of the actual processes through firms "learn" remain limited (Locke & Jain 1995). Exhibit 2-30, taken from the organisational learning literature, reviews the significant theories regarding the organisational learning process. As the many learning theories adopt a different number of activities to explain the learning process, Exhibit 2-31 groups the stages, where appropriate, to simplify comparison.

Argyris & Schon (1978)	Nevis (1992); Nevis et al. (1995)	Slocum & Dilloway (1990)
<i>Discovery</i> of a gap between expectations & reality which indicates new knowledge is needed.	<i>Acquisition</i> , i.e. the development of skills, insights, relationships.	<i>Acquisition</i> of knowledge through research, investigation, purchased advice, or education.
<i>Invention</i> , i.e. analysis of performance gaps & development of solutions.	<i>Sharing & dissemination</i> of what has been learned.	<i>Institutionalisation</i> , i.e. put knowledge into systems, standards, processes.
<i>Production & implementation</i> of appropriate solutions.		<i>Application</i> , i.e. the response to clear need to search for better way.
<i>Generalisation</i> , i.e. evaluate experience & encode them into organisational routines, conceptual maps, and norms.	<i>Utilisation</i> , i.e. the integration of learning so it is broadly available and can be generalised to new situations.	<i>Review</i> of experience.

Sinkula (1994) ²⁴	Weick (1979)	Levinson & Asahi (1995) ²⁵
<i>Acquisition</i> of knowledge, i.e. the process by which knowledge is obtained.	<i>Enactment</i> - creating a variety of ideas.	<i>Identification</i> of new knowledge.
<i>Dissemination</i> of information, i.e. the process by which information from different sources is shared.		<i>Transferring/interpreting</i> new knowledge.
<i>Shared interpretation</i> , i.e. the process by which distributed information is given one or more commonly understood interpretations.	<i>Selection</i> - the process of choosing or implementing the ideas.	<i>Using</i> knowledge by adjusting behaviour (adaptive learning).
<i>Organisational memory</i> is the means by which knowledge is stored for future use.	<i>Retention</i> - ensuring that the ideas endure.	<i>Institutionalising</i> knowledge by reflecting on what is happening (generative learning).

²⁴ Market information processing and organisational learning

²⁵ Inter-organisational learning in an alliance context.

Day (1994c) ²⁶	Kim (1993) ²⁷	Huber (1991)
<i>Scanning</i> – open-minded inquiry.	Individual <i>action</i>	<i>Acquisition</i> of knowledge.
<i>Data distribution</i> – widespread information distribution.	Individual mental models	<i>Distribution</i> of information.
	Shared mental models	
<i>Interpretation</i> - mutually-informed mental models.	Organisational <i>action</i>	<i>Interpretation</i> of information.
<i>Action</i> – information utilisation.		
<i>Reflection</i> – systematic evaluation of outcomes.	Environmental <i>response</i>	Organisational <i>memory</i>

Exhibit 2-25: Organisational Learning Processes in the Literature

2.5.4.1 INDIVIDUAL & ORGANISATION LEARNING

In addition to absorbing the knowledge of other firms, learning takes place at the individual, group/team, and business levels (Meyers & Wilemon 1989; Mills & Friesen 1992). However, much of the knowledge/organisational learning research focuses on learning as a single concept, and its impact. Less effort is devoted to the study of the linkages between individual-level cognitions, and the development of shared understandings and organisational action. This has lead to a very fragmented view of these linkages (Lyles & Schwenk 1992).

Although individual learning is important to firms, organisational learning is not simply the sum of each individuals' personal learning (Fiol & Lyles 1985). Locke & Jain (1995) posit that all learning is individual learning, and that there is no such thing as organisational learning, except metaphorically, i.e. its short-hand for 'learning by organisational members' (Argyris & Schon 1978; Kim 1993). Simon (1991) states that:

All learning takes place inside individual human heads. An organisation learns in only two ways: (i) by the learning of its members, or; (ii) by ingesting new members who have knowledge the organisation didn't

²⁶ Learning in the context of markets.

²⁷ Based on March & Olsen (1975)

previously have. (p.125).

Much of the research on organisational learning seems to assume that the learning process is fundamentally the same for individuals and firms (e.g. Huber 1991). Learning is typically described following Lewin (Kolb 1984), in which a person continually cycles through a process of having an experience; making observations and reflecting on that experience; forming ideas, generalisations, or explanations based on the observations and reflections; and testing those ideas in a new situation, which leads to another experience, and so on. This cycle encompasses and links know-how and know-why, i.e. it connects thought and action.

A basic assumption of many authors is that there are shared understandings within firms which influence organisational behaviour, though it may not be necessary for knowledge to be shared in order to influence behaviour (Hedberg 1981). In such situations, individual learning occurs as people acquire tacit knowledge through education, experience, or experimentation. Firms have been shown to develop shared frames of reference, recall past events, the creation of stories and myths, vicarious learning, unlearning and memories (Jelinek 1979). Conversely, it has been observed that the diffusion of individual learning to the business will reflect the size, extent and degree of organisational networks, the symbolic importance of member roles (March 1991), and the existence of a rich and substantive organisational language (Norman 1985).

In understanding the nature of individual and organisational learning it is helpful to consider three categories of meaning that organisational members construct (Dixon 1997): (i) *private meaning* (the private office) is the meaning which the individual constructs but does not make accessible to others; (ii) *accessible meaning* (the hallway) are places where meaning is not just exchanged, it is constructed in the dialogue between organisational members; (iii) *collective meaning* (the storeroom) is meaning that organisational members hold in common – they are the norms, strategies, and assumptions that specify how work gets done and what work is important to do. Collective meaning may be codified in policies and procedures, but to be collective, this meaning must also reside in the minds of

organisational members. Collective learning involves the diffusion of knowledge and skills from the individual to members of the business (i.e. collective) which increases the organisation's "capacity to take effective action" (Kim, 1993, p. 43). Diffusion occurs when members of the collective are no longer dependent upon the holder of the knowledge for its continued existence. It has been observed that a gap exists in the literature about how the process of diffusing individual knowledge and skills to the business occurs (Tompkins 1995). An understanding of the diffusion process would help firms understand how collective learning occurs, and provide the opportunity for management to look for new ways to make the process more efficient.

The importance of mental models in the process of sharing individual learning has also been noted in the literature. It has been suggested that individual learning becomes organisational learning when new knowledge is transferred across unit boundaries to others in the business who can benefit from what has been learned (Hamel 1991). The knowledge gained expands the possible actions a business can take in each function of the value chain. This transfer process can be regarded as a form of new *mental model* (Kim 1993; Markides 1997). Mental models represent a person's view of the world, including explicit and implicit understandings. They provide the context in which to view and interpret new material, and determine how stored information is relevant to a given situation. The mental models in individual's heads are where a vast majority of a business' knowledge lies, both know-how and know-why (Garvin 1993; Kim 1993). Shared mental models are what make the rest of the organisational memory usable. By explicitly revealing our mental model of how we believe the business works or should work, we create a precise language with which to share our understanding. By comparing our model with others, we provide a mechanism not only to converge on a shared model, but also to communicate to younger, less experienced managers the business' stored experience and knowledge. The extent to which individual mental models can influence collective mental models depends on the influence that certain individuals or groups can exert, e.g. the top management team tends to be one of the most influential groups (Romme & Dillen 1997; Prokesch 1997).

2.5.4.2 THE PROCESS OF STORING ORGANISATIONAL LEARNING

It is suggested in the organisational learning literature that that which is learned in the business is retained, i.e. stored, in two ways: (i) in *institutional mechanisms*, i.e. in the routines, structures, technologies, and systems that hold and co-ordinate routines; (ii) in the *beliefs* possessed and shared by organisational members. In this way, organisational learning is shared across organisational boundaries of space, time, and hierarchy. It also survives the turnover of individuals (Ulrich et al. 1993; Dixon 1993).

Stata (1989) posits that the difference between organisational learning and individual learning is that organisational learning occurs through shared insights, knowledge, and models, it builds on past knowledge and experience - that is, on memory. Thus, the presence of organisational memory is required if a business is to continually learn from the lessons of the past.

Organisational memory depends on the institutional mechanisms, e.g. policies, strategies, and explicit models, used to retain knowledge. Hedberg (1981) writes:

“Although organisational learning occurs through individuals, it would be a mistake to conclude that organisational learning is nothing but the cumulative result of their members’ learning. Organisations do not have brains, but they have cognitive systems and memories. As individuals develop their personalities, personal habits, and beliefs over time, firms develop world views and ideologies. Members come and go, and leadership changes, but firms’ memories preserve certain behaviours, mental maps, norms and values over time”.

Van Heijst et al. (1997) posit that two types of learning exist, ‘top-down’ or strategic learning, and ‘bottom-up’ learning which refers to the process whereby staff create “lessons learned” and attempt to distribute it throughout the business. Research has taken place into the concept of storing “lessons learned” or bottom-up learning, i.e. the process where an employee at any level learns something which might be useful and attempts to distribute it throughout the business. This can be a revolutionary idea or a relatively minor change, e.g. to process or product. Heijst et al. (1997) posit that storage of such lessons learned, i.e.

memory, should be: (i) easy for individual workers to access; (ii) easy for workers to decide which co-workers possess particular knowledge; (iii) easy for workers to determine who else should be interested in the knowledge; (iv) easy (and rewarding) for a worker to contribute knowledge; (v) offer well-defined criteria for defining if something is a useful lesson learned; (vi) provide mechanisms for keeping memory consistent; (vii) offer a facility to distribute a newly created piece of knowledge to those that need the knowledge. Building on these criteria, four examples of (lessons learned) memory are developed, and presented in Exhibit 2-31:

	Passive Collection	Action Collection
Passive Distribution	<p><i><u>"The Knowledge Attic"</u></i></p> <p>The simplest form of corporate memory. It is used as an archive which can be consulted when needed. In practice, this type of memory will be the most feasible one.</p>	<p><i><u>"The Knowledge Sponge"</u></i></p> <p>The business is actively trying to develop a corporate memory. Whether the memory is actually used to improve the quality of the organisational processes is left to the individual.</p>
Active Distribution	<p><i><u>"The Knowledge Publisher"</u></i></p> <p>Entering lessons learned is left to the individual. The role of the memory maintainers is to analyse the incoming lessons, combine them with knowledge in the memory and forward them to those for which the lessons learned might be relevant.</p>	<p><i><u>"The Knowledge Pump"</u></i></p> <p>This is the most complex type of corporate memory. In theory, the model ensures that the knowledge developed is fully exploited to improve the performance of the business . It emphasises the top-down nature of organisational learning because the business decides what is a lesson learned and who in the business should know about it.</p>

Exhibit 2-26: Types of "Lessons Learned" Corporate Memory (Heijst et al. 1997).

Over long periods, merely storing knowledge does not preserve it. For old knowledge to have meaning, people must relate it to their current problems and activities. They have to translate it into contemporary language, frame it within the context of current issues, and make it appropriate and relevant to their business (Starbuck 1992). The parts of a business' memory that is relevant for organisational learning are those that constitute active memory – those that define

what a business pays attention to, how it chooses to act, and what it chooses to remember from its experience – that is, individual and shared mental models (Kim 1993).

The traditional business and marketing strategy literature has long emphasised that firms are likely to be more successful if they stick to developing products and markets that reflect their core competence (Montoya-Weiss & Calantone 1994). However, only recently has research begun to explore the mechanisms through which stored information, or memory, may affect the product development process (Moorman & Miner 1997). Initial research by Moorman & Miner (1997) suggests that organisational memory affects NPD processes by influencing the interpretation of incoming information, and the performance of new product action routines. Cohen & Levinthal (1990; 1994) found that high levels of previous learning increase a business' absorptive capacity, which permits effective use of extramural knowledge. Garud & Nayyar (1994) suggest that firms should develop routines for reactivating previously acquired knowledge in the NPD process. Conversely, some research on organisational learning and technological change highlights the possibility that stored memory may prove a liability when organisational environments are changing rapidly as the stored memory, when activated, will relate only to a previous context (Miner 1990; Tushman & Anderson 1986; Leonard-Barton 1992a).

2.5.5 Barriers to Organisational Learning

Learning does not always move a business towards achieving its goals, and Locke & Jain (1995) seek an understanding of the “inefficiencies” in organisational learning. Research identifies possible disconnects, or learning states, whereby organisational learning may remain incomplete or incapable of being sustained over the long-term (Kim 1993; March & Olsen 1975; Romme & Dillen 1997). These situations include:

- *Role-constrained learning* occurs if individual learning processes do not have an effect on individual learning actions (March & Olsen 1975; Senge 1990a).

- *Audience learning* occurs where individuals only influence organisational actions in an ambiguous way, or not at all. What the individual learns is not adopted by or integrated into the business (March & Olsen 1975).
- *Superstitious learning* occurs where actions are undertaken, the reactions from the environment are observed and, on the basis of this, learning takes place. However, there is no substantial link between the actions undertaken and the reactions on the environment. Hence, a certain 'superstition' about the effect of actions on the environment develops (March & Olsen 1975).
- *Learning under ambiguity* occurs where the causal link between events and the environment are no longer obvious (March & Olsen; Levinthal & March 1993). Operational learning processes do take place, resulting in changing routines, but conceptual learning is totally absent.
- *Situation learning* occurs when the individual forgets or does not codify the learning gained for future use (Kim 1993).
- *Fragmented learning* occurs when the individual learns, but the business does not. The link between individual mental models and the collective model is poorly maintained (Kim 1993).
- *Opportunistic learning* occurs when organisational actions are taken based on an individuals' (or small group of individuals') actions and not on the business' widely shared mental models, e.g. values, cultures, myths, or standard operating procedures (Kim 1993).

Locke & Jain (1995) categorise the barriers to organisational learning into three broad areas: (i) individual- and group-level; (ii) organisational; (iii) and environmental. Since firms learn through their members, any limitations to learning at the *individual* level will limit organisational learning, e.g. individuals not knowing how to learn (Argyris 1991). *Group* barriers include: (i) group norms that foster conformity and adherence to old rules; (ii) fear of change that will disrupt traditional group relationships; (iii) differences in group goals and interests; (iv) groupthink. *Organisational* barriers include: (i) corporate culture;

(ii) focus on existing capabilities at the expense of exploration (March 1991); (iii) emphasis on organisational consensuality (Sims & Lorenzi 1992); (iv) lack of feedback on performance; (v) the structure of the organisational memory; (v) inability to correctly infer causation in input-output relationships; (v) failure to learn from past failures. Although some managers believe *environmental* factors are outside of their control, an understanding of the barriers faced can enable a business to either adapt to challenges or to change them for their own advantage. The *environmental* barriers faced include: (i) steep learning curves in entering new industries/markets; (ii) fast-changing technology; (ii) regulation; (iii) high environmental volatility.

2.5.6 Factors Influencing Organisational Learning

There is an abundance of literature which identifies factors which impact the extent to which organisational learning takes place (Lundberg 1995; Hayes et al. 1988; Pedler et al. 1989; Watkins & Marsick 1983). Some of these are presented in Exhibit 2-32 and discussed in the following text.

Nevis et al. (1995) identified ten facilitating factors and seven learning orientations which promote organisational learning. Learning orientations are the values and practices that reflect where learning takes place, and the nature of what is learned. These orientations form a pattern which identifies a business' "learning style". Facilitating factors are the structures and processes that affect how easy or hard it is for learning to occur, and to the degree to which effective learning takes place. These are standards based on best practice.

	Learning Orientations (i.e. Where & What)		Facilitating Factors (i.e. Ease of Learning)
1	Knowledge source: internal – external	1	Scanning imperative
2	Product-Process focus: what? – how?	2	Performance gap
3	Documentation mode: personal – public	3	Concerns for measurement
4	Dissemination mode: formal – informal	4	Experimental mind-set
5	Learning focus: incremental – transformative	5	Climate of openness
6	Value-chain focus: design – deliver	6	Continuous education
7	Skill development focus: individual – group	7	Operational variety
		8	Multiple advocates
		9	Involved leadership
		10	Systems Perspective

Exhibit 2-27: Learning Orientations & Facilitating Factors (Nevis et al. 1995)

2.5.6.1 STRATEGY FACTORS INFLUENCING ORGANISATIONAL LEARNING

The business' strategic posture has been found to partially determine its learning capacity (Fiol & Lyles 1985). Strategy determines the goals and objectives and the breadth of actions available for carrying out the strategy. Thus, strategy influences learning by providing a boundary to decision-making and a context for the perception and interpretation of the environment (Cyert & March 1963). Slocum et al. (1994) suggested firms should develop specific learning strategies and posited that the content of such strategies should include: (i) a strategic intent to learn; (ii) a commitment to continuous experimentation; (iii) an ability to learn from past success and failures.

The Miles & Snow (1978) strategy schema, which identifies a business' choice of strategic posture (e.g. defender, prospector), has also been found to influence the nature of the innovation pursued, i.e. incremental or continuous and it may, one could hypothesise, impact the business' learning orientation by guiding the acquisition of knowledge in particular areas.

2.5.6.2 STRUCTURE FACTORS INFLUENCING ORGANISATIONAL LEARNING

How a business is organised has an important impact on how its key tasks are carried out (e.g. Van de Ven & Ferry 1980). Poor communication between people and between firms can be a major block to learning and quality improvement (Stata 1989). The structure adopted by the business must, therefore, ensure obstacles to communication are removed and positive learning behaviours are promoted and encouraged (Dodgson 1993).

While a traditionally structured organisation can be a learning organisation, a centralised, mechanistic structure tends to reinforce past behaviours. An organic, more decentralised structure tends to allow shifts of beliefs and actions (Fiol & Lyles 1985; Mills & Friesen 1992). By reducing the information demands, a decentralised structure reduces the cognitive workload of the individuals, thereby facilitating the assimilation of new patterns and associations (Galbraith 1973). Carley (1992) concluded that firms with a hierarchical structure are less vulnerable to personnel turnover than firms with a flat structure (teams, networks), as new knowledge and skills of staff are to some extent also transferred to executives, managers, or team leaders. Conversely, hierarchical firms have been found not to perform as well as flat firms, particularly if much information gets filtered through different hierarchical levels. In referring to the decentralised structure at BP, John Brown the CEO states "a virtue of this organisation structure is that there is a lot of transparency...not only can the people within the business unit understand clearly what they have to do, but I and the other senior executives can understand what they're doing" (Prokesch 1997).

2.5.6.3 SYSTEMS FACTORS INFLUENCING ORGANISATIONAL LEARNING

Processes of knowledge creation and management are guided by managerial systems, which represent the formal and informal ways of creating knowledge and directing learning. A number of management systems have been linked to the development of learning in the business.

Specific Learning Systems

Chew et al. (1991) observed that there are four learning *systems* a business can adopt: (i) *vicarious* learning from the experience of *others*; (ii) *simulation* through constructing artificial models of the new technology and experimenting with it; (iii) *prototyping* with new technology on a small scale in a controlled environment; (iv) *on-line learning* by examining the actual, full-scale technology implementation while it is operating as part of the normal production process. A hierarchy exists among these four methods. As one moves through the list both costs and fidelity, i.e. closest to current practice, gets higher. The ideal learning strategy would include parallel and simultaneous use of all methods to mix varying contributions of fidelity and cost, e.g. the purpose of prototyping is to learn of problems and opportunities that were not found during simulation but which would cause delay or expense if they were left to on-line learning.

Active Training Systems

Instead of passive, classroom-type training and education programmes, active, on-the-job techniques - such as job rotation (Nonaka 1991; Nonaka 1988b), cross-training, and inter-functional transfers - can facilitate organisational learning. Systematic efforts to improve knowledge about a product or process, e.g. R&D activity, is also an important method of organisational learning.

Communication Systems

For learning to be more than a local affair, knowledge must spread quickly and efficiently throughout the business (Garvin 1993). Ideas carry maximum impact when they are shared broadly rather than held in few hands, and some firms have been observed to make knowledge-related employee behaviour a specific target of their projects. Firms must therefore develop the systems that enable staff to learn from others, from past failures and from other firms, e.g. business tours, staff transfers, education and training (Garvin 1993; Shaw & Perkins 1991; Pedler et al. 1989; Goh and Richards 1997).

Enlightened managers know that even firms in completely different firms can be fertile sources of ideas and catalysts for learning (Garvin 1993), e.g. benchmarking competitors and talking to customers. AT&T benchmarking group, Xerox Palo Alto, and Motorola offer good examples. It is therefore important that firms establish systems which promote the generation, dissemination and realisation of employee ideas (Robinson & Stern 1997). Benchmarking is a technique management can use to learn from others, and serves as goals and standards for world-class performance. It offers a process of measuring and comparing a business' processes, products and performance against those of a market leader (in that or a similar product/process), then striving to do better. One can establish both internal and external benchmarking processes (Locke & Jain 1995). In an external context, one can "steal" ideas (Ulrich et al. 1993) from competitors, trade associations, market research agencies...etc., while internal benchmarking will involve learning from the direct experience of others.

Review Systems

When studying a number of firms to identify competitive advantage in the learning organisation, Pedler et al. (1989) observed the need for individuals, groups and departments to exchange and share information on *expectations* and to feedback about *satisfactions* to assist the learning process. Successful learning firms have been shown to systematically review their successes and failures, assess them, and record the lessons in a form that staff find open and accessible (Garvin 1993). Post-project appraisals are useful methods for recording knowledge and transferring it to others, and they can lead to important insights and understanding which guide future successes. Examples include IBM's development of the 360 computer and Boeing's development of the 757 aircraft (Maidique and Zirger 1985).

Planning Systems

The existence of a disciplined planning and budgetary process has been observed to provide a strong learning mechanism within a business. Planning can make a contribution through the way in which activities in the planning cycle are related

to the "learning cycle". For example, at the oil business Shell, scenario planning workshops are used as a means to review experience, while business planning, project planning and budgeting are the means for internalising the experience gained (Mills & Friesen 1992). Similarly, Senge (1990a) suggests that microcosms of real business settings can be set where managers can learn how to learn. Such learning laboratories compress time and space to allow managers to experience the long-range consequences of decision-making, without the disadvantages.

Incentive Systems

Knowledge is more likely to be transferred, and learning to take place, when the right incentives are in place. Care and imaginative compensation systems are therefore likely to be an important influence on the outcomes of individual and organisational learning. Rewards can be given on the basis of knowledge performance (skills-based pay), quality, teamwork or productivity. Such systems have more elements than purely financial rewards, and among the non-monetary ones are opportunity, growth and personal involvement. An interesting alternative compensation approach involves the concept of "pay-for-knowledge" (Mills & Friesen 1992) - the idea where staff are compensated for improving or diversifying their skills portfolio, and which provides the business with opportunities for multi-skilling.

Information Technology Systems

Use of information technology systems which enable organisational members to question current operating assumptions, seek information for individual collective learning, and to structure and store new information and knowledge (Pedler et al. 1989; Nonaka 1988b).

Storing Knowledge

In an alliance context, what knowledge is "stored" and "retrieved" may depend in part upon the knowledge structure already in place in the business (Lyles & Schwenk 1992). For example, organisational routines store organisational

experience in a form that allows for a rapid transfer of that experience to new situations, e.g. a draft of a letter of intent for a new venture is likely to reflect previous experiences (Simonin 1997).

2.5.6.4 SHARED VALUES AND STYLE FACTORS INFLUENCING ORGANISATIONAL LEARNING

Authors of a number of popular books have attempted to prove the link between culture and performance (e.g. Peters & Waterman 1982). Similarly, the values and culture of a business have been found to possess a significant impact on the learning process and on how effectively a business can adapt and change (Lundberg 1995; Fiol & Lyles 1985). It has been observed that only in cases where the institutionalised culture is one which values change, learning, and flexibility, can either planned or unplanned change to the culture itself be successful (Levinson & Asahi 1995). The cultivation of a learning culture may thus become one of the primary means to attain and maintain competitive advantage (Day 1994c; Senge 1990a; 1992). For example, Barrett (1995) has observed that an appreciative learning culture can nurture innovative thinking by fostering an affirmative focus, expansive thinking, a generative sense of meaning, and creating collaborative systems.

Within the organisational learning literature, Schein (1996) has identified three particular cultures which may well explain why some firms fail to learn: (i) the *operator* culture is an internal culture based on a business' operational success; (ii) the *engineering* culture is made up of designers and technocrats and has its roots in a world-wide occupational community; (iii) an *executive* culture also has its roots in a world-wide occupational community in the sense that they have common problems that are unique to their jobs. These three cultures are often not aligned with each other, and it is this lack of alignment that could cause the failure of firms to learn.

The time taken for a business to change its culture and show improved organisational learning results will depend on a great many factors, including: (i) the reason and urgency of the change; (ii) the strength of the existing culture; (iii)

the business' existing systems, procedures and structure; (iv) top management involvement in the change; (v) environmental volatility (Locke & Jain 1995).

A number of shared values and management styles were identified in the literature as being likely to impact the efficiency and effectiveness of learning and, consequentially, the multi-dimensional performance of the business. These are now reviewed.

Learning Orientation

Learning orientation, positive or negative, spoken or tacit, correct or incorrect, exists in organisational cognition and, as such, is a driving force in the development of knowledge and action in firms. Learning orientation has been conceptualised as giving rise to that set of organisational values that influence the propensity of the business to create and use knowledge (Sinkula et al. 1997), and its existence is believed to affect the information that firms attend to, interpret, evaluate, and ultimately accept or reject (Argyris & Schon 1978). Three organisational values posited to be routinely associated with the predisposition of the business to learn are (Sinkula et al. 1997): (i) commitment to learning; (ii) open-mindedness; (iii) shared vision.

Commitment to Learning

"Commitment" underlies human knowledge-creating activities (Polanyi 1966). Thus, commitment is one of the most important components for promoting the formation of new knowledge within a business, particularly within the context of innovation (Nonaka 1994). A business' commitment to learning influences whether it is likely to actively promote a learning culture (Sinkula et al. 1997). For example, if a business places little value on learning, it is unlikely that learning will take place (Norman 1985). Commitment to learning is related to Senge's (1990a; 1990b) discussion of learning principles, Tobin's (1993) notion of "thinking literacy", and Galer and van der Heijden's (1992) belief that a "culture amenable to learning" is a prerequisite to its ability to improve its understanding of its environment over time. Previous research indicates that

learning-efficient firms that are committed to learning reflect on the causes and effects of their actions (Shaw and Perkins 1991).

Openness / Open-Mindedness

As discussed previously, mental models represent a person's view of the world, including explicit and implicit understandings. They provide the context in which to view and interpret new material, and determine how stored information is relevant to a given situation. Individual mental models is where a vast majority of a business' knowledge lies, e.g. know-how and know-why (Quinn et al. 1996; Kim 1993; Whitehall 1997). Shared mental models are what make the rest of the organisational memory usable. For example, new product successes and failures of the past are likely to support the formation of mental models. Over time, these models may no longer hold true but may still operate unless a business has the open-mindedness to continually question the basis on which they were formed (Day 1994a; Senge 1992; Sinkula 1994).

When firms proactively question long-held routines, assumptions, and beliefs, they may be engaging in the first phase of *unlearning* (Leonard-Barton 1992a). Unlearning is at the heart of organisational change, and open-mindedness is an organisational value that may be necessary for unlearning efforts to transpire. The need for openness to outside ideas has a significant impact on how the business is structured. For example, some firms are re-organising themselves internally to put staff in direct contact with customers. In doing so, staff are in a position to discover and become more responsive to customers needs.

Shared Vision & Purpose

Agreement and disagreement are apparent at many levels of the organisation at all times, and as organisational members strive towards agreement (or disagreement) they continue to develop organisational knowledge, enabling finer distinctions to be made, creating what Lyles & Schwenk (1992) call a core-set of knowledge

structure ("shared beliefs at the organisational level", p.156)²⁸. "Vision is an idea of a valued outcome which represents a higher order goal and a motivating force at work" (West, 1990, p.310). Shared vision and purpose may be defined as the degree to which staff have a clear vision of the organisation and understand how they can contribute to its success and achievement (Senge 1990a; 1992; Mohrman & Mohrman JR. 1995; Goh & Richards 1997).

If a business does not have a clear purpose, people in the business will not understand what kind of knowledge is critical and what they have to learn in order to improve performance. A clear purpose allows a business to focus its learning efforts in order to increase its competitive advantage (Prokesch 1997). The importance of the degree to which staff have a clear vision of the business and understand how they can contribute to its success and achievement has been identified by a number of researchers (Senge 1990a; 1992; Goh & Richards 1997).

Building a shared vision, especially of a future desired state has been observed to create a tension that leads to learning (Senge 1990a; 1992). In such instances, staff understand the gap that exists between the vision and the current state and as a consequence better strive to overcome that gap (Mohrman & Mohrman JR. 1995). Senge's (1990b) principle of 'creative tension' highlights the importance of articulating a vision: the difference between a business' vision and its current reality leads to a creative tension, which necessitates the need for learning to take place.

Shared vision is different from commitment to learning and open-mindedness (see previous sections) in that shared vision influences the direction of learning, whereas commitment and open-mindedness influence the intensity of learning. It is important to include both dimensions (direction and intensity) to build a comprehensive learning orientation construct that is in congruence with extant

²⁸ Lyles & Schwenk (1992) make a distinction between knowledge structure and culture & climate: "The concept of knowledge structure deals with goals, cause-and-effect beliefs, and other cognitive elements. Thus, it is narrower than culture and climate, both of which refer more to affective or emotional elements. Further, the knowledge structure is more clearly linked to an organisation's strategy for survival and more subject to change than an organisation's climate or culture, neither of which changes readily or provides specific strategies for action for an organisation" (p. 157).

theory and practice (Sinkula et al. 1997). Commitment to a shared vision provides a focus for learning that fosters energy, commitment, and purpose among organisational members (Day 1994a). Without commitment to, and agreement with, the direction the organisation is taking, less motivation to learn is likely (McKee 1992; Senge 1990). Without a shared vision, individuals are less likely to know what organisational expectations exist, what outcomes to measure, or what theories in use are in operation (Sinkula et al. 1997).

Collaborations on NPD projects is especially susceptible to divergent views (Clark & Fujimoto 1990; Day 1994c). Divergent or conflicting assumptions about the corporate vision may impact learning by undermining the ability of the management team to develop a focused response to market trends or environmental shocks (Sinkula et al. 1997). Schrage (1989) notes that "almost without exception, at the root of the (NPD) failures...is a business that's kidding itself about what it really wants...firms that succeed at innovation are those that make an unwavering commitment to it" (p. 47). Innovation goals focus the attention of learning (McKee 1992), and such integration of innovation and learning helps overcome the tendency for departments to focus on functional issues that can be counterproductive at the organisational level (Ginn & Rubenstein 1986).

Experimentation and Risk-Taking

As global competition intensifies, firms will have to conceive, design, produce, and deliver a wide array of new products in unlimited combinations to capture and satisfy the desires of ever smaller market niches. To develop such rapid learning required, it has been posited that firms will have to implement practices that facilitate experimentation with new products and processes (Slocum, McGill & Lei 1994; Simonin 1997). Such systems should aim to help managers to encourage experimentation whilst at the same time maintaining accountability and control over the experiments, without stifling creativity by unduly penalising staff for failures (Pedler et al. 1989; Shaw and Perkins 1991; Garvin 1993; Pedler et al. 1989; Slocum, McGill & Lei 1994; Goh and Richards 1997). Chew et al. (1991)

found that new manufacturing operations use simulation and prototyping techniques, with real data, before going "live", to anticipate the problems that might be encountered.

Firms which learn how to fail intelligently, i.e. tolerate failure and encourage employee participation across projects, have been found to outperform firms that seek to minimise the frequency of failure (McKee 1992; Gupta & Wilemon 1990). This suggests a cycle of learning to innovate, where new product failure is instrumental to the success of subsequent attempts at innovation (Maidique & Zirger 1985). It has been observed that for programme-level learning to occur, firms must tolerate failure and encourage employee participation across projects (Gupta & Wilemon 1990).

"I think it's impossible to predict what will happen when you deploy a strategic thought inside an organisation...I don't think you can predict people's behaviour....therefore, you've got to experiment...you've got to see what people actually do...you've got to see how the idea works" (John Brown of BP, from Prokesch 1997).

In a study of Chaparral Steel, Leonard-Barton (1992b), notes the emphasis on problem-solving, constant integration of knowledge, continual innovation and experimentation. The author also noted that the management system is supported by a reward system which particularly encourages the kind of behaviours required.

Leadership Style

One of the key tasks of the leadership of a business is to instil a clear, shared sense of purpose and to encourage teamwork, empowerment, exploration, and risk taking within the organisation (Locke & Jain 1995). The leader has to encourage these values by what he says and does. In this way, top management, along with appropriate organisational structures, contribute to solving the fragmented learning situations in that they can help make individual mental models shared.

Leadership style has been identified as an important factor in determining successful learning across projects (Adler et al. 1989).

A particularly complex environment calls for a complex style of leadership and a transformational facilitative leader (Slater & Narver 1995). It has been found that facilitative leaders encourage individuals to break through learning boundaries (Bass 1985). They focus upon developing the people around them. They are adept at motivating people to want to learn, and creating a 'demand pull' system in which people in the organisation want to learn more. In this way, the leadership helps staff learn and to demonstrate behaviours that are consistent with an experimenting and changing culture (Garvin 1993; Slocum et al. 1994; Goh & Richards 1997). Facilitative leaders in learning organisations expect employees to take business time to pursue knowledge that is outside the immediate scope of their work, and actively encourage cross-functional transfers that force employees to learn and to develop new skills (Nonaka 1991).

General management must systematically examine and support the opportunities for team member learning, project management learning, and organisational learning across a number of projects. Taking advantage of cross-project opportunities for learning requires that each project have as a key objective the development of new technical know-how and new organisational capabilities, not just the delivery of a defined product or process by a certain date.

Facilitative leaders are communicators. They constantly articulate and reinforce the vision of the business both internally and externally. They share information on trends and competitors' activity to maintain competitive focus, and operational information to communicate successes and identify potential problems. Staff are continually informed about business financial performance (Slater & Narver 1995).

It has been observed that as a business adopts a flatter structure, significant changes in the roles and expectations of staff must take place. In particular, the empowerment of staff will provide the autonomy that permits learning and innovation to emerge (Mills & Friesen 1992). In such firms, the sense is that management become facilitators, rather than supervisors and controllers.

Facilitative leaders must take the lead role in 'unlearning'. In challenging their own assumptions and mental models (Senge 1990a), they encourage staff to do the same. Slater & Narver (1995) suggest that the ability to lead unlearning could be the single most important role of the CEO, in particular, for breaking through the learning boundary to encourage generative learning. However, Levinthal & March (1993) warn that the business has to be careful not to lose too many 'lessons' from the failures of people who have been unsuccessful in the past, who have been removed or who were demoted.

Innovativeness

Hurley & Hult (1998) suggest that organisational learning is an antecedent to innovativeness. Innovation is the: "generation, acceptance and implementation of new ideas, processes, products or services" (Thompson 1965, p. 36), "an idea, practice or material artefact perceived as new by the relevant unit of adoption" (Zaltman et al. 1973, p. 2); and the "successful implementation of creative ideas within an organisation" (Amabile et al. 1986, p. 25). Organisational learning may be classified as a three-tier framework - single-loop, double-loop and meta-learning. In innovation terms, these learning processes are often juxtaposed with three types of innovation- incremental, discontinuous and institutional, or programme (McKee 1992; Slater & Narver 1995; Osland & Yaprak 1995; Romme & Dillen 1997). Each level of learning is supported by different organisational learning processes (McKee 1992)²⁹. Innovativeness is an organisational culture, and capacity to innovate is an outcome. Organisational learning, along with aspects of the organisational culture, acts as an antecedent to an innovation orientation. "It is the orientation to innovation and the capacity to implement innovations that determine whether the organisation's market and

²⁹ Incremental innovation requires expertise focused close to operational levels with a great deal of highly specific information on a particular aspect of the business. It emphasises the integration of functions, e.g. R&D and marketing (Gupta, Wilemon 1990; Saghafi, Gupta, Sheth 1990). Discontinuous innovation requires learning to relate the business to its environment in a new way. This often requires the use of high level skills which originate outside the business. Programme-level innovation requires the business to generalise innovation skills across projects (Takeuchi and Nonaka 1986). One aspect of this learning is, as Schrage (1989) notes, "businesses that learn how to fail intelligently outperform businesses that seek to minimise the frequency of failure" (p. 46).

learning orientations will lead to the development of the business and the achievement of superior performance” (Hurley & Hult 1998).

Entrepreneurship

The central idea surrounding entrepreneurship is *new entry*, that is, entering new or established markets with new or existing goods (Slater & Narver 1995). In contrast, innovation is a broader concept that addresses the *implementation* of new ideas, products, or processes (Thompson 1965). Innovation might not involve entering new markets.

Schumpeter (1934) observed that entrepreneurial firms out-compete other firms and are able to earn excess profits in the short-term, but ultimately their innovations will be copied by competitors, and profit levels will return to normal. Entrepreneurial activity has been associated with not only creating and commercialising products before competitors, but also in creating them before customers explicitly state their needs or requirements (Brown 1991; Hamel & Prahalad 1991). This is particularly risky in NSD when the time needed to copy competitor services is shorter than that required in NPD. To minimise that risk, and to maximise learning, entrepreneurs will seek to work more closely with lead users (von Hippel 1986), undertake numerous low-cost experiments (Hamel & Prahalad 1991; Kanter 1989), or continuously experiment through on-going quality improvement or cost-reduction programmes (Garvin 1993). To be successful, Webster (1994, p. 14) states “management must develop a broader concept of organisational culture that focuses the business outward – on its customers and competitors – and creates an overwhelming predisposition toward entrepreneurial and innovative responsiveness to a changing market”.

Entrepreneurship has become to be regarded as an important input into the learning organisation (Slater & Narver 1995). However, to be effective, entrepreneurial values must be made explicit. A culture that explicitly values entrepreneurship and innovation provides the environment in which learning from exploration and experimentation is most likely to take place (Hamel & Prahalad 1991; Quinn 1985).

Entrepreneurial cultures are also often associated with firms which value high tolerance for risk (Sykes & Block 1989), proactiveness (Naman & Slevin 1993), and receptivity to innovation (Kanter 1989). Slater & Narver (1995) suggest that entrepreneurial cultures are strongly associated with: (i) knowledge acquisition through exploration; (ii) challenging assumptions to create generative learning; and (iii) the rapid development of new behaviours to leverage learning.

2.5.6.5 STAFF & SKILLS FACTORS INFLUENCING ORGANISATIONAL LEARNING

An important aspect of commitment to knowledge and learning is the selection of people. Bringing in staff from outside the business can often be used to challenge the assumptions of staff (Shaw and Perkins 1991; Mills & Friesen 1992). Hiring people, and expecting to train them in all they'll need to know, largely results in poor knowledge acquisition and learning.

Senge (1990) identified the importance of leaders' role in learning firms as designers, teachers and stewards. He also noted that these roles also required new skills: the ability to build shared vision, to bring to the surface and challenge prevailing mental models, and to foster more systemic patterns of thinking.

Research has identified that the practices of non-expert membership of teams (Romme & Dillen 1997) and the laying-off or replacing staff and/or managers (Huber 1991) contributes to the business' ability to unlearn.

Organisational learning is a social process, wherein managers learn and develop mental models together (Nonaka 1994). Crucial to this social process is the successive rounds of dialogue between organisational members. During dialogue, managers exchange individually-acquired mental models, test the mental models they are confronted with, negotiate with other members and develop new mental models from this confrontation (Bood & Postma 1997).

Successful learning organisations promote and encourage the use of teams to solve problems and generate new and innovative ideas (Senge 1990a; 1992; Garvin 1993; Goh and Richards 1997). It has therefore been suggested that staff

must become disciplined in their thinking and more attentive to details (Garvin 1993). They must continually ask, "How do we know that's true?", e.g. Xerox's systematic problem-solving processes. Like other learning approaches, problem-solving consists of a systematic effort to learn from experience in a continuously improving organisation. Numerous approaches are used, including suggestion systems (Robinson & Stern 1997) and creative problem-solving groups (Basadur & Finkbeiner 1985; Davies & Pearson 1980).

2.5.6.6 ENVIRONMENTAL EFFECTS ON LEARNING

One of the most fundamental tenets in theories of organisational learning and knowledge creation holds that the value of knowledge and organisational memory is contingent upon the setting in which the business operates (Cyert & March 1963; Nonaka 1994). When an environment is unstable, managers need to seek knowledge in order to develop increased understanding of the changing market conditions and to increase their confidence in decision-making (Menon & Varadarajan 1992). Too much change and turbulence may also make it difficult for learners to map their environments (Fiol & Lyles 1985; March & Olsen 1975). Conversely, it has been observed that too much stability within a business can be dysfunctional, i.e. there is little inducement to learn and/or change if established behaviours never grow obsolete.

In innovation terms, two types of external environmental turbulence have been posited to moderate the effect of organisational learning (Moorman & Miner 1997; Cyert & March 1963); (i) *technological turbulence* is the degree of change associated with new product technologies; (ii) *market turbulence* is the rate of change in the composition of customers and their preferences (Jaworski & Kohli 1993). Both types of turbulence may have a potentially disruptive effect on memory's positive effect on new product performance because turbulence is likely to reduce the value of prior learning, which forces the organisation to search for and process more information (Sinkula 1994).

There might be an effect of external environmental turbulence on the development of creative new products (Moorman & Miner 1997). Specifically, a fast-changing

environment may act as a trigger to "unlearn" current new product routines (Cyert & March 1963; Leonard-Barton 1992a). As firms attempt to modify previously accepted ways of thinking and behaving, the concept of *unlearning* becomes important (Takeuchi & Nonaka 1986; Fiol & Lyles 1985; Leonard-Barton 1992a). For a business to unlearn, it needs to free itself and its managers from a number of roadblocks that will hinder re-learning: culture; continuous experimentation; network intimacy; information systems; reward systems; human resource practices; leaders mandate. Once this is done, new practices need to be embraced.

2.5.7 Organisational Learning in Alliances

Collaboration in alliance relationships has been found to enhance organisational learning (Hamel 1991).

Alliance relationships serve as a locus of innovation because they provide timely access to knowledge and resources that would otherwise be unavailable, while also testing internal expertise and learning capabilities (Grant 1996; Powell et al. 1996), e.g. a community of universities, suppliers, and research laboratories. Organisational learning is therefore both a function of a business' access to knowledge and its own internal capabilities for utilising and building on the knowledge attained externally (Powell et al. 1996). Internal capabilities are indispensable in evaluating research done outside the business (Cohen & Levinthal 1990; 1994), but external collaboration may provide access to news and resources that cannot be generated internally.

Learning can be viewed in the context of outcomes and processes. Osland & Yaprak (1995) posited that firms learn through four processes, three of which involve a business developing competences from a partner: (i) experience-based learning (informal process); (ii) imitation; (iii) grafting; (iv) synergism.

Experience-based learning occurs as firms independently experiment and acquire knowledge through trial and error, e.g. experience-based learning curves. However, firms are recognising the increasing difficulty in generating enough knowledge to compete successfully in a knowledge-rich environment (Menon and

Varadarajan 1992). *Imitation* involves internalising the technologies, strategies and functional activities of other firms. Hamel (1991) refers to the concept of "competitive collaboration" where firms partner and then exit the alliance to use the knowledge gained to compete against the former partner. Huber (1991) introduced the concept of *grafting* whereby a business increases its knowledge store by acquiring another business, engaging in long-term alliance relationships or licensing products and processes, rather than building its knowledge organically. *Synergism* occurs as firms collaborate to produce new knowledge. Synergism often occurs in the computer and pharmaceutical industries where firms share R&D facilities and personnel.

2.5.8 Measuring Organisational Learning

Over the long-run, firms must be able to learn at a rate that at least equals environmental change if they are to develop and maintain core competences that have value in the market (Stata 1992). Learning at a slower than baseline rate of environmental change is indicative of learning deficiencies that are likely to lead to an eroded market position. For example, Chaparral Steel believes that its know-how, built up over a number of years and diffused throughout the organisation, gives it a significant advantage in discerning valuable new ideas, adopting them rapidly, and then extending and refining them over time (Adler et al. 1989). But what learning is to be measured, and how should it be measured?

Many firms have tremendous difficulty in establishing a systematic approach to organisational learning. Continual pressure to achieve financial (in particular) targets leads to reactive, unsystematic, and expensive problem solving (Chew et al. 1991). The resource implications of learning activities (e.g. opportunity cost) need to be budgeted for, and from a narrow perspective of traditional investment they may offer few quantifiable returns.

The ability to measure learning offers an opportunity to "prove" the benefits. It has been observed that one of the main problems with the implementation of an organisational learning strategy is that no methodology currently exists in the literature for measuring learning capability (Goh & Richards 1997). A major

challenge for organisational learning researchers therefore is to develop valid measures of learning outcomes (Slater & Narver 1995; Prahalad & Hamel 1990; Stata 1992).

In fostering a supportive environment where learning is encouraged, it has been suggested that firms should establish appropriate metrics for exploring new ideas around learning. For example, executives at Pfizer Central Research have experimented with a set of metrics that includes individual learning³⁰ and feedback across groups.

2.5.8.1 TYPES OF MEASUREMENT

Finding measures for the evaluation of learning is emerging as an important, but heretofore overlooked, control function (Fiol & Lyles 1985). Measurement can be either direct or indirect. Measurement expressed through indirect measures would include 3M's goal that 25% of sales must come from products that did not exist five years before (Schrage 1989). Direct measures of learning would involve the actual increase in knowledge gained as a consequence of personal or organisational action. The following briefly summarises the traditional objective and judgmental methods used to measure organisational learning.

Performance Improvement

Garvin (1993) has proposed the use of a three-stage organisational learning measurement model, where the stages may overlap. The first stage is cognitive, where members are exposed to new ideas and begin to think differently. The second stage is behavioural, where staff internalise their insights. The third stage is performance improvement, with changes in behaviour leading to performance improvements. Questionnaires can be used at the cognitive level to focus on attitudes and depth of understanding, to assess behavioural changes questionnaires are supplemented by direct observation, e.g. the use of mystery shopping in the

retail sector, and a full learning audit is required to assess performance improvement.

Balanced Scorecard

In the management literature, Kaplan & Norton (1992) introduced the concept of a *balanced scorecard* when discussing the measurement of firm performance. They argue that performance should be measured with a mind to four perspectives: (i) financial; (ii) customer; (iii) internal business process; (iv) learning and growth.

Experience Curves

Traditionally, the solutions to measuring organisational learning have been the “learning curve” and “manufacturing progress functions”. Both concepts date back to the discovery, during the late 1920s and 1930s, that the costs of airframe manufacturing fell predictably with increases in cumulative volume. Later studies expanded the focus by looking at total manufacturing costs and the impact of experience in other industries. Firms like Boston Consulting Group raised these ideas to a higher level in the 1970s. Drawing on the logic of the learning curves, they argued that industries as a whole faced “learning curves”. Although both these measures are still used today, they are sometimes regarded as being incomplete (Garvin 1993). The criticism is that they focus on a single measure of output (cost or price) and ignore the learning that affects other competitive variables, like quality, new product introductions, service, delivery. Experience and learning curves suggest only one possible learning driver, total production volumes. They tell us little about the sources of learning and the levers of change.

³⁰ They expect that staff and management will travel and talk to customers, meet with vendors, attend conferences, publish, and certainly to read journals. Top management see that there is money set aside to support this activity, and it is carefully protected.

Half Lives

Another measure emerged in response. Called the "half life" curve (Stata 1989), it was originally developed by Analog Devices. It is a measure of the time it takes to achieve 50% improvement in a specified performance measure. Half life curves are easy to operationalise, they provide a simple measuring stick, and they allow for ready comparison among groups. Their weakness is that they focus solely on long-term results, and therefore short-term progress may be missed. Half-life curves are essential for ensuring that cognitive and behavioural changes have actually produced results.

Judgmental Measures

Because learning effects are sometimes hard to quantify with "hard numbers", a number of qualitative techniques have emerged as important measurement processes. For example, Luthans et al. (1995) observe that the results of organisational learning in areas such as customer satisfaction, training effectiveness...etc. can be measured through questionnaire surveys and interviews.

Input vs. Output Measures

An alternative to the traditional measures might include assessments of specific inputs - resource and personnel utilisation, and the outputs - projects completed, processes changed or improved, complaints received, and new products introduced.

2.5.9 Conclusions

Solving a problem, introducing a product, or re-engineering a process all require creating and integrating new and existing knowledge, and acting accordingly. In the absence of learning, firms and individuals will simply repeat old practices. The literature on organisational learning still has a strongly theoretical nature (Romme & Dillen 1997) and may be regarded as being excessively broad (Cohen & Sproull 1991), fragmented (Shrivastava 1983), without direction (Fiol & Lyles

1985), and lacking in cumulative and integrative work (Huber 1991). Garvin (1993) suggests three critical issues remain unresolved in the literature: (i) the need for a plausible, well-grounded definition of learning firms; (ii) the need for clearer guidelines for practical management of learning; (iii) the need for better tools for assessing a business' rate and level of learning. Once these issues have been addressed, managers may have a firmer foundation for launching learning firms.

Distinctions are often drawn between organisational learning and the learning organisation. While Nonaka (1988b) writes of a learning organisation transforming "the flow of information into a stock of knowledge and, at the same time, spreads it to other departments and stimulates the systematic self-organising of information" (p. 70), Kofman & Senge (1993) assert that there is no such thing as a learning organisation. They posit it is a category which we create in language, and like every linguistic creation, this category is a double-edged sword that can be empowering or tranquillising.

Individual learning is important to firms, but organisational learning is not simply the sum of each individuals' personal learning (Fiol & Lyles 1985). Although much has been written about the nature of organisational learning in both academic and practitioner journals, understanding of the actual processes through which firms "learn" remain limited (Locke & Jain 1995).

It is suggested in the organisational learning literature that that which is learned in the business is retained, i.e. stored, in two ways: (i) in *institutional mechanisms*, i.e. in the routines, structures, technologies, and systems that hold and co-ordinate routines; (ii) in the *beliefs* possessed and shared by organisational members. In this way, organisational learning is shared across organisational boundaries of space, time, and hierarchy. It also survives the turnover of individuals (Ulrich et al. 1993; Dixon 1993).

Over the long-run, firms must be able to learn at a rate that at least equals environmental change if they are to develop and maintain core competences that have value in the market (Stata 1992). Learning at a slower than baseline rate of

environmental change is indicative of learning deficiencies that are likely to lead to an eroded market position.

Nowhere is organisational learning more important than in the development of new products and services, where one technological platform can lead to families of products, and learning must be transferred from one team to the next (Lynn et al. 1998). In firms where an innovation programme exists, product innovation does not end with the first innovation. Maidique & Zirger's (1985) "new product learning cycle" illustrates that new products strongly influence the performance of their successors, and in turn, are a function of the victories and defeats of their predecessors.

It has been observed that within an innovation programme, the experience and know-how the task group members acquire during the life cycle of one particular project can be transferred to subsequent projects (Meyers & Wilemon 1989; Brown 1991). For example, in their study of Japanese and U.S. product development approaches, Takeuchi & Nonaka (1986) found that the drive to accumulate knowledge across levels and functions is only one aspect of learning. The authors also observed an equally strong drive on the part of product development team members to transfer their learning to other outside the group, e.g. project review formats replicated to other subsequent NPD projects.

Lynn et al. (1998) found that learning was critical to the successful products that they studied, and was generally absent in the failures. Evidence that firms learn to innovate may be found in the historical decline of new product failure rates (Booz, Allen & Hamilton 1982) as well as in the ability of some firms to develop new products with more consistent success than their competitors (Cooper & Kleinschmidt 1987a; Hopkins 1980).

3 CONCEPTUAL MODEL

The objective of this chapter is to briefly introduce the conceptual model which operationalises the theory being investigated. The chapter offers explanations for the components of the conceptual model (with appropriate theoretical support for particular definitions adopted) and presents the research questions posed.

3.1 Introduction

Although this research is grounded in the theory of knowledge management and services innovation, it draws heavily upon a diverse streams of literature: NPD innovation (e.g. Clark & Wheelwright 1993); service marketing (e.g. Berry & Parasuraman 1993; Gronroos 1983); NSD (e.g. Easingwood 1986); NSD/NPD performance measurement (e.g. Hart 1996; Griffin & Page 1993; 1996); communication and integration in NSD/NPD (e.g. Lievens & Moenaert 1994; Gupta, Raj & Wilemon 1986a); knowledge management (e.g. Grant 1996a; 1996b; Nonaka 1994); and organisational learning (e.g. Argyris & Schon 1978; Senge 1990a; 1990b; McKee 1992).

The theory underlying this research is that services firms can use knowledge strategy to improve the innovation performance of their business. From the discussion of the literature in Chapter 2, a conceptual model was developed. This is presented in Exhibit 3-1. The model represents a set of empirical relationships that can be tested empirically – i.e. it operationalises the theory that knowledge strategy impacts innovation performance in services firms.

The 'happy atom' framework (i.e. a structural plan or basis for analysing the activities of a firm) used to investigate the phenomenon was developed by McKinsey and popularised by Peters & Waterman (1982). It postulates that the output of a total organisation is formed by its strategy-shared values-style-structure-skills-staff-systems, and has been used in previous NPD programme research (see Dwyer & Mellor 1992; John & Snelson 1988).

3.2 Model Summary

Each new service development generally begins with a coarse, information-poor format and gradually evolves to a detailed, information-rich format. Information, interpreted at each stage of the NSD process, is the raw material used to generate the new personal and collective technical, organisational and commercial knowledge and expertise required to execute the NSD project (Wheelwright & Clark 1992). In this way, the NSD process may be regarded as the knowledge management process for NSD. The performance of a service business' NSD programme is influenced by the characteristics of both the internal organisational environment which supports innovation activity (i.e. the NKE (NSD Knowledge Environment)), and the proficiency with which the NSD process is executed. In turn, the degree of external environmental turbulence will directly influence NSD programme performance, the NKE, and the proficiency with which the NSD process is executed.

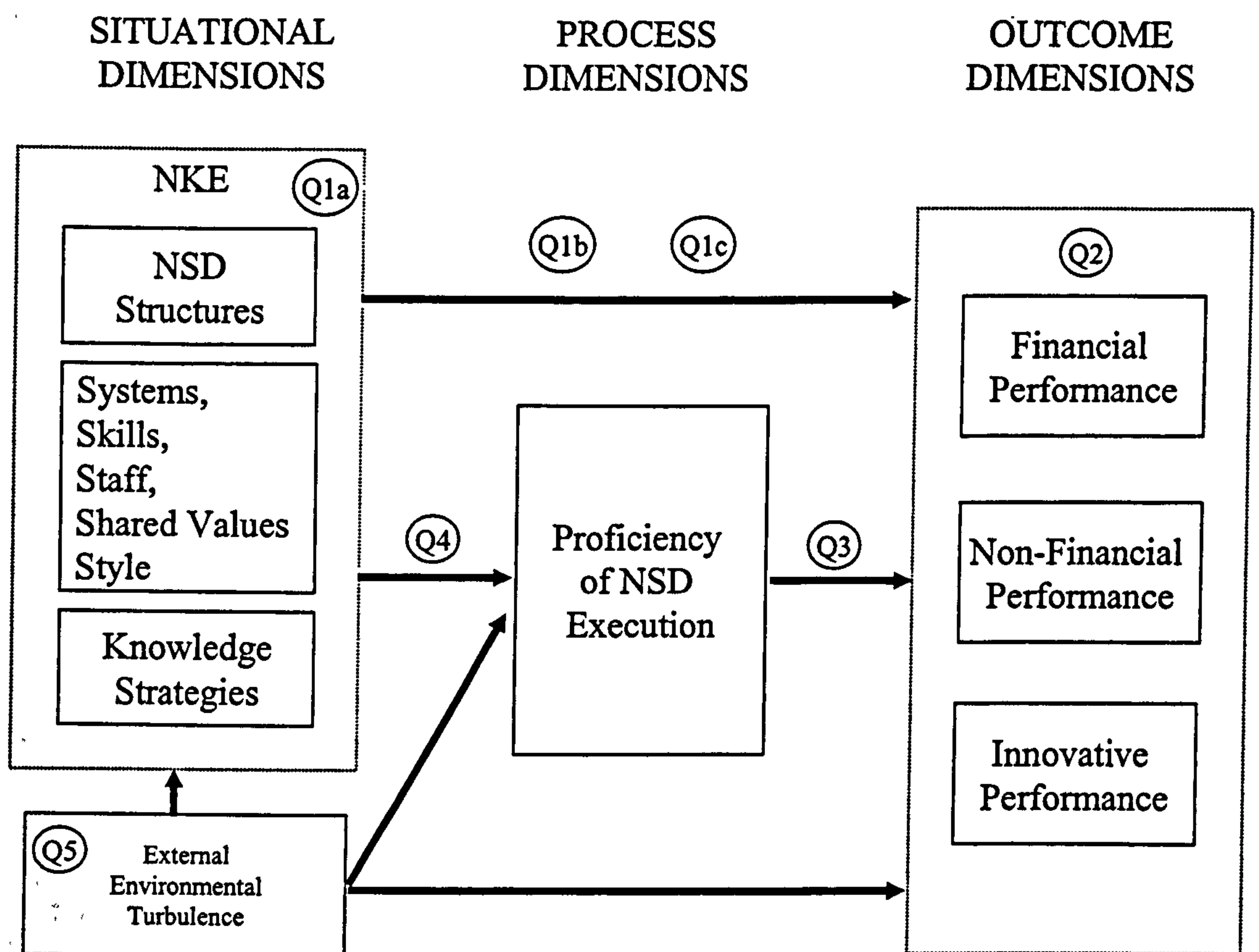


Exhibit 3-1: Conceptual Model for this Research

3.3 The Research Questions

This research specifically seeks to advance the body of academic knowledge in four main areas: (i) identification of the elements of the internal environment which impact the management of knowledge in a NSD programme; (ii) determination of whether these internal factors influence the proficiency with which the NSD process is executed, and the success of the NSD programme; (iii) confirmation that the proficiency with which the NSD process is executed influences the performance of a service business' NSD programme (Edgett 1996); (iv) to explore whether NSD innovativeness is associated with other types of NSD success. To explore these issues, two primary and five secondary research questions are posed. These are summarised below:

Primary Research Questions

- Q1a: Which internal organisational factors comprise the NSD Knowledge Environment (NKE)?
- Q1b: What is the impact of the NKE on the performance of the NSD programme?

Secondary (Supporting) Research Questions

- Q1c: What is the impact of the NKE on the innovativeness of the NSD programme?
- Q2: Are innovative NSD programmes more successful on other performance measures than less innovative programmes?
- Q3: What is the impact of NSD process proficiency on the performance of the NSD programme?
- Q4: What is the impact of the NKE on the proficiency with which the NSD process is executed?
- Q5: Does external environmental turbulence affect the performance of the NSD programme, the NKE, or the proficiency with which the NSD process is executed?

In the text below, each component of the conceptual model will now be discussed in more detail.

3.3.1 Outcome Dimensions

Crucial to understanding a service business' position with regard to NSD is being able to measure the "success" or "failure" of individual services, and the overall NSD programme(s). Research seeking to measure the impact of a number of variables on NSD performance needs to define, or to elicit from the sample

respondents, appropriate measures of success. The evaluation of performance in service firms is more challenging than in traditional tangible product firms, e.g. Banks, in trying to measure the profitability of their different accounts, find it difficult to measure performance because of the presence of shared delivery systems. It has even been observed that few service business even attempt to measure the performance of their innovations (Voss 1992). However, without the existence of methods of appraising the performance of a business' NSD activities it becomes almost impossible to identify the actions required to improve the business's innovative capability.

There have been a number of studies which have attempted to categorise measures of success (e.g. Craig & Hart 1993; Griffin & Page 1993; Hart 1996; Voss 1992). These studies of performance measurement have acknowledged the different levels at which the analysis can take place: (i) the project level (i.e. the success of an individual new product); (ii) the programme level (i.e. the success of new product development over a period of time). NSD performance can also be evaluated at the *corporate* level. However, "the use of indicators of corporate financial performance is only appropriate for measuring new product success given an adequate time lapse from the launch of the new product" (Hart 1996, p2).

3.3.1.1 LEVEL OF PERFORMANCE MEASUREMENT

It is just as important to measure the performance of a service business' NSD activity at the programme level as it is at the project level. The programme level is important because it measures the success of a procession of NSD projects, rather than one-off successes or failures. Equally, a single successful project is not an indication that the service business is good at NSD: circumstances may have lead to the business being well-positioned for that one opportunity. Although comprising the same category of performance measures as found at the project level, programme-level measures have tended to evaluate the success of the business over more than one NSD project. Programme-level measures should provide an indication of the extent to which the service business has learnt from the successes and failures of individual projects, and incorporated that learning

into the business' on-going development activity. Programme-level measures may be regarded as an indication of the service business' long-term growth potential.

This research investigates the NSD programme level, i.e. a series of related NSD projects. Because a selection of new services may possess different objectives, it is proposed therefore to measure the performance of the NSD programme against a number of different financial and non-financial dimensions. These are briefly reviewed in the following text.

3.3.1.2 CATEGORIES OF SUCCESS

The measurements of NSD performance reviewed below are largely drawn from the NPD and NSD literatures (e.g. Hart 1993; 1996; Griffin & Page 1993; 1996).

Financial Measures of Performance

When evaluating the success of NSD projects and programmes, firms have traditionally based their evaluation of success almost entirely on financial criteria, e.g. revenue, profit or profit-margin (Hart 1993). Since the primary aim in launching a new product is to return a profit to the business in the long run, even if not in the short run, it is not surprising that profitability is the most frequently used measure of performance in studies of new product success. However, financial measures of performance have been criticised on the grounds that while one of the easily quantifiable industrial performance yardsticks, they are far from the only important ones. For example, failure in financial terms can also result in important organisational, technical and market developments, anticipated or unanticipated (Maidique & Zirger 1985). Other financial measures which have been used include: shareholder benefits, profit-margin, payback period, costs and development/investment costs. Sales-based measures are often used as financial performance measures, and they are an indication of the degree of power a business has in the marketplace. Sales-based measures employed in the literature include the level of sales, market share, customer use and sales growth.

Traditional Non-Financial Measures of Performance

In response to the criticisms levelled at using financial performance measures, researchers have begun to introduce, and investigate, a number of other non-financial measures: percentage of successful new product launches; sales or profit from recent new products; average development cost per product; the number of new product launches; the number of killed projects prior to launch; and the 'number of design awards'. These measures reflect a number of potential extra benefits, i.e. "non-direct" benefits, from developing new services: improved business reputation; improved development capability; enhanced customer loyalty; moving the business in a new direction; increased consumption of existing products by current customers and by new customers; retaining customers³¹; and improving a business' reputation (Easingwood & Percival 1990); Drew 1995a). Non-financial performance measures are often classified into groups, related by their common characteristics, e.g. technological; market; design; activity; commercial (Hart 1996).

NSD Programme Innovativeness

A number of researchers have noted the importance of firms being 'innovative' (Rogers 1983). However, much of the associated literature focuses on the concept of 'innovativeness' as a dependent variable, i.e. an innovative outcome. There is little understanding of the way in which firms match the competencies of the service business with market needs, to create innovative outcomes.

Although some researchers have suggested that the business needs to demonstrate an innovative capability "to gain a competitive edge in order to survive and grow" (Gronhaug & Kaufmann 1988, P.3), the relationship between innovativeness and performance is an under-explored one. Deshpande et al. (1993) found that organisational innovativeness is positively related to business performance. In a survey of 125 Industrial product firms, Kleinschmidt & Cooper (1991) identified a

³¹ Rust & Zahorik (1994) identify that "retention rate is seen to be the most important component of market share" (p. 199).

u-shaped relationship between product innovativeness and product performance. New-to-the-world products and innovative product lines were observed to perform particularly well in terms of measures such as success rate, overall profitability, market shares, new windows of opportunities and meeting sales and profit objectives. Non-innovative products, namely modifications, revisions, cost reductions and repositionings, also perform well in terms of ROI and domestic market share, and they are a close second to innovative products on most other measures. In comparison, moderately innovative products, fared poorly. These included less innovative new lines to the business and new items in existing lines. Research has indicated that service firms seek competitive advantage largely through 'copying' competitive initiatives, rather than attempting to produce innovative offerings themselves (e.g. Easingwood 1986, Scheuing & Johnson 1989).

Another stream of research identifies a relationship between knowledge and innovativeness. Two lines of thinking appear to dominate. Firstly, high levels of knowledge, and organisational memory have been found to enhance creativity and innovativeness (Moorman & Miner 1997). This assertion is supported by the work of Cohen & Levinthal (1990) who reported that organisational memory can enhance an business' ability to assess and import new outside information, which promotes creativity and innovativeness. Secondly, it has also been found that change may become more difficult for a business as memory in a particular domain increases (Moorman & Miner 1997). The presence of a 'competency trap' (March 1991; Leonard-Barton 1992a) in the context of NSD could therefore indicate that NSD programmes with strong memory levels are least able or likely to deviate from prior action patterns, thus knowledge gained from the success or failure of past projects is not adequately leveraged (Leonard-Barton 1992a; Dougherty 1990; 1992). This research seeks to understand:

Q2: Are innovative NSD programmes more successful on other performance measures than less innovative programmes?

Q1c: What is the impact of the NKE on the innovativeness of the NSD programme?

3.3.2 Situational Dimensions (The NKE)

Two primary research questions are investigated with regard to the internal (NKE) environment:

Q1a: Which internal organisational factors comprise the NSD Knowledge Environment (NKE)?

Q1b: What is the impact of the NKE on the performance of the NSD programme?

3.3.2.1 WHAT IS AN INTERNAL ORGANISATIONAL ENVIRONMENT?

Throughout the management literature, and particularly in NSD and NPD research, an overriding concern raised over and over again is the need for a supportive and innovative internal environment (e.g. de Brentani 1993). As service firms are heavily dependent upon the knowledge and ideas of their staff, such a supportive internal environment is even more vital for achieving and maintaining competitive advantage.

A business' internal environment may be conceptualised in terms of the resources, structures, practices, and culture which support business growth through innovation. Organisational 'context' or 'environment' are often used interchangeably in referring to the business' culture, its incentives, its structure, and its people (Markides 1998). An innovative environment must be fostered and manipulated by top management, and must permeate downward throughout the whole business (Knight 1987). Over the years, a number of significant *multi-variable* frameworks have emerged which assist the researcher and practising manager to categorise and recall the important elements of business structure which need to be investigated if useful insights are to be attained: (i) Leavitt developed the concept of the "Leavitt Diamond" which incorporated task,

structure, people, information and control, and environment; (ii) and, Peters & Waterman (1982) created the "happy atom", which was used as the guide in the text "In Search of Excellence". In researching the internal environment of the service business, this research adopts the Peters & Waterman framework for two reasons: (i) it is instantly recognisable by students and practising managers alike; (ii) it has been adopted and used successfully in similar research (e.g. Dwyer & Mellor 1991b). A review of the McKinsey framework is presented in Appendix H.

Management theorists have long attempted to prove the link between culture, climate and performance (e.g. Peters & Waterman 1982). Within the innovation literature, the internal setting within which development takes place has been found to be an important influence on both NPD performance (Dwyer & Mellor 1991; Cooper & Kleinschmidt 1987a: 1987b; John & Snelson 1988) and NSD performance (Storey & Easingwood 1996a; Thwaites 1992; de Brentani 1993a). Thwaites (1992) posits that the only way for a services business to achieve long-term competitive advantage is through the development of "an organisational climate that is responsive to change and supportive of new product initiatives" (p. 303). Similarly, de Brentani (1993a) suggests that the primary factor in the development of successful new services is the creation of an innovative NSD environment where ideas and open communication are encouraged by supportive management.

A business must therefore strive establish the appropriate culture, structure, incentives, systems, and processes that somehow allow innovation to happen as part of daily business (Markides 1997). It has also been observed that within any business, there exists a core knowledge set about its mission, justification for its existence, and the basic business plan. This core knowledge set helps to define the most basic of the repertoire of organisationally-relevant knowledge structures that describe the events and behaviours appropriate to the particular business and the people within it (Lyles & Schwenk 1992). In this research, the NKE is conceptualised to consist of the knowledge set which forms the internal environment which either supports or hinders NSD.

3.3.2.2 THE INTERNAL ORGANISATIONAL ENVIRONMENT AND THE NKE

In adopting a knowledge-based view of the business, this research conceptualises a notion of a NKE (hypothesised to be a sub-set of the internal corporate environment) to conceptualise the internal organisational factors which influence the way in which NSD is executed. The following text identifies the characteristics of the NKE, and their likely impact upon NSD programme performance. In the next section, the specific impact of the NKE on NSD process execution is explored.

3.3.2.3 STRATEGY IMPACTS ON NSD PERFORMANCE

Strategy is defined as the plan leading to the allocation of resources (Peters & Waterman 1982), it is a plan, a pattern, a position or a perspective (Mintzberg 1994). Competitive advantage can result from implementing a value-creating strategy not simultaneously being implemented by any current or potential competitors (Barney 1991), or through superior execution of the same strategy as competitors.

From the literatures presented in Chapter 2 and initial interviews with practising managers, this research posits that there is evidence to suggest that four different strategies are associated with NSD performance: (i) information management strategy; (ii) knowledge management strategy; (iii) intellectual asset management strategy; (iv) NSD strategy. Although it is hypothesised that each of these strategies has a common goal of helping the business identify and leverage its key information and knowledge assets, little empirical evidence exists on the impact of different knowledge-based strategies have on business performance.

In many instances, a strategy can be emergent rather than planned, especially where uncertainty is high, as in the birth of a new industry when the business is testing new product processes and designs (Methe 1997). Few strategies are purely deliberate, and few purely emergent. One suggests no learning, the other, no control. All real-world strategies need to mix these in some way - to attempt to control without stopping the learning process (Mintzberg 1994). It is anticipated

that some form of 'formal' strategy will be in place if the business is serious about leveraging its information and knowledge assets.

NSD Strategy

A NSD strategy, in effect, identifies the key knowledge required in the development of a set of new service offerings. Bowers (1986) defined a NSD strategy as "a plan that outlines the type of new products to be developed" (p.70). The NSD strategy should create knowledge about the nature of the services to be developed, the markets to be served, the technology employed and the orientation and characteristics of the new service process. It is posited that what differentiates one strategy from another is the business' goals and the degree of familiarity the business has with its new services, products, markets, and technologies and processes (Cooper 1983a; Crawford 1980).

Over the years, management theorists have identified a number of broad styles of development strategy available to firms (e.g. Freeman 1974; Parker 1978). One of the more comprehensive and parsimonious typologies for understanding organisational strategy has been developed by Miles & Snow (1978) which categorised firms according to four generic innovation strategies: (i) prospectors; (ii) analysers; (iii) defenders; (iv) reactors³². Development processes and performance achievements have been demonstrated to differ across these categories (Griffin & Page 1996; Cooper 1984b; Storey & Kelly 1998).

Q1b-1: What is the impact on NSD performance of the strategic approach adopted to NSD?

³² The four strategic groupings are: (i) *prospectors* value being first with new services, markets and technologies; (ii) *analysers* are seldom first to market but frequently are a fast follower with a more cost-efficient or innovative service; (iii) *defenders* locate and maintain a secure niche by protecting their position in a relatively stable service area; (iv) *reactors* respond to service and market changes only when forced by environmental pressures.

The Three Knowledge Strategies

The relationship between data, information, knowledge and intellectual assets is much discussed in academic literature (e.g. Boisot 1995b; Haeckel & Nolan 1994). However, it is often not defined precisely enough to be helpful to practising managers. "Information is a commodity capable of yielding knowledge, and what information a signal carries is what we learn from it" (Dretske 1981). That is, information affects knowledge by adding something to it or by restructuring it in some way (Machlup 1983). To be effective in managing knowledge assets, or to move towards a co-ordinated approach to managing its knowledge assets, a service business, it may be argued, should establish formal, or guiding, principles with regard to the management of its key information, knowledge, and intellectual assets.

Information Management Strategy

In firms where annual employee and supervisor turnover rates could reach 25% or more, the challenge faced by service firms is to capture, disseminate, store and maintain information gained during a single individual project, and leverage it to the advantage of the NSD programme as a whole (McKee 1992; Cahill 1995). However, useful information created for one project may be 'unavailable' to other projects for many reasons, e.g. staff transfer, functional boundaries, lack of understanding of its importance to others, and absence of suitable means to transfer it easily.

Because of the importance of product development to a service business, a formal information strategy may assist the service business to identify the vital information generated, disseminated and stored across different teams within a NSD programme³³. A service business which ventures into a totally new and unfamiliar set of products, markets, and technologies is likely to have greater need for information and knowledge about the market and technology to reduce the risk

³³ For example, when a market researcher collects information about technological trends and distributes it more than one project team may benefit. If that report were to become a report with the researchers' beliefs and understandings based on experience' then that would be new knowledge.

of new product failure (Gupta, Raj & Wilemon 1986a). It is likely that this will need to be shared across more than one project. Thus, an information management strategy guides the business' decision with regard to the information required to support the execution of the NSD process and the management of the NSD programme.

Knowledge Management Strategy

By identifying the knowledge it requires to execute the NSD process, the service business can determine if any "gaps" exist which may prevent it from achieving sustained competitive advantage across the NSD programme. Existing knowledge is thus leveraged by extending its scope beyond the existing product / market / technology mix, and new knowledge is created to add value where the business requires it most. In effect, the business is identifying the knowledge it possesses, or wishes to possess, and which could, from the perception of the customer, add value to the offers placed in the market³⁴.

Because many different types of knowledge exist, it has been posited that the business needs to develop a strategy for each type of knowledge to ensure its dissemination, growth and protection (Whitehall 1997; Wiig 1997a). Firms with such strategies have been observed to undertake specific programmes and activities, provide supporting infrastructure capabilities, and sometimes create incentives to motivate individual staff, teams, and even business units to co-operate to achieve knowledge objectives (Wiig 1997b). Although research has reported that firms are beginning to identify the need for, and to implement, knowledge-based strategies (Bierly & Chakrabarti 1996), it has also been observed that most have yet to formally define explicit practices. Bierly & Chakrabarti (1996) found that a knowledge strategy typology can provide a guide to action for managers, assist the learning process, help build core competences into sustainable competitive advantage, and give more insight than the basic static strategy typologies developed to date.

Intellectual Asset Management (IAM) Strategy

The knowledge literature reports the emergence of interest in intellectual asset management (Edvinsson 1997; Roos & Roos 1997). Intellectual asset management is different to knowledge management. The goal of knowledge management is to improve the business' value chain creation capability through more effective use of knowledge. The goal of intellectual asset management is to improve the business' value generating capabilities through identifying, capturing, leveraging, and recycling intellectual capital. This includes both value creation and value extraction (Edvinsson 1997). IAM strategy places an emphasis on enterprise-level management of specific intellectual assets such as patents, technologies, operational and management practices, customer relations, organisational arrangements, and other structural knowledge assets, e.g. NPD competences (Wiig 1997a). Management's task is to renew, organise, evaluate, protect and increase the availability and marketing of these assets.

If NSD capability is regarded as a key intellectual asset, resources are likely to be made available by the business to maintain and enhance such assets. However, the efforts required to manage and measure intellectual assets, while laudable, may eventually require significant changes in the way firms operate if they are to become institutionalised (Davenport, Long & Beers 1998). There is little evidence which suggests service firms have established such strategies at present.

Q1b-2: Are service firms which have established formal knowledge strategies³⁵ (i.e. information, knowledge and intellectual asset) more successful at NSD than those that have not?

³⁴ This combines both a resource-based (Grant 1996b) and a market-based (John & Davies 1998) view of the business.

³⁵ Although it is noted that an organisation can have a pattern (or realised strategy) without knowing it, let alone making it explicit (Mintzberg 1987), this research was particularly interested in the awareness of the importance of these three strategies within the service business. It is anticipated that the questioning of 'formal strategy' may detect relevant strategies, irrespective of the process which was used to produce them. This approach would therefore detect Mintzberg's 'umbrella strategies', which are produced by top management and modified by others lower down in the organisation (especially prevalent in businesses that require great expertise and creativity).

3.3.2.4 STRUCTURE IMPACTS ON NSD PERFORMANCE³⁶

The impact of organisational structure and control systems on business performance has long been a dominant issue in research (Jaworski et al. 1993; Zeithaml et al. 1988; Edvardsson et al. 1995). A number of formal structures, and styles of business have been identified in the literature as being likely to affect the performance of the NSD programme.

How a business is structured has an important impact on how information is disseminated across functions and individuals, and consequently how key tasks are executed (Van de Ven & Ferry 1980). Poor levels of communication and knowledge sharing between people, and firms, have been found to be a major block to learning and business performance (Stata 1989). Indeed, it has been observed that one of the reasons for the innovation problems of large, Western organisation lies in the inflexibility of tightly specified and articulated systems of knowledge, which makes it difficult to be consistent and to engage in projects not perceived to fit 'what the company is all about', i.e. physical structures adversely impact the knowledge structures (Hedlund 1994).

Classic organisational designs may not work in a knowledge environment (The McKinsey Quarterly 1, 1998). Hierarchy, specialisation, and centralisation have been found to be major sources of distortion and blockage of intelligence (Harold Wilensky 1967), and a centralised, mechanistic structure tends to reinforce past behaviours. It is, however, possible for a traditionally structured business to be effective at knowledge management and organisational learning (Nonaka 1994). Carley (1992) concluded that firms with a hierarchical structure are less vulnerable to personnel turnover than firms with a flat structure, as new knowledge and skills of staff are to some extent also transferred to executives, managers, or team leaders.

Conversely, by reducing the information demands, the decentralised structure seeks to reduce the cognitive workload of the individuals, thereby facilitating the

³⁶ In this research, the Peters & Waterman definition of 'structure' has been extended to incorporate both the structure as represented by the organisation chart, as well as the specific structures which are used to control and to implement NSD projects.

assimilation of new knowledge, patterns, associations, beliefs and actions (Galbraith 1973; Fiol & Lyles 1985; Mills & Friesen 1992). In the services sector, many management theorists have long argued for flattening the organisation chart and turning it upside down, thereby placing customer contact personnel on the higher level of an inverted pyramid (Carlzon 1987). By inverting the structure, managers more effectively support staff in their tasks, and act as coaches and role models to help them provide better service to customers, thus ensuring their ideas for future service development are more accessible and valued.

A close match between the physical communication structure of the business and the information and knowledge requirements has been recognised to be associated with, and related to, higher business performance (Galbraith 1974; Tushman & Nadler 1978; Tushman 1979a; 1979b; 1979c; Nonaka 1994). Thwaites (1992) has suggested that to be successful in its development efforts, a business must: (i) achieve high levels of communication in all directions of the business; (ii) promote the use of problem-solving activity through teams; (iii) encourage high levels of co-operation; (iv) develop a simple, well-documented organisation structure which is understood by all staff and only has the number of tiers necessary to be effective and allow rapid adjustments to changed circumstances.

3.3.2.5 SYSTEMS IMPACTS ON NSD PERFORMANCE

Systems are the proceduralised control processes implemented by service firms (Peters & Waterman 1982). In addition to the NSD process, arguably the most important system utilised by the service business, a number of other systems are utilised by the service business to manage NSD. These are reviewed.

The NSD Process

Although specific process models for controlling a new service development project have emerged from research (e.g. Bowers 1986; Johnson, Scheuing & Gaida 1986; Donnelly, Berry & Thompson 1985), it has been found that service

suppliers do not, in general, use sophisticated and formal development procedures (Bowers 1989; Scheuing & Johnson 1989a; Martin & Horne 1993).

One may regard the development of a new service as generally starting with a coarse, information-poor format (e.g. an idea for a new service) and gradually evolves, generally via a NSD process, to a detailed, information-rich format (e.g. charts, blueprints, new services & systems). At each stage of the process, new or modified knowledge (e.g. market, process, commercial, or technical) is added with the help of the know what, know how & know why (Quinn 1996) (i.e. tools, methods, models, and architectural knowledge). Dougherty (1990; 1992) has posited that functional departments comprise "thought worlds", each with its own "fund of knowledge" (what staff and management know) and "system of meaning" (how staff and management know). The importance of the observation is that in new service development, individuals from different areas of the business, involved in new service development, may well understand discrete aspects of the business, and the common understandings they share may be grasped in different ways. The dissimilarities may lead to difficulties when applying that knowledge in a group context. What distinguishes successful firms is how they overcome the barriers which exist.

Whilst NSD tends to follow the same generic process as NPD, the relative importance of each stage, and how each stage is carried out, is affected by the unique characteristics of services (Atuahene-Gima 1996a). For example, financial service firms skip significant stages of the process, e.g. concept screening, concept testing, service testing and market testing were found to be little used (Edgett 1996; Edgett & Jones 1991). Where particular stages are carried out by service firms, they are done less than proficiently, even though evidence suggests they have a high impact on the project outcome (Cooper & de Brentani 1991; Reidenbach & Moak 1986; Mohammed-Salleh & Easingwood 1993; Reidenbach & Moak 1986; Edgett & Jones 1991; de Brentani 1991; 1995b). The omission of certain key activities has been consistently linked to failure (Brentani & Cooper 1992, p. 2). Edgett (1996) posits that "how well various activities of the NSD process are carried out separates the winners from the losers".

Systems & Procedures to Store NSD Knowledge

Firms focused on programme-level development need to generalise innovation skills by adopting a number of key practices (Brown 1991). Making the knowledge obtained or created during a single project available to those engaged in programme level innovation is one such practice. The process of storing NSD knowledge for subsequent projects may be likened to a type of 'organisational memory' (Cyert & March 1963; Argyris & Schon 1978). The learning achieved during a single NSD project becomes a continually evolving process resulting in an expansion and improvement in experience and capability as individuals acquire new insights and share it, over time and space, with those who would make use of it during aspects of the NSD programme (Walsh & Ungson 1991; Huber 1991; Nonaka 1991). Evidence that firms have been successful in storing memory would typically be found where: (i) a new service is being developed for a familiar market segment; (ii) the customer's preferences are well understood and relatively stable; (iii) the technology for a new service is familiar to the business; (iv) the length of team members' service is high; (v) a particular NSD phase is a well-developed competency of the business (Moorman & Miner 1997).

Organisational memory becomes powerful when it, and its context, is stored in a form which makes it easily retrievable by staff and management who have need of it. The most likely storage locations for organisational memory are posited to be: (i) individual memories; (ii) organisational culture; (iii) transformations, i.e. the guidelines by which work processes are managed; (iv) organisational structure; (v) the physical structure of workplaces (Walsh & Ungson 1991). External storage places can also be of importance, e.g. former staff, competitors, regulatory authorities, academic institutions, peers in relevant 'interest groups'.

Research indicates that high levels of organisational memory may: (i) improve financial performance, particularly in the short-term, by increasing efficiencies and the likelihood that previous successes will be repeated (Cyert & March 1963; Walsh & Ungson 1991; Cooper & Kleinschmidt 1986); (ii) enhance the creative outcomes of a business and its overall innovativeness (Moorman & Miner 1997); (iii) enhance a business' ability to assess and capture new, particularly external,

information, which could promote creativity and innovativeness (Cohen & Levinthal 1990). However, change may become more difficult as memory in a particular domain increases (Moorman & Miner 1997). The resulting 'competency trap' (March 1991; Leonard-Barton 1992a) could make NSD programmes less able to deviate from prior action patterns, thus knowledge gained from the success or failure of past projects is not adequately leveraged (Leonard-Barton 1992a; Dougherty 1990; 1992).

This research seeks to identify: (i) if service firms store NSD knowledge as organisational memory; (ii) in what form NSD knowledge is most effectively stored as organisational memory; (iii) the extent to which organisational memory is made available to all staff and management of the business; (iv) the impact that memory has upon NSD programme performance.

Systems to Stimulate Creativity in Employees

The term '*creativity*' refers to the generation of novel ideas, '*entrepreneurship*' to the commitment of the business to innovation, and '*innovation*' simply to the exploitation of ideas commercially. In this way, organisational creativity may be regarded as a subset of the broader domain of innovation. It has been previously demonstrated that the development of creative marketing initiatives can set a product apart from the competition in a meaningful way, i.e. creativity will impact performance (Andrew & Smith 1996) – it is anticipated that stimulating ideas from employees will similarly lead to better business performance.

Creativity may be stimulated by establishing policies specifically targeted to enhance the environment in which staff and management work, and by making it easy for staff and management to share new ideas.

Many factors may be influential in shaping the development of creative behaviour and creative outcomes. These include when: (i) leadership is democratic and collaborative; (ii) the organisational structure is organic, adaptive and flexible rather than mechanistic (King & Andersen 1990); (iii) creative problem-solving processes are used (Basadur & Finkbeiner 1985); (iv) sufficient resources are

allocated to the creation process (Tushman & Nelson 1990); (v) staff perceive that management values goals related to creativity (Tesluk et al. 1997); (vi) appropriate group/team compositions are used (Payne 1990; Monge et al. 1992); (vii) idea generation systems and systems, e.g. based on information technology, make it easier to communicate ideas quickly and efficiently (Kanter 1988; Robinson & Stern 1997)³⁷; (viii) individuals and teams have relatively high levels of freedom and autonomy and a sense of ownership and control over their own work and their own ideas (West 1986); (ix) rewards are offered to encourage the required creative behaviour. Management can also nurture cultures that encourage the search for new opportunities by instilling values and a normative system that supports a diversity of beliefs, free exchange of information, open questioning and interaction (Kimberley & Evanisko 1981).

3.3.2.6 SHARED VALUES & STYLE IMPACTS ON NSD PERFORMANCE

An 'effective' culture was found by de Brentani (1996) to be highly significant, ranking first in importance of the internal factors associated with NSD success/failure. Emphasis is often placed upon the importance of creating and encouraging an internal environment where innovation is supported, where senior managers are actively involved, and where staff and front line personnel – and often customers – are part of a team that plans, develops and launches new services. Johnes & Snelson (1988) observed that "it is difficult for analysts to grapple with issues that deal with the more intangible aspects of an organisation such as culture and atmosphere...however, it is clear that it is precisely these factors that distinguish successful innovator business from the less successful" (p.124).

A number of cultural characteristics of a service business have been identified in the literature as being likely to affect the performance of the NSD programme. Questions, or items, were then developed from this literature.

³⁷ For example, Robinson & Stern (1997) report on the employee suggestion systems used by businesses like American Airlines, the workgroup systems used to connect "interested" groups together, and the Kaizen teian systems designed to involve 100% of the business' staff.

Entrepreneurial Leadership

While creativity is the source of new ideas, the notion of entrepreneurship in NSD is grounded in a commitment to supporting the development of ideas through from conception to commercialisation. Drucker (1985) defined entrepreneurship as "a commitment to the systematic practice of innovation" that produces entrepreneurial success. Ross & Unwalla (1986) suggest that an entrepreneurial business has a number of characteristics: (i) it takes risks; (ii) stays innovative; (iii) focuses on results; (iv) is flexible; (v) sees the business as a system; (v) views change as good; (vi) tolerates mistakes; (vii) believes managers possess intrinsic motivation to succeed. It is likely that entrepreneurship won't be sustained in large firms if they operate internal environments which are bureaucratic and fail to provide the rewards and personal autonomy which is required to have entrepreneurship survive and flourish (C. Wesley Morse 1986).

A business climate which values entrepreneurship and innovation has been shown previously to: (i) provide the environment in which learning is most likely to take place (Hamel & Prahalad 1991; Quinn 1985; Lant & Mezias 1990); (ii) outperform those dominated by internal cohesiveness or by rules (Deshpande et al. 1993). A entrepreneurial climate is therefore anticipated to be closely correlated with NSD performance.

Learning Orientation

To successfully introduce a new service, to re-engineer a process, or to solve a problem, all require seeing the world from a new perspective and acting accordingly. In the absence of learning, firms and individuals are likely to simply repeat old practices. The need to learn has become even more intensified by the competitive challenges of the 1990s, which threaten many of the established management practices of service firms. Among these challenges are the globalisation of competition, shorter new service life cycles, fragmentation of end-user markets, advances in technology, and more demanding customer expectations.

The drive to accumulate knowledge across levels and functions is only one aspect of learning in NSD. An equally strong desire on the part of development team members is the transfer of learning outside the group, e.g. project review formats replicated to subsequent projects in the NSD programme (Takeuchi & Nonaka 1986). At the organisational level, the collective desire to pass insights onto others may be regarded as a *learning orientation*. Learning orientation may be conceptualised as giving rise to that set of organisational values that influence the propensity of the business to create and use knowledge effectively (Sinkula et al. 1997). Learning orientation is believed to affect the information that firms attend to, interpret, evaluate, and ultimately accept (or reject) in the form of new knowledge (Argyris & Schon 1978).

Evidence that firms learn to innovate across NSD development projects to the programme level is found in the ability of some firms to develop new products and services with more consistent success than their competitors (Storey & Easingwood 1996)³⁸.

It has been reported that the learning orientation of the business has a great influence on the overall innovativeness of the business and its ability to process knowledge proficiently, e.g. learning-efficient firms reflect on the causes and effects of their actions (Shaw and Perkins 1991). However, if a business places little value on learning, it is unlikely that learning will take place (Norman 1985), and performance will therefore suffer. Schrage (1989) notes that "almost without exception, at the root of the failures [to learn]...is a business kidding itself about what it really wants. Organisations that succeed at innovation are those that make an unwavering commitment to it" (p. 47).

The past successes and failures of service firms are likely to support the formation of strong mental models. However, over time, and particularly in turbulent periods, these models may no longer hold true - but may still operate unless a business has the open-mindedness to continually question the basis on which they

³⁸ It has also been suggested that decline of new product failure rates is illustrated in the two studies by Booz, Allen, Hamilton (1969; 1982).

were initially formed (Day 1994a; Senge 1992; Sinkula 1994). When service firms proactively question long-held routines, assumptions, and beliefs, they may be regarded as engaging in the first phase of 'unlearning' (Leonard-Barton 1992a). Unlearning is at the heart of organisational change, and open-mindedness is an organisational value that has been associated with unlearning. There is a degree of consensus in the innovation literature that a different way to think, create, store and retrieve knowledge, requires time, commitment, and a degree of open-mindedness to new approaches which can be difficult to achieve (Dumas 1997).

It has been found that collaborations on development projects are likely to be especially susceptible to divergent views (Clark & Fujimoto 1990), and divergent or conflicting assumptions have been found to undermine the ability of the management team to develop a focused response to market trends or environmental shocks (Sinkula et al. 1997), consequently impacting business performance. McKee (1992) found that innovation goals and visions focus the attention of learning orientation and help overcome the tendency for departments to focus on functional issues which are likely to be counterproductive to achieving its primary objective (Ginn & Rubenstein 1986). The degree to which staff possess a clear vision of the business, and understand how they can contribute to its success has been identified as an important factor in business success by a number of management researchers (Senge 1990a; 1992; Mohrman & Mohrman JR. 1995; Goh & Richards 1997).

Experimentation and Fear of Failure

As global competition intensifies, and economies' dependence upon services increases, firms will have to conceive, design, produce, and deliver an even wider array of new services in unlimited combinations to capture and satisfy the desires of ever smaller market niches. This will require the development of a management style which encourages controlled experimentation with new processes, markets, products and technologies (Leonard-Barton 1992b; Slocum, McGill & Lei 1994; Simonin 1997).

The behavioural perspective in organisational learning assumes that firms are routine-based systems which respond to experience by repeating and experimenting with behaviours which have been successful and avoiding those which have not (e.g. Levinthal & March 1981). Thus, a service business will seek to capture and store the knowledge about past successes, and will use this knowledge to benefit the service business' NSD programme. However, lessons can also be gained from past failures.

Although a business may reward staff experimenting with new ways of doing things, it is important that staff and management do not fear failure (Lievens, Moenaert & S'Jegers 1997b). It has previously been noted that "you don't kick your child out of school for scoring poorly on a single test - you work with him or her to figure out what actions to take so that it does not happen again" (Lynn et al. 1998, p. 51).

Schrage's (1989) observation that "firms that learn how to fail intelligently outperform firms that seek to minimise the frequency of failure (p. 46) is supported by similar research (McKee 1992; Gupta & Wilemon 1990; Maidique & Zirger 1985). This suggests a cycle of learning to innovate, where experimentation and new product failure is instrumental to the success of subsequent attempts at innovation (Maidique & Zirger 1985).

3.3.2.7 SKILLS & STAFF IMPACTS ON NSD PERFORMANCE

'Skills' refer to the distinctive capabilities of the business, i.e. the specialist knowledge and techniques applied for executing NSD tasks, and 'staff' are the type of functional specialists employed by the business, i.e. the types of functional specialists which exist for executing NSD tasks (Peters & Waterman 1982). The skills and expertise investigated in this thesis are those required to execute the NSD process. They are conceptualised in this research as *NSD knowledge*. NSD knowledge is distinct from information which feeds the growth of new knowledge and modifies the nature of existing knowledge. In addition to noting its presence or absence from the business, one may also acknowledge two other characteristics

of NSD knowledge: (i) levels of NSD knowledge; (ii) dispersion of knowledge (Moorman & Miner 1997).

The need for a business to possess NSD knowledge if it is to effectively execute the activities of the NSD process is recognised in the innovation literature (John & Snelson 1988). Conceptually, NSD knowledge is closely related to the know-what, know-how, know-why and care-why referred to in the knowledge literature (Garvin 1993; Brown & Duguid 1998; Chew et al. 1991). The NSD literature stresses the importance of 'technical knowledge' and 'marketing knowledge': technical knowledge is required to execute the technical stages of the NSD process, e.g. technical assessments and service development stage; marketing knowledge is required to execute the marketing aspects of the NSD process, e.g. market testing and launch.

High Levels of NSD Knowledge

High levels of NSD knowledge have been found to be a key factor distinguishing between success and failure in NSD (Edgett 1994; Edgett & Parkinson 1994; Cooper et al. 1994; de Brentani 1991; 1993a; Cooper & de Brentani 1991; de Brentani & Cooper 1992; Storey & Easingwood 1994; 1996a). Without a well-planned NSD process, and adequate knowledge of how to execute the stages of that process, projects are likely to be poorly executed, thus affecting performance. *Know-how* "built-up over a number of years and diffused throughout the organisation", provides a significant advantage when developing new products (Adler et al. 1989, p. 12). In NSD and NPD research, it has been found that higher performing new services and tangible new products generally possess higher levels of marketing and technological synergy between the new development and the business' existing competences (Montoya-Weiss & Calantone 1994; Varadarajan 1983; Zirger & Maidique 1990). From this, one may make the assumption that the NSD knowledge required to execute the NSD process is high.

High Levels of Knowledge Dispersion³⁹

As well as possessing high levels of NSD knowledge, a service business can distribute that knowledge widely. The need to disperse NSD knowledge is a reflection on the extent to which staff from many functions are more involved in product development in service firms than in tangible product development. The importance of different groups being able to effectively execute a NSD process, regardless of who 'owns' the project is noted in the literature⁴⁰.

Research from the NPD field has posited that high levels of knowledge dispersion can increase the effectiveness and efficiency of decision-making and implementation, and impact NPD financial performance (Moorman & Miner 1997). As dispersion levels increase, a NPD team's shared mental models become unified, cross-functional understanding and co-operation is enhanced, resulting in timely, cost-effective decisions that improve the short-term financial performance of NPD activities (Day 1994a; Griffin & Hauser 1993; Hauser & Clausing 1988; Imai, Nonaka & Takeuchi 1985). It has also been suggested that low levels of knowledge dispersion within a business can have a positive effect on innovation (Quinn 1986; March 1991), i.e. organisational innovation may come from recombining routines which were previously separate (Nonaka 1990; Nelson & Winter 1982). This may suggest that organisational knowledge dispersion could inhibit innovation by reducing organisational heterogeneity, thus restricting the number of competencies available for generating new actions (Moorman & Miner 1997).

3.3.3 Process Dimensions (NSD Process Proficiency)

The following text builds on the previous section by exploring the pivotal role played by the NSD process. The NSD process performs a number of roles: (i) it

³⁹ Dispersion could involve total organisational knowledge being shared equally across the business (i.e. overlap is high). Alternatively, it may involve total organisational knowledge being divided-up widely across the business (i.e. overlap is low).

⁴⁰ For example, the development of new services, although potentially part of the same NSD programme, may be managed by different groups of staff. This staff may be resident in either operations or marketing.

integrates knowledge in a single NSD project; (ii) it is the means by which a service business ensures that all activities required to make a new project successful; (iii) provides the system for standardising and sharing knowledge and information across a NSD programme⁴¹.

The proficiency of NSD process execution is largely dependent upon the way in which the knowledge, skills and expertise of a service business' staff and management (i.e. NSD knowledge) are applied to the NSD process. New services which relate highly on these dimensions are deemed to successfully exploit the different types of expertise available within the business (de Brentani 1991).

Although one of the main conclusions to be drawn from studies into new services is the importance of a formal process, backed by experienced and knowledgeable staff who are adequately and effectively resourced, the mere presence of a process in no way guarantees high performance (Johnes & Storey 1998). Proficiency of execution is paramount.

In this section, the impact proficient execution of the NSD process has upon NSD programme performance is examined (Q3), and the affect the NKE has upon the proficiency of execution is discussed (Q4).

3.3.3.1 THE AFFECT OF NSD PROCESS PROFICIENCY ON NSD PROGRAMME PERFORMANCE

Although proficient execution of a single NSD project is important, a continuous flow of new services is vital for long-term competitive success. In firms where annual employee and supervisor turnover rates can reach 25% or more, the challenge faced by service firms is to capture, disseminate and store the NSD knowledge gained during a single individual project and leverage it to the advantage of the NSD programme as a whole (McKee 1992; Cahill 1995).

⁴¹ In this research, only the activities completed as part of the NSD process were identified. It is acknowledged that traditional process models imply a clear separation between the different stages of the process, often as a result of external turbulence, and the use of iterative routines (e.g. Iansiti 1995; Nonaka 1990; Shostack 1984a; 1984b; Scarborough & Lannon 1989). Although of interest, the implication of this separation was not explored in this research.

In a survey of commercial financial services firms, Edgett (1996) observed a strong link between the quality of execution of the stages of the NSD process and the overall performance of NSD projects. In particular, the author noted that the NSD activities which strongly distinguished the high performers were the "pre-development" stages of the NSD process. While Edgett (1996) found that top performers are more proficient in the execution of the stages of the NSD process, the conclusion was arrived at by aggregating the scores for all respondents' individual NSD *projects*.

This research will test the assertion on a cross-sector sample of individual firms NSD *programmes*:

Q3: What is the impact of NSD process proficiency on the performance of the NSD programme?

3.3.3.2 THE AFFECT OF THE NKE ON NSD PROCESS PROFICIENCY

It has been reported that certain organisational characteristics are associated with proficient execution of NSD process activities, and the proficiency of execution is associated with the commercial success and failure of new projects (Dwyer & Mellor 1991). A research question is therefore posed in the context of the NKE:

Q4: What is the impact of the NKE on the proficiency with which the NSD process is executed?

Shared Values & Style

Entrepreneurial individuals and groups have been observed to be more proficient at identifying new market and technological trends and creating new options and directions which the business can pursue. There is also some evidence that large firms are insensitive to the nuances and idiosyncratic work styles of the entrepreneurial individual or work group, and succeed only in strangling it through the establishment of over-structured and controlling environments (Sinetar 1984). Although no direct evidence was found in the literature to prove a

link between entrepreneurial leadership style and the proficiency with which the NSD process is executed, some indirect indications can be assumed: (i) top management's encouragement of entrepreneurial behaviour can endow employees with clearly defined discretionary powers to carry out their innovation work (Edgett 1994; Edgett & Parkinson 1994); (ii) more open, imaginative and creative management styles encourage middle management to function effectively during the NPD process (Rothwell 1979).

While Takeuchi & Nonaka (1986) observed a strong desire on the part of development team members to transfer their learning outside the group, e.g. project review formats replicated to other subsequent NPD projects, the authors also found that the drive to accumulate knowledge across levels and functions during a single NSD project is an important aspect of learning in product innovation. This observation is believed to hold true for the NSD programme.

Individual learning occurs as people acquire tacit knowledge through education, experience, or experimentation. This could take place across a single NSD project or within the context of a NSD programme. The benefits of staff experimenting and not fearing failure have already been discussed in terms of the performance of the NSD programme. However, the impact on the proficiency with which a NSD process is executed is less clear in the literature. One would anticipate that although individual and group learning would result from experimentation and controlled risk-taking (evidence of lack of fear) during a single NSD project, the learning may take place too late for it to be translated into increased proficiency at the individual project level⁴². It may even lead to less proficient outcomes. The benefit is more likely to be demonstrated at the programme level.

Systems

Employees have long been identified as an important source of winning new ideas (McGuire 1973; MacMillan & McCaffrey 1984). In service firms, given the

⁴² Time may well be the major influence on whether there is an affect on proficiency. One may hypothesise that the more strategic the development, the longer the cycle of development, and the more likelihood of proficiency being impacted (see Scarborough and Lannon 1989).

physical and psychological proximity of customer contact personnel to customers, it has been observed that steps should be taken to establish a mechanism to encourage and reward new service ideas from employees, particularly contact personnel (Bowers 1989). However, the operations and customer service functions of service firms, in spite of their opportunity to do so, are the source of relatively few ideas (Easingwood 1986). One would anticipate that by encouraging and rewarding employee ideas for adding to the knowledge of the NSD process (e.g. ideas for new services, or suggestions for product and market testing), the proficiency of decision-making during the NSD process is likely to be enhanced, particularly in the early stages of the NSD process where ideas from the involvement of front-line staff are likely to be more important.

It is anticipated that staff and management will seek to use a diversity of mechanisms to transfer ideas⁴³ about improving the NSD process, depending on the characteristics of the knowledge. NSD knowledge is likely to be complex and multi-dimensional, i.e. tacit. As opposed to explicit knowledge, ideas for improving the NSD process will need to convey the more complex meaning of a situation or an activity. As information gains in complexity, so its diffusion becomes more limited (Polanyi 1958). It is only as complexity is mastered and reduced – this often calls for capacity to “abstract” – that the knowledge that one carries in one’s head can be structured and either set down on paper or embedded in objects – i.e. codified. Once information has been transposed from individual brains into documents or physical objects it can be diffused quite rapidly (Boisot 1995b). However, in reducing complexity, some of the original value of the idea may be lost.

Although a service business gains NSD knowledge from its past successes and failures, i.e. the development of insights, knowledge, and associations between past actions, these past ‘learnings’ need to be stored and made available to future

⁴³ A number of factors will influence the difficulty faced in transferring information about complex knowledge: (i) the characteristics of a unit of knowledge may influence its ease of transfer; the characteristics of the source may influence its ease of transfer (Szulanski 1996); the characteristics of the recipient may influence its ease of transfer (Cohen & Levinthal 1990; Rogers 1983); the characteristics of the context itself may influence its ease of transfer.

projects if the proficiency with which the NSD process is executed is expected to be improved. Service firms are liable to lose the 'lessons learned' from the successes and failures of past projects if staff and management leave the business, or are transferred (Levinthal & March (1993). The solution may therefore lie in the better management of a stored organisational memory (Cyert & March 1963; Argyris & Schon 1978). By storing NSD knowledge, and making it readily available to all staff and management involved in a NSD project, learning becomes a continually evolving process which results in an expansion and improvement in experience, capability and decision-making (Walsh & Ungson 1991; Huber 1991; Nonaka 1991).

Structure

The NSD process may be viewed as consisting of a number of task groups whose members are chosen from functionally differentiated firms or departments. The process must therefore be organised to provide the integrating mechanism through which full-time and part-time staff and management connect, while continuing to enable individuals to maintain their functional specialisation (Grant 1996b; Gupta, Raj & Wilemon 1986; Moenaert & Souder 1990a; 1990b; Demsetz 1988). The NSD process also needs to ensure that information and knowledge can be shared co-operatively. Only by closely interconnecting the specialised roles of the product development function can excellent communication and the real sharing of ideas and visions take place (De Brentani & Ragot 1996, p. 525). NSD researchers posit that the co-ordination required to achieve effective information and knowledge flows in successful projects can be achieved via structures which operate both at the level of the project and at the level of the business. For example, internal marketing (Gronroos 1983) has been identified as a good internal organisational communication mechanism (Morris & Westbrook 1996), and the use of formal multi-functional project development teams is continually advocated by NSD researchers (Edgett 1994; Edgett & Parkinson 1994; Atuahene-Gima 1995, 1996a, 1996b).

For these reasons, the nature of the formal structures adopted to execute the NSD process are likely to have a major influence on the proficiency with which the NSD process is executed. A number of formal organisational mechanisms have been observed to be used for innovation projects, e.g. new product committees; project teams; new product or venture departments (Randall 1980; Edgett 1993; Johne & Davies 1993; Chan, Go & Pine 1998). The choice of the NSD structure adopted may also be influenced by the stage of the innovation process being executed⁴⁴. While a number of researchers have revealed that the earlier stages of innovation are often marked by an informal, decentralised organisation, in the later stages a more formal and centralised organisational strategy often appears to be the proper approach (Johne 1984; Moenaert & Souder 1990a). The 'looseness' of the structures in the early stage of the NSD process may support the finding that the probability of creative (strategy, idea and concept development) outcomes is more likely when the structure is organic, adaptive and flexible rather than mechanistic (King & Andersen 1990).

Q4-a: Which organising structures are more effective at producing proficient execution of the NSD process?

Skills and Staff

To be an effective process, the NSD activities must be executed to a consistently high standard (Edgett 1996). The level of NSD knowledge used to execute the stages of that process is therefore likely to be an important factor in achieving high levels of proficiency. For example, if a service business possesses higher levels of marketing and technological synergy between the new development and the business' existing competences, it may be assumed that they are more likely to be more proficient at executing the stages of the NSD process than those with lower levels (Montoya-Weiss & Calantone 1994; Varadarajan 1983; Zirger & Maidique 1990).

⁴⁴ It is recognised that the strategic nature of the development and the timescales involved may also significantly impact the characteristics of the organising method.

The NSD knowledge required to execute the NSD process is unlikely to be held by one person, or to be held by one functional area. Therefore, the dispersion of information and knowledge may be regarded as a critical success factor. The importance of information exchange between organisational functions is widely reported in the innovation literature (Gupta, Raj & Wilemon 1986a; Moenaert & Souder 1990a; 1990b). Empirical research supports the proposition that the eventual success of an individual industrial new product or service is directly related to the effectiveness or ineffectiveness of information exchange (Cooper 1979; Maidique & Zirger 1984; Lievens, Moenaert & S'Jegers 1997b). The developers of successful new tangible goods have been found to transfer more information of all types across the functional interfaces in a continuous manner to execute the activities in the development process (Clark & Fujimoto 1991; Rochford & Rudelius 1992; Takeuchi & Nonaka 1986). High levels of knowledge dissemination have also been found to increase the effectiveness and efficiency of decision-making and implementation (Moorman & Miner 1997).

NSD projects which are characterised by inadequate internal communications and which do not receive the attention they require from the different functional areas perform poorly on most of the success measures" (de Brentani 1989, p.251). In a study of tangible product development, Rochford & Rudelius (1992) discovered that a large number of functional areas do not contribute or use information in many of the development stages. When directly assessing the proficiency with which the NSD process is executed, de Brentani (1993a) notes that "personnel at all levels need to think in innovative terms, and business must establish and support systems that stimulate communication and involvement by employees who represent specialised functions and who have different skills and points of views" (p.19).

Strategy

The NSD strategy adopted can influence the proficiency with which the NSD process is executed, by indicating: (i) the NSD process to be adopted (Edgett 1994); (ii) providing evidence of top management support (Edgett 1994); (iii)

supporting the need for inter-functional co-ordination and communication (Edgett 1994); (iv) encouraging the involvement of front-line employees (Atuahene-Gima 1995; 1996a; 1996b); (v) supporting the use of formal multi-functional development teams (de Brentani & Ragot 1996); (vi) indicating the importance of product synergy, (Cooper et al. 1994), (de Brentani & Cooper 1992), and market knowledge (Edgett 1994); (vii) establishing the need for market orientation (Atuahene-Gima 1995; 1996a; 1996b); (vii) indicating the need for market synergy, e.g. customer need for service (Edgett & Parkinson 1994). Using the Miles & Snow (1978) typology, this research seeks to determine whether the proficiency with which the NSD process is executed in the service business is influenced by the NSD strategy adopted (see Griffin & Page 1996).

Q4-b: Do the characteristics of the NSD strategy adopted influence the proficiency with which the service firms executes stages of the NSD process?

Effective development processes have been shown to involve continuous information sharing and utilisation (Imai et al. 1985; Hutt et al. 1988). At the project-level, NSD innovation activities may therefore be regarded as “discrete information processing activities aimed at reducing uncertainty” (Moenaert & Souder 1973; Moenaert & Souder 1990a; 1990b; Souder & Moenaert 1992; Craig & Hart 1992b). Uncertainty is the difference between the amount of information required to perform a particular task and the amount of information already possessed by the business (Galbraith 1973). Key project uncertainties have been identified as market uncertainty, i.e. customers & competitors and technological uncertainty, i.e. technical & resource (Moenaert & Souder 1990a; 1990b). The greater the uncertainty, the more difficult the execution of the NSD process is likely to be. The product innovation literature has found that the success and failure of single industrial new products is related to the effectiveness or ineffectiveness of information processing activities (Cooper 1979; Maidique & Zirger 1984; Rochford & Rudelius 1992; Ottum & Moore 1997). As information feeds the development of knowledge (Drucker 1990) and a strategy should direct the processing of information, this research seeks to identify a relationship

between a formalised information management strategy and the proficiency with which the NSD process is executed. However, little empirical evidence exists to support the existence of an information management strategy in service firms.

Q4-c: Does the existence of a formal information management strategy influence the proficiency with which the service business executes the NSD process?

Little empirical evidence supports the prevalence of knowledge and intellectual asset management strategies in service firms. Therefore, this research seeks to identify the nature of the relationship between the existence of a formalised knowledge management or intellectual asset management strategy and the proficiency with which the NSD process is executed.

Q4-4: Does the existence of a formal knowledge or intellectual asset management strategy influence the proficiency with which the service business executes the NSD process?

3.3.4 External Environmental Turbulence

In controlling for external environmental turbulence, this research seeks to identify whether real differences exist in the characteristics of the NKE, the performance of NSD programmes and the execution of the NSD process across different firms, or whether the relationships identified in the data are a consequence of market and technological turbulence (e.g. Bantel & Jackson 1981). Most empirical studies using external environmental turbulence as a moderating factor have been largely conducted in the tangible product development area, and are focused on environments characterised by largely predictable technological and market foundations (Iansiti 1995). This research adopts a different approach.

3.3.4.1 IMPACT OF EXTERNAL TURBULENCE ON NKE

The ability to continuously innovate, and adapt to changing environments, is more important now than ever before in the service sector. When external environments, e.g. markets and technologies, are changing rapidly, organising to exploit a series of innovations is extremely difficult. Management must leverage elements of the internal organisational environment to adapt continually in order to achieve the required behaviour from staff. In innovation terms, two types of external environmental turbulence have been posited to moderate the effect of organisational knowledge on new project outcomes (Moorman & Miner 1997; Cyert & March; Levitt & March 1988): (i) technological turbulence, the degree of change associated with new service technologies; (ii) market turbulence, the rate of change in the composition of customers and their preferences (Jaworski & Kohli 1993).

Researchers have posited that the value and impact of stored prior learning may deteriorate with environmental change (Achrol 1991; Glazer 1991). Rapid change, in particular, creates uncertainty which destroys competences (Anderson & Tushman 1990; Tushman & Anderson 1990; Leonard-Barton 1992a). It will become increasingly difficult for managers to map their environments (Fiol & Lyles 1985; March & Olsen 1975) accurately, and previous knowledge may begin to stand in the way of effective action (Moorman & Miner 1997). A turbulent external environment should therefore have a significant impact on the NKE. Successful firms should adapt effectively, unsuccessful firms may not adapt at all or may react inappropriately.

3.3.4.2 IMPACT OF EXTERNAL TURBULENCE ON NSD PROFICIENCY

In situations of high external environmental turbulence, managers have been observed to seek more information in order to develop greater understanding of the evolving market and technological conditions, and to provide greater stability and to increase management's confidence in their decision-making ability (Menon & Varadarajan 1992). However, too much stability within a business can be dysfunctional, i.e. there is little inducement to learn and/or change if established

behaviours never grow obsolete⁴⁵. When the external environment is highly turbulent, it is anticipated that the gap in proficiency between firms should widen as more adaptability is required to be successful.

3.3.4.3 IMPACT OF EXTERNAL TURBULENCE ON NSD PROGRAMME PERFORMANCE

External environmental turbulence may have a potentially disruptive affect on new service performance because turbulence is likely to reduce the value of prior learning, which forces the business to search for and process more information (Sinkula 1994). Moorman & Miner (1997) also observe that external environmental turbulence may also have a positive impact on the development of creative new products. Specifically, a fast-changing environment may act as a trigger for successful firms to “unlearn” current new service routines (Cyert & March 1963; Leonard-Barton 1992a). Therefore, it is anticipated that in a highly turbulent external environment, the significance in the gap between successful and unsuccessful firms will widen.

Q5: What affect does external environmental turbulence have on the performance of the NSD programme, the NKE, and the proficiency with which the NSD process is executed?

⁴⁵ Although not investigated in this research, it has been posited that effective developers of products in turbulent environments perform best with a development process which is characterised by extreme flexibility and responsiveness, i.e. they have the ability to gather and rapidly respond to new knowledge about technical and market information as a project evolves (Iansiti 1995).

4 METHODOLOGICAL APPROACH

This section describes the theoretical basis of the research, the process followed in producing the research design, the survey instrument adopted, the sample frame generated, and the process approach and principal statistical techniques selected to analyse the resultant data.

4.1 Building on Previous Methodologies

It has been proposed that to increase the validity/reliability of research results, and hence to increase the level of knowledge gained, a combination of inductive-based research and deductive-based research should be adopted (Bergadaa & Nyeche 1991). Following these recommendations, this thesis adopts a combination of deductive/inductive, qualitative/quantitative inquiry, and follows proven methodologies in the area of innovation research (Storey 1994; Edgett 1993)⁴⁶. It draws heavily upon previous marketing research in respect of:

- The statistical techniques used to analyse success/failure data, e.g. large quantitative studies using cluster and factor analysis (Calantone & Cooper 1981; Cooper 1984a; Martin & Horne 1993; Storey & Easingwood 1996a; Thwaites 1992; Chan et al. 1998; Atuahene-Gima 1996a).
- Using the development programme as the unit of measurement (John & Harborne 1985; John & Vermaak 1993; Reidenbach & Moak 1986).
- Employing single respondent surveys to minimise cost, whilst at the same time attempting to maximise industry and business coverage (Calantone 1993; Storey & Easingwood 1996a).
- Using 7-point measurement scales to increase data reliability

⁴⁶ Both of whom used an inductive/deductive line of inquiry to investigate success/failure as part of their doctoral thesis.

- In collecting, structuring and analysing interview data to frame the terms of reference for the field study (Hart 1989).

In designing the research, some previous criticisms of product innovation research are acknowledged and have been addressed. In particular, the thesis leverages both the 'rational plan' and 'communication web' perspectives⁴⁷ of product development research identified by Brown & Eisenhardt (1995): the authors being especially critical of the former. Brown & Eisenhardt assert that because the results of rational plan studies are often empirically observed correlations with success (as is this research), the theoretical understanding of relationships usually is quite limited, and non significant findings are often not reported. However, this research also adopts aspects of the communication web research as defined by the authors. This complements the rational plan approach by including "political and information-processing aspects of product development...[resulting in an] excellent theoretical understanding of a narrow segment of the phenomenon" (p.354). All this is set in the context of understanding one stream of product development literature, i.e. that of services development. The use of a set of seven topic guide interviews at the beginning of the research enable a greater appreciation of the phenomenon being investigated, and its relevance to business performance.

In summary, this study adopted a triangulation approach to make the research findings more robust and to enrich the questionnaire data. Triangulation is broadly defined by Denzin (1978, p.291) as "the combination of methodologies in the study of the same phenomenon". Triangulation enables the deficiencies of both qualitative and quantitative research to be overcome (Colgate 1998).

⁴⁷ The rational plan perspective emphasises that successful product development is the result of: (i) careful planning of a superior product for an attractive market; (ii) the execution of that plan by a competent and well co-ordinated cross-functional team, that operates with the blessing of; (iii) senior management. The communication web perspective is focused on one independent variable - communication. These studies emphasise the depth, not breadth as in the rational plan, by looking inside the 'black box' of product development.

4.2 Theory Construction

Although this thesis uses both qualitative and quantitative logic as constituent elements of an inductive/deductive design, it may be regarded as a quantitative-inductive study. A number of questions, propositions and hypotheses have been advanced in this research. In using a deductive approach (hypotheses) many questions were answered about new service development performance. In adopting an inductive approach (propositions and questions) an exploratory and explanatory investigation of the internal environment used by service firms to support NSD activity was made possible.

Qualitative logic in marketing research concerns the work whose objective is to identify the essential qualities of the research object, without examining quantities or enumerating existing cases. *Qualitative-deductive* logic is based on the determination whether certain real objects and behaviour patterns possess the qualities and relationships predicted in the model (through falsification). *Qualitative-inductive* logic has as its aim the understanding of those qualities essential to an object, so that a theory can be induced from the information obtained. Quantitative logic has as its object the enumeration of a large number of cases; "it tends towards the counting of units, the listing of the objects to be studied or described, the noting of how often a phenomenon occurs" (Grawitz, p.367). *Quantitative-deductive* logic bases itself on the determination of whether various objects representative of the research would possess properties and relationships previously predicted in the model. *Quantitative-inductive* logic, on the other hand has as its objective to identify the specific relationships existing between a large number of objects and to induce from these a law that can be generalised throughout the world where these objects originated (Bergadaa & Nyeche 1991).

As outlined earlier, although largely a quantitative-inductive study, this research uses elements of all four approaches. The general approach is presented graphically in Exhibit 4-1. The deductive approach is represented on the right hand side of the circle, and begins with theories (i.e. theories are tested by hypotheses). The inductive approach is represented on the left hand side of the

circle, and starts with observations (which are empirically-tested to produce a theory).

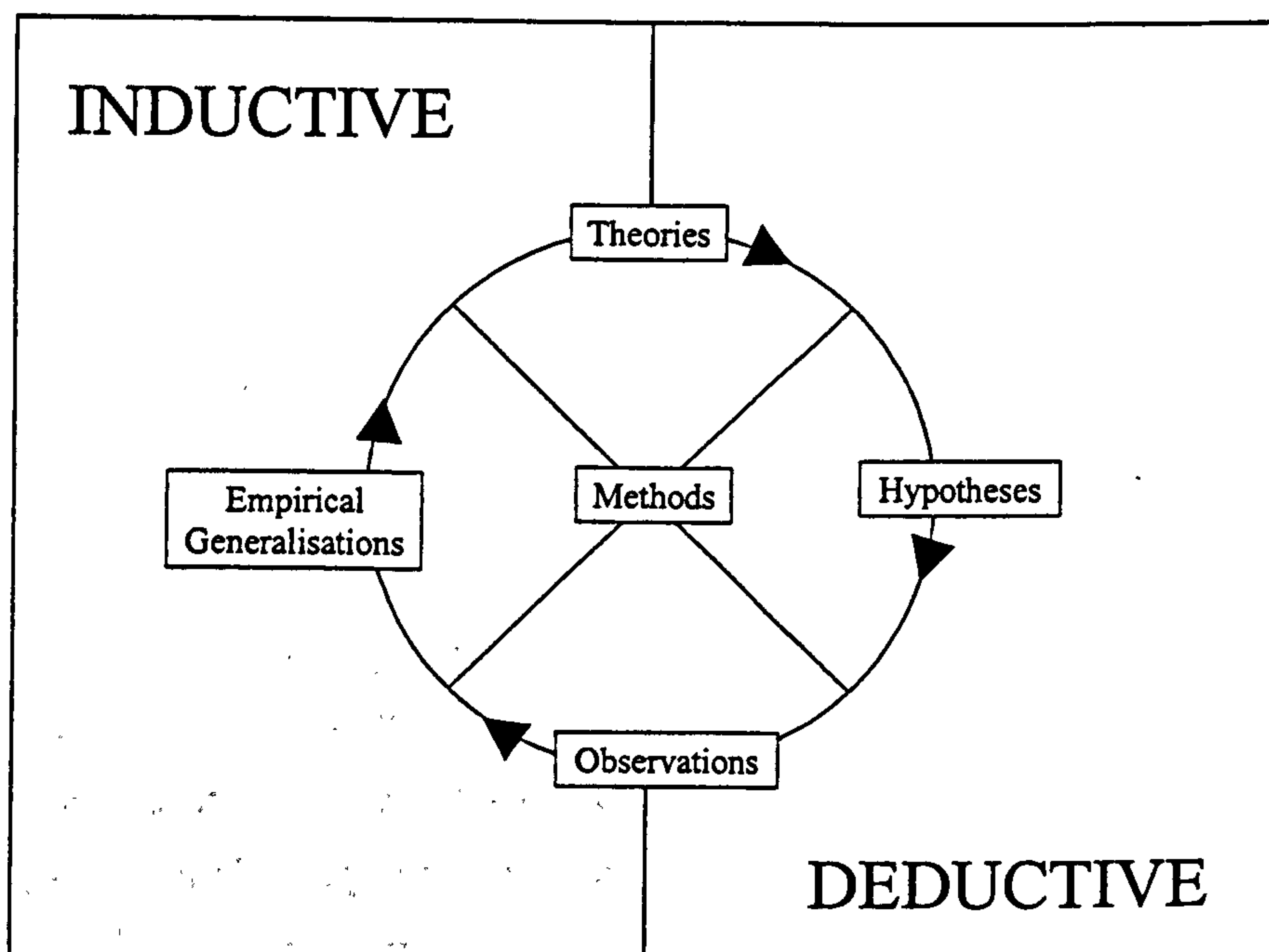


Exhibit 4-1: Inductive/Deductive Research (adapted from Zaltman et al. 1983)

4.3 Stages of the Research

The process pursued in developing this thesis is presented in Exhibit 4-2.

First Stage (Qualitative-Inductive)

The first stage was inductive. It involved learning by reflecting upon the prior experiences of researchers presented as academic research, and through the preliminary formalisation of concepts and generalisations which might explain these experiences (Gill & Johnson 1991). It was executed via a preliminary review of the services, product development (NSD and NPD, including success/failure), and performance literatures. The insights gained were used to identify potential research areas, and to formulate questions about subject areas

which would be explored further using the topic guide interviews conducted in the second phase.

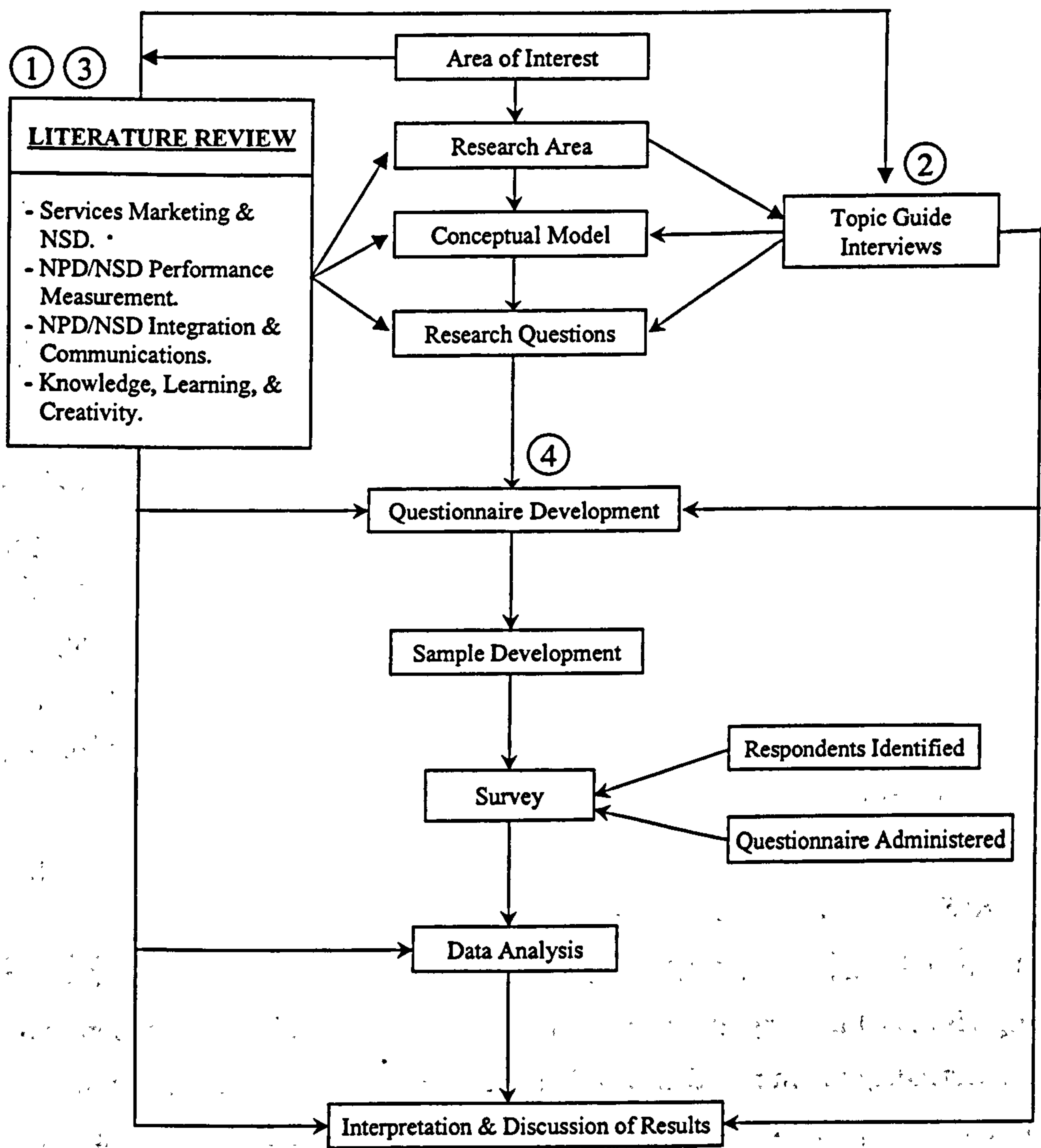


Exhibit 4-2: Research Methodology (Incorporating the 4 Steps)

Second Stage (Qualitative Inductive)

The second stage was also inductive. It involved inducing from specific observation, concepts which could be generalised into a wider research project. The insights gained were used to formulate the preliminary conceptual model, and to develop the research questions and propositions about the importance of information and knowledge to NSD success. In particular, the second stage involved learning by reflecting upon the past experiences of managers of firms involved in the development of new service offerings in UK service firms.

The second stage was executed through topic guide interviews with managers from seven UK service firms. A useful set of data was collected through these interviews. The administration and analysis of the interviews, which falls largely under the auspices of qualitative research, was based on the approach proposed by Hart (1989). The use of exploratory interviews to develop understanding is supported by the research literature:

Theory-building, case study research may be the most appropriate when little is known about a topic and where in consequence there can be little reliance on the literature or previous empirical evidence. Such approaches may also be most useful in the early stages of research or to provide a new perspective in a well-researched area (Gill & Johnson 1991).

Third Stage (Qualitative Inductive)

Based on findings from the first and second stages, a review of the knowledge and organisational learning literature was undertaken with the objective of more fully understanding the implications and importance of particular forms of knowledge in the NSD process, and the characteristics of the internal environment which supports knowledge management and organisational learning. Specific relationships between knowledge activity in NSD and other relevant organisational factors were explored, with the intention of inducing a model that could be generalised to explain NSD performance in terms of knowledge management activity. The insights gained at this stage were used to formulate a theoretical model of the impact the internal organisational environment has upon

the proficiency of executing the NSD process and the performance of the NSD programme.

Whilst the NSD literature was examined further, little additional theoretical insight into the subject was discovered.

Fourth Stage (Quantitative Inductive)

The fourth stage of the research involved empirical testing of the conceptual model, and specific questions and propositions via a field survey. This used quantitative-inductive and quantitative-deductive research approaches.

Assertions put forward by the theory were compared with the “facts” collected (Gill & Johnson 1991). The strengths of a survey approach are in its population validity and reliability. Surveys, which entail careful random selection of samples, enable the results to be generalised to a wider population with a high degree of confidence. In addition, a highly structured questionnaire that is quantitatively analysable can be easily replicated and hence reliable in the long-term. It is criticised, however, on the grounds of internal validity, i.e. whether the identified “causes” actually produce the measured “effects” and ecological validity, i.e. artificial or a lack of naturalism (Gill & Johnson 1991).

4.4 Design of the Survey

This section reviews the survey instruments employed, and the sample frame chosen.

4.4.1 Topic Guide Interviews

Before progressing to the development of a survey instrument, the second stage of this research involved learning from the past experiences of managers of in seven firms involved in the development of new service offerings in UK service firms.

The Firms Approached

The seven firms who consented to give interviews came from a cross-section of UK-based service firms: (i) financial services; (ii) travel, retail & utilities; (iii) telecommunications & IT; (iv) professional services & media. Confidentiality of business name and individual views were respected. Six of the seven topic guide interviews involved multi-respondents. This provided more robust research data, and offered the possibility of carrying out a more detailed study of the firms at a later stage.

A number of criteria were used to identify the firms invited to take part in the interviews: (i) they were recognised to be highly reliant upon the knowledge of their staff to achieve business performance; (ii) they were deemed to be active developers of service-based offerings; (iii) they were believed to possess an internal new service development capability; (iv) they were recognised to have a significant operating office in the UK, and were engaged in service development in the UK.

Service Firm	Interviews
IBM	2
Microsoft	2
Linklaters	2
Cap Gemini	1
PricewaterhouseCoopers	2
Robson Rhodes	2
Retailer (unnamed)	1

Exhibit 4-3: Topic Guide Interviews Conducted

The Individuals Interviewed

Senior managers of twelve firms were contacted by letter and asked to participate in a 2-3 hour interview. Contact was then established with each an individual by telephone and an appointment was made to meet them. Seven of the twelve contacts agreed to interviews within a period of three weeks. Two firms failed to return any of the telephone calls, letters or emails, and three firms refused to take part due to time restraints.

In five of the seven firms, interviews were conducted with more than one person. The second person was generally referred to the interviewer by the first interviewee.

Questions Posed

In the topic guide interviews, managers were encouraged to talk freely about a number of issues, in particular: (i) the strategic role of NSD; (ii) the internal and external factors which drive or hinder NSD; (iii) the NSD process and its effective management; (iv) the culture and climate used by the business to support product innovation in the business; (v) NSD performance; (vi) the systems and procedures adopted by firms to create, disseminate and store different categories of knowledge during and after a NSD project.

Lesson Learned

Two major advantages were gained from conducting the interviews: (i) identifying and qualifying the key variables which needed to be included in the survey instrument; (ii) determining the most appropriate style and format for the questionnaire to gain maximum response rates.

4.4.2 Survey Instrument (Questionnaire)

The fourth stage of the research involved the collection of data. A questionnaire field survey was deemed appropriate.

The questionnaire was formulated only after comprehensive fieldwork and a broad and varied literature review. The pilot questionnaire was pre-tested extensively with academic staff and participating firms who expressed an interest in maintaining involvement with the research. The pilot sample consisted of managers from seven firms and five academic personnel. After receiving detailed feedback from the initial questionnaire, two further rounds of amendments were made. The questionnaire is presented in Appendix I. The design of the

questionnaire, its implementation, and the conduct of the survey were based on the total design method proposed by Dillman (1978). That is:

- The initial questionnaire was personalised with a covering letter, and included an attractive questionnaire format.
- Follow-up mailings were sent to the entire sample (including non-respondents) at a later stage.

4.4.2.1 APPROPRIATENESS OF QUESTIONS

The assessment of the phenomenon being evaluated was largely facilitated through a questionnaire with self-rating questions, i.e. by asking respondents to give their opinion about the organisation's NSD programme performance, and the characteristics of their internal and external environment. Because the questionnaire was to be targeted at directors, and equivalents, who controlled a service development operation, it was anticipated that most interviewees would possess the specific insights required to provide a valuable assessment. Self-rated questionnaires have been extensively used as a method of data collection in previous NSD/NPD success/failure research.

4.4.2.2 QUESTIONNAIRE STRUCTURE AND FLOW

The questionnaire was divided into seven distinct sections. sections were created to minimise the cognitive 'stress' placed upon the respondent (i.e. the questionnaire could be completed in more than more sitting). Although sectioned, it was important not to 'lead' the respondent in their replies to the questions. General questions which framed the subject area were positioned at the front of the questionnaire. 'Sensitive' questions related to performance were asked at the end to take advantage of the 'rapport' developed with the respondent who had reached that point, and to obtain as much information as possible before the respondent become disillusioned (McDaniel & Gates 1993).

The first set of questions (Section 1: Questions 1-3)⁴⁸ required the respondent to supply information about the formal knowledge strategies pursued by the business. The questions were presented in closed-ended dichotomous-choice form, with the respondent being restricted to two fixed alternatives. These questions were worded carefully to avoid the possibility of measurement error often caused by the presentation of polarised alternatives (McDaniel & Gates 1993).

The next question (2: 1-4) was on the subject of NSD strategy (adapted from Miles & Snow 1978). This was presented in multiple-choice format.

The respondents were then asked if the business was proficient in a series of well established NSD activities on a 7-point scale (3: 1-9). The scale was anchored with 'Strongly Disagree' (1), 'Neutral' (4), and 'Strongly Agree' (7). The activities mirrored those steps identified in the Bowers (1986a; 1986b) model of NSD, which was in turn based on the Booz, Allen, Hamilton (1982) model. The Booz, Allen, Hamilton model incorporates the essential activities of other NPD models and is empirically derived from a large sample of firms engaged in development.

The majority of questionnaire data was derived using seven-point scales (101 questions, including the two control questions). The use of a point scale (versus use of a continuous scale) has the advantage of forcing the respondent to select from a limited number of categories. It is easy to construct and use, and produces more reliable ratings than do continuous scales (Churchill 1979). The advantage of using a seven rather than a five point scale is that it increases the reliability of the measurement (Churchill & Peter 1984). In the literature, no differences were claimed for reliability of scales which have all the points labelled compared with those with only the end points labelled (Churchill & Peter 1984). Therefore, the scale used in the thesis labelled both ends and the mid-point. In the marketing literature, the use of seven point scales is common practice (Storey & Easingwood 1996a).

⁴⁸ This format will be used to refer to the section and question numbers in the rest of this section of text.

The next sixty-eight out of seventy-six questions (4: 1-20 / 5: 1-33 / 6: 1-7 & 16-23) all used the same seven-point scale and asked respondents questions on the cultural values⁴⁹, systems, and structures found in the service business. Because the unit of analysis was the NSD programme, and the fact that the scope of the NSD programme was not determined prior to the questionnaire being sent, these questions related to both the business as a whole and to the NSD programme in particular (e.g. Thwaites 1992).

Eight more questions (6: 8-15), using the same question format which was employed earlier in the strategy section (i.e. closed-ended dichotomous-choice form, with the respondent being restricted to two fixed alternatives), was used to obtain data about the NSD structures the service business adopts when implementing NSD projects constituting the NSD programme.

The next part of the questionnaire posed 24 questions about the performance of the NSD programme (7: 1-24). Respondents were initially required to provide details of the total number, and percentage, of new services which had been launched as part of the NSD programme over the last three years (7: 1-3 & 5-6). These six questions were presented in open-ended form to obtain an absolute number, or percentage figure, - without 'leading' the respondent, and therefore limiting their available choice (McDaniel & Gates 1993). Questions (7: 4 & 8-24) adopted the same seven-point scale, and asked respondents to supply information on the different types of success measures used to evaluate NSD programme performance in the business. Where respondents were required to provide total numbers, e.g. number of services launched, these were recalculated as percentages to assist meaningful comparison with variables that required responses as percentage. The new variables created were "success rate" and "failure rate".

The final part of the questionnaire posed four questions (8: 1-4) on the nature of the external technical and market turbulence faced by the business' NSD

⁴⁹ Quinn (1988) has suggested that effective organisations are likely to contain many aspects of culture when certain environmental needs arise. In accordance with this view, this research allowed respondents to evaluate each culture on a 7-point Likert scale that indicate the degree to which they thought their division reflects certain characteristics. Cultures were not constrained to be competing.

programme. All were presented on a 7-point scale, anchored with 'Strongly Disagree' (1), 'Neutral' (4), and 'Strongly Agree' (7).

4.4.2.3 QUESTIONNAIRE MEASURES

The questionnaire explored the characteristics of the NSD programmes using 127 measures, derived from the conceptual model (see Exhibit 3-1). The 127 measures are categorised in Exhibit 4-3.

Description	Measures
Measures of the NSD Knowledge Environment	90
Measures of the NSD process	9
Measures of NSD performance	24
Measures of external turbulence	4
Total	127

Exhibit 4-4: Measures Used in the Research

Two further measures were used for control purposes, and three questions were input into the questionnaire to classify respondents' industry, turnover, and position.

4.4.3 Population and Sample

This section addresses three issues: (i) why were particular industries, firms, and respondents selected; (ii) the characteristics of the sample obtained; (iii) other sample and respondent factors.

4.4.3.1 INDUSTRIES

The conceptual model addressed the reasons for choosing to survey only services firms. In summary, the reasons were: (i) the world economy has been marked by a steady shift away from the production of goods toward a greater emphasis on services; (ii) the probability is that the development of services will be the key to growth for most firms, as well as industries and nations; (iii) a service is largely

an intangible and employee expertise, motivation, and self-management plays a much more critical role in new services success than in new product success.

Selection of Industries

In order to break away from a single industrial focus, questionnaires were sent to 400 service sector firms from: (i) financial services; (ii) travel, retail & utilities; (iii) telecommunications & IT; (iv) professional services & media. Exhibit 4-4 illustrates the criteria used to select the services firms sampled in this research: information use; decision-making style; time with customer; problem awareness; transferability. The typology is adapted from the research of Mills & Margulies (1980).

Dimension	Maintenance-Interactive	Task/Personal-Interactive
	Banks/Insurance Travel/Transportation/Transport Computing/Telecommunications Retail/Utilities	Advertising Consulting/Accountancy Media
Information: <ul style="list-style-type: none"> Information quantity Information quality 	Low High	Moderate or High Moderate or Low
Decision: <ul style="list-style-type: none"> Employee decisions Importance Feedback (client to staff) 	Simple Low Immediate	Complex Moderate or High Slow
Time: <ul style="list-style-type: none"> Interface duration Total time in direct contact 	Brief High	Moderate or High Moderate or High
Problem Awareness: <ul style="list-style-type: none"> Client knowledge about problems Client ability to evaluate services Client expectations vs. service capabilities 	High High High	Moderate or Low Moderate or Low Moderate or Low
Transferability: <ul style="list-style-type: none"> Substitutability of employee 	High	Moderate or Low

Exhibit 4-5: A Typology of Service Firms (From Mills & Margulies 1980)

The success of the interaction between the employee and the customer in the *maintenance-interactive* organisation rests on the business' ability to subject service-delivery activities to few changes and the tendency to routinise service delivery, e.g. bank account transactions. The focus in *task-interactive* or *personal-interactive* industries is on the tasks to be performed (e.g. the development of a new advertising campaign) or on the improvement of the client/customer's direct and intimate well-being (e.g. professional services). In the latter case, one may argue the greater importance of the employee in converting client information into knowledge. Such a classification, it is hoped, will help to predict behaviour in different circumstances.

Source of Service Firms

The sample of firms from the targeted industries was taken from trade directories which listed the largest firms by turnover in each service sector (Times Top 1,000). A reasonable cross-section of industries was studied, thus permitting some generalisation of the findings).

4.4.3.2 INDIVIDUAL RESPONDENTS ⁵⁰

Senior people were chosen as respondents for reasons of data validity. Executives have a broad perspective of their business' overall NSD efforts and, in most cases, were the only people with the necessary knowledge to complete the questionnaire, given the nature of variables explored. The research identified one senior executive per business as having directorial responsibility for a NSD programme. This individual was identified from records of previous research and, most importantly, from telephoning the target organisation directly. A letter was sent to the individual asking them to participate in the survey by responding to the questionnaire. The steps taken at the initial stage to maximise the response rate included:

⁵⁰ Single respondents were selected in an attempt to minimise cost and maximise industry and business coverage, whilst maintaining reliability and validity of the results.

- Telephone calls to verify that the business did indeed meet the criteria for the study, and to obtain the name of the executive responsible for NSD.
- Questionnaires and a cover letter were sent to the respondent directly, with a reply-paid envelope.
- A follow-up "reminder" letter and questionnaire were sent four weeks after the questionnaire was mailed.
- Follow-up telephone calls to non-respondents in low responding segments of the population were made two weeks after the second mailing (Dillman 1978).
- Offer a copy of the results to participating managers

4.4.3.3 SAMPLE PROFILE

This section presents details of the characteristics of the sample taken: response rate; industry representation and respondent positions.

Response Rate

Of the 400 firms initially contacted by letter and asked to participate in the study, fully completed questionnaires were received from 115 respondents. This represents a 30% response rate, similar to that achieved by other surveys where firms had not been subject to a personal approach or telephone call to solicit co-operation (Drew 1995a).

The response rates achieved by NSD success/failure surveys vary considerably: Storey & Easingwood (1998) obtained a 67% response rate; Cooper & Brentani (1991) received responses from 37 firms at 67%; in a single sector survey, Bowers (1986a) received 180 responses at 36%; in a single-sector survey, Cooper et al. (1994) received 173 responses at 35.2%; in a single-sector survey, Reidenbach & Moak (1986) received 121 responses at 24.2%; in a three-stage, multi-sector research survey of NSD success/failure, Martin & Horne (1993) received 217

responses at 22%; in a multi-sector survey in Hong Kong, Chan et al. (1998) received 99 questionnaires at 10.6%.

An industry profile of the sample returned by this survey is presented in Exhibit 4-5, and a profile by overall turnover of the entire organisation (including the business) is presented in Exhibit 4-6.

Respondent's Industry	Frequency
Financial Services	41
Travel, Retail, Utilities	25
Telecos & IT	28
Professional Services & Media	21
Total	115

Exhibit 4-6: Sample Profile by Industry

Industry	Frequency	Percentage of Total
> £1 Billion	34	29.60%
£251 Million - £1 Billion	33	28.70%
< £250 Million	48	41.70%
Total	115	100.0%

Exhibit 4-7: Sample Profile (Annual Sales Revenue)

The reported positions of the respondents in the study, presented in Exhibit 4-7, indicates that over half had directorial/general management responsibility for the business. The other half were either previously identified as having responsibility for a NSD programme or had the questionnaire passed to them by the original recipient of the questionnaire, were largely marketing managers (21%).

Industry	Frequency	Percentage of Total (%)
Sales & Marketing Director	41.0	35.70%
Marketing/Product Manager	25.0	21.70%
Strategy Manager	14.0	12.20%
Information/Knowledge Manager	11.0	9.60%
General Manager/Line of Business Director	11.0	9.50%
CEO	5.0	4.30%
Other	8.0	7.00%
Total	115	100.0%

Exhibit 4-8: Sample Profile (Position of Respondent in Business)

4.4.3.4 RESPONDENT ERROR, NON-RESPONSE BIAS & RESPONSE RATE

This section addresses the issues of single-respondent error, non-response bias, and the overall response rate achieved from the sample.

Single-Informant Error

Kumar et al. (1993) assert that researchers frequently rely upon key informants for insights. The authors suggest that "relying on key informant accounts is appropriate when the context of inquiry is such that complete or in-depth information cannot be expected from representative survey respondents" (p. 1633-1634). In such circumstances, key informants generalise "about patterns of behaviour, after summarizing either observed (actual) or expected (prescribed) organisational relations" (Seidler, 1974: 817). Kumar et al. (1993) posit that researchers select informants because they are supposedly knowledgeable about the issues being researched and are able and willing to communicate about them.

In spite of the appropriateness of the respondents selected, concerns about single respondents remain an issue. Two main drawbacks have been identified in research.

- It has been previously found that that wide variations in responses between members of the same top team indicate that the use of single respondents in strategy research "may need to be treated with some caution" (Bowman &

Ambrosini 1997, p. 122). Similarly, informants due to differences related to informants varying organisational roles was identified by Seidler (1974).

- Random error can result from hindsight bias, attributional bias, subconscious attempts to maintain self-esteem, or impression management (Huber & Power, 1985). Thus, there may be little correspondence between informants reports and actual events.

However, Bowman & Ambrosini (1997) also observe that difficulty even exists in dealing with diverse responses from multiple responses due to lack of consensus.

- A selection problem is the challenge of identifying two or more informants competent to report on a particular dyadic relationship.
- A perceptual agreement problem is the frequent dissimilarity of the reports of competent multiple informants.

In support of using senior managers in single respondent surveys, Snow & Hrebiniak (1980) assert that "top managers have the best vantage point for viewing the entire organisational system". In similar NSD research, Calantone (1993) suggests that the use of single informants is valid when the respondents possess unique process insights.

The reality is that many of the empirical NSD studies on which this research is based are largely based on single respondent surveys (e.g. Storey & Easingwood 1996a).

Non Response Bias

A concern to all researchers is the matter of how to explain non-respondents.

"Trusting the results of a mail survey is like lowering yourself into a dark pit in search of treasure and trusting that you won't be bitten by a snake" (Pearl & Fairley, 1985, p.559).

Non-response bias occurs if there is a difference between the preferences of these non-respondents and those of the responders on whom estimates are based. The

magnitude of the difference multiplied by the proportion of non-respondents gives the expected size of the bias. The problem is particularly acute for mail surveys which sometimes have response rates well below 50% (Pearl & Fairley 1985). Researchers who conduct mail surveys have traditionally tried to reduce the size of the non-response bias in a variety of ways, most notably through efforts to stimulate higher participation (Linsky 1975). A similar approach was adopted in this research. In this research, the profile of non-respondents was compared with that of participating firms to determine if any differences existed between the two groups (Barczak 1995). A comparison of the two groups on the basis of turnover, industrial grouping, and individual respondent revealed no significant differences at the 0.10% level, indicating no serious problems with non response bias (Atuahene-Gima 1996a).

4.5 Analysis Approach

In this section, the approach adopted to analyse the data is defined, and reasons for using particular techniques are offered. Chapters 5-7 discuss the actual method of implementation used for each of the techniques in relation to the actual data.

4.5.1 Exploring the Data

In order to provide statistical support for the research questions, the data gathered for this study was analysed using a number of statistical techniques. The techniques were executed using SPSS Version 7.5/8.0 for Windows 95. Standard procedures were used for data entry and cleaning.

4.5.1.1 OUTLIERS

The strong influence of outliers, e.g. particularly in factor analysis, has been noted by some researchers (Chatterjee et al. 1991; Hair et al. 1998). Outliers are observations with a unique combination of characteristics identifiable as distinctly different from the other observations. Outliers cannot be categorically

characterised as either beneficial or problematic, but instead must be viewed within the context of the analysis. They should be evaluated by the types of information they may provide. This research adopts a conservative approach, as recommended by Hair et al. (1998), who suggests researchers should "strive to identify only those truly distinctive observations and designate them as outliers" (p. 65). In this research, outliers were only detected when analysing the performance data - and they are dealt with in that particular results section.

4.5.1.2 SIMPLE STATISTICAL ANALYSIS

General descriptive statistics were used as initial analytical tools. Frequency tabulations, chi-squares, t-tests, and ANOVAs were all used to test the levels of significance in the data collected. The remaining areas of analysis required a more sophisticated approach; thus a number of multivariate techniques were developed.

The multivariate statistical techniques employed to analyse both NKE and performance data were very similar. Therefore, a *description* of the main multivariate statistical techniques is presented in this section. The specific *implementation* of each of these techniques, and why they were selected in particular circumstances, is discussed in each of the results chapters.

4.5.1.3 FACTOR ANALYSIS

Factor analysis is a particular form of multivariate technique and identifies groups of variables that are inter-related, and thus component measures of a larger more aggregate dimension, called a factor. The result is a database with many variables reduced to a smaller number of overall dimensions which are manageable and interpretable, yet contain most of the original information. A factor is a linear function of its components and is named to reflect these. It may be viewed as a grouping of those input variables that measure or are indicators of the factor (Aaker & Day 1980; Hair et al. 1998). Combining variables together in a factor has been demonstrated to increase measurement reliability and to decrease the specificity of the measure (Churchill 1979).

Deciding On Factor Analysis

Before executing a factor computation it is recommended that several tests of the variables should be conducted to determine whether such an approach is appropriate for the data set. In particular, a visual inspection of the data should indicate that a large number of correlations exceed the recommended minimum level of 0.3 (Nunally 1978).

Another test of the appropriateness of using factor analysis on a data set is the Bartlett test of sphericity, which is used to confirm that the data matrix is not an identity matrix (Bartlett's test of sphericity is a sensitivity test of the hypotheses that the correlations in a correlation matrix are zero, which is an identity matrix. Diagonal terms are 1 and all off-diagonal terms are 0). A large Bartlett value, with an associated high significance level, indicates that the data are appropriate for factor analysis.

Another statistic relevant to an analysis of the relationship between variables in a data set is the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy. The index of sampling adequacy provides a measure of the context to which the variables belong and, thus, whether factor analysis is appropriate. Measures above 0.50 for the entire matrix or an individual variable indicate appropriateness (Hair et al. 1998). The higher the value the more appropriate the data.

The issue of the ratio between variables and cases needs also to be addressed. Lawlis & Chatfield (1974) suggest that the size of the sample should be twice the variable size with a minimum sample size of 100. In commenting that many researchers are forced to analyse a set of data with only a two-to-one ratio of observations to variables, Hair et al. (1987) recommend interpreting findings cautiously. Consistent with these observations, this research practises conservative interpretation of the results.

The number of variables used as inputs into factor analysis may differ from the number of variables collected through the questionnaire, e.g. where respondents have supplied incomplete responses and/or missing values. The problem of missing data was addressed through mean substitution which, it is recognised, has

little effect on results if the amount of missing data is small (Hyman 1987). In this research only less than 1% of the data was substituted.

Using Factor Analysis

Principal component analysis (PCA)⁵¹ was used as the factor extraction method because it is the method of choice in similar success/failure studies. Compatibility with previous research was an important consideration in this thesis. The other available extraction methods which could have been used were unweighted least squares, generalised least squares, maximum likelihood, principal axis factoring, alpha factoring, and image factoring.

Once it had been decided to use factor analysis, and the factor model had been chosen, the selection of the rotation method becomes important. The two main options available to the researcher are orthogonal rotation⁵² and oblique rotation⁵³. The main difference between the two approaches is that for the orthogonal solution, each factor is independent of all other factors, thus there is no correlation between the factors. Conversely, in the oblique method the factors are computed so that the extracted factors are correlated. Much of the NSD and NPD research, where factor analysis is employed, has adopted the orthogonal (Varimax) method of rotation (e.g. Storey & Easingwood 1996). However, Hair et al. (1987) comment:

No specific rules have been developed to guide the analyst in selecting a particular orthogonal or oblique rotation technique. In most instances, the analyst simply utilises the rotational technique provided by the computer program...However, there is no compelling analytical reason to favour one

⁵¹ "A factor model in which the factors are based upon the total variance. With component analysis, unities (1's) are used in the diagonal of the correlation matrix, which computation implies that all of the variance is common or shared" (Hair et al. 1987, p. 234).

⁵² Orthogonal factor solution - "A factor solution in which the factors are extracted so that the factor axes are maintained at 90 degrees. Thus each factor is independent of or orthogonal from all other factors" (Hair et al. 1987).

⁵³ Oblique factor solution - "A factor solution computed so that the extracted factors are correlated, rather than arbitrarily constraining the factor solution so the factors are independent of each other" (Hair et al. 1987).

rotational method over another. The choice of an orthogonal or an oblique rotation should be made on the basis of the particular needs of a given research problem...However, if the ultimate goal of the factor analysis is to obtain several theoretically meaningful factors or constructs, an oblique solution is appropriate. This conclusion is reached because, realistically, very few variables are uncorrelated, as they are in orthogonal rotation" (p.384).

Because the investigation of the NKE was exploratory, it was deemed appropriate to adopt an oblique (Oblimin from SPSS) method of rotation. To provide consistency, oblique rotation was also used to compute factor solutions for both the NKE and performance variables.

It has been previously acknowledged that several decision criteria should be applied when choosing the final number of factors to be extracted (Hair et al. 1987). The most commonly used guide is that of evaluating the value of the eigenvalues⁵⁴. All factors with an eigenvalue of greater than one are considered significant. In this research, factors returning eigenvalues of less than one were not regarded as being significant, and were therefore not included in any of the groups of factors selected.

Consistent with the conservative approach adopted by this research, factor solutions were computed through a range of forced limits on the number of factors. The next stage was the selection of the factor loadings⁵⁵. In determining what factor each variable will best load onto, the rotated factor matrix is reviewed and the factor in which the variable has the highest loading is selected. Based on the number of variables, the number of cases and the number of factors produced, a loading of 0.45 or greater by a variable on a factor is considered to be significant and used to describe and characterise each factor (Hair et al. 1998). The larger the absolute size of the factor loading, the more significant the loading is in interpreting the factor matrix.

⁵⁴ Eigenvalues - "The column sum of squares for a factor; also referred to as the latent root. It represents the amount of variance accounted for by a factor" (Hair et al. 1987, p. 234).

The internal consistency and reliability of the factor solution is measured and evaluated by calculating the Cronbach alpha. The coefficient (Cronbach Alpha) and correlations⁵⁶ have been observed to be the most appropriate methods of determining reliability of the multi-item scale that has been used (Nunally 1978): "the alpha coefficient represents the most widely used and most general form of internal consistency estimate" (Murphy & Davidshofer, 1994, p.83). One issue when utilising the coefficient is to know what value can be considered acceptable. If the statistical value is low, the items have little in common. The management literature usually considers an alpha superior to 0.7 as being appropriate (Nunally 1967), although Bowman & Ambrosini (1997) suggest that such a modest reliability is usually only acceptable in the early stages of predictive or construct validity research. In their study, Bruner II & Hensel (1993) found that even though the reliability of scales used in the 1980s ranged from a very low 0.28 to 0.98, the mean was a respectable 0.77.

The final action required in creating factor solutions is to assign names to each of the factors produced. Name selection is the result of an arbitrary decision by the researcher and is designed to capture the underlying nature of the factor. The process used to name the factors in this research consisted of: assigning an initial name; renaming after reviewing the literature; qualification of the naming convention with a group of academics and practising business managers⁵⁷.

4.5.1.4 CLUSTER ANALYSIS

In marketing research, cluster analysis has been used for a number of applications: market segmentation; understanding buyer behaviour; identifying new product opportunities; test market selection; and, importantly for this research, as a general

⁵⁵ Factor loadings - "The correlation between the original variables and the factors, and the key to understanding the nature of a particular factor" (Hair et al. 1987, p. 234).

⁵⁶ Correlations were used to review the reliability of factors comprising only two variables.

⁵⁷ The panel consisted of academics involved in NSD and NPD research; and the practising managers comprised directors of a global consulting business engaged in knowledge management and innovation research.

data reduction technique to develop aggregates of data which are more general and more easily managed than individual observations (Punj & Stewart 1983).

Cluster analysis is a purely empirical method of classification and, as such, is primarily an inductive technique. It has no statistical basis upon which to draw statistical inferences from a sample to a population. It is an exploratory multivariate technique whose primary purpose is to group objects based on the characteristics they possess. Cluster analysis classifies objects, e.g. cases or respondents, so that each object is very similar to others in the cluster with respect to some predetermined selection criteria. The resulting clusters of objects should then exhibit high internal (within-cluster) homogeneity and high external (between-cluster) heterogeneity. Thus, if the classification is successful, the objects within clusters will be close together when plotted geometrically, and different clusters will be far apart.

Using Upon Cluster Analysis

One of the most critical decisions to make when using cluster analysis is the selection of the variables to be used to cluster the cases or variables. It is observed that there must be some rationale for the selection, and it is suggested that this rationale may grow out of an explicit theory or be based on a predetermined hypothesis. Even one or two irrelevant variables may distort an otherwise useful cluster solution (Punj & Stewart 1983).

Cluster analysis is sensitive to the inclusion of outliers, i.e. objects that are very different from others. Hair et al. (1998) suggest that outliers represent either: (i) an under-sampling of the population from which they are drawn; (ii) truly 'aberrant' observations that are not representative of the general population. In this research, the effect of outliers was minimised by using factor scores as the variables around which clusters were formed. The variables which constituted the factor dimensions were themselves previously tested for the presence of outlier observations. Standardisation of the variables entered into the cluster analysis was found to be unnecessary because only factor scores were used to cluster cases.

It has been observed that the selection of a similarity/dissimilarity measure appears to be less important for determining the outcome of a clustering solution than the selection of a clustering algorithm (Punj & Stewart 1983). Inter-object similarity is the "correspondence or association of two objects based on the variables of the cluster variate" (Hair et al. 1998, p. 471). Based on an inspection of this research data, and the direction offered in the literature, Ward's minimum variance method⁵⁸ was adopted by this research as the clustering algorithm to cluster cases around both NKE and performance factors (Punj & Stewart 1983). The Squared Euclidean distance measure was used as the recommended distance measure to be used with Ward's method of clustering (Hair et al. 1998).

How to select the number of clusters has been observed to be a perplexing issue. The advice of Hair et al. (1998) was adopted: "it is probably best to compute a number of different cluster solutions (e.g. two, three, four) and then decide among the different alternative solutions by using a priori criteria, practical judgement, common sense or theoretical foundations" (p. 499).

The issue of interpreting, validating and profiling the NKE and performance clusters was addressed by examining the statistical differences between the mean values of both the factor dimensions used to cluster, and other appropriate variables which proved insightful, e.g. ANOVAs and Duncan multiple range tests were used to detect differences in the means of other variables between clusters (Chan et al. 1998). The high cost of data collection precluded validation using a new sample of NSD programmes.

4.5.1.5 MULTIPLE REGRESSION

Multiple regression is an established statistical technique, and is used extensively in marketing research. Montoya-Weiss & Calantone (1994) indicate that many NPD performance studies have used multiple regression in the analysis of performance data. However, for completeness, a description of the technique is

⁵⁸ Ward's method is a hierarchical clustering procedure in which the similarity used to join clusters is calculated as the sum of squares between the two clusters summed over all variables. This method has the tendency to result in clusters of approximately equal size due to its minimisation of within-group variation (Hair et al. 1998).

presented below. Its implementation is discussed in the results chapters, where it highlights a hypothesised relationship.

What is Multiple Regression?

Multiple regression is a multivariate statistical technique that can be used to analyse the relationship between a single dependent variable and several independent variables. It offers both prediction and explanation capabilities. Each independent variable (or factor in this thesis) is weighted by the regression analysis procedure to ensure maximal prediction from the set of independent variables. The weights denote the relative contribution of the independent variable to the overall prediction, and facilitate interpretation as to the influence of each variable in making prediction.

The ability of more than one independent variable to improve the prediction of the dependent variable is related not only to its correlation to the dependent variable, but also to the correlation(s) of the additional independent variable to the independent variables already in the regression equation. The set of independent variables forms the regression variate, a linear combination of the independent variables that best predicts the dependent variable.

The Use of Multiple Regression in This Research

The multiple regression technique is employed in this research as an explanatory technique. It is used to consider the contribution of the individual independent variables to the prediction of the dependent variable. In such circumstances, Hair et al. (1998) state that the interpretation of the variate may rely on three perspectives: (i) the performance of the independent variables; (ii) the types of relationships found; (iii) or the interrelationships among the independent variables (this is termed 'multicollinearity' and refers to the correlation among three or more independent variables).

Before using multiple regression, particular criteria were used to determine the suitability of its use (Hair et al. 1998):

- The ratio of observations to independent variables should not fall below 5:1, if generalisability is required. However, the desired level is between 15 – 20 observations for each independent variable⁵⁹. If a stepwise procedure is used, then the ratio recommended is 50:1.
- Histograms of residuals were used to test the data for normality⁶⁰. These “provide a simple yet powerful set of analytical tools for examining the appropriateness of regression model” (Hair et al. 1998, p. 176).
- The Levene test for heteroscedasticity was used to measure the equality of variance between single pairs of variables.

4.5.2 Analysing Programme Performance

A process consisting of six main stages was followed in analysing the NSD programme performance data:

- Production of general descriptive statistics for all performance data, e.g. frequencies, means, simple correlations.
- Computation of factor solutions based on relevant Likert-scaled performance variables to define underlying dimensions
- Multiple regression of performance factors on overall success to determine relative importance.
- Production of clusters of NSD programmes, by performance factors, to identify groups of cases with similar characteristics.
- Creation of additional factor solution for innovative performance.
- Analysis of performance data in relation to the three control measures, i.e. turbulence, industry and size of business.

⁵⁹ A representative sample remains a constant requirement.

⁶⁰ Normal data shows no pattern in the residuals.

The characteristic of each of these three stages, and the methods and techniques of implementation, are subsequently explained.

4.5.2.1 GENERAL DESCRIPTIVE STATISTICS

General simple descriptive statistics (e.g. means, frequencies) were used initially to explore all the variables in the NSD programme performance data. This data included: (i) open questions on activity rates, e.g. total number of services launched; (ii) global measures of relative NSD programme performance, e.g. overall success rate; (iii) all other 'Likert scale' self-rated variables exploring other financial and non-financial performance.

Pearson correlation coefficients (2-tailed test) were computed to explore the relationship between the measures of performance and three 'general' measures of NSD programme performance, e.g. overall success, success vs. competitors, competitive nature of the NSD programme. It has been observed that this tends to underestimate the "true" correlation when variables are measured by items with few, i.e. less than 10, scale points (Hyman 1987). It is also important to note that correlation illustrates relationship and does not prove causation.

4.5.2.2 MULTIVARIATE ANALYSIS OF PERFORMANCE DATA

When working with a large number of variables, interpretation of the results can be difficult. Univariate statistics do not offer sufficient explanation about the interrelations amongst the variables. Therefore, multivariate data analysis is required. As discussed in the previous section, factor analysis was selected as the method by which to identify whether there were any underlying dimensions of performance in the NSD programmes sampled. Such an approach has been previously demonstrated to successfully delineate underlying relationships in NSD success/failure research (e.g. de Brentani 1993a; 1995a; Storey & Easingwood 1996a). To further investigate the performance properties of the sample of service firms NSD programmes, cluster analysis was employed to categorise the NSD programmes. Cluster analysis has also been used extensively

in other NSD success/failure studies to categorise data (e.g. Reidenbach & Moak 1986; Thwaites 1992).

Factor Analysis on the Performance Measures

Reliability of the Data Set

Before attempting to use factor analysis, reliability analysis was performed on the performance variables. The variables selected as inputs into the creation of the factor solution were determined by: (i) their use of scaled data; (ii) they all sought to measure elements of the same phenomena; (iii) they did not have high levels of missing data.

Item-total correlations were computed to determine which performance variables did not have strong relationships with the other variables, and were therefore unsuitable for inclusion in the factor computation. No variables with a correlation of less than the acceptable minimum value of 0.4 were identified. Therefore, none of the variables needed to be removed. The lowest correlation observed was 0.518.

The performance data set was also explored to determine whether a factor analysis would be an appropriate statistical technique to adopt. The Cronbach alpha on the remaining variables was found to be 0.925, thus indicating that the data set was highly consistent, and possessed fairly comparable variances. This led to 9 of the 24 performance variables being used as inputs into the factor analysis. The fifteen variables not used as inputs included six which were open 'activity' questions, three measures of overall success, and six measures of the performance of the NSD process). The number of cases was 115 and the ratio of cases to variables was over 12:1, above the minimum of 2:1 suggested by the literature (Hair et al. 1998).

Factor Rotation

Principal component factor analysis with an oblique (Oblimin delta was Zero) rotation was used because the objective in using factor analysis was to obtain

several theoretically meaningful factors or constructs (Hair et al. 1998). The previous section outlined the reasons behind selecting the Oblimin method of factor rotation.

Confirmation of the Factors

The resultant factors were checked to determine if there were any *single variable factors*, i.e. factors with only one variable, or variables that did not have a recognisably significant loading of greater than 0.4 on any one factor. One variable, 'leverage of other services and products', was omitted from the final computation because it failed to load above 0.4 on any one of the three factors produced. The choice of the appropriate number of factors was made by requiring all factors to have eigenvalues of greater than 1.0. However, with fewer than 20 variables this method has been identified as being likely to produce too few factors (Alt 1991). Therefore, a range of factor solutions (one below and one above that proposed by SPSS, i.e. two and four) was forced, and factoring was stopped "when the factors stopped making sense" (Aaker 1981, p.166).

Additionally, the validity and reliability of the factor solutions were explored in a number of ways. The reliability of the factors was tested by calculating Cronbach Alpha (coefficients of 0.90, 0.82, and 0.71 were observed). Nunally (1978) suggests that the minimum reliability coefficient should be 0.5. Based on the number of variables, the number of cases and the number of factors produced, a loading of 0.45 or greater by a variable on a factor is considered to be significant, and was therefore used as the cut-off point to characterise and describe each factor (Hair et al. 1998).

To test the validity of the overall factor approach, two further statistics were analysed:

- The Kaiser-Meyer-Olkin measure of sampling adequacy for the selected data was found to be 0.871. As discussed earlier, the KMO is a measure of the context to which the variables belong together and, thus, whether factor analysis is appropriate. Measures above 0.50 for the entire matrix or an individual variable indicate appropriateness (Hair et al. 1998) - the higher the value the more appropriate the data.
- The Bartlett test of Sphericity was significant (494.865; Sig. = 0.000). As discussed earlier, the Bartlett test of sphericity is used to confirm that the data matrix is not an identity matrix. A large Bartlett value, with an associated low significance level such as this, indicates that the data is appropriate for factor analysis.

The Relative Importance of The Performance Factors

The relative importance of the performance factors was tested in two ways. Firstly, multiple regression was employed to associate all three performance factors (independent) with overall success (dependent). In the absence of additional sample data, the adjusted R^2 was used as the statistic to determine the proportion of the variance in the dependent variable explained by the independent variables. The adjusted R^2 value of 0.432 was found to be within acceptable limits compared to those reported by previous research in this area⁶¹.

Secondly, correlations between all three performance factors and five of the performance measures were computed. The five were: (i) overall success; (ii) success rate; (iii) kill rate; (iv) success making the business more competitive; (v) success vs. the competition. This sought to further highlight the importance of the three performance factors in achieving other NSD activity objectives.

⁶¹ Ottum & Moore (1997) reported maximum adjusted R^2 values of 0.36 when investigating the impact of marketing information on performance. De Brentani (1989) reported an adjusted R^2 of 0.836, De Brentani (1995a) figures of 0.52, and De Brentani (1993a) reported figures of 38.6.

Cluster Analysis on the Performance Factors

Cluster analysis was used to profile the performance characteristics of the NSD programmes. This multivariate technique has the advantage of making it possible to observe whether distinctive groups of NSD programmes existed in the data and, if so, what the nature of the different performance characteristics were. The clusters produced were used subsequently to profile different types of NSD programmes according to the nature of the internal organisational environment.

Ward's hierarchical clustering algorithm was used. The factors were clustered using the three performance factors computed earlier. The use of factors, rather than individual variables, is in accordance with the advice of Punj & Stewart (1983) who suggested that "there must be some rationale for the selection of variables for cluster analysis...that rationale may grow out of an explicit theory or be based on a hypotheses" (p.146). The three performance factors may be regarded as satisfactorily representing the underlying performance factors of the NSD programmes, and therefore are likely to be more representative of multi-dimensional NSD programme performance.

Cluster analysis produced four clusters of NSD programmes, each group sharing similar characteristics. The number of clusters formed was determined by both the cluster interpretability, and the size of the difference in coefficients between stages (Hair et al. 1998). To seek greater explanation, computations were produced for both three and five cluster solutions.

4.5.2.3 PRODUCING AN INNOVATIVE PERFORMANCE FACTOR

This research, in addition to exploring traditional measures of NSD performance (i.e. financial and non-financial as defined in the literature), sought to investigate the impact of 'innovativeness' on NSD programme performance. The nature of the relationship between innovativeness and other types of performance has rarely been measured in NPD research (see Cooper & Kleinschmidt 1991) and never, to the author's knowledge, in a services context.

A review of the services and NSD literature indicated that 'innovativeness' could be defined in terms of: (i) the *processes* used to produce innovative new services, i.e. Fitzgerald et al. (1991) previously proposed that the performance of the development process itself should be employed as a success criteria; (ii) performance *outcomes*, i.e. the production of an innovative new service. A distinction has previously been drawn between measuring success of the development outcome and measuring the performance of the development process (Voss 1992).

The objective of the statistical analysis was to retain the nature and character of the original variables, but to reduce their number to simplify the subsequent multivariate analysis, if necessary. Therefore, the conceptual reasoning behind entering the variables into a factor computation were threefold: (i) to measure the phenomenon of 'innovativeness' in NSD; (ii) to determine whether the variables selected from the literature really did measure the phenomenon called 'innovativeness'; (iii) to reduce the five variables into a new variable which could subsequently be used as another dimension of NSD performance, alongside the other financial and non-financial performance dimensions produced. This approach appears to be supported by Hair et al. (1998) who state that "when used in a new research effort, factor analysis can also determine structure and/or create new composite scores from original variables [for example] to assess its dimensionality and the appropriateness of the selected variables" (p.96-97).

4.5.2.4 ANALYSIS OF CONTROL VARIABLES

The performance characteristics of the NSD programmes were then compared against each other under three different contexts or settings: (i) under varying external environmental turbulence (market and technological - see Lynn et al. 1998); (ii) according to different organisational sizes; (iii) under different industrial settings. To determine if the differences in performance of the NSD programmes were statistically significant, t-tests and F-Values were computed on the means of the performance factor scores, where appropriate. Correlations, with significance levels, were also used to evaluate the strengths of relationships.

External Turbulence

Means were calculated for the four external turbulence variables. A 2-cluster solution was then produced using the four variables, and subsequently each cluster was profiled using the measure of overall performance. This identified whether NSD programme performance was different under changing levels of environmental turbulence.

Industrial Setting

The four industry groupings were then profiled against the four performance factors, and one measure of overall success, to determine whether differences in the performance of the NSD programmes were associated with particular industries. F-Values were used to test significance levels.

Business Size

The data was also explored to determine whether there were any significant differences in the performance of the NSD programmes according to the size of the business. F-values were used to test significance levels.

4.5.3 NSD Knowledge Environment (NKE)

The six-step process used to analyse the NKE data, was similar to that followed when analysing the NSD performance data set:

- Production of general descriptive statistics for all NKE data, e.g. frequencies, means.
- Creation, and analysis, of factor solutions (based on relevant Likert-scaled NKE data) to define underlying dimensions.
- Multiple regression of NKE factors (independent variable) on overall success (dependent variable) to determine relative importance of the individual NKE factors.

- Analysis of the impact of nominal data, e.g. presence of formal structures or strategies.
- Creation of groups of NSD programmes around NKE factors to identify groups of cases with similar NKE characteristics. Analysis of their impact on NSD programme performance.
- Analysis of NKE data by three control measures, i.e. turbulence, industry and size of business.

The characteristic of each of these three stages, and the methods and techniques of implementation, are subsequently explained.

4.5.3.1 UNIVARIATE ANALYSIS

As a starting point to analysing the characteristics of the NKE, general simple descriptive statistics of the 80 designated NKE variables (e.g. means, frequencies) were provided. This provided a 'feel' for the data, and indicated the extent to which each of the measured variables was important to the service firms sampled..

4.5.3.2 MULTIVARIATE ANALYSIS

When working with a large number of variables, interpretation of the results can be difficult, and univariate statistics do not offer sufficient explanation about the interrelations amongst the variables. Therefore, multivariate data analysis is required. As discussed in the previous section, factor analysis was selected as the method by which to identify whether any underlying dimensions to the internal organisational environment existed (i.e. the NKE). To further investigate the properties of the sample of service firms' NSD programmes, cluster analysis was also employed.

Factor Analysis to Produce NKE Factors

The analysis of the NKE data was an inductive stage of the research. No previous empirical studies had sought to explore the relationships among such a set of variables, in the context of NSD. By examining the underlying patterns and

relationships between the variables constituting the NKE, and by reducing this information into a smaller number of factors, the complex and multidimensional interaction among the variables that occurs during the NSD programme could be better identified. The use of exploratory factor analysis was deemed appropriate because the objective was to more fully understand the relationship between specific elements of the NKE. If a model of pre-determined constructs was being tested then a confirmatory technique like Structured Equation Modelling (SEM) might have been adopted.

Reliability of the Data Set

Before computing the factor solutions, reliability analysis was performed on the NKE data, using the same criteria as was adopted for the creation of factor scores on the performance variables. Sixty of the potential 80 variables were deemed suitable. Two sets of variables were removed because of the characteristics of the data structure, which was dichotomous. The variables from questions 6: 8-23 were removed because they measured the NSD structure used. The variables from questions 1: 1-3 were also removed. Both these sets of variables were to be evaluated separately.

Item-total correlations were computed to identify any NKE variables which were unsuitable for inclusion in the factor computation. Variables with a correlation of less than the acceptable minimum value of 0.4 were removed. After identifying and removing variables which returned unsatisfactory values, the process was repeated until scores reached the acceptable limit (this cycled through three stages). As a consequence, 34 of the then possible 60 variables were deemed suitable for input into factor analysis. These variables possessed a Cronbach Alpha of 0.9471. The data was then tested to determine whether a factor analysis would be an appropriate statistical technique to adopt. The Kaiser-Meyer-Olkin measure of sampling adequacy was 0.879 (i.e. above 0.6) and the Bartlett test of Sphericity was significant (i.e. 2519.549; Sig. = 0.000), therefore indicating the appropriateness of using the data in a factor computation. The number of cases available was 115, and the ratio of cases to variables was just over 3.5:1, in excess of the minimum of 2:1 suggested by the literature (Hair et al. 1998).

Factor Rotation

As reviewed previously, principal component factor analysis using (Oblimin delta was zero) oblique rotation was selected for the computation of the factor solutions because the objective in analysing the NKE data was to obtain several theoretically meaningful factors or constructs (Hair et al. 1998)⁶² which could later be used for further empirical testing.

Confirmation of the Factors

Next, analysis determined whether there were any single variable factors (i.e. factors with only one variable with a loading of greater than 0.4, or variables that did not have a loading of greater than 0.4 on any factor. No variables were eliminated. In total, nine factors were produced. The choice of the appropriate number of factors was made by requiring all factors to have eigenvalues of greater than 1.0. However, with fewer than 20 variables this method may produce too few factors (Alt 1991). Therefore a range of factor solutions (one below and one above that proposed by the SPSS statistical package) was forced and factoring was stopped "when the factors stopped making sense" (Aaker 1981, p.166). Additionally, each of the factor solutions were evaluated for reliability. This was achieved by calculating Cronbach Alpha scores (which ranged between 0.675 and 0.913). Nunally (1978) suggests that the minimum reliability coefficient should be 0.5. Based on the number of variables, the number of cases and the number of factors produced, a loading of 0.45 or greater by a variable on a factor was considered to be significant and was used to characterise each factor (Hair et al. 1998). This produced a nine-factor solution.

Relative Importance of the NKE Factors

The relative importance of the NKE factors was tested by using multiple regression to associate the nine NKE factors (independent variable) with overall success (dependent variable). In the absence of additional sample data, the

⁶² The appropriateness of using an oblique rotational method was reviewed earlier.

adjusted R^2 was used as the statistic to determine the proportion of the variance in the dependent variable explained by the independent variables. The adjusted R^2 value of 0.343⁶³ is within acceptable limits compared to those reported by previous research in this area⁶⁴.

Analysing Nominal Data

As the questionnaire used both ratio and nominal data, a different approach was used to analyse the results from both data sets. Although a dummy variable could have been applied, and the strategy questions entered into the factor analysis, it is was important to have these variables remain separate for subsequent analysis.

The nominal data consisted of questions on organisational strategies. To determine if the differences in the means of these measures had a significant impact on NSD programme performance, t-tests and F-Values were computed, where appropriate. As an exploratory study, a 90% significance level was adopted.

On the NSD *strategy* data, means were calculated for the strategic groups (e.g. prospector.). These groups were profiled against the NKE factors, and then again against the performance factors. F-values were used to test for significant differences. For the three *knowledge strategies*, t-tests were used to determine whether any statistical difference in performance (factors and individual variables) existed between those firms with and without formal strategies.

Grouping of NSD Programmes

Unlike the analysis of the performance data, cluster analysis was not used to cluster the NSD programmes according to the profiles of the internal environment.

⁶³ Where all nine NKE factors were entered into the regression against overall performance.

⁶⁴ In a similar study, investigating organisational memory and new product outcomes, Moorman & Miner (1997) reported adjusted R^2 figures of 0.310 and 0.255.

Grouping by Presence of Formal Knowledge Strategies

Three groups of NSD programmes were formed by re-coding the data to create a new variable which identified groups of NSD programmes according to the presence of: (i) no formal knowledge strategies; (ii) an information management strategy only; (iii) the presence of a formal knowledge strategy (and/or information management and intellectual asset management strategy).

Profiling the Strategic Groups

The three groups created by the new variables were then profiled against the four performance factors to determine whether NSD programmes which originated from particular internal environments possessed distinctive performance characteristics. ANOVAs with F-values were used to determine the significance of the relationships identified.

4.5.3.3 ANALYSIS OF CONTROL VARIABLES

The specific NKE characteristics of the NSD programmes were compared against each other under three different contexts, as was completed for the NSD programme performance data. To determine if the differences in the NKE characteristics of the NSD programmes were statistically significant, the means of the NKE factor scores were subjected to t-tests, F-Values, where appropriate. Correlations, with significance levels, were also used to evaluate the strengths of relationships.

Turbulence

The same groups of NSD programmes clustered previously by varying degrees of external environmental turbulence were used in this instance to identify differences in the NKE factors. F-values were used to test for significant differences.

Additionally, NSD programme performance was analysed in circumstances where external environmental turbulence was: (i) high; (ii) low; (ii) under normal

conditions, i.e. when all the sample was present. This indicated the extent to which NSD programme performance varied along with external environmental turbulence and the NKE.

Industrial Setting

Correlations between the industry groups and the performance factors were used to identify significant relationships, i.e. does the industrial setting impact the nature of the NKE? Chi-Squared tests were also performed on the data to determine whether the choice of innovation and knowledge strategy were closely related to the industrial market being targeted. The chi-squared statistic tests whether two variables (i.e. prospector strategy and industrial market) are independent of each other.

Business Size

The data was also explored to determine whether there were any notable differences in the NKE of the NSD programmes according to the size of the business. F-values were used to test significance levels. Additionally, chi-squared tests were also performed on the data to determine whether the choice of innovation and knowledge strategy were closely related to the size of the business or whether the two variables (i.e. prospector strategy and firms > \$1 Billion) are independent of each other.

4.5.4 NSD Proficiency

The final part of the analysis explored the proficiency of the NSD process. The elements of the NSD process were not included in the NKE factor analysis as they constituted the process by which knowledge was disseminated through the NSD process. It was therefore a situation variable which was applicable to one particular project. In comparison, the other NKE variables reflected the prevailing culture and climate impacting, amongst other things, the NSD programme.

The stages followed in the analysis of NSD proficiency were:

- Production of general descriptive statistics for all NSD process data, e.g. frequencies, means.
- Analysis of the impact that NSD process proficiency has upon NSD programme performance.
- Analysis of the impact that NKE factors have upon NSD process proficiency.
- Analysis of the impact of the nominal data on NSD process proficiency, e.g. organisational structures and strategies.
- Analysis of NSD process proficiency in three control settings, i.e. turbulence, industry and size of business.

The characteristic of each of these three stages, and the methods and techniques of implementation, are explained.

4.5.4.1 UNIVARIATE STATISTICS

As a starting point to analysing NSD programme performance general simple descriptive statistics (e.g. means, frequencies) were calculated. This enabled the research to determine to what extent service firms completed the nine stages of the NSD process proficiently. T-tests were used to highlight the significance of the execution of each of the stages, and to establish if differences in the proficiency with which the early and later stages of the NSD process were conducted existed.

4.5.4.2 MULTIVARIATE STATISTICS

Proficiency & Programme Performance

Correlations between the 9 development activities and the performance factors were computed to illustrate the strength of the relationship between the proficient execution of the NSD activities and the performance achieved at the NSD programme level.

Proficiency and NKE

Correlations between the 9 development activities and the NKE factors were produced to show the relationship between the effectiveness of the execution of NSD activities and the most beneficial NKE environment.

Proficiency and Types of NSD Programmes

Correlations were computed to evaluate the nature and strengths of relationships between NSD process proficiency and: (i) different types of NSD programme performance; (ii) NKE characteristics. Relationships were observed for significance. When investigating the significance of the impact of NSD strategies on the proficiency of NSD activities, the means of the activities were subjected to t-tests, F-Values, where appropriate.

Proficiency and Types of NSD Structures

Simple means comparison were calculated to identify which NSD structures are used most often and which are most effective.

Proficiency and Types of NSD Strategy

Simple ANOVAs were used to identify the relationship between NSD strategy and NSD proficiency, while t-tests were employed were adopted to determine the degree to which the proficiency of the NSD process was associated with the existence of formal knowledge strategies.

Analysis of Control Variables

The mean values for the proficiency of execution of the NSD process were analysed by varying degrees of external environmental turbulence, organisational size, and industrial setting. To determine if the differences in the mean values of the activity scores were statistically significant, the means of the scores were subjected to t-tests, F-Values, where appropriate

5 DIMENSIONS OF NSD PERFORMANCE

This is the first of three chapters which describe, analyse and interpret the results of this thesis. In each of the three chapters, the research questions raised are resolved, and the hypotheses put forward (in the conceptual model) are discussed in light of the data collected. The chapters comprise: (i) dimensions of NSD performance; (ii) NKE dimensions; (iii) NSD process proficiency.

5.1 Introduction to the Results on NSD Performance

Before making any attempt to explore the characteristics of the NSD Environment (NKE) and its affect on NSD programme performance, this chapter examines the prevailing categories of NSD performance and the degree to which service business' NSD programmes are successful. It follows a limited amount of research carried out into the performance of new services and the measurements used.

The key research contributions made by the results of this chapter are in: (i) identifying the underlying dimensions of NSD performance in UK service firms; (ii) establishing the importance of NSD to UK service firms; (iii) exploring the nature of the relationship between innovativeness and other types of NSD programme performance.

In order to determine the extent to which a NSD programme has been successful, it is important that appropriate measures are identified and used. There have been very few empirical studies into the performance measures used by managers in evaluating NPD success, and none which examine NSD. A recent exception is the study by Griffin & Page (1993). The authors found that the majority of firms in tangible goods industries use two or three evaluation measures for assessing the performance of new products after launch. Although firms employ a wide range of different measures, such measures are, on the whole, based on financial or sales criteria. Less frequently used measures include estimates of customer acceptance, customer satisfaction and product life length. Griffin & Page also found that a

number of firms do not carry out evaluation of their new products. This was discovered to be mainly a consequence of the absence of appropriate systems, an incomplete understanding of the development process required to measure success, or to the fact that the culture (the will, authority and long-term view) of the business did not support a measurement process. Subsequent research identified that although customer acceptance, customer satisfaction and the degree of competitive advantage achieved by the business are rarely used as measures, in practice they are considered by managers to be the most useful (Griffin & Page 1996). It has also been found that the time-frame considered affects the perceived usefulness of measures (Hultink & Robben 1995). For example, process based measures may be used to measure short-run success, and financial and customer measures to gauge long-run success.

The majority of service firms are not able to measure the true cost of introducing a new service (Easingwood 1986). Therefore, service firms may find financial criteria inappropriate as a tool for measuring NSD performance. It might be expected that service firms who have greater experience in measuring elements such as service quality and customer satisfaction would employ these measures in their evaluation of new service success to a greater extent than tangible product firms .

5.2 NSD Activity

In addition to exploring the performance of service firms' NSD programmes, this thesis posed a number of questions about NSD programme activity in general. Respondents were initially asked to indicate how many new services were released as part of the NSD programme being investigated. The results are presented in Exhibit 5-1.

# of New Services Launched (Over the last 3 years)	Number of Respondents	
	<i>Valid Percentage</i>	<i>Frequency</i>
1 – 9	38.04%	35
10 – 19	33.70%	31
20 – 29	13.04%	12
Over 30 ⁶⁵	15.22%	14
Total¹	100.00%	92²
¹ Average number of new services launched over a three year period is 17.93;		
² 20% of the 114 respondents did not supply data for this question.		

Exhibit 5-1: Number of Services Launched by NSD Programmes

Number of New Services Launched

It was found that 84.78% of service firms launched between 1 - 29 new services as part of their NSD programme over the previous three years, i.e. between 1 - 10 new services per year. The broad range reported might reflect the diversity of industries sampled, the varied size of business operation responding, the different level of NSD capability reached in each industry (i.e. NSD rates in recently privatised industries might be anticipated to be lower than those reported in industries where open competition has been taking place for many years). Additionally, the range may be influenced by the respondents' ambiguous interpretation of the term 'new service'⁶⁶. These results are higher than those reported by Storey (1994) in his single-sector survey which identified that the majority of financial services firms launched between 1 - 5 new products onto the market annually, but the results are similar to those reported by Edgett & Jones (1991) who found that firms *expected* to launch a minimum of 5 and a maximum of 12 new services, in addition to a number of product re-launches (the definition of a new service may also cause some variability in the results reported). Perhaps more significantly, one explanation for the high level of NSD activity is the

⁶⁵ One response returned a value of 450. This was classified as an 'outlier' in analysis where it would quite distort (or misrepresent) the reported findings.

⁶⁶ Although a new service was clearly defined in the questionnaire as a service which was 'new to the business... distinct from improving or making modifications to existing services'.

greater importance of new services to firms since the previous studies were conducted (as opposed to their publication).

Success Rate

Respondents were also questioned about the performance of their NSD programme in delivering successful new services to market, using a number of well-established measures. They were invited to estimate the degree to which the new services developed had succeeded, failed or were killed-off before launch. The results are presented in Exhibit 5-2.

Activity Measures	Mean Value
Total number of new services which have been launched over the last three years ²	17.93
Percentage of new services which succeeded? ¹	73.04%
Percentage of new services which failed after launch?	26.07%
Sub Total	100%
Percentage of development projects which were killed-off before launch?	26.54%
¹ Percentages calculated from questionnaire data; ² Of the 115 cases, one was excluded from the analysis of the total number of services launched because their response was considered to distort the findings. However, the case was included in the percentage analysis.	

Exhibit 5-2: NSD Programme Activity Measures

It was found that 73.04% of new services succeeded, 26.07% failed, and 26.54% were killed-off before launch. For all service firms, the mean failure rate of approximately 26%, indicates that NSD remains a risky business. These findings may be regarded as being consistent with the success rates quoted in other NSD research: Edgett (1996) found that 62.5% of projects launched were commercial successes, 19.8% were commercial failures, and 17.7% were killed or cancelled before launch⁶⁷.

⁶⁷ While this thesis drew a distinction between the outcome of services launched, Edgett (1996) examined the outcomes of new services developed. The approach adopted is believed to be consistent with Crawford's (1987) statement that "ideas that are in the process of development are not finished products. If we want to evaluate a firm's product innovation performance, we should evaluate finished output, that is, marketed products" (p.21).

In terms of tangible product development, Cooper (1981) identified that 21.9% of new products are cancelled prior to launch (but after development has completed); and Crawford (1987), in reviewing a number of published studies of new tangible product success rates found the average for new consumer products to be 65% and the average for new industrial products to be 75%.

5.3 Importance of NSD to Service Firms

It was hypothesised earlier in this chapter that NSD has become more important to service firms. Does the data support this? To determine the value of NSD capability to a service business, respondents were questioned about the importance of the NSD programme in relation to their business. This was achieved using a number of well-established measures, i.e. estimates of the percentage of sales and profits coming from new services launched as part of the NSD programme over the last three years. The results are presented in Exhibit 5-3.

Performance Measure	Mean Value
Percentage of sales coming from new services introduced in the last three years?	29.73%
Percentage of profits coming from new services introduced in the last three years?	27.65%
¹ Percentages calculated from other questionnaire data;	

Exhibit 5-3: Importance of NSD to Business Performance

From the sample, it was observed that 29.73% of sales and 27.65% of profits came from new services launched in the last three years. This seems to illustrate the significance of the impact NSD has upon the success of the overall business. The findings are consistent with previous NSD studies. Drew (1995a) reported that "successful financial institutions obtained on average 15% of current year's revenues from new products launched within the previous two years...[while] successful firms projected over 30% of revenues from new products in five years". In the field of tangible product development, Cooper & Kleinschmidt

(1995) noticed that new product developers had 28.4% of their current sales made up of new products introduced over the last three years. It may be anticipated that active NSD firms will achieve *higher* levels of sales, and profits, from new services introduced over a three year period than their tangible counterparts for a number of reasons: (i) the service industries sampled in research were contributing ever-increasing amounts to UK GDP (i.e. 30%+ of UK GDP was contributed by services industries); (ii) service firms face an increasingly competitive global marketplace and have to be more proactive in seeking differentiation in the eyes of the customer; (iii) the service firms sampled identified that they developed new offerings in an effort to maintain and grow customer satisfaction; (iv) in general, services are easier to develop than tangible products⁶⁸.

5.4 Performance of Service Business' NSD Programmes

To gauge respondents' perception of the multi-dimensionality of the business' overall NSD programme performance, a wide range of additional questions were posed. These were adapted from both the NPD & NSD performance literature, a performance survey reported by the author (Storey & Kelly 1998b), and from the responses received during the initial topic guide interviews. The approach sought to benefit from the generalised findings of previous surveys, but also to ensure that the measures were appropriate for the population being sampled. For example, Griffin & Page (1993) previously observed that academics and managers tend to focus on rather different sets of product development success/failure measures.

⁶⁸ An example from the topic guide interviews can be provided here. A global systems and services business, identified that the speed of technological advancement had resulted in an ever-increasing demand for new products to solve problems, and meet opportunities, raised by political, economic and social change. These changes included the European Monetary Union (EMU) due in 1999 and the Millennium bug. Without new services in these area, the business would miss out on potential sales growth of 30% per annum over the period in question.

5.4.1 Overall Success

Respondents were questioned about the 'overall success of their NSD programmes in meeting its objectives'. Each respondent, having been identified as holding directorial responsibility for the management of the business' NSD programme, was required to rate the overall success of the NSD programme in meeting its performance objectives. This was measured on a 1 - 7 Likert scale: "very unsuccessful" (1) to "very successful" (7). The evaluation of business achievement against internally set objectives has regularly been used as a measure of overall success in studies of new products and services (e.g. Cooper & Kleinschmidt 1987a; de Brentani 1989; Edgett & Jones 1991; Martin & Horne 1993; Storey & Easingwood 1996). For example, Baker (1975) has previously suggested that researchers must accept that "a new product has failed when its originator comes to this conclusion based on his own criteria" (p.16). The results are presented in Exhibit 5-4.

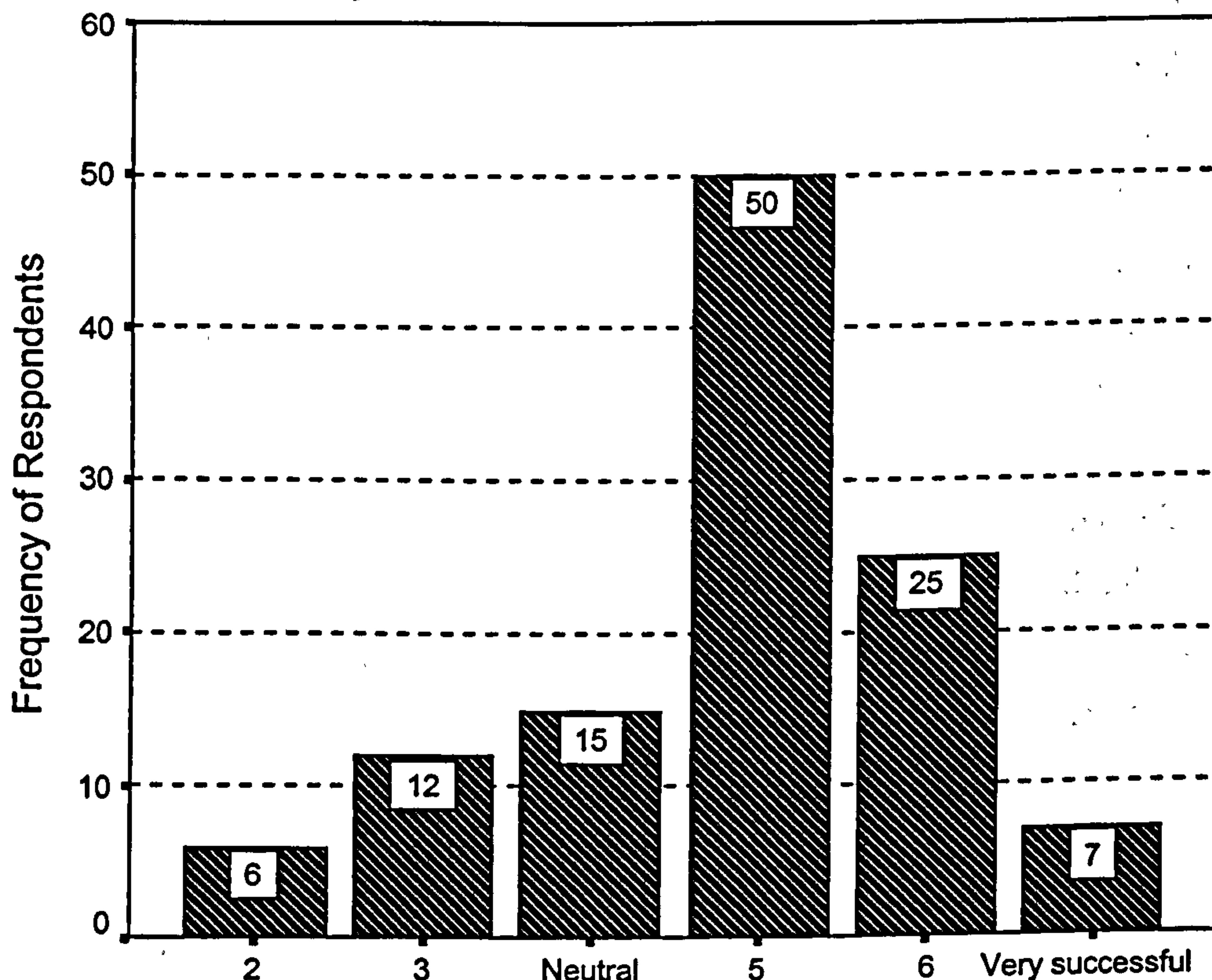


Exhibit 5-4: Overall Success of NSD Programme in Meeting its Objectives

The average mean value of overall success was 4.84. This indicates that most NSD programmes were classified by respondents as being successful (i.e. 71.3% of the NSD programme scores were 5 or above)⁶⁹. The measure 'overall success of NSD programme in meeting its objectives' will be referred to as 'overall success' from hereon.

⁶⁹ The overall success measure was found to be highly and significantly correlated with all other financial and non-financial success measures (see Exhibit 5-7). As such, it may be perceived to be a valid measure of NSD programme success.

5.4.2 Competitive Performance

To gauge respondents' perception of the degree of success their NSD programmes achieved against competitive programmes, two further questions were posed. Firstly, respondents were required to rate the performance of the business' NSD programme against that achieved by their competitors. The response was measured on a scale of 1 (very unsuccessful) to 7 (very successful). Secondly, respondents were asked whether the NSD programme had been successful in making the business more competitive. This was also evaluated on a scale of 1 (strongly disagree) to 7 (strongly agree). The results are presented in Exhibits 5-5 and 5-6.

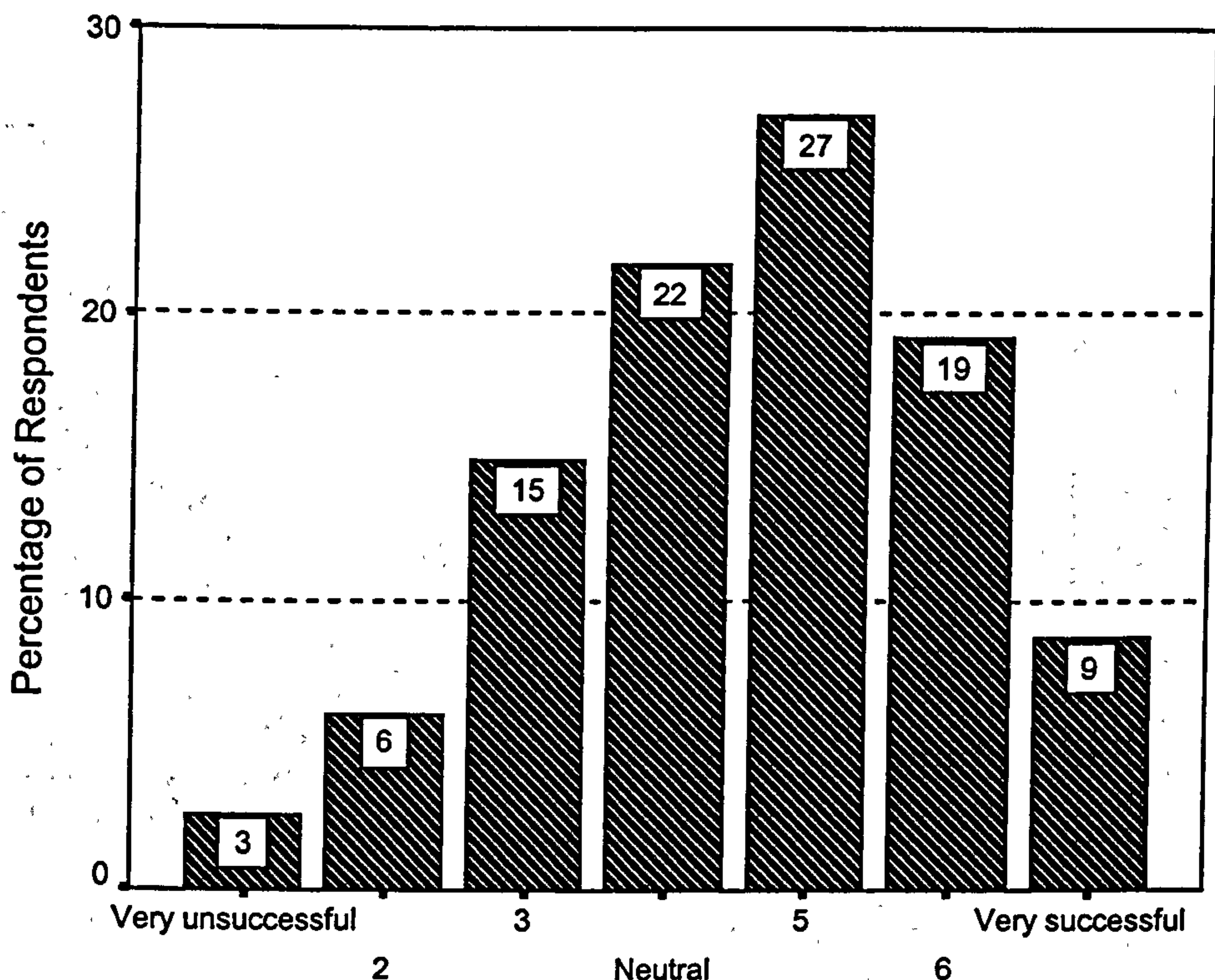


Exhibit 5-5: Success of the Business' NSD Programme vs. Competitors

The fact that service business executives universally agree that the NSD programme has been successful in making the business more competitive ($\bar{x} = 5.42$)

would seem to indicate the importance of NSD to the overall performance of the service business. However, most respondents also perceived their business' NSD programme to be more successful than that of their competition ($\bar{x} = 4.57$). This may well demonstrate a lack of awareness of the competitive strength of their respective NSD programmes.

The results would also appear to indicate that although NSD programmes assist in making the business more competitive, the competition remains fierce. No place for complacency therefore exists.

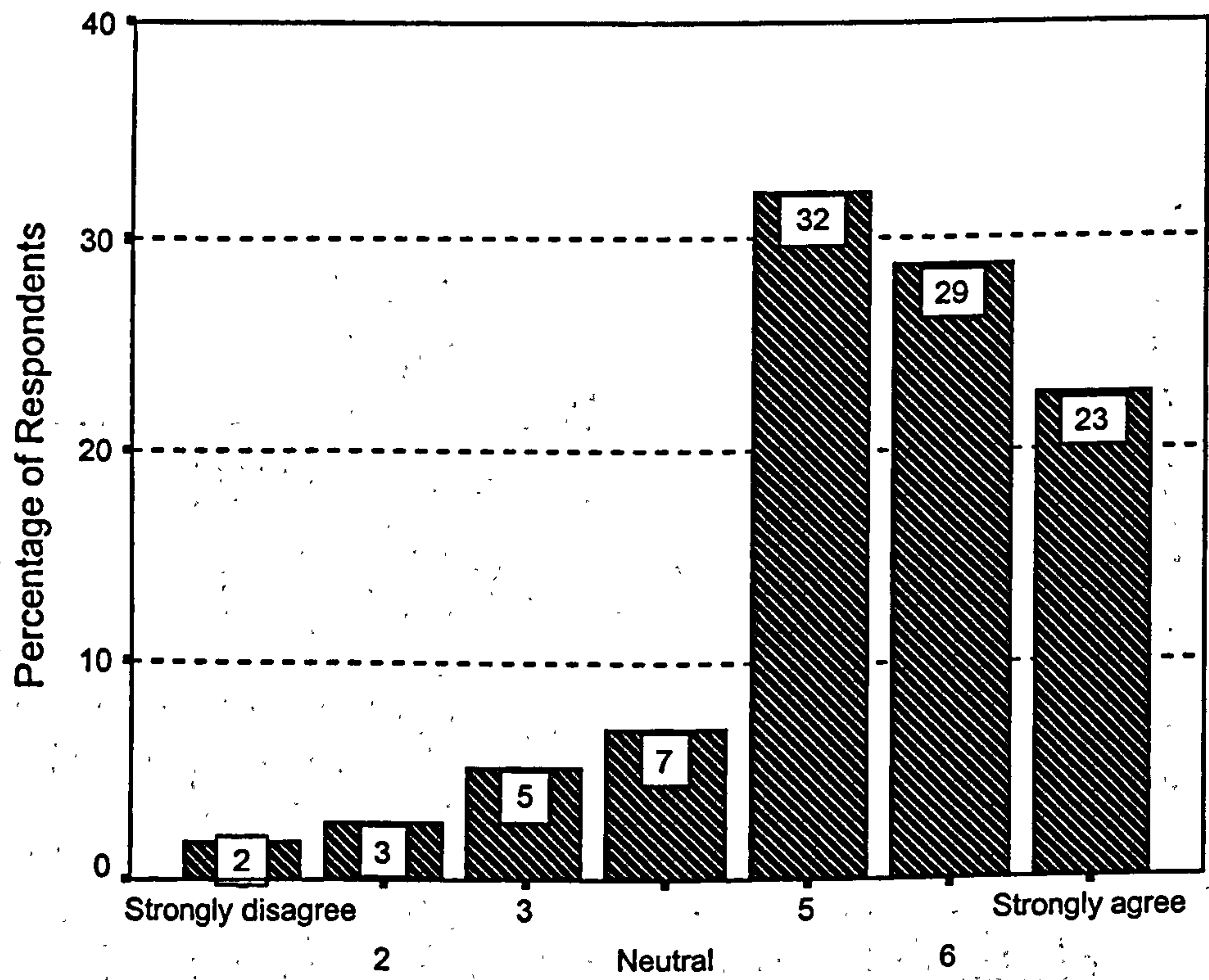


Exhibit 5-6: Success of the Business' NSD Programme in Making the Business More Competitive

In interpreting the results of these two questions (and other similar questions), one must be aware that respondents may well adopt different perspectives of 'competitiveness'. The results may also serve to highlight the tendency of

respondents to overrate when using a self-rating data collection method (e.g. Kerssens-van Drongelen & de Weerd-Nederhof 1998). However, because this research is more interested in relative values, this issue is not considered a major problem in the analysis and interpretation of the results.

5.4.3 Financial & Non-Financial Performance

Contemporary reviews of the performance research have observed that whilst financial-based criteria are often the most frequently used measures of success, a plethora of other performance criteria are used (e.g. Montoya-Weiss & Calantone 1994). Hart (1993) has observed that evaluations of corporate performance can be facilitated by financial and non-financial measures of success, and this distinction is a helpful one when assessing success in NSD. To more closely define the nature of the success achieved by the NSD programmes sampled, and to establish a metric for evaluating the impact of the independent variables, a total of 10 measures of financial and non-financial performance were therefore formulated as short statements, and respondents were invited to evaluate the extent to which each statement applied to the business' NSD programme. The responses were measured on a 1 - 7 Likert scale, labelled either "strongly disagree" or "very unsuccessful" (1) and "strongly agree" or "very successful" (7). Exhibit 5-7 presents the average mean scores for all 10 performance questions. Correlations were also computed between each of these 10 variables and the measure of overall success (see previous section) to evaluate whether the 10 variables selected were indeed a good measure of success.

Performance Measure ¹	Mean	Correlation with Overall Success
Financial Measures (2)²		
Success of business' NSD programme in generating sales	4.94	0.582***
Success of business' NSD programme in generating profits	4.59	0.464***
Non-Financial Measures (8)		
Success ensuring the long-term viability of the business	5.32	0.595***
Success making the business more flexible in responding to customer needs	5.23	0.509***
Success bringing new clients to the business	5.18	0.483***
Success creating new market opportunities	5.34	0.445***
Success achieving better utilisation of resources	4.80	0.406***
Success retaining existing customers	5.22	0.380***
Success leveraging sales of other products and services	4.90	0.266***
Success establishing new markets	4.96	0.237**
Note: The measures were sorted by the level of correlation within the category. ¹ Likert scale 1-7; ² Number of measures in category; ***. Correlations significant at the 1% level; **. Correlations significant at the 5% level;		

Exhibit 5-7: Financial/Non-Financial NSD Programme Performance Measures

5.4.3.1 FINANCIAL MEASURES

While there has been some criticism of grouping sales and profit measures together, e.g. Hart (1993) found too few significant associations between non-financial and financial measures to provide any insights into the existence of a relationship, the factor analysis employed later in this research identified a close connection.

Most respondents perceived their NSD programmes to be successful on the two main financial measures of NSD performance: sales ($\bar{x} = 4.94$); and profits ($\bar{x} = 4.59$). In addition to highlighting the perceived financial success of the NSD programmes, the results also indicate that higher levels of sales are easier to achieve than are higher profits, as one might anticipate in a competitive

marketplace⁷⁰. Sales and profits are also highly and significantly correlated with the measure of overall success: sales ($r = 0.582$; Sig. = 0.000); profits ($r = 0.464$; Sig. = 0.000). This suggests that managers regard financial success as being of primary importance in achieving overall business objectives.

It would be interesting to extend the scope of the research further to explore the nature of the relationship between perceived NSD programme performance (i.e. sales and profits) and the business' overall performance in the market, as demonstrated by more objective and quantitative measures. For example, one could use reported shareholder returns, or the business' return on assets, to further analyse whether success in NSD is directly related to the overall performance of the business (see McNamara & Baden-Fuller 1997⁷¹).

The results of this research also support the findings of previous research which indicate that financial measures dominate 'firm level' analyses (Cooper 1984c; Hart & Service 1988).

5.4.3.2 NON-FINANCIAL MEASURES

Previous studies into NSD success have shown that the financial dimension of performance (i.e. sales and profit) is distinct from those measures that deal with more strategic issues, i.e. internal measures (Cooper et al. 1994, Storey & Easingwood 1998). In response to the criticism levied at using purely financial performance measures, researchers have begun to introduce a number of non-financial measures. These are explored below.

Long-Term Viability & Resource Utilisation

The importance of NSD in achieving business success can be identified in the strength of the correlations between the measure for 'overall success' and 'long-

⁷⁰ In a recent presentation, the Chairman of British Gas R. Giordano (1998) indicated that, in comparison to their USA counterparts, the financial position of UK businesses suffered from their tendency to target too much low margin business.

⁷¹ The authors use stock market price movements to assess whether knowledge based alliances really do provide value.

term viability' ($r = 0.595$; Sig. = 0.000) and 'better utilisation of resources' ($r = 0.406$; Sig. = 0.000). This suggests that respondents perceive that the overall success of the NSD programme is closely and significantly associated with achieving long-term viability and more effective utilisation of the business' resources. It would appear that most service firms are successful in achieving viability ($\bar{x} = 5.32$) and resource utilisation ($\bar{x} = 4.80$).

The necessity of developing performance measures which indicate long-term viability and performance of the business, rather than relying on short-term financial measures, has long been recognised (e.g. Aaker 1988). This is what Kaplan & Norton (1992) term *learning and growth*.

Retaining and Developing Existing Business Opportunities

The ability of the service business to retain existing clients ($r = 0.380$; Sig. = 0.000) and to respond flexibly to their needs ($r = 0.509$; Sig. = 0.000) is closely related to the achievement of overall success.

The establishment of new, profitable, customers is an expensive and resource-sapping process, and the loyalty of those clients, once established, is vital in achieving the overall objectives established for the NSD programme. This finding is supported by previous research which indicates that customer retention is closely associated with profitability (Reicheld & Sasser 1990), long-term growth (Varadarajan & Berry 1983), and market share (Rust & Zahorik 1993). In fact, in the financial services sector, many new service developments in recent years have been of a defensive nature, being designed purely to retain existing customers (Davison, Watkins & Wright 1989, Drew 1995). Flexibility in responding to customer needs may include providing a range of new attractive services, as well

as providing high levels of customer satisfaction with the existing range of services⁷².

It has long been recognised that a business' ability to cross-sell products is an important element of marketing strategy (e.g. Berry 1986). In addition to increasing sales, cross-selling may enable enhanced cost-efficiencies through, e.g. shared delivery systems. In this research, the business' success in leveraging sales of other products and services, e.g. related services in the NSD programme, although correlated with 'overall success', was relatively less strongly so than that of many other measures. This may further indicate the increasing importance of a continuous flow of new services in making a service business more competitive⁷³.

New Market Opportunities, Establishing New Markets & New Customers

Johne & Davies (1998; 1988b) make a distinction between market innovators and product innovators. The differentiation is useful in highlighting the importance of a business pursuing a number of different types of complementary development approaches, depending upon the context in which development is taking place. NSD is often undertaken to "prepare for the future", by attracting new customers, or opening up new markets (Easingwood & Percival 1990). In this research, although significantly correlated with 'overall success', 'success establishing new markets' was less strongly correlated with 'overall success' than all other performance measures ($r = 0.266$; $\text{Sig.} = 0.011$). This may reflect service firms' historical reliance upon copying to achieve its NSD objectives, rather than pioneering in new markets. Therefore, the capability of establishing new markets has not been successfully developed. Alternatively, it may indicate that the establishment of new markets is not the key measure of success for most service firms, i.e. other measures are more important. For example, although the business

⁷² In the topic guide interviews, a legal services company indicated that the development of new global service offerings was largely an attempt to retain the services of its existing clients who were increasingly performing business outside of their traditional geographical territory. They believed that failure to develop these new services would eventually lead to them 'losing out' on new opportunities and, eventually, losing the business of their existing customers in the local market.

⁷³ The measure for leveraged sales was significantly correlated with the measures for increased competitiveness ($r = 0.432$; $\text{Sig.} = 0.000$) and success vs. competition ($r = 0.402$; $\text{Sig.} = 0.000$).

may aggressively seek new market *opportunities*, it may be more conservative in its attempts at exploitation. In support of this view, the 'creation of new market opportunities' was found to be significantly correlated with the 'overall success' ($r = 0.445$).

The service firms sampled in this research were found to be very successful in bringing new clients to the business ($\bar{x} = 5.12$). The measure was also highly and significantly correlated with 'overall success' ($r = 0.483$; Sig. = 0.000). It is likely that these customers are being stolen from competition offering similar services in existing markets. The benefit of attracting new customers is the hope that they will become long-term users of other services offered by the business, and therefore the business achieves greater long-term value from each retained customer. In fact, new services are often introduced specifically with the objective of attracting new customers (Edgett & Jones 1991)⁷⁴, and UK banks, in particular, have been observed to be dependent rely upon customer lethargy. The high mean score reported for attracting new clients to the business is important because, in previous research, it has been found that attracting new customers is considerably more difficult and costly than the "soft option" of selling to existing ones" (Meidan 1984).

5.5 Underlying Performance Dimensions

To simplify the analysis of the independent variables, factor analysis was used to investigate whether any underlying dimensions of performance, other than those previously mentioned, existed in the data for the NSD programmes sampled. Nine variables ('success leveraging sales of other services and products' was omitted from the final computations because it failed to load above 0.4 on any one of the three factors) were input into the computation and a three factor solution was produced (Oblimin rotation). Reliability analysis was applied to each of the factors to assess the degree of consistency between the variables. Each dimension

⁷⁴ For example, financial institutions seek to attract new mortgage customers by offering them a more attractive product offering than they make available to their existing clients.

was found to possess a reliability coefficient of greater than 0.7. Exhibit 5-8 presents the results, and the factors are described in the subsequent section. Appendix J presents the correlations between all the performance variables

Factor ¹	Factor Components	Factor Loading ³
Financial Performance ($\alpha = 0.892^2$) ⁴	Success of business' NSD programme in generating profits	0.926
	Success of business' NSD programme in generating sales	0.872
New Opportunities ($\alpha = 0.818$)	Success establishing new markets	0.992
	Success creating new market opportunities	0.729
	Success bringing new clients to the business	0.639
	Success achieving better utilisation of resources	0.517
Customer Responsiveness ($\alpha = 0.715$)	Success making the business more flexible in responding to customer needs	0.850
	Success retaining existing customers	0.753
	Success ensuring the long-term viability of the business	0.518
Note: Factor analysis uses principle components (PCA), and Oblimin (oblique) rotation; KMO = 0.871; Bartlett Test of Sphericity = 494.865 (Sig. 0.000). ¹ Factors sorted by descending value of Cronbach alpha; ² Cronbach alpha reliability measure. ³ Loading of variable on factor; ⁴ The correlation between the two variables was 0.813***		

Exhibit 5-8: NSD Programme Performance Dimensions

5.5.1 Factor Descriptions

The three factors produced are now described in more detail.

5.5.1.1 FINANCIAL PERFORMANCE

The financial performance dimension indicates how successful the service business' NSD programme has been in generating sales (loading = 0.926) and profits (loading = 0.872). The Cronbach alpha of 0.892 indicates that the factor is a highly consistent measure.

As reviewed in the previous section, financial measures of success, e.g. sales and profits from recent new developments, have long been a dominant 'firm level' success measure in academic research (Hart & Service 1988). Financial

performance was identified as one of three underlying performance dimensions in the research of Cooper et al. (1994)⁷⁵. Since the primary aim in launching a new product is to return a profit to the business in the long run, even if not in the short run, it is not surprising that profitability is the most frequently used measure of performance in studies of new product success.

However, financial measures of performance may be criticised on the grounds that while one of the easily quantifiable industrial performance yardsticks, they are far from the only important ones.

5.5.1.2 NEW OPPORTUNITIES

The new opportunities performance dimension identifies the success of the business' NSD programme in innovating in markets. The dimension measures the business' performance in creating new market opportunities (loading = 0.729), establishing new markets from those opportunities (loading = 0.992), and in bringing new clients into the business (loading = 0.639). Additionally, the dimension measures, but to a lesser extent, the success the business achieved in better utilising the business' resources in doing so (loading = 0.517).

A dimension with such characteristics is new to NSD research, although the concept of 'enhanced opportunities' was reported by Storey & Easingwood (1996) as an important dimension of NSD performance⁷⁶. A Cronbach alpha of 0.892 indicates that the construct is highly consistent in what it is intended to measure. This finding builds upon the work of Cooper & Kleinschmidt (1987b) who recognised that new tangible product development offers the business a 'window of opportunity' to open up markets to exploit for future financial success. Creating ideas for new market opportunities does not guarantee success.

⁷⁵ At the project level. The measures included the new product's growth in the level of sales exceeded objectives, the new product exceeded its market share and sales level objectives, total sales of the new product were very high, the profitability of the new product exceeded its objectives, the new product has a large market share, the new product is very profitable.

⁷⁶ Storey & Easingwood's (1996) 'enhanced opportunities' included: (i) changed the company's image; (ii) opened up a new market to the company; (iii) platform to introduce further new products; (iv) positive impact on company's image.

It's one thing to think of a new opportunity, but another to make it work. The whole business must be managed appropriately to give the new idea a chance.

Establishing new markets, or pioneering, is difficult to achieve. Even if the business has a potentially superior product, the timing of market entry is recognised to be a strategic, qualitative decision as well as a tactical, quantitative one, which is subject to a substantial degree of variability. The strategic choice between pioneering and following competitors to market is largely a problem of balancing the advantages and disadvantages of being a pioneer or a follower. Although empirical evidence was not found in the NSD literature, a review of the relevant literature indicates that the first entrant into a market is likely to witness high returns if he is successful, but also to bear the risk of a lower likelihood of success than later entrants, i.e. the business is unsuccessful as a pioneer (Lilien & Yoon 1990; Biggadike 1976; Tufano 1992). Studies also indicate that the probability of a first-ranked business in a particular industry surviving in first place is about 96%, i.e. 'breaking the rules of the game' offers the potential for long-term success (Markides 1997). In recognising the relationship between market and product innovation, Robinson & Fornell (1985) found that market pioneers tend to have higher quality products, broader product lines, and stronger distribution supports. In the UK, BskyB's leadership role in the UK satellite and cable entertainment market was largely achieved through product differentiation and close control of the distribution mechanism.

5.5.1.3 CUSTOMER RESPONSIVENESS

The customer responsiveness dimension measures the ability of the business' NSD programme to retain existing customers (loading = 0.850), making the business more flexible in responding to client needs (loading = 0.753), and establishing the basis for long-term viability predicated on current client opportunities (loading = 0.518). The Cronbach alpha for the dimension (0.715) indicates it is a highly consistent measure. Such a measure of performance has been previously identified as an important underlying dimension of NSD success in the study by

Cooper et al. (1994)⁷⁷. The authors observed that “whereas financial performance may be the overriding measure of success for many managers, the fact that a new product (i.e. service) enhances the relationship with clients and/or aids the saleability of other company products to these clients may also be of prime concern” (p. 289).

In addition to opening up new market opportunities and winning new clients, it is important that a business manages, and cares for, its existing client base and ensures its NSD programme strives to meet the expectations of existing customers. The measurement of success from the perspective of the existing customer is not a new phenomenon (Sampson 1970), e.g. the services marketing literature has previously recognised the relationship between both customer retention and performance (Reicheld & Sasser 1990), customer retention and long-term business growth (Varadarajan & Berry 1983). When faced by competitors who were differentiating themselves in specialised and new growth markets, British Telecom grew its business through increasing the opportunities for existing customers.

5.5.2 The Relative Importance of the Performance Factors

So far, this research has identified the impact of individual performance measures on overall programme success, and factor analysis has demonstrated that there are three distinct dimensions to NSD performance, i.e. financial performance, customer responsiveness, and new opportunities. However, the relative importance of each of these measures has not been investigated. In order to do so, two further tests were conducted.

Firstly, multiple regression was employed to identify the nature of the relationship between the three performance dimensions (the independent variables) and the measure of ‘overall success’ (the dependent variable). The result of the regression analysis is significant (F value significant at the 0.000 level). The implication is

⁷⁷ The Cooper et al. (1994) dimension included: (i) increased customer loyalty; (ii) enhanced image with the customer; (iii) impact on other company products.

that 47.7% of the variance in the dependent variable is explained by the three independent variables (adjusted $R^2 = 0.432$). This is slightly lower than the results reported in similar success/failure studies (Storey & Easingwood 1998).

Secondly, correlations were computed between the three performance dimensions, 'overall success', and four other global performance measures/activities. The results are presented in Exhibit 5-9. The results illustrate that four of the five global measures of NSD performance correlate significantly, and highly, with all three performance factors.

	Overall Success ¹	Success Rate	Kill Rate	Business More Competitive	Success vs. Competition
New Opportunities	0.419***	0.290***	-0.107	0.567***	0.546***
Customer Responsiveness	0.584***	0.216**	-0.192*	0.520***	0.548***
Financial Performance	0.558***	0.382***	-0.268***	0.548***	0.748***
¹ Likert scale 1-7; ***. Correlation is significant at the 1% level; **. Correlations significant at the 5% level; *. Correlations significant at the 10% level.					

Exhibit 5-9: Correlations Between Performance Factors & Global Competitive Success Measures

Overall success in meeting NSD programme objectives is closely and highly correlated with all three performance dimensions ($r = 0.419$ & above; Sig.= 0.000). This indicates that service firms require a balanced set of performances for its NSD efforts.

The *success rate* of NSD programmes is correlated very highly, and significantly, with all three performance dimensions ($r = 0.290$ & above; Sig.= 0.000), indicating that the percentage of successful new services launched is closely related to a number of performance criteria, not just one. This would seem to suggest that success rate is an important measure of NSD performance.

Kill rate correlates negatively with all three performance dimensions, but the relationship is particularly significant with financial performance ($r = -0.268$; Sig.=

0.000). The implication is, therefore, that the more projects a service business kills-off before launch, the poorer the performance of the overall NSD programme will be. Killing projects before launch is likely to have a greater influence on the financial performance of the NSD programme. Interestingly, the relationship between kill rate and new opportunities was less significant, i.e. to create and establish new opportunities, the service business is less discouraged from allowing more new services to be released through to launch.

As one would expect, the correlation between the global competitive performance measures and the three performance dimensions was high and significant. That is, the business is more likely to increase its '*competitiveness in the market*' ($r = 0.520$ & above; Sig.= 0.000), and its '*relative performance against the competition*' ($r = 0.546$ and above; Sig.= 0.000) if it scored highly on the three performance dimensions.

5.6 Performance Clusters

The preceding analysis identified three performance dimensions underlying the dimensions of NSD programme success. The next stage was to explore whether there were any identifiable groups of NSD programmes which possessed similar, or dissimilar, performance characteristics. In doing so, the research sought to identify those service firms who were performing effectively across more than one performance dimension. To investigate this issue, cluster analysis was conducted using the three performance dimensions as the grouping criteria⁷⁸. The results of the cluster analysis indicate the presence of five quite distinct groups in the data. These are presented in Exhibit 5-10 and examined below.

⁷⁸ Ward's method. The number of clusters was based on interpretation.

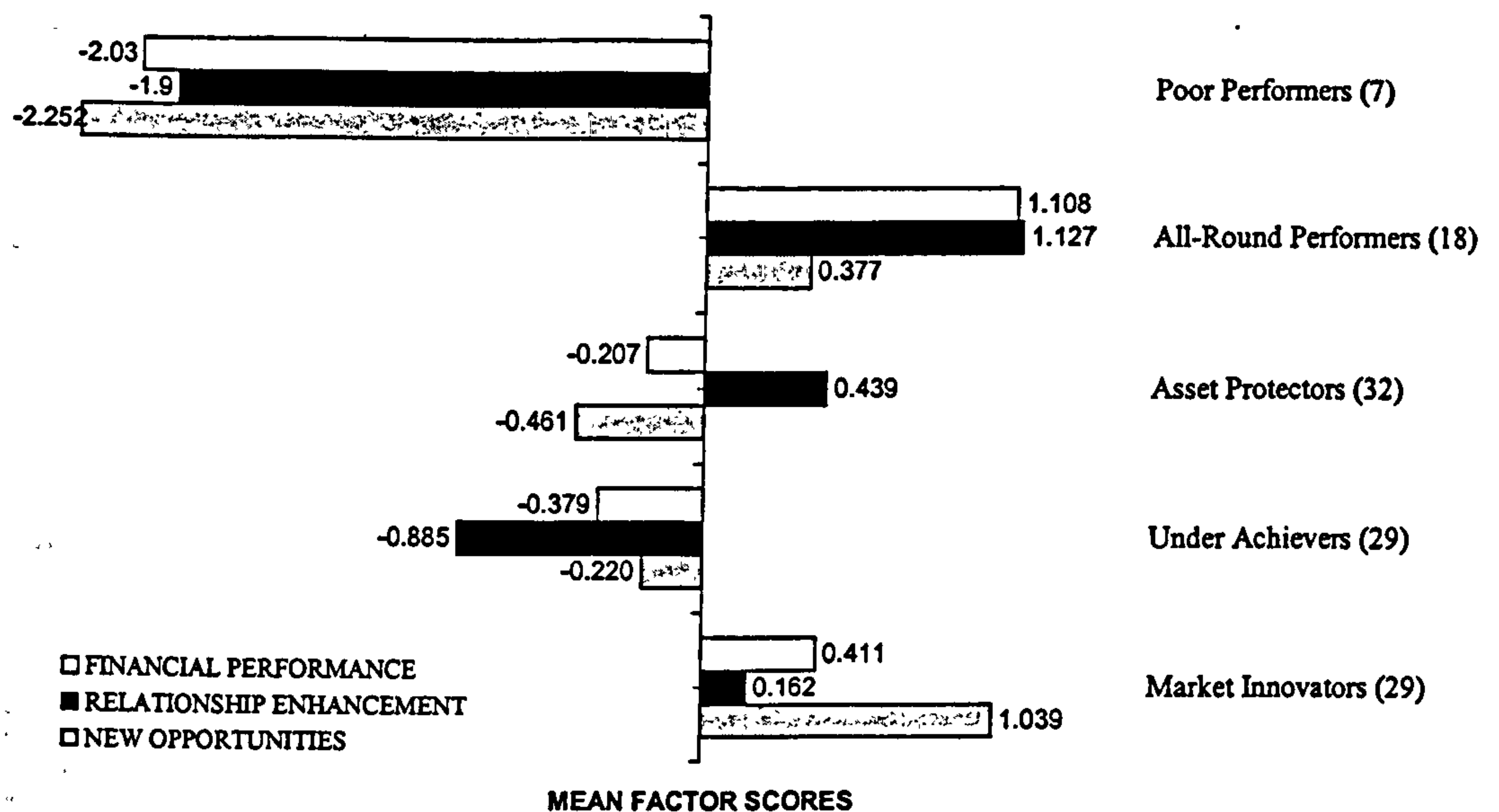


Exhibit 5-10: Types of Performers⁷⁹

To further qualify the performance characteristics of these groups, Exhibit 5-11 profiles each cluster against the five global NSD activity and performance measures.

All-Round Performers

All-round performers constitute the second smallest grouping with 18 cases (15.65% of the sample responses), and they comprise the most successful group of NSD programmes. In addition to achieving the highest average factor scores on two of the three performance dimensions: customer responsiveness ($\bar{x} = 1.127$); financial performance ($\bar{x} = 1.108$), all-round performers were more likely to be perceived by their managers to have largely met the overall objectives set for the NSD programme (i.e. $\bar{x} = 5.8$). Incredibly, 83.32% of the new services launched by all-round performers succeeded. They generated the second largest percentage of sales from new services introduced in the last three years ($\bar{x} = 35.56\%$), but did so most profitably, i.e. 41.33% of profits came from new services introduced in the

⁷⁹ New Opportunities (F = 58.691; Sig. = 0.000); Customer Responsiveness (F = 60.061; Sig. = 0.000); Financial Performance (F = 32.363; Sig. = 0.000).

last three years. These results indicate the existence of a small group of service firms who have identified a way of achieving both greater financial and non-financial success for their NSD programme.

	F- Values ³	MI ⁵ (29) ¹	UA (29)	AP (32)	ARP (18)	PP (7)
Performance Variable						
Overall success of business' NSD programme in meeting its performance objectives ² (115)	F = Sig.= 0.000	5.14 (1.06) ⁴	4.28 (0.84)	4.97 (1.26)	5.78 (0.73)	3.00 (1.00)
Percentage of new services which succeeded (92)	F = 2.404 Sig.= 0.056	75.20 (15.46)	73.20 (20.71)	74.93 (22.21)	83.32 (19.41)	51.66 (30.60)
The percentage of sales coming from new services introduced in the last 3 years (81)	F = 2.952 Sig.= 0.025	42.79 (32.90)	29.25 (31.06)	18.52 (22.03)	35.56 (25.91)	10.00 (7.07)
The percentage of profit coming from new services introduced in the last 3 years (80)	F = 2.571 Sig.= 0.045	36.83 (33.93)	28.21 (31.29)	17.33 (21.76)	41.33 (24.79)	8.20 (5.36)
¹ . Number of respondents in group; ² . Question measured on a 1 - 7 Likert scale ³ . One-way ANOVA statistic; ⁴ . Standard deviation; ⁵ . Initials relate to the names of the clusters.						

Exhibit 5-11: Performer Types and Programme Performance

Market Innovators

Along with the all-round performers, market innovators are the only strategic grouping which reported above average mean factor scores (relative to other factors) on all three performance dimensions. They are the second largest group of NSD programmes with 29 cases, comprising 25.21% of the sample of NSD programmes.

In comparison with the all-round performers, market innovators are relatively high achievers on the new opportunities dimension ($\bar{x} = 1.038$), but poorer performers on the dimensions of financial performance ($\bar{x} = 0.411$) and customer responsiveness ($\bar{x} = 0.162$). The grouping is distinctive in that 42.79% of its sales come from new

services introduced in the last three years, although the percentage of profits is somewhat lower at 36.83%. This may be indicative of a desire on the part of market innovators to penetrate and grow markets quickly, at the expense of potential short-term profits. Market innovators possess the second highest new service success rate ($\bar{x} = 75.20\%$), further suggesting a good understanding of market requirements.

Asset Protectors

Asset protectors particularly seek to protect their existing business from competitive pressures and forces. They are the largest grouping, comprising 27.8% of the sample.

Asset protectors achieved below average factor scores on new opportunities ($\bar{x} = -0.461$) and financial performance ($\bar{x} = -0.207$), but reported above average scores on customer responsiveness ($\bar{x} = 0.439$). While asset protectors receive only 18.5% of sales from new services introduced in the last three years, they are perceived to be relatively successful by their respondent managers ($\bar{x} = 5.0$). This could indicate the existence of a deliberate strategy which seeks to protect existing business by developing new services for existing markets and clients. Alternatively, one could argue that the presence of an under-performing management team⁸⁰.

Under Achievers

Under achievers are neither failing badly nor succeeding well. However, in relative terms, they are under-performing against their competition. They are the second largest grouping of the sample (along with the market innovators) with 29 cases, 25.21% of the sample.

While reporting below average factor scores on financial performance ($\bar{x} = -0.379$) and new opportunities ($\bar{x} = -0.220$), under achievers particularly under-performed on customer responsiveness ($\bar{x} = -0.895$). This indicates that the NSD programme is concurrently neglecting the needs of existing clients, failing to deliver new

⁸⁰ To answer this question, one would need to ascertain the objectives of the businesses in the grouping.

markets, new clients or financial returns to the overall business. Under achievers are characteristic in achieving performance levels a little below average on most measures, and above average on failure rate. The mean score of 4.28 for its performance against objectives, indicates that, in relative terms, the NSD programmes are not delivering on the goals that were established for them.

Poor Performers

Poor performers achieved significantly poor factor scores on financial performance ($\bar{x} = -2.03$), customer responsiveness ($\bar{x} = -1.9$) and new opportunities ($\bar{x} = -2.252$). They are the smallest grouping with only 7 cases, comprising only 6.09% of the sample responses⁸¹.

The mean score reported by managers for the 'overall success' confirms the interpretation of the performance of the poor performers as unsatisfactory ($\bar{x} = 3.00$). The groups' poor performance on new opportunities indicates that NSD programme performance is likely to get worse, rather than better.

5.7 Innovative Performance

In addition to exploring traditional measures of NSD performance (i.e. financial and non-financial as defined in the literature), this research sought to investigate the impact of 'innovativeness' on NSD programme performance. In doing so, innovativeness was defined in terms of: (i) the processes used to produce innovative new services, i.e. Fitzgerald et al. (1991) previously proposed that the performance of the development process itself should be employed as a success criteria; (ii) performance outcome, i.e. the production of an innovative new service⁸². A distinction has previously been drawn between measuring success of the development outcome and measuring the performance of the development process (Voss 1992).

⁸¹ Their small sampling needs to be considered when attributing meaning to the results.

⁸² At the programme level it is difficult to draw a distinction between the development of innovative new services, new processes and new markets, as elements of each are likely to be present in any new service.

The nature of the relationship between innovativeness and other types of performance is rarely measured (see Cooper & Kleinschmidt 1991), and never, to the author's knowledge, in a services context.

5.7.1 Innovative Performance Measures

To more closely define the nature of innovativeness in the NSD programmes sampled, a total of 5 measures of innovative processes and innovative outcomes were formulated as short statements, and respondents were required to evaluate the extent to which each statement applied to the business' NSD programme. This was measured on a 1 - 7 Likert scale, labelled either "strongly disagree" or "very unsuccessful" (1) and "strongly agree" or "very successful" (7). Exhibit 5-12 presents the average mean scores for all 5 performance measures.

Innovative Performance Measures ¹ (5) ²	Mean
<i>Innovative Process Measures</i>	
The business is good at idea generation	5.16
The business is good at commercialising new service ideas	4.52
Relative to the competition the business is faster at commercialising new service ideas	4.03
<i>Innovative Outcome Measures</i>	
Success developing innovative new services	5.19
Relative to the competition the business is perceived by customers to be innovative.	4.28
¹ Likert scale 1-7; ² Number of measures;	

Exhibit 5-12: NSD Innovative Performance and Performance Measures

The fact that the items measured both innovative *processes* and *outcomes*, is an important observation to make. A business may well possess very innovative internal processes but, for a number of reasons, that innovativeness may not result in the development of innovative new services which are attractive to customers, and/or satisfies customer needs or wants. When a business is developing an incremental new service, the choice of innovative approach is simplified because customers are typically known and their needs and wants can be more easily satisfied. This is less so with more radical new services.

The items which measured innovativeness were found to be all highly correlated with the measure for the 'overall success'. This would seem to indicate that an innovative new service (process and outcome) is also likely to be an overall success in terms of the objectives established for the business' NSD programme.

Innovative Process Measures

Previous research has indicated that although organisational creativity (personal and group) may produce the new service idea, it is the service business' innovative processes which implement the idea (Woodman et al. 1993). Innovative processes may therefore be defined as the ability of the service business to generate and commercialise an innovative idea *before* the competition. Failure to implement the idea would lead one to admire only the creativity of the business in generating the idea (supported by a supportive creative climate). This concept follows the findings of Cooper & Kleinschmidt (1991) who observed, in a study of tangible new products, a close relationship between NPD proficiency (process) and innovativeness (outcomes).

The results, presented in Exhibit 5-12, indicate the NSD programmes sampled are proficient at idea generation ($\bar{x} = 5.16$), commercialising new ideas ($\bar{x} = 4.52$). The speed at getting those services to market before their competition ($\bar{x} = 4.03$) was a little lower.

The increasing importance of being fast to market with new services is driven primarily by two competitive issues which are driving the search for more rapid development practices (Drew 1995b): (i) the sophistication of many service firms' NSD processes are continually improving; (ii) the 'window of opportunity' is decreasing as firms find it increasingly easy to copy competitive products quickly. Specifically, this research also indicates that service firms regard themselves as being relatively less successful at commercialising new ideas and bringing them to market quickly ($\bar{x} = 4.03$).

Innovative Outcome Measures

The innovative outcome variables indicates the success achieved by service firms in producing innovative new services, and the perception of a service business' customers as to the business' level of innovativeness.

While the mean scores indicate that service firms believe their NSD programmes to be successful in generating innovative new services ($\bar{x} = 5.19$), respondents also acknowledge that the perception of their customers is likely to be a little less generous ($\bar{x} = 4.28$). As this is a self-rated questionnaire, one must be wary in interpreting these results. However, one would not be surprised to find that the actual response of customers is a little lower, indicating a greater gap.

5.7.2 Innovative Performance Dimension

The five innovative process and outcome variables were input into a factor computation in order for them to be re-used at a later stage, with the other factors of NSD programme performance created, in further analysis when investigating the NKE. Although the inputs comprised a small number of measures, factor analysis was a convenient way to identify the correlations between the variables and the nature of any underlying dimensions. The production of a one-factor solution (no rotation) indicated the existence of a uni-dimensional factor solution.

Factor reliability was tested by assessing the degree of internal consistency between the variables in each factor. The factor produced, innovative performance, possessed a reliability coefficient of greater than 0.825, indicating that the 5 measures were highly consistent with each other. Exhibit 5-13 presents the results.

Factor	Factor Components	Factor Loading ²
Innovative Performance $\alpha = 0.825^1$	Relative to the competition the business is faster at commercialising new service ideas	0.822
	Relative to the competition the business is perceived by customers to be innovative	0.809
	The business is good at idea generation	0.740
	The business is good at commercialising new service ideas	0.733
	Success developing innovative new services	0.726
Note: Factor analysis used Principle components (PCA); KMO = 0.809; Bartlett Test of Sphericity = 193.130 (Sig. 0.000). ¹ Cronbach alpha reliability measure. ² Loading of variable on factor.		

Exhibit 5-13: NSD Programme Innovative Performance Dimension

The innovative performance dimension measures the service business' success in establishing innovative processes and outcomes within the NSD programme. In addition to gauging the extent to which the business (loading = 0.726) and its customers perceive the NSD programme to be innovative (loading = 0.809), the innovative performance dimension indicates that the business is good at generating ideas for new services (loading = 0.740), commercialising them (loading = 0.733), and delivering them to market quickly (loading = 0.822). With a Cronbach Alpha of 0.825, the innovative performance dimension would seem to endorse its use as a measure in assessing a business' innovative performance in the context of a NSD programme. This measure could therefore be used to complement traditional measures of financial and non-financial performance.

5.7.3 Innovativeness & NSD Programme Performance

The research sought to identify the nature of the relationship between innovativeness and other types of success measures in the NSD programmes sampled.

Q2: Are innovative NSD programmes more successful on other performance measures than less innovative NSD programmes?

Having defined innovativeness in the previous section as a dimension, the 115 NSD programmes were subsequently classified into three groups using the innovative performance dimension as the grouping criteria (the variable was recoded into three equal groups - the size of membership of the three groups was determined by interpreting the cumulative percentages from the frequency tables for 'innovative performance'). Innovative performance was used as the categorisation factor because it was hoped that the resultant groups would clearly highlight differences in innovativeness across the NSD programmes sampled. Three categories of innovative NSD programme were identified: (i) low innovativeness programmes ($\bar{x} = -1.099$; Sig.= 0.000); (ii) moderately innovative programmes ($\bar{x} = 0.002$; Sig.= 0.000); (iii) highly innovative programmes ($\bar{x} = 1.125$; Sig.= 0.000). The three groupings were then profiled against other financial and non-financial performance measures to ascertain their financial and non-financial performance characteristics. The results are presented in Exhibit 5-14.

		Innovative Clusters		
Performance Measure	F-Value ³	Low (39) ⁴	Moderate (38)	Highly (38)
Overall Success of NSD programme in meeting its performance objective ¹ (115)	F = 14.084 Sig.= 0.000	4.18	4.87	5.50
New Opportunities ² (115)	F = 16.214 Sig.= 0.000	-0.622	0.130	0.508
Customer Responsiveness ² (115)	F = 13.235 Sig.= 0.000	-0.557	0.072	0.499
Financial Performance ² (115)	F = 20.640 Sig.= 0.000	-0.618	-0.110	0.644
Percentage of new services which succeeded (92)	n/s	68.95	75.74	78.04
The percentage of sales coming from new services introduced in the last 3 years (81)	F = 7.025 Sig.= 0.002	19.69	26.42	46.83
The percentage of profit coming from new services introduced in the last 3 years (80)	F = 4.337 Sig.= 0.016	18.69	26.42	40.83

¹ Likert scale 1-7; ² Factor scores; ³ One-way ANOVA statistic; ⁴ Number of cases in grouping;

Exhibit 5-14: NSD Innovativeness and NSD Programme Performance

The results would seem to confirm that a service business' NSD programme which possesses high relative innovative performance, is likely to be successful on other financial and non-financial dimensions. Such NSD programmes are likely to: (i) be significantly more profitable; (ii) contribute significantly much greater sales to the business; (iii); significantly satisfy existing clients more; (iv) provide significantly greater opportunities for the business in new markets.

These results support the observations of de Brentani (1989) who found that new services need to be unique and truly innovative in order to achieve major advantage in the marketplace. Similarly, Deshpande et al. (1993) found that organisational innovativeness is positively related to business performance. New services can be easily imitated, and unless they are clearly differentiated, it is likely that customers will tend to view them as generic, and base their decision to purchase using other criteria, e.g. price. The uniqueness of truly innovative new services was observed by Booz et al. (1982) in their study which concluded that the most innovative new products represented only 30% of the introductions, but 60% of the 'most successful new products' (no service classification was included in the Booz et al. Survey).

5.8 Control Measures

The final step in analysing the performance data was to explore the impact of external environmental turbulence, industrial setting and business size on the performance of service firms' NSD programmes. In investigating the performance characteristics of the NSD programmes under varying degrees of change in each of these environments, the sensitivity to performance changes could be analysed.

5.8.1 Impact of External Environmental Turbulence on NSD Programme Performance

To explore the extent to which the performance of a service business' NSD programme is moderated by the affects of external environmental turbulence, respondents were initially required to evaluate the degree to which technology and customer preferences were changing in the market in which their NSD programme

operated. The questions were measured on a 1 - 7 Likert scale, labelled "strongly disagree" (1) and "strongly agree" (7). Questions have often been used in academic research to gauge the degree of change taking place in the external environment (Moorman & Miner 1997; Jaworski & Kohli 1993).

5.8.1.1 DEGREE OF EXTERNAL ENVIRONMENTAL TURBULENCE

Exhibit 5-15 presents the results of the mean scores for external technological and market turbulence.

Factor ¹	Standard Deviation	Mean Score
It is very difficult to forecast where the technology will be in the next five years (115) ²	1.80	4.9
A large number of new service ideas have been made possible through technological breakthroughs (115)	1.58	5.1
Customer's service preferences change quite a lot over time (115)	1.51	4.8
Customers tend to look for new services all the time (115)	1.41	4.6
¹ Measured on a Likert 1 - 7 scale; ² Number of cases;		

Exhibit 5-15: Mean Scores of External Turbulence

The results indicate that most respondents perceived their NSD programme to be operating in a highly turbulent external environment. Their perception was that it is difficult to forecast where technology will be in five years ($\bar{x} = 4.9$), but that new services had been made possible because of technological breakthroughs ($\bar{x} = 5.1$). Similarly, respondents believed that their customers' preferences were changing rapidly ($\bar{x} = 4.8$), and that they tended to look for new services all the time ($\bar{x} = 4.6$).

5.8.1.2 IMPACT OF EXTERNAL TURBULENCE ON PERFORMANCE

The responses to the four turbulence questions were used to cluster the 115 cases into two groupings: (i) those experiencing high levels of external environmental

turbulence; (ii) those experiencing low levels of turbulence⁸³. A two-cluster solution was identified in the data. Both groupings were then profiled by the measure of 'overall success'. The results, presented in Exhibit 5-16, highlight that NSD programmes operating in more turbulent environments outperform those operating in less turbulent environments. The difference in overall success was significant ($t = 1.740$; $\text{Sig.} = 0.085$).

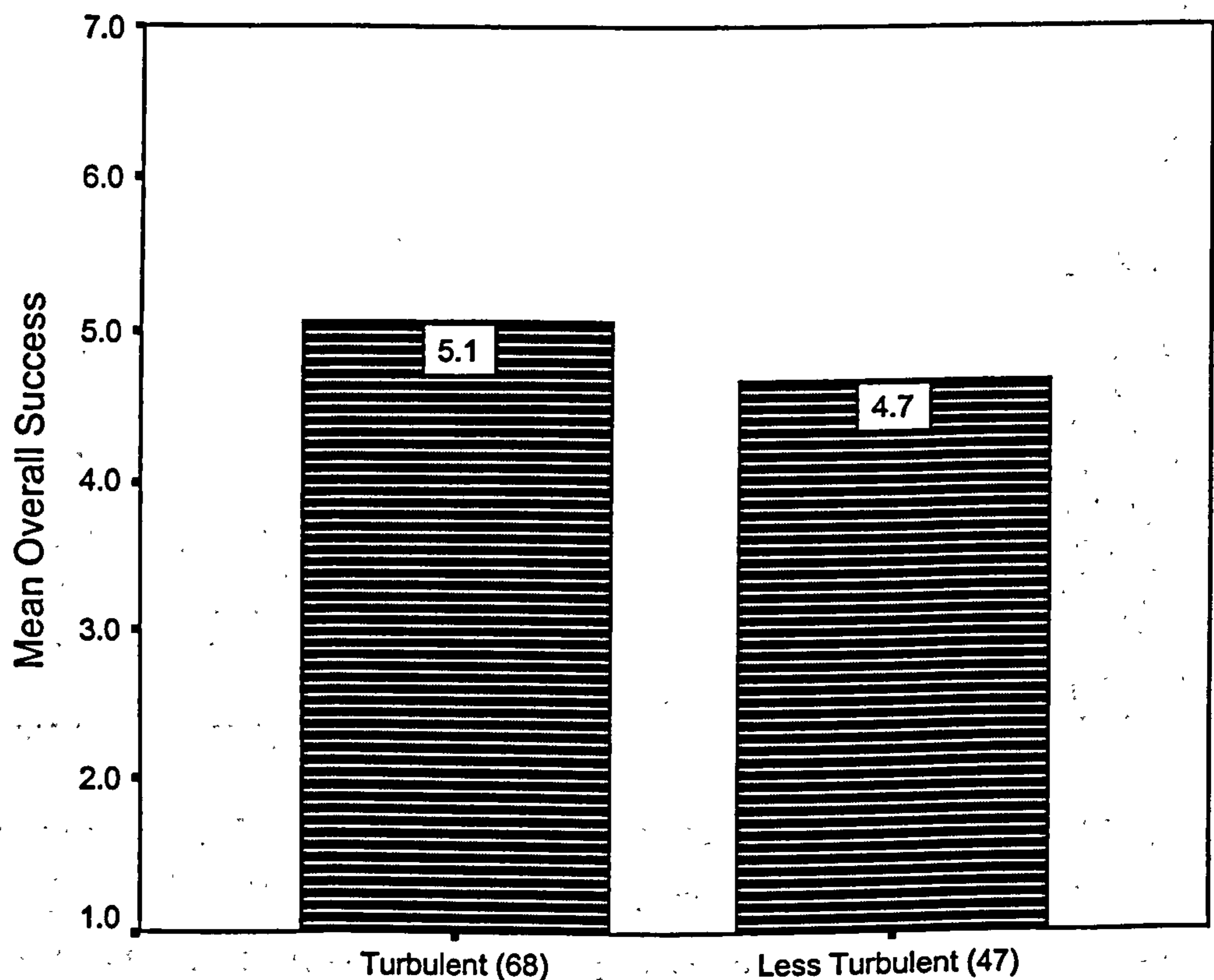


Exhibit 5-16: Impact of External Turbulence on NSD Performance

The implication is that as external markets and technologies change, more opportunities to develop new services emerge. In less volatile external environments, it may be difficult for service firms to differentiate their offerings

⁸³ Ward's method. The number of clusters selected to produce the largest possible different in coefficients.

from those of their competition, and the pressure on profits is therefore greater. For NSD programmes operating in more turbulent external environments, the mean profit level from new services introduced in the last three years was 33.86%, whereas the profit in NSD programmes operating in less turbulent external environments was 16.84 (sig. = 0.010). In the next chapter, the extent to which the internal environment has an impact on translating, and effectively processing, the external signals is evaluated ⁸⁴.

5.8.2 Performance & Industrial Setting

The performance data was additionally explored to determine whether there were any significant differences in the performance achieved by NSD programmes from different industrial markets. Although the results indicated there were variations in the performance of NSD programmes across the different industrial markets (overall success, new opportunities, customer responsiveness, financial performance, and innovative performance), none of the differences were statistically significant. This supports the observations of previous research. Easingwood (1986) found no differences in NSD between the consumer and business/industrial service sectors he surveyed, and Cooper (1982) identified that none of the various measures of new product performance adopted were strongly related to the industrial setting. The results of this survey are therefore not reported.

5.8.3 Performance & Business Size

The data was additionally explored to determine whether there were any significant differences in the performances of NSD programmes across different sized firms. The results are presented in Exhibit 5-17.

⁸⁴ Nonaka (1988b) suggested that an organisation placed in a context of rapid environmental changes can improve its success with new products if the influx of problems and solutions (from the external environment) is activated and participants who can lead problems into solutions exist

Performance Measure	F- Values ³	>£ 1 Billion (34) ¹	£ 251 Million - £ 1 Billion (33)	<£ 250 Million (48)
Overall Success	F = 3.408 Sig.= 0.037	5.09 ⁴	4.39 ²	4.98
New Opportunities	n/s	-0.148 ²	-0.010	0.173
Customer Responsiveness	F = 5.495 Sig.= 0.005	0.326	-0.438	0.070
Financial Performance	F = 5.015 Sig.= 0.008	0.091	-0.439	0.237
Innovative Performance	n/s	0.035	-0.161	0.086
¹ Number of respondents in group; ² Factor scores with mean value = 0; ³ One-way ANOVA statistic; ⁴ 1 - 7 Likert scale;				

Exhibit 5-17: Business Size & Programme Performance

Kerssens-van Drongelen & de Weerd-Nederhof (1998) previously identified that larger firms have more formal measurement procedures than do smaller organisations. Although 'formality' was not tested for in this research, differences were indeed found in the characteristics of performance *outcomes* in firms of varying sizes.

In general, management observers frequently claim that smaller firms are more innovative than larger ones (Quinn 1985), and operate more sophisticated marketing activities (Colgate 1998). It has been posited that this may be due to: (i) the risks associated with failure are higher in larger firms, i.e. jeopardising the other projects, jobs, products and communities which the business supports; (ii) big firms face costs that newcomers do not bear, like converting existing operations and customer bases to the new solution (i.e. the cultural dimension); (iii) new firms do not face the psychological pain and the economic costs of laying off employees and shutting down existing operations which were built-up over many years. But is this commonplace necessarily true?

The results of this research imply the existence of a U-shaped relationship between business size and NSD programme performance. The indication is that the largest firms with the greatest resources, or the smallest firms with a tendency to operate more closely to the market (Crane 1993), are the most successful at NSD. The largest service firms reported both the highest scores for overall

success ($\bar{x} = 5.09$) and the greatest factor scores for customer responsiveness ($\bar{x} = 0.326$). The smallest-sized firms reported the highest factor scores for financial performance ($\bar{x} = 0.237$). Conversely, medium-sized firms achieved the lowest scores for overall success ($\bar{x} = 4.39$), customer responsiveness ($\bar{x} = -0.438$), and financial performance ($\bar{x} = -0.439$). Viewed from a different perspective, one may suggest that overall success and customer responsiveness is greatest with the largest firms, whilst financial performance is highest with the smallest service firms.

The implication is that smaller service firms have to focus on particular market, technology or product domains and, in doing so, are therefore better able to concentrate their more limited resources on achieving sales and profits goals. Conversely, the greater resources of the largest service firms may be allocated to managing the existing client business more effectively (obviously existing customers are a key asset of the larger business). This supports the findings Ettlie & Rubenstein (1987) who hypothesised that size had an indirect impact on NSD success.

Appendix K addresses the issue of business size in more detail.

5.9 Conclusions

The service firms sampled in this research release an average of six new services per year, which is slightly higher than the figures reported by previous studies. However, the findings also indicate the extent to which UK service firms are active in the development of new services. The mean failure rate of approximately 26% is higher than that reported by similar studies, suggesting that competition is getting increasingly fierce.

The importance of NSD to UK service firms is unquestionable. Nearly 30% of the sales and over 27% of the profits of UK service business' in this research originate from new services launched in the previous three years, and respondents universally agreed that their NSD programme has been successful in making the business more competitive. The contribution of new services is higher than that

reported by similar studies and, in many instances, is higher than the figure reported by previous tangible product development research. However, as competition in the services sector increases, and external market and technological turbulence becomes more volatile, it is to be anticipated that this trend will be maintained, and may even intensify. For example, during the late 1990s, the UK services sector has been increasing as a percentage of GDP, and the Internet is making many previous products and distribution channels obsolete.

Three dimensions of NSD programme performance were identified in the research: (i) financial performance indicates the success of the NSD programme in achieving sales and profits; (ii) new opportunities identifies the success of the NSD programme in innovating in markets; (iii) customer responsiveness measures the ability of the business to retain existing customers. All three dimensions are closely correlated with the overall success of the NSD programme in meeting its performance objectives, success rate, kill rate, and making the business more competitive.

Five clusters of NSD programmes were distinguishable in the data: (i) all-round performers performed well above average on all three performance dimensions; (ii) market innovators were particularly successful in establishing new markets and winning new clients; (iii) asset protectors sought to protect their "turf"; (iv/v) while underachievers returned below average scores on all three performance dimensions, poor performers were significantly outperformed by all other clusters.

The research also identified a multi-dimensional concept of innovativeness, comprising both measures of innovative outcomes and innovative processes. Significantly, it was identified that the more innovative NSD programmes were more successful on many other performance dimensions (financial and non-financial) than their counterparts, i.e. innovative NSD programmes were more successful than their competition on all three performance dimensions, as well as having a very high percentage of sales and profits originating from new services introduced in the last three years.

It was found that most service firms are operating in highly turbulent external environments (market and technology). However, those operating in relatively

higher turbulent environments are likely to be significantly more profitable than those operating in relatively less turbulent environments. Statistically, industrial setting was found to have little impact on the performance of the NSD programmes of UK service firms, and a U-shaped relationship was identified between business size and NSD programme performance.

6 NSD KNOWLEDGE ENVIRONMENT (NKE) DIMENSIONS

This is the second of the three chapters which describe and analyse the results of this thesis. In the previous chapter, four dimensions of NSD programme performance were identified: (i) financial performance; (ii) new opportunities; (iii) customer responsiveness; (iv) innovative performance.

6.1 Introduction to the Results on the NKE

In this chapter, the specific research questions raised in relation to the internal environment (i.e. the NKE) are resolved in light of the data collected. Factor analysis is employed to distinguish the significant underlying dimensions of the NKE, multiple regression is used to determine the relative impact of those dimensions on NSD performance, and cluster analysis is adopted as the method by which groups of NSD programmes which possess similar NKE characteristics are identified.

The key research contributions made by the results of this chapter are in: (i) confirming the existence of relationships between the variables of the NKE and indicating the strength of those relationships; (ii) demonstrating the strength of the relationship between the variables of the NKE and NSD programme performance.

In this chapter, the interrelationships between different components of the NKE are explored and, in doing so, specific research questions raised in relation to the NKE are resolved in the light of the data collected. The primary research questions addressed in this chapter are:

Q1a: Which internal organisational variables comprise the NSD Knowledge Environment (NKE)?

Q1b: What is the impact of the NKE on the performance of the NSD programme?

A secondary question related to the impact of the NKE on NSD programme performance was also addressed:

Q1c: What is the impact of the NKE on the innovativeness of the NSD programme?

6.2 Exploring The Dimensions of the NKE

Each new service development generally begins with a coarse, information-poor format and gradually evolves to a detailed, information-rich format. Information, interpreted at each stage of the NSD process, is the raw material used to generate the new personal and collective technical, organisational and commercial knowledge and expertise required to execute the NSD project (Wheelwright & Clark 1992). In this way, NSD may be regarded as an important knowledge management process.

In adopting a knowledge-based view of the firm, a notion of the NKE was created to conceptualise the grouping of the variables comprising the service business' internal environment which support, or hinder, knowledge management activity during NSD. In this way, the NKE was thought to influence the way in which knowledge: (i) was managed during a single NSD project; (ii) was made available to the NSD programme as a whole. In pursuing this line of thinking, it was hypothesised that the NKE directly, or indirectly, impacted the performance of the service business' NSD programme.

6.2.1 Internal Organisational Variables Input into the Factor Analysis

Eighty-three variables, reflecting the characteristics of a service business' internal environment which impact knowledge management activity, were used to conceptualise the NKE. The variables were selected from both the literature review and the topic guide interviews. Appendix L presents a list of all these variables and their associated mean values. Although the impact of the internal environment on NSD performance has been investigated in previous research, this

is the first time such a concept has been operationalised, and empirically tested, within a model exploring NSD as a knowledge management activity.

6.2.2 The Underlying NKE Variables Found in the Data

Although data was collected on the eighty-three variables thought to comprise the NKE, it was anticipated that each variable would influence knowledge activity and therefore NSD performance, in different ways, and to different degrees. Exploratory factor analysis was therefore used to explore the underlying dimensions of the NKE. The research question posed was:

Q1a: Which internal organisational variables comprise the NSD Knowledge Environment (NKE)?

Sixty of the eighty-three variables were entered into a factor computation. This produced a nine factor solution. The remaining 23 variables were found to either not measure the same phenomenon (e.g. the variables associated with NSD structures) or they did not employ ratio scales to collect the data (e.g. presence of formal strategies was dichotomous). The latter are investigated later in this chapter. The variables excluded from the analysis are presented in Appendix M.

A reliability test was used to assess the degree to which the variables in each of the factors produced exhibited high levels of internal consistency, thus indicating that they measured the same phenomenon. Eight of the nine factors were found to have coefficients of greater than 0.75, indicating good reliability. The results are presented in Exhibit 6-1. Each of the NKE factors comprised variables from more than one of the elements of the McKinsey "happy atom". The nine factors are now profiled.

Factor ¹	Factor Components	Factor Loading ²
Climate of Learning $\alpha = 0.913^3$	The basic values include learning as key to improvement Staff and management basically agree that the ability to learn is key to its competitive advantage Learning is seen as a key process necessary for guaranteeing organisational survival	0.840 0.802 0.784
Creative Climate $\alpha = 0.868$	Managers encourage staff to experiment in order to improve the NSD process No matter what function they are in, staff get recognised for contributing task knowledge to the NSD process, e.g. ideas New staff and management are encouraged to question the way NSD is carried out Staff and management are not afraid to question the assumptions made about its customers Innovative ideas that work are often rewarded by management, irrespective of the source Front line staff are actively encouraged to contribute ideas to the NSD process	0.608 0.552 0.534 0.552 0.449 0.439
NSD Knowledge Depth $\alpha = 0.866$	Compared to other firms this business has a great deal of practical experience in implementing NSD tasks and activities Compared to other firms this business has invested more time and money in its NSD task knowledge Compared to other firms this business has greater knowledge of NSD tasks and activities	0.797 0.737 0.615
Entrepreneurial Climate $\alpha = 0.836$	The head of the business is an entrepreneur, an innovator, or a risk-taker The business is dynamic & entrepreneurial. Staff and management are willing to stick their necks out and take risks The glue that holds the business together is a commitment to innovation. There is an emphasis on being first	0.827 0.670 0.619
Collaborative Climate $\alpha = 0.831$	Organisational problems are solved by teams drawn from various departments Co-operation between departments is very high There are high levels of communication in different directions between staff and management at all levels.	0.846 0.790 0.673

Factor	Factor Components	Factor Loading
Goal Climate $\alpha = 0.810$	There is total agreement on the business vision across all levels, functions, and divisions. There is a commonality of purpose Staff and management involve themselves as “associates” in charting future business direction	0.827 0.574 0.533
Effective NSD Memory $\alpha = 0.797$	GroupWare systems are used to store task knowledge for subsequent use on other NSD projects. Intranets are used to store task knowledge for subsequent use on other NSD projects. Expert systems are used to store task knowledge for subsequent use on other NSD projects. NSD task knowledge is generally ‘stored’ as new processes and routines immediately after project completion.	0.888 0.757 0.606 0.565
Personal Interaction Mechanism $\alpha = 0.775$	Scheduled one-to-one face-to-face meetings are used extensively to transfer ideas between staff and management. Impromptu one-to-one phone mechanisms are used extensively to transfer ideas between staff and management. Impromptu face-to-face meetings are used extensively to transfer ideas between staff and management.	0.840 0.679 0.696
NSD Knowledge Dispersion $\alpha = 0.675$	Staff involved in NSD projects spend time discussing how best to carry out particular NSD tasks. There is a high consensus on the best method of executing NSD tasks among staff involved in the development of new services. Formal procedures exist for documenting the lessons learned from completed NSD projects.	0.811 0.632 0.471
¹ Factors sorted by value of Cronbach alpha; ² Loading of variable on factor; ³ Reliability coefficient (α) for each factor Note: KMO = 0.879; Bartlett Test of Sphericity = 2519.549, Sig. 0.000.		

Exhibit 6-1: The Nine NKE Dimensions Produced by Factor Analysis

6.2.2.1 NSD KNOWLEDGE DEPTH

The NSD knowledge depth dimension comprises three variables which indicate the depth of the knowledge and expertise which exists in the service business to execute the steps nominally conceptualised to constitute a NSD process. It comprises: (i) practical experience in implementing the NSD process (loading =

0.797); (ii) more time and money has been invested in NSD knowledge (loading = 0.737); (iii) greater knowledge of NSD tasks and activities (loading = 0.615).

While the NSD knowledge depth dimension distinguishes the *depth* of the knowledge the service business has available to execute the NSD process, NSD *proficiency* measures the extent to which the service business has applied that knowledge in NSD projects (through a series of activities) comprising the NSD programme. Service firms scoring highly on the NSD knowledge depth dimension are likely to possess a great deal of knowledge about implementing NSD projects.

A service business may have developed a deep reservoir of NSD knowledge through the implementation of a diverse selection of organisational actions, e.g. training programmes, development of a knowledge sharing culture, establishment of supportive organisational systems, encouragement of job rotations, targeted recruitment programmes.

6.2.2.2 NSD KNOWLEDGE DISPERSION

The NSD knowledge dispersion dimension comprises three variable which measure the extent to which NSD knowledge is shared broadly across the service business. It comprises: (i) staff discuss how best to carry out particular NSD tasks (loading = 0.811); (ii) there is a high degree of consensus on the best method of executing the NSD process (loading = 0.632); (iii) formal procedures exist for documenting the lessons learned from completed NSD projects (loading = 0.471). A service business scoring highly on NSD knowledge dispersion would be likely to possess staff who regularly share insights on, and agree on the best methods of, executing the activities comprising the NSD process.

For learning to be more than a single project affair, NSD knowledge must spread quickly and efficiently throughout the business (Garvin 1993)⁸⁵. NSD knowledge, and ideas related to the improvement of that knowledge, will carry maximum

⁸⁵ Unless it is assumed that the same people implement all the projects in the NSD programmes (an unlikely circumstance).

impact when shared broadly rather than retained in fewer hands. In fact, some firms have been observed to make knowledge-related employee behaviour a specific, and measurable, target of their projects⁸⁶. If such behaviour is to be promoted, service firms must be encouraged to develop management and technical systems which enable staff to learn from others, from past failures and from other firms, e.g. business tours, staff transfers, education and training (Garvin 1993; Shaw & Perkins 1991; Pedler, Boydell & Burgoyne 1989; Goh and Richards 1997).

Fahey & Prusak (1998) found that many firms now document their "best practices" as a means of encapsulating knowledge at work, and disseminate such descriptions and results to a wide range of potential internal users. However, the authors also recognise the need to track and monitor improvement and innovations in each best practice as it is applied and enhanced by various groups.

A culture which promotes and facilitates discussion and creative dialogue among NSD among staff and management, regardless of hierarchical position, permits a long-lasting 'creation of fluctuation', which allows free-wheeling dialogues which are the chief bases for effective strategy formulation and decision-making (Nonaka 1988b).

6.2.2.3 PERSONAL INTERACTION MECHANISM

Following the discussions above, the personal interaction mechanism dimension measures the extent to which individuals in the service business exchange ideas and personal knowledge using particular methods. The most important dimensions identified from the research comprise: (i) scheduled one-to-one face-to-face meetings (loading = 0.840); (ii) impromptu one-to-one telephone (loading 0.670); (iii) impromptu face-to-face meetings (loading = 0.696). Service firms with NSD programmes scoring highly on the personal interaction mechanism dimension are

⁸⁶ This behaviour was observed in the topic guide interviews.

likely to possess staff and management who regularly adopt more *personal* methods to effectively transfer ideas and personal knowledge⁸⁷.

Conceptualisation of a personal interaction mechanism follows the work of Kahn (1996) who distinguished between interaction and collaboration. Kahn defined interaction as a transactional mechanism which encourages greater information flow, i.e. within the business, while collaboration was regarded as a philosophy of continuous relations, where there is an emphasis on the strategic alignment of departments through a shared vision, collective goals, and an accent on informal organising structures.

6.2.2.4 EFFECTIVE NSD MEMORY

The effective NSD memory dimension comprises four variables which identify the most important methods employed by service firms to store NSD knowledge effectively for use on subsequent projects. The methods included in the dimension are: (i) GroupWare (loading = 0.888); (ii) intranets (loading = 0.757); (iii) expert systems (loading = 0.606); (iv) storing NSD knowledge as processes (loading = 0.565).

A service business which scores highly on the effective NSD memory dimension is likely to store the NSD knowledge required to execute the activities of a NSD project in a form which makes it more easily retrievable by staff and management working on parallel or subsequent NSD projects. It is important that the method of storage does not result in the loss of significant meaning as a consequence of abstracting the original knowledge⁸⁸.

⁸⁷ Because these items were identified as one factor in the data, service businesses scoring highly on this dimension are more likely to use all of these three mechanisms, or none of them.

⁸⁸ Because these items were identified as one factor in the data, service businesses scoring highly on this dimension are more likely to use all of these three mechanisms, or none of them.

6.2.2.5 CLIMATE OF LEARNING

The climate of learning dimension comprises three variables which constitute a strong measure of the nature of the learning orientation of the business. This is then likely to impact upon the learning climate in the NSD programme. The dimension identifies the extent to which both staff and management: (i) recognise that learning constitutes a key value of the business (loading = 0.840); (ii) are in agreement that the ability to learn is key to competitive advantage (loading = 0.802); (iii) understand that learning is key for guaranteeing organisational survival (loading = 0.784).

The identification of such a dimension supports the findings of Sinkula et al. (1997) who asserted that commitment to learning is routinely associated with the predisposition of a business to learn⁸⁹. Service firms scoring highly on climate of learning may therefore be posited to possess a strong commitment to fostering learning within the NSD programme.

6.2.2.6 CREATIVE CLIMATE

The creative climate dimension comprises six variables which indicate the characteristics of the creative climate existing in the service business. The six variables are: (i) managers encourage staff to *experiment* in order to improve the NSD process (loading = 0.608); (ii) staff get *recognised* for contributing NSD knowledge and ideas to the NSD process (loading = 0.552); (iii) new staff and management are encouraged to *question* the way NSD is carried out (loading = 0.552); (iv) staff and management are not afraid to *question* their assumptions about customers (loading = 0.552); (v) front line staff are encouraged to *contribute* ideas to the NSD process (loading = 0.439); (vi) innovative ideas are *rewarded* (loading = 0.449). Service firms scoring highly on the creative climate dimension are likely to possess an internal environment which is very supportive of generating new ideas for the improvement of NSD knowledge.

⁸⁹ Along with open-mindedness and shared vision.

The planning, development and realisation of new services involves a number of tasks that call for creative solutions (Geschka 1983). Ideas are not only required to identify an exciting and unique concept for a new service, they are vital for all stages of the development process. Andrews & Smith (1996) have previously observed that meaningful differentiation is facilitated by the ongoing development of creative marketing programmes.

6.2.2.7 ENTREPRENEURIAL CLIMATE

The entrepreneurial climate dimension identifies the extent to which a service business has developed "a commitment to the systematic practice of innovation" which produces a successful output (Drucker 1985). The dimension comprises three variables: (i) the head of the business is an entrepreneur (loading = 0.827); (ii) the business is dynamic and entrepreneurial (loading = 0.670); (iii) the glue which holds the business together is a commitment to innovation (loading = 0.619).

Entrepreneurial spirit is crucial to any innovation strategy. However, it is likely that management will face a major challenge in fostering, supporting, and constantly reinforcing entrepreneurial action (MacMillan & McCaffrey 1984).

It is important to recognise that the entrepreneurial climate dimension differs from the creative climate dimension identified previously. Whilst the presence of a supportive creative climate indicates the existence of organisational supports to encourage creative behaviour, entrepreneurial climate measures the extent to which motivation and commitment exists to transform creative ideas into new services. Staff and management draw from an entrepreneurial climate to bring new ideas to fruition, i.e. to innovate.

Service firms scoring highly on the entrepreneurial climate dimension are likely to possess staff and management who perceive themselves to be operating in an environment where they are expected and encouraged to support, and engage in, innovative behaviour. Service firms may instigate a number of activities to achieve integration of idea development and innovative behaviour, e.g. idea tracking systems, rewards and incentives, self-managing development teams. The problem, as identified by previous research, is usually is not a lack of tactics or

ideas, but a lack of will to put the tactics into practice, i.e. Markides (1998) defines this as entrepreneurship.

6.2.2.8 COLLABORATIVE CLIMATE

The collaborative climate dimension comprises three variables which indicate the extent to which staff and management in a service business work together collaboratively during a NSD programme. The three variables are: (i) organisational problems are solved by teams drawn across departments (loading = 0.846); (ii) co-operation between departments is very high (loading = 0.790); (iii) there are high levels of communication in all directions (loading = 0.673). A service business scoring highly on the collaborative climate dimension would be one which is characteristic of co-operation, not competition.

To drive the process of change in a service business, and to encourage continuous innovation, the new knowledge created during a single NSD project needs to be diffused across the entire NSD programme. For such diffusion to take place, staff and management from different constituent units should be provided with the freedom to communicate, to generate creative conflicts, and to maintain an expanded possibility to take in chance information (Nonaka 1988b). The lever for collaboration may be the use of teams drawn from different organisational units.

The collaborative climate dimension follows the work of Kahn (1996) who defines collaboration as a philosophy of continuous relations, where there is an emphasis on the strategic alignment of departments through a shared vision, collective goals, and an accent on informal organising structures.

6.2.2.9 GOAL CLIMATE

The goal climate dimension comprises three variables which identify: (i) the extent to which there is total agreement on the business vision across all levels of the organisation (loading = 0.827); (ii) there is a commonality of purpose in the business (loading 0.574); (iii) that staff and management involve themselves as 'associates' in charting future business direction (loading = 0.533). The shared vision

and collective goals one would expect to find in a collaborative relationship are measured in the goal climate factor. A service business scoring highly on the goal climate dimension is likely to possess a NSD programme with a high degree of collective agreement on business strategy.

If there is a strong consensus among organisational members regarding the mission of the business, how to achieve it, and how to interpret external environmental signals, one can regard the business as a 'tightly coupled' knowledge structure (Lyles & Schwenk 1992), i.e. there are low levels of variability in the goals pursued by staff and management. However, it is important that the goal climate does not become so tightly coupled that it becomes difficult for the business to remain sensitive to changes that may take place outside of their jointly held assumptions, i.e. to prevent core knowledge sets become core rigidities (Leonard-Barton 1992a).

6.3 NKE and NSD Programme Performance

The thesis sought to determine the nature of the relationship between the NKE and NSD programme performance. The research question posed was:

Q1b: What is the impact of the NKE on the performance of the NSD programme?

To determine the strength of the relationship between the nine NKE dimensions and the performance of the NSD programme, correlations were computed between the NKE dimensions and the main performance measures, i.e. three primary performance dimensions and the measure of overall success. The results are presented in Exhibits 6-2 and 6-3, and the relationships are then reviewed in the subsequent text.

NKE Dimension	Overall Success ¹
NSD Knowledge Depth	0.450 ^{***}
NSD Knowledge Dispersion	0.364 ^{***}
Effective NSD Memory	0.133
Personal Interaction Mechanism	0.215 ^{***}
Climate of Learning	0.267 ^{***}
Creative Climate	0.249 ^{***}
Entrepreneurial Climate	0.388 ^{***}
Collaborative Climate	0.375 ^{***}
Goal Climate	0.330 ^{***}
¹ . Created by a Likert scale 1-7; ***. Correlation is significant at the 1% level; **. Correlations significant at the 5% level; *. Correlations significant at the 10% level.	

Exhibit 6-2: Correlations Between NKE Dimensions & Overall Success in Meeting NSD Programme Objectives

NKE Dimension	NSD Performance Dimension		
	Financial Performance	Customer Responsiveness	New Opportunities
NSD Knowledge Depth	0.293 ^{***}	0.350 ^{***}	0.302 ^{***}
NSD Knowledge Dispersion	0.304 ^{***}	0.180 [*]	0.083
Effective NSD Memory	0.236 ^{**}	0.169 [*]	0.226 ^{**}
Personal Interaction Mechanism	0.285 ^{***}	0.244 ^{***}	0.170 [*]
Climate of Learning	0.322 ^{***}	0.172 [*]	0.232 ^{**}
Creative Climate	0.246 ^{***}	0.273 ^{***}	0.161 [*]
Entrepreneurial Climate	0.351 ^{***}	0.223 ^{**}	0.362 ^{***}
Collaborative Climate	0.265 ^{***}	0.476 ^{***}	0.326 ^{***}
Goal Climate	0.307 ^{***}	0.326 ^{***}	0.352 ^{***}
***. Correlation is significant at the 1% level; **. Correlations significant at the 5% level; *. Correlations significant at the 10% level.			

Exhibit 6-3: Correlations NKE Dimensions and NSD Programme Performance

6.3.1.1 NSD KNOWLEDGE DEPTH

As one would anticipate, the correlations between NSD knowledge depth and NSD programme performance are all very high and significant: overall success ($r = 0.450$; $\text{Sig.} = 0.000$); new opportunities ($r = 0.302$; $\text{Sig.} = 0.000$); customer responsiveness ($r = 0.350$; $\text{Sig.} = 0.000$), and financial performance ($r = 0.293$; $\text{Sig.} = 0.000$).

In NSD and NPD research, it has been found that higher performing new services and tangible new products generally possess higher levels of marketing and technological synergy between the new development and the business' existing competences (Montoya-Weiss & Calantone 1994; Varadarajan & Berry 1983; Zirger & Maidique 1990), i.e. the business possesses a high level of expertise in, and knowledge of, the market and technology to be used in the development of a new offering.

The results of this thesis extend previous findings to suggest that the depth of a service business' NSD knowledge is also closely related to the performance of its NSD programme. Although this empirical support is new, former research has observed that the *know-how* "built-up over a number of years and diffused throughout the organisation", can provide a significant advantage when developing new products and services (Adler et al. 1989, p. 12).

6.3.1.2 NSD KNOWLEDGE DISPERSION

The NSD knowledge dispersion dimension is significantly correlated with three of the four performance dimensions. In particular, there is a high and significant relationship between NSD knowledge dispersion and: overall success ($r = 0.364$, $\text{Sig.} = 0.000$); and financial performance ($r = 0.304$; $\text{Sig.} = 0.000$). This would appear to indicate that as the development of new services is a collaborative exercise, and the contributing functions within the service business are functionally interdependent⁹⁰, both full-time and "part-time marketers" (Gummesson 1991b) will need to share NSD knowledge if particular forms of NSD success are to be achieved. While the broad dispersion of NSD knowledge would have been anticipated to support the business' achievement of its NSD programme objectives, the broad dispersion of NSD knowledge also appears to increase the likelihood of higher sales and/or profits.

Although NSD knowledge is required in the development of new services, the lower correlation between NSD knowledge and customer responsiveness ($r = 0.169$;

⁹⁰ Gronroos (1990) has referred to front-line personnel as the "interactive marketing function".

Sig.= 0.10) may be explained by the fact that the need to share NSD knowledge is less imperative, in these particular circumstances, than feedback on customer satisfaction with the existing products and services (Varadarajan & Berry 1983)⁹¹.

The low correlation between NSD knowledge dispersion and new opportunities ($r = 0.083$; Sig. n/s) is a surprise. One explanation may be the heavy loading of the '*establishment* of new markets' in 'new opportunities'. If service firms are reliant upon a smaller number of staff and management for the depth of NSD knowledge in *establishing* new markets, rather than having that knowledge dispersed across the business, this would cause NSD knowledge dispersion to figure less significantly in a correlation with new opportunities. In fact, one may infer that new opportunities for new markets in service firms are developed more by venture teams and smaller committees, than by traditional cross-functional teams (Johne & Snelson 1988)⁹². This is supported by the fact that venture teams were found to be extensively used to develop new services in this research.

6.3.1.3 PERSONAL INTERACTION MECHANISM

The personal interaction mechanism is significantly correlated with all four performance measures: overall success ($r = 0.215$; Sig.= 0.000); new opportunities ($r = 0.170$; Sig.= 0.10); customer responsiveness ($r = 0.244$; Sig.= 0.05), and financial performance ($r = 0.285$; Sig.= 0.000).

In research examining the cross-functional integration between marketing and R&D functions in tangible product firms, high co-operation teams have been found to differ from low co-operation teams both in terms of their increased use of informal methods for communication as well as their reasons for communicating. Moenaert & Souder (1990a) found widespread agreement among technologists and marketers on the importance of interpersonal communication. This supports

⁹¹ The measure of customer satisfaction is not a formal measure of NSD success in this research.

⁹² In the topic guide interviews, one professional service business interviewed indicated that the development of some new services was very much the responsibility of a small number of 'specialist' staff and, in particular, management. Delivery staff would have very little input.

the findings of Kohli & Jaworski (1990) who propose that greater use needs to be made of informal communication of information.

The importance and significance of the personal interaction mechanism dimension may therefore lie in the capability of the identified methods of knowledge transfer to offer spontaneous and relatively free format idea exchange, without losing intended meaning⁹³. The implication is that the staff and management involved in the development of successful NSD programmes are more at ease with using more traditional methods of communication (i.e. one-to-one and face-to-face meetings). These methods have long been regarded as the most effective mechanism by which tacit knowledge is conveyed, without high levels of abstraction, whereby a significant amount of the initial meaning is lost. This finding obviously has implications for the management of virtual teams, or global development groups who rarely meet face to face, and for the development of technology-based knowledge management solutions.

The lower correlation between 'personal interaction mechanism' and 'new opportunities' is a little surprising. However, if one examines the correlations between 'new opportunities' and the other NKE dimensions more closely, the relatively greater importance of the other dimensions, e.g. NSD knowledge depth, and an entrepreneurial, a collaborative and a goal-based climate can be observed. The implication is, therefore, that although the presence of personal interaction mechanism is a significant issue in explaining the development of new opportunities, it is of less importance than other NKE dimensions.

6.3.1.4 EFFECTIVE NSD MEMORY

The effective NSD memory dimension is significantly correlated with three of the four performance dimensions, but at lower levels than the other NKE dimensions.

⁹³ Of the 12 mechanisms of idea transfer presented in the questionnaire, only four possessed significant correlations with overall success, i.e. Scheduled one-to-one (phone), although possessing a significant correlation was excluded from a valid factor (non significant variables excluded from the original factor analysis were: email, Internet, written reports, written memos, formal group meetings, teleconferencing, voice mail).

The high correlation with financial success ($r = 0.236$; $\text{Sig.} = 0.05$) may be explained by hypothesising that the development of an effective NSD memory contributes to increased profits through lower transaction costs or speedier response times⁹⁴. The high correlation between effective NSD memory and new opportunities ($r = 0.226$; $\text{Sig.} = 0.005$) may indicate that an efficient storage mechanism enables NSD knowledge to be combined in ways which enable 'creative perspectives' to be taken on existing and new information, irrespective of the number of individuals involved in the NSD programme. Combining knowledge sets may therefore lead to the development of new insights which highlight new market opportunities and illuminate possible strategies for market development. Although the relationship between effective NSD memory and customer responsiveness demonstrates some degree of correlation, its significance level is lower than that for other relationships ($r = 0.169$; $\text{Sig.} = 0.10$). This suggests that the storage of NSD knowledge, i.e. in lower cost or more efficient storage systems, only explains a small amount of the variation in the business' ability to manage its relationships with existing clients. This may suggest that a less formal NSD process is required for NSD's which are driven largely by the needs of existing customers, i.e. the process is less complex and information-intensive.

Interestingly, the effective NSD memory dimension is not correlated with overall success. The implication being that the achievement of the business' objectives for the NSD programme is not furthered by technology-assisted NSD knowledge storage. Rather, effective memory indirectly facilitates the achievement of objectives through being an enabler of other processes and activities⁹⁵.

Fahey & Prusak (1998) have observed that one pivotal error underlying some uses of IT which severely limit its potential contribution to organisational knowledge: technological contact is equated with face-to face dialogue. Although it is a

⁹⁴ This hypothesis would seem to be valid. The correlations between 'effective memory mechanism' and the variables comprising the 'financial performance' dimension suggest that effective memory has a closer relationship with the level of profits: sales ($r = 0.267$; $\text{Sig.} = 0.05$); profits ($r = 0.394$; $\text{Sig.} = 0.000$).

⁹⁵ The individual correlations are inconclusive as all four variables are correlated, but to varying degrees. Correlations between variables in effective memory mechanism and overall success: Intranets ($r = 0.191$; $\text{Sig.} = 0.05$); expert systems ($r = 0.299$; $\text{Sig.} = 0.000$); GroupWare ($r = 0.156$; $\text{Sig.} = 0.10$); processes ($r = 0.394$; $\text{Sig.} = 0.10$).

wonderful facilitator of data and information transmission and distribution, IT can never substitute for the rich interactivity, communication and learning that is inherent in dialogues.

6.3.1.5 CLIMATE OF LEARNING

The research found that the climate of learning dimension is strongly correlated with the success of the NSD programme: overall success ($r = 0.267$; Sig. = 0.000), new opportunities ($r = 0.232$; Sig. = 0.05); customer responsiveness ($r = 0.172$; Sig. = 0.10); and financial performance ($r = 0.322$; Sig. = 0.000).

The lower and less significant correlation identified in the relationship between the climate of learning dimension and customer responsiveness may reflect the fact that in a relationship with existing clients the information states are changing less rapidly and learning, although still important, exerts *relatively* less direct influence on the associated performance objectives (e.g. retaining customers) than it does on other performance goals, e.g. learning about new markets (new opportunities).

It is generally recognised that the window of opportunity for service firms to gain competitive advantage through the release of new service offerings is narrowing, i.e. new services are being copied more quickly (Drew 1995b). Becoming more proficient at executing the activities required to develop new services, e.g. learning from past successes and failures, is even more important than it historically was. On this basis, it may be hypothesised that the rate at which individuals and firms learn may become its only sustainable competitive advantage (Stata 1989). The orientation of the business' staff and management towards learning may therefore be an important contributor to its success in achieving continuing high levels of NSD programme performance.

6.3.1.6 CREATIVE CLIMATE

The presence of a highly creative climate is significantly correlated with NSD programme performance across all four dependent performance measures: overall

success ($r = 0.249$; Sig. = 0.000); new opportunities ($r = 0.161$; Sig. = 0.10); customer responsiveness ($r = 0.273$; Sig. = 0.000); financial performance ($r = 0.246$; Sig. = 0.000).

The results confirm previous findings that, in attempting to stimulate the creativity of its staff, management must recognise that ideas can come from anywhere in the business. Management have previously been observed to support creative cultures and climates by instilling appropriate values through the establishment of systems that support a diversity of beliefs, free exchange of information, open questioning (Nonaka 1988b), collaborative interaction (Kimberley & Evanisko 1981), and in personally encouraging, assessing, developing, and supporting ideas for new services, wherever in the business they originate (Mullins & Sutherland 1998).

Experiments in particular are a crucial source of the data and information necessary for the invigoration of knowledge, and in most respects, the creation of new knowledge. Experiments may include trying new approaches to analysis, initiating pilot projects, doing things on a trial-and-error basis, and allowing individuals to assume additional tasks and responsibilities (Fahey & Prusak 1998).

The organisational learning and innovation literature identifies that the flexibility, responsiveness, and rapid learning across NSD projects required to produce innovative and successful NSD programmes demands supportive management practices which encourage staff to experiment with new knowledge (Nonaka 1988b), new services, and new processes without fearing the consequences of failure (Slocum, McGill & Lei 1994; Simonin 1997; Gupta & Wilemon 1990).

The fact that a creative climate is not as significantly correlated with new opportunities as it is with other performance dimensions, may once again be explained by the heavy loading of the '*establishment of new markets*' in '*new opportunities*'. As was discussed previously in this section, one may infer that new opportunities for new markets in services firms are developed more by

venture teams and smaller committees, than by traditional cross-functional teams (Johns & Snelson 1988)⁹⁶.

6.3.1.7 ENTREPRENEURIAL CLIMATE

The entrepreneurial climate dimension is highly and significantly correlated with all four performance measures: overall success ($r = 0.388$; $\text{Sig.} = 0.000$); new opportunities ($r = 0.362$; $\text{Sig.} = 0.000$); customer responsiveness ($r = 0.223$; $\text{Sig.} = 0.05$), financial performance ($r = 0.351$; $\text{Sig.} = 0.000$).

The findings of this research support previous observations that a business culture which values entrepreneurship and innovation provides the environment in which learning is most likely to take place (Quinn 1985; Lant & Mezias 1990). Similarly, firms with corporate cultures which stress competitiveness and entrepreneurial behaviour have been found to outperform those dominated by internal cohesiveness or rules (Deshpande et al. 1993). This suggests that top management has a significant role to play in encouraging entrepreneurial behaviour in all staff, achieved in many instances by balancing empowerment and control. The lower down in the business entrepreneurial instinct sits, the greater the role for top management in protecting and fostering it (Knight 1987)⁹⁷.

6.3.1.8 COLLABORATIVE CLIMATE

The collaborative climate dimension is highly and significantly correlated with all four performance dimensions: overall success ($r = 0.375$; $\text{Sig.} = 0.000$); new opportunities ($r = 0.326$; $\text{Sig.} = 0.000$); customer responsiveness ($r = 0.476$; $\text{Sig.} = 0.05$), financial performance ($r = 0.265$; $\text{Sig.} = 0.000$).

Internal communication has long been posited to be essential in stimulating the cross-functional co-operation of innovation team members, guiding internal

⁹⁶ Two of the main variables loaded onto creative climate correlation significantly. However, the correlation between creative climate and 'new markets' is not significant ($r = 0.148$; $\text{Sig.} = \text{n/s}$).

⁹⁷ McKee (1992) notes that top management create the analytical environment in which innovations take place. This framework is built by: cultivating particular skills; encouraging an innovative mindset; and sponsoring on-going experiments and linkages among those experiments.

marketing efforts and empowering service staff and frontline personnel (Lievens, Moenaert & S'Jegers 1997b). Similarly, the development of a new service requires that both staff and management work closely together (e.g. Edgett et al. 1992; Grden-Ellson et al. 1986).

Because collaboration is a vital aspect of all business activity, it is not surprising that the collaborative climate dimension correlates significantly with all performance dimensions. The correlation between collaborative climate and customer responsiveness is particularly strong. This may be explained by the fact that information and knowledge about existing clients is likely to be held by many different groups of people in the business, and will therefore require greater co-operation to share it⁹⁸.

6.3.1.9 GOAL CLIMATE

Goal climate is highly and significantly correlated across all four performance dimensions: overall success ($r = 0.330$; $\text{Sig.} = 0.000$); new opportunities ($r = 0.352$; $\text{Sig.} = 0.000$); customer responsiveness ($r = 0.326$; $\text{Sig.} = 0.05$), and financial performance ($r = 0.307$; $\text{Sig.} = 0.000$). The consistently high correlations across all performance measures would seem to indicate the need for the senior management of a service business to offer clear management direction to all NSD staff and management if the business is to be successful in developing new services.

Vision and leadership has been found to be an important issue in achieving success in NSD (Thwaites 1992). Similarly, George (1990) has suggested that internal communication can be used to achieve an externally-oriented "strategic service vision" and to establish a set of common shared values among a core group of staff which will facilitate the maintenance of that strategic vision over the long-term.

⁹⁸ For example, in the topic guide interviews a computer software and services business indicated that once a client had been 'recruited', knowledge of that client's activities would become spread across a magnitude of staff and management in the sales, technical support, finance administration, and business consulting divisions. Even if codification of this information was carried out, there would be a big requirement for co-operative interaction in order to share meaningful insights.

It has been observed that goals set by the management of the business may be presented as strategic concepts which not only provide broad direction, but they also allow freedom of interpretation because of their equivocal meaning (Nonaka 1988b). The strategic ambiguity they represent nurtures fluctuation of viewpoints and creativity within the business. This may be especially required in the opening stages or processes of a NSD programme or project.

6.4 NKE and Innovative NSD Programme Performance

This thesis sought to understand the nature of the relationship between the NKE and the overall innovativeness of the NSD programme. The research question posed was:

Q1c: What is the impact of the NKE on the innovativeness of the NSD programme?

To identify the impact, correlations were computed between the NKE dimensions and the measure of innovative performance. The results are presented in Exhibit 6-4. Correlations were found to be strong and highly significant. The results are insightful in that they establish a close relationship between the characteristics of the NKE and the innovativeness of a NSD programme, i.e. innovativeness is likely to be under the influence of management action, and therefore not purely reliant upon the inspiration of a creative individual.

NKE Factor	Innovative Performance
NSD Knowledge Depth	0.450***
NSD Knowledge Dispersion	0.268***
Effective NSD Memory	0.362***
Personal Interaction Mechanism	0.412***
Climate of Learning	0.356***
Creative Climate	0.357***
Entrepreneurial Climate	0.627***
Collaborative Climate	0.460***
Goal Climate	0.373***
¹ Likert scale 1-7; ***. Correlation is significant at the 1% level; **. Correlations significant at the 5% level; *. Correlations significant at the 10% level.	

Exhibit 6-4: NKE Factors and Innovativeness of NSD Programmes

High levels of *NSD knowledge* were found to be important in a service business being able to create and implement truly innovative new services ($r = 0.450$; Sig. = 0.000). This supports the findings of previous research which observed that high levels of knowledge, and organisational memory, can enhance creativity and innovativeness (Moorman & Miner 1997).

A significant relationship also existed between innovativeness and NSD *knowledge dispersion* ($r = 0.268$; Sig. = 0.000). This may be at odds with previous research which identified that high levels of knowledge dispersion can inhibit product innovation by reducing organisational heterogeneity, thus restricting the number of competencies available for generating new actions (Moorman & Miner 1997). However, because this thesis is dealing with a specific form of knowledge, i.e. NSD knowledge, one could reasonably argue that a wide dispersion would provide individuals with greater confidence in experimenting with innovative approaches, rather than spending a disproportionate amount of time on integrating new know-how.

A close relationship was identified between the *personal interaction mechanism* and innovative performance ($r = 0.412$; Sig. = 0.000). Providing individuals with the opportunity to transfer new ideas freely has long been observed to influence both business success and creative outcomes (Moorman & Miner 1997). This thesis builds on those initial findings to suggest that particular forms of interaction

mechanism more effectively facilitate more innovative processes and outcomes than others, i.e. personal mechanisms are more efficient at transferring knowledge. The creation of new knowledge has been found to be a direct outcome of experiences, reflection and dialogue – three activities which are more likely to be shared in face-to-face contact (Fahey & Prusak 1998).

The *effective NSD memory* dimension is significantly and highly correlated with innovative performance ($r = 0.362$; $\text{Sig.} = 0.000$), which suggests that service firms which possess a greater propensity to use technology to store NSD knowledge for future use, and to embed that knowledge into organisational routines, are more proficient at creating and commercialising innovative new services. This supports the findings of Cohen & Levinthal (1990) who reported that organisational memory (i.e. stored knowledge) can enhance a business' ability to assess and import new outside information, which promotes creativity and innovativeness. Failure to store such knowledge for future use will result in the loss of such learnings, and the inability of a business to leverage the for their creative purposes.

The relationship between *climate of learning* and innovative performance is particularly strong ($r = 0.356$; $\text{Sig.} = 0.000$), highlighting the influence climate of learning has upon the development of innovative performance across a NSD programme. This follows the work of McKee (1992) who similarly observed that innovativeness and a business' learning skills are closely related.

The *entrepreneurial climate* dimension correlates very highly and significantly with innovative performance ($r = 0.627$; $\text{Sig.} = 0.000$). The innovative performance dimension contains two variables which indicate that the service business both perceives itself to be innovative, and its clients perceive it to be innovative. This supports the observations of Drucker (1985) who defines entrepreneurship as "a commitment to the systematic practice of innovation" that produces entrepreneurial success.

A high correlation exists between *collaborative climate* and innovative performance ($r = 0.460$; $\text{Sig.} = 0.000$). This reflects the need for the staff and management in the business to work co-operatively in order to obtain the diversity

of experience and knowledge required to generate truly innovative new ideas (Nystrom 1979).

The presence of a strong *goal climate* and innovative performance were strongly and highly correlated ($r = 0.373$; $\text{Sig.} = 0.000$). This follows the findings of Tesluk et al. (1997) who found that many variables may be influential in shaping the development of creative behaviour and outcomes in the business, including staff's perception that top management value goals related to creativity.

Creative climate and innovative performance ($r = 0.357$; $\text{Sig.} = 0.000$) are closely correlated (this relationship is discussed more fully in the previous section on creative climate and NSD programme performance).

6.4.1 The Relative Importance of NKE Factors in Predicting NSD Programme Performance

Although factor analysis identified nine underlying dimensions of the NKE, the relative impact of these nine dimensions on NSD programme performance has not been determined. In order to do so, multiple regression was employed to project the NKE factors (independent variables) onto the measures of NSD programme performance (dependent variables). The results are presented in Exhibits 6-5 and 6-6.

Variables	Regression Co-efficient	Beta	T value	Statistical Significance
(constant)	4.843	-	48.807	0.000
NSD Knowledge	0.545	0.450	5.351	0.000
(constant)	4.843	-	49.957	0.000
NSD Knowledge Depth	0.447	0.369	4.406	0.000
Entrepreneurial Climate	0.343	0.283	3.375	0.001
(constant)	4.843	-	51.898	0.000
NSD Knowledge Depth	0.378	0.312	3.776	0.000
Entrepreneurial Climate	0.322	0.266	3.284	0.001
NSD Knowledge Dispersion	0.305	0.252	3.143	0.002
(constant)	4.843	-	52.924	0.000
NSD Knowledge Depth	0.341	0.282	3.432	0.001
Entrepreneurial Climate	0.286	0.237	2.945	0.004
NSD Knowledge	0.290	0.239	3.039	0.003
Dispersion				
Goal Climate	0.223	0.184	2.330	0.022

Exhibit 6-5: Multiple Regression Coefficient

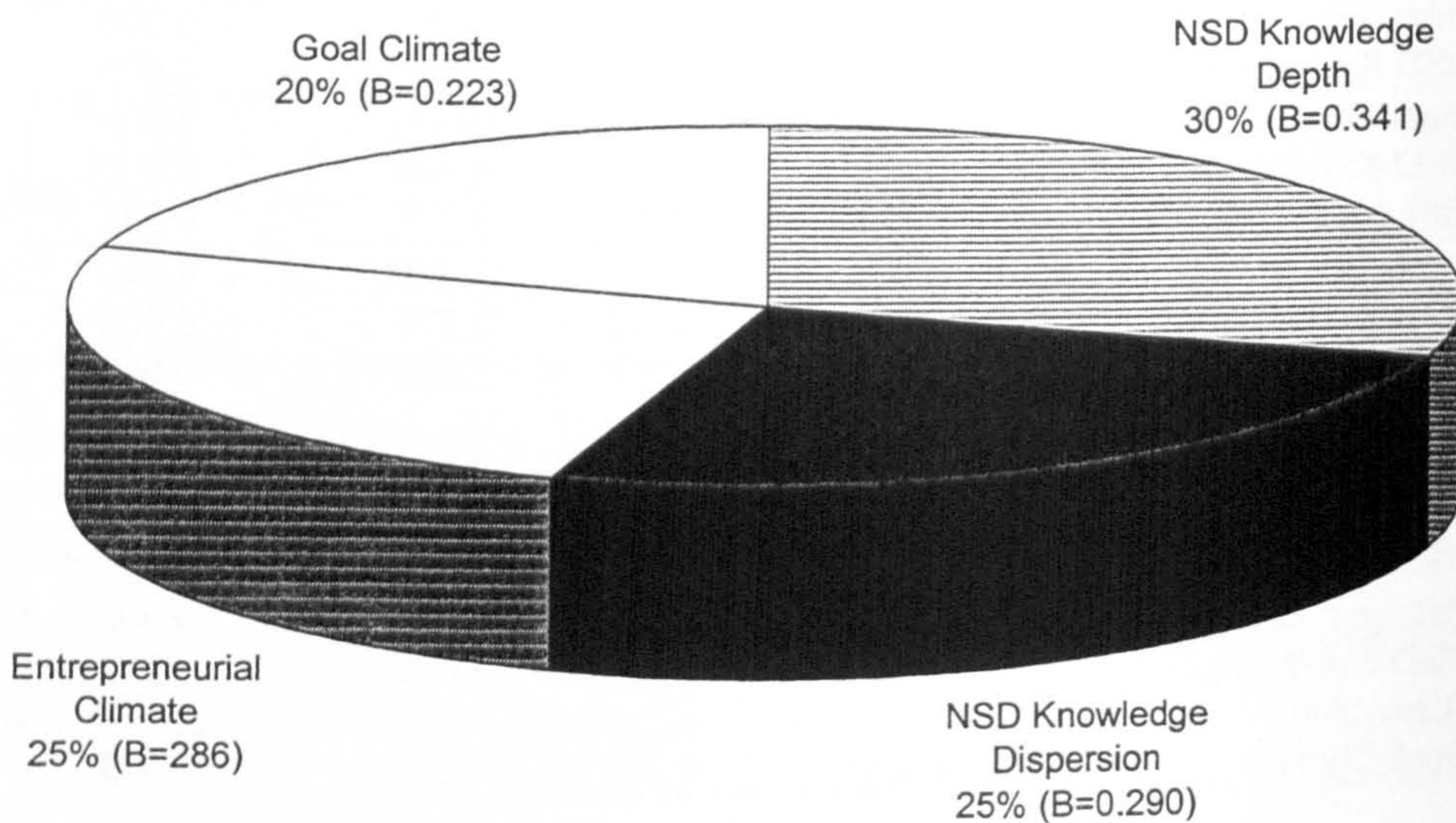


Exhibit 6-6: Relative Impact of NKE Dimensions on Overall Performance⁹⁹

The results of the regression analysis are significant (adjusted $R^2 = 0.366$; $F = 15.893$; $\text{Sig.} = 0.000$). Thirty-six percent of the variance in the total overall success of the business in achieving its objectives for the NSD programme (the dependent variable) is explained by the NKE factors. However, the thirty-six percent comprises only four of the independent variables¹⁰⁰: NSD knowledge depth; entrepreneurial climate; NSD knowledge dispersion; goal climate. The implication is that these four factors are the key dimensions of the NKE when predicting NSD programme performance.

⁹⁹ The slices indicate the percentage of the total variation in "overall success" explained by each NKE dimension. In a stepwise regression, only these four variables were entered.

¹⁰⁰ The adjusted R^2 figure of 0.366 is consistent with the results reported by previous studies examining similar phenomenon (Moorman & Miner 1997).

6.5 Strategy Measures

This section addresses the impact of formal knowledge strategies on NSD programme performance. The variables affected included the seven strategy questions.

6.5.1 Formal Strategies Contributing to the NKE

Data was collected on four formal business strategies which were identified in the literature as being likely to have an impact on the way in which knowledge is managed during a NSD programme, and its eventual success. The strategies adopted influence the decision about which knowledge will be important in achieving competitive advantage. The four strategies were: (i) NSD strategy; (ii) information management strategy; (iii) knowledge management strategy; and (iv) intellectual asset management strategy. The relationship between the strategies and the NKE is presented in the subsequent sections.

6.5.1.1 NSD STRATEGY

It has been observed that the role of strategy in new product and service development is to determine the services, products and markets of interest to the business, and the role technology and new products will play (Nystrom 1985). However, two issues remain of interest and deserve to be explored: (i) the extent to which the strategy is formalised; (ii) the characteristics of the strategy adopted. Previous NPD research has identified that the presence of a formal development strategy, and the characteristics of that strategy, has a significant impact on performance (Mercer 1994; Griffin 1997). Little research has been carried out in the field of NSD. This research explores whether the success of a *service business*' NSD programme according to the characteristics of the NSD strategy adopted. The question posed was:

Q1b-1: What is the impact on NSD performance of the strategic approach adopted to NSD?

Respondents were initially invited to identify the type of NSD strategy pursued by their business. The four options presented were adopted from the Miles & Snow (1978) typology: (i) prospector; (ii) analyser; (iii) defender; (iv) reactor (although this question uses a self-rated question, the validity of the strategic groupings are supported by other performance data supplied by the respondent, e.g. the strategies are profiled against the nine NKE dimensions and the performance of the NSD programme). Responses to the Miles & Snow typologies (the independent variables) were profiled against two sets of performance data (the dependent variables): (i) the nine NKE factors, to determine the impact of the NSD strategy on the internal environment created by each strategic grouping; (ii) the measure for overall success, to identify the extent to which the NSD strategy impacts the performance of the NSD programme. The results are presented in Exhibits 6-7 and 6-8, and their implication is discussed in the subsequent text.

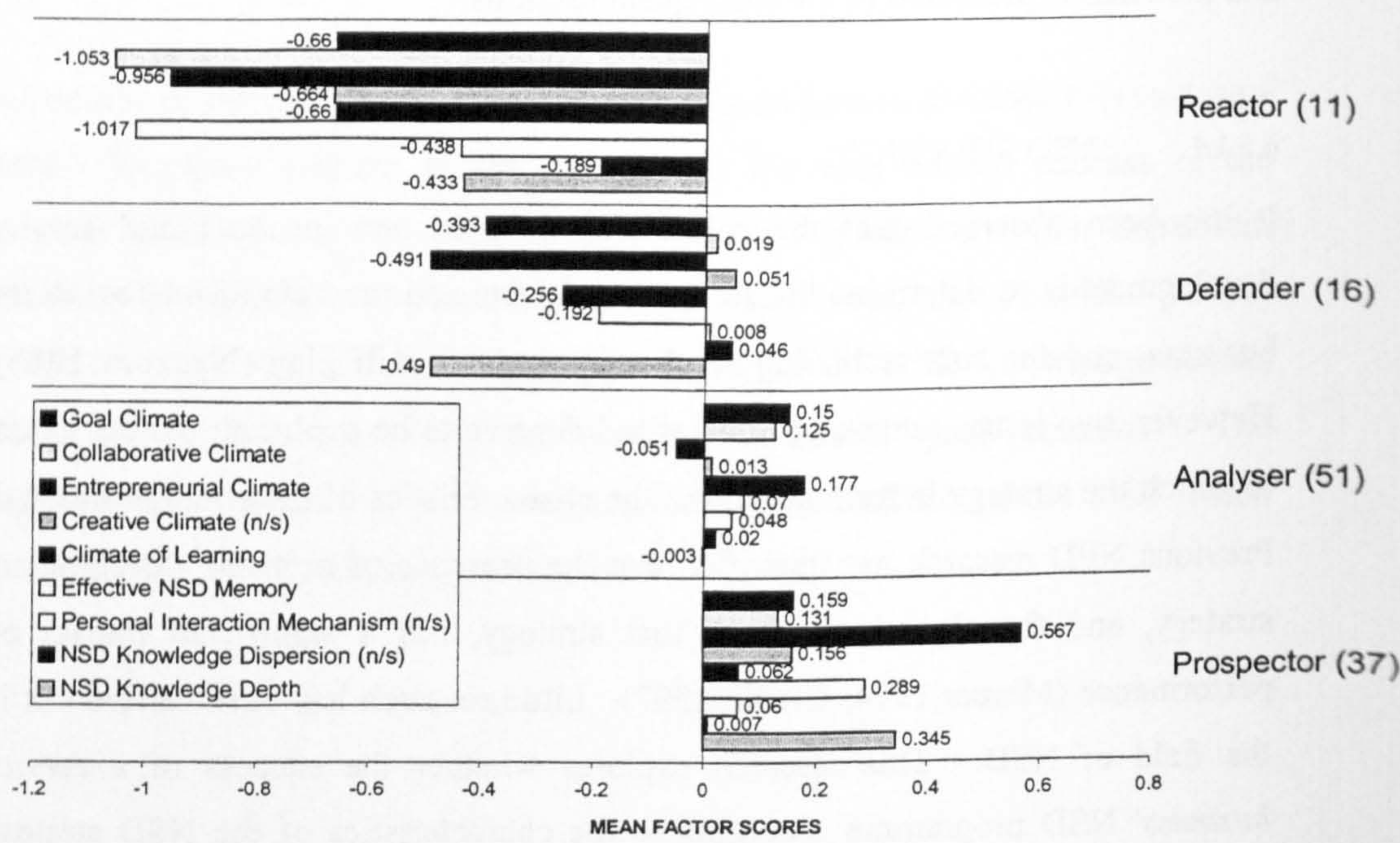


Exhibit 6-7: NSD Strategy Profile by NKE

	F- Values ³	Prospector Strategy ¹ (37)	Analysers Strategy (51)	Defender Strategy (16)	Reactor Strategy (11)
Performance Measures					
<i>Performance Dimensions</i> ²					
New Opportunities	F = 7.331 Sig.= 0.000	0.267	0.003	0.109	-1.204
Customer Responsiveness	F = 2.669 Sig.= 0.051	0.221	-0.024	0.061	-0.723
Financial Performance	F = 6.843 Sig.= 0.000	0.381	0.047	-0.376	-0.954
Innovative Performance	F = 23.638 Sig.= 0.051	0.748	-0.076	-0.627	-1.249
<i>Other Performance Variables</i>					
Overall success ⁴	F = 4.305 Sig.= 0.007	5.24	4.86	4.50	3.91
% sales from new services	F = 3.695 Sig.= 0.015	45.16	23.18	23.21	21.00
% profits from new services	F = 2.618 Sig.= 0.057	40.52	22.69	22.86	17.00
Success rate	F = 0.662 Sig.= n/s	75.67	75.28	66.53	74.90
¹ . Number of respondents in group; ² . Factor scores with mean value = 0; ³ . One-way ANOVA statistic; ⁴ . Measured on a 1-7 Likert scale.					

Exhibit 6-8: NSD Programme Performance by NSD Strategy

Which Strategy?

The majority of respondents, i.e. 76.52%, perceived that their firms either pursued prospector or analyser strategies. Although this confirms the findings of Storey &

Kelly (1998a) who found that 74.42% of service firms adopted such strategies, the percentage adopting prospector strategies was lower in this research¹⁰¹.

NSD Strategy and NKE Profile

Prospectors reported high mean factor scores on all nine NKE dimensions, analysers above average mean scores on eight out of nine, defenders four out of nine, and reactors zero from nine. The implication is that prospectors and analysers have supportive internal environments, whilst defenders and reactors are failing to create an environment which is favourable towards knowledge management activity and innovation.

Although differences were identified in the mean factor scores across all four groups, in three instances the differences were not significant: (i) creative climate; (ii) personal interaction mechanism; (iii) NSD knowledge dispersion. NSD programmes with reactor strategies possessed significantly poorer creative climates than those of the strategic groupings. However, it was found that the other three strategic groupings positively required the presence of a creative climate in order to effectively execute their chosen approach. As a consequence, it was harder to identify a significant difference in creative climate between defenders, analysers and prospectors. The same situation occurred for personal interaction mechanism and NSD knowledge dispersion, i.e. all three were common requirements across the three strategies.

NSD Strategy and Performance

The strategic posture adopted by the service business was found to significantly impact the NSD programme performance. This confirms the findings of previous NSD studies which investigated the link between project performance and development strategy (Griffin & Page 1996; Storey & Kelly 1998a). The nature of the relationship for each of the four groups is now discussed.

¹⁰¹ This research found that 32.17% of businesses pursued prospector strategies, while Storey & Kelly (1988) found, in a smaller survey, 41.86% pursued prospector strategies.

Prospectors

Prospectors, the second largest strategic grouping with 37 cases, value being first with new services, markets and technologies. Service firms which pursue prospector strategies possess the most successful NSD programmes. In this research, they report the highest mean factor scores on all four performance factor dimensions: new opportunities (\bar{x} = 0.267); customer responsiveness (\bar{x} = 0.221), financial performance (\bar{x} = 0.381); and innovative performance (\bar{x} = 0.748). Prospectors receive over 40% of their sales and profits from new services introduced in the previous 3 years, and achieve the highest overall success and success rate ratings.

These findings are consistent with the view that a prospectors' strategy is aiming to be 'first' with new technologies, markets and services. The results also support previous NPD research findings which indicate that the first entrant into a market is likely to witness high returns if they are successful (Lilien & Yoon 1990; Biggadike 1976; Tufano 1992). However, it is at odds with previous NSD research which posits that the advantages of being first in the market with a new service are lower than those for tangible goods because services are inherently intangible, and therefore cannot be protected by patents (Bitner & Zeithaml 1987). Previous research also suggests that the likelihood of a first-ranked business in a particular industry surviving in first place is about 96%, i.e. 'breaking the rules of the game' offers the potential for long-term success (Markides 1997). However, it might be argued that prospectors receive value from being first into a market because they turn around new services much faster and are therefore able to keep ahead of the competition.

Analysers

Analysers, the largest strategic grouping with 51 cases, are seldom first to market, but are frequently fast followers, potentially with a more cost-effective or innovative service. This suggests that NSD programmes which adopt an analyser strategy do so deliberately. In this thesis, analysers reported near mean factor scores on most of the four performance dimensions: new opportunities (\bar{x} = 0.003);

customer responsiveness (\bar{x} = -0.024); financial performance (\bar{x} = 0.047); and innovative performance (\bar{x} = 0.076).

While analysts received only 23.18% of their sales and 22.69% of their profits from new services introduced in the last three years, their overall success rating (\bar{x} = 4.86) indicates that managers perceive analyst strategies to be very successful against the objectives set for the NSD programme. That is, their NSD programmes are achieving what they set out to achieve, rather than under-performing against prospectors.

It has previously been suggested that striving to be a pioneer is not the critical determinant of success for really new products, because a fast follower can just as easily be successful as a pioneer (Lynn et al. 1998). It is therefore surprising that analysts are not more successful in financial terms (\bar{x} = 0.047). The implication of the results of this thesis is, therefore, that in order to achieve a financially successful NSD programme, service firms should develop prospector strategies.

Defenders

Defenders, the second smallest strategic grouping with 18 cases, locate and maintain a niche by protecting a position in a relatively stable service area. In this research defenders perform relatively poorly in terms of financial performance (\bar{x} = -0.376) and innovative performance (\bar{x} = -0.627). They return an average factor score in terms of customer responsiveness (\bar{x} = 0.061), but above average on new opportunities (\bar{x} = 0.109).

Defenders' reported scores on customer responsiveness implies a focus on protecting existing business streams. However, if a defender strategy is a formal and deliberate approach, one would have anticipated the grouping to have performed more successfully in terms of financial performance. It might therefore be suggested that the strategy to develop new services for existing clients is not deliberate, or is being executed very poorly. Defenders' out performance of analysts in terms of new opportunities is somewhat surprising and difficult to

interpret¹⁰². One explanation may be that defenders' conceptualisation of what constitutes a new service may be narrower than that adopted by firms with other strategies. A new opportunity may be characterised by defenders as a new niche opportunity in an existing target market, although this has no evidence to support this view.

The implication is that service firms need to be careful when adopting a 'defender-like' strategy for their NSD programmes. Although this research suggests that a defender strategy is likely to offer benefits in protecting existing business, it has not proven to deliver superior financial performance or high success rates, i.e. in some circumstances, a service business is likely to find it difficult to achieve competitive advantage in the market-place.

Reactors

Reactors, the smallest strategic grouping with 11 cases, respond to service and market changes only when forced to do so by environmental pressures. They are the least successful NSD programmes of those sampled. Reactors reported the lowest mean factor scores on all four performance dimensions: new opportunities ($\bar{x} = -1.204$); customer responsiveness ($\bar{x} = -0.723$); financial performance ($\bar{x} = -0.954$); and innovative performance ($\bar{x} = -1.249$). Managers of NSD programmes with reactor strategies perceive their NSD programmes to be under-performing those of the competition (i.e. overall success $\bar{x} = 3.91$). Reactors achieve the lowest percentage sales ($\bar{x} = 21.00\%$) and profits ($\bar{x} = 17.00\%$) from new services introduced in the previous three years of all strategic groupings.

The implication is that a service business which pursues a NSD strategy which reacts to environmental changes will under-perform the competition on most measures. It has been observed in previous research that adopting reactor strategies may have particularly serious consequences in highly turbulent external

¹⁰² In analysing the data further, defenders scored highest of all strategic groupings on the "new markets" performance measure in the 'new opportunities' factor. As this is the highest loading variable, the corresponding score for the dimension is high. One would need to investigate the individual cases further to determine the reason for the discrepancy.

environments, i.e. when unexpected suppliers poach traditional customers (John & Vermaak 1993), e.g. First Direct's emergence in the UK banking market.

6.5.1.2 KNOWLEDGE STRATEGIES

Three knowledge strategies were identified in the literature and topic guide interviews. Their impact upon NSD programme performance was evaluated in two ways: (i) by examining the impact of each strategy on NSD performance; (ii) by exploring the impact of a service business adopting at *least one* of the three formal knowledge strategies. The research question posed was:

Q1b-2: Are service firms which have established formal knowledge strategies (i.e. information management, knowledge management, intellectual asset management) more successful at NSD than those that have not?

Impact of Individual Knowledge Strategies on NSD Performance

Respondents were required to state whether their firms had established formal strategies for information management, knowledge management and intellectual asset management. The three questions were presented in closed-ended dichotomous-choice form, with the respondent limited to two mutually exclusive alternatives.

Information Management Strategy

Initially, the data was tested for the presence of a formal information management strategy. The results are presented in Exhibit 6-9.

Using t-tests to identify significance, 54% of the sample were found to possess a formal information management strategy. Those *with* a formal strategy were significantly more successful on three of the four performance dimensions than those firms without one: new opportunities ($t = -2.040$; Sig. = 0.044); customer responsiveness (n/s); financial performance ($t = -2.292$; Sig. = 0.025); and innovative performance ($t = -2.210$; Sig. = 0.029).

The implication is that service firms' NSD programmes are likely to be more successful if a formal information management strategy is a constituent element of the NKE. To the author's knowledge, this relationship has never been previously tested, and it follows the observations of Gupta, Raj & Wilemon (1986a) who found that a business which ventures into a totally new and unfamiliar set of products, markets, and technologies is likely to have greater need for information and knowledge about the market and technology. The presence of a *formal* information management strategy may act to focus the business' attention onto those information sources which the business should attend to. It should also indicate the value of those sources in helping the business achieve its NSD and overall business objectives.

	Does Your Business Have a Formal Information Management Strategy?		
	t-test (Sig.)	Yes	No
Performance Factors¹		63	52
New Opportunities (115)	t= -2.040 Sig.= 0.044	0.170	-0.206
Customer Responsiveness (115)	t= -1.623 Sig.= 0.111	0.136	-0.165
Financial Performance (115)	t= -2.293 Sig.= 0.025	0.190	-0.231
Innovative Performance (115)	t= -2.210 Sig.= 0.029	0.186	-0.225
Other Performance Measures			
Overall Programme Success ³ (115)	n/s ²	4.89	4.79
Percentage success rate (92)	n/s	74.74	73.19
The percentage of sales coming from new services introduced in the last 3 years (81)	n/s	26.13	34.46
The percentage of profit coming from new services introduced in the last 3 years (82)	n/s	25.53	30.37
¹ . Average factor scores; ² . Relationship not significant (n/s); ³ . Measured on a 1-7 Likert scale.			

Exhibit 6-9: NSD Programme Performance and Formal Information Management Strategies

Knowledge Management Strategy

Secondly, the nature of the relationship between the existence of a formal knowledge management strategy and NSD programme performance was tested. The results are presented in Exhibit 6-10.

Although differences were observed in the performance achieved by service firms with and without a formal knowledge management strategy, no significant statistical relationships were identified. Interestingly, only 22.6% of the respondents reported that their business has even established a formal knowledge management strategy.

	Does Your Business Have a Formal Knowledge Management Strategy?		
	t-test (Sig.)	Yes	No
Performance Factors ¹		26	89
New Opportunities (115)	-0.572 (n/s ²)	0.090	-0.029
Customer Responsiveness (115)	-0.677 (n/s)	0.117	-0.034
Financial Performance (115)	-0.025 (n/s)	0.004	-0.013
Innovative Performance (115)	-1.555 (n/s)	0.266	-0.078
Other Performance Measures			
Overall Programme Success ³ (115)	-0.748 (n/s)	5.00	4.80
Percentage success rate (92)	-0.984 (n/s)	78.27	72.93
The percentage of sales coming from new services introduced in the last 3 years (81)	-0.339 (n/s)	31.88	29.16
The percentage of profit coming from new services introduced in the last 3 years (82)	-0.382 (n/s)	30.06	27.00
¹ . Average factor scores; ² . Relationship not significant (n/s); ³ . Measured on a 1-7 Likert scale.			

Exhibit 6-10: NSD Programme Performance and Formal Knowledge Management Strategies

These findings confirm the results of previous research which suggested that some firms are only just beginning to identify the need for, and to implement, knowledge-based strategies (Bierly & Chakrabarti 1996). The fact that the existence of a formal knowledge management strategy on its own does not directly influence the performance of the NSD programme may be due to a

number of factors: (i) knowledge management strategies may only be emerging in service firms, and the lessons learned from non-service firms have yet to be internalised; (ii) the link between a knowledge management strategy and NSD strategy is not being made; (iii) firms may be addressing knowledge management issues at the individual business process level (Whitehall 1997; Wiig 1997a).

Intellectual Asset Management Strategy

Finally, the relationship between the existence of a formal intellectual asset management strategy and NSD programme performance was tested. The results are presented in Exhibit 6-11.

	Does Your Business Have a Formal Intellectual Asset Management Strategy?		
	t-test (Sig.)	Yes	No
Performance Factors¹		22	93
New Opportunities (115)	0.884 (n/s ²)	0.028	-0.006
Customer Responsiveness (115)	0.724 (n/s)	0.068	-0.016
Financial Performance (115)	0.387 (n/s)	0.166	-0.039
Innovative Performance (115)	0.754 (n/s)	0.065	-0.140
Other Performance Measures			
Overall Programme Success ³ (115)	0.503 (n/s)	5.00	4.81
Percentage success rate (92)	0.621 (n/s)	71.55	74.52
The percentage of sales coming from new services introduced in the last 3 years (81)	0.338 (n/s)	22.86	31.16
The percentage of profit coming from new services introduced in the last 3 years (82)	0.574 (n/s)	23.64	28.50
¹ . Average factor scores; ² . Relationship not significant (n/s); ³ . Measured on a 1-7 Likert scale.			

Exhibit 6-11 NSD Programme Performance and Formal Intellectual Asset Management Strategies

Once again, no statistically significant relationship was observed in the performance of NSD programmes which incorporated a formal intellectual asset management strategy, in comparison to those that didn't. Interestingly, only 19% of respondents report the existence of an intellectual asset management strategy within their business.

The knowledge literature has only recently begun reporting the emergence of interest in intellectual asset management (Edvinsson 1997; Roos & Roos 1997). It might well be asserted that it is too early for a "general sample" of service firms to find strong associations between NSD performance and strategies designed to leverage enterprise-level management of specific intellectual assets.

Impact of Groups of Knowledge Strategies on NSD Performance

An analysis of the impact of the three knowledge strategies on NSD performance identified that significant correlations at the 0.01 level. The questions related knowledge strategies in NSD programmes were therefore recoded into three groupings, reflecting the existence of groups of formal knowledge strategies¹⁰³. The objective was to understand whether NSD programmes were more than successful than others in situations where: (i) just an information management strategy had been established; (ii) a knowledge management strategy existed on its own, or along-side an information management or intellectual asset management strategy; (iii) no formal strategies had been established whatsoever.

The three groups of NSD programmes were profiled against the nine NKE dimensions to determine whether they possessed distinct internal environments.

The results are presented in Exhibit 6-12.

¹⁰³ 11 (9.56%) of the cases were excluded from the analysis as they did not fit the theory being investigated. That is, they did not fit into the three categories, but for many different reasons.

NKE Factors	F- Values ³	No Strategies (48)	Information Only (30)	Knowledge only/ Knowledge & Information or IAM (26)
NSD Knowledge Depth	F = 4.647	-0.163	-0.074 ¹	0.485
	Sig.= 0.012			
NSD Knowledge Dispersion	n/s	-0.150	0.121	0.099
Effective NSD Memory	F = 10.629	-0.456	0.192	0.545
	Sig.= 0.001			
Personal Interaction Mechanism	n/s	-0.056	0.101	0.074
Creative Climate	F = 2.311	-0.163	0.312	0.098
	Sig.= 0.104			
Climate of Learning	F = 4.261	-0.278	-0.016	0.430
	Sig.= 0.017			
Entrepreneurial Climate	n/s	-0.178	0.012	0.218
Collaborative Climate	n/s	-0.085	-0.136	0.332
Goal Climate	F = 3.669	-0.259	0.169	0.325
	Sig.= 0.029			
¹ . Mean values; ² . Relationship not significant (n/s); ³ . Number of cases;				

Exhibit 6-12: Characteristics of a Supportive Knowledge Climate

The NSD programmes operating in service firms which had not established either of the three formal knowledge strategies were found to possess less supportive internal environments, i.e. achieved low mean factor scores on all nine NKE dimensions. Five of the relationships were significant. NSD programmes operating in service firms which had established just an information management strategy, reported near average factor scores on all nine NKE dimensions (in terms of collaborative climate they under performed against the 'no strategies', and in terms of creative climate they outperformed the 'knowledge strategies'). Those firms which had established a formal knowledge management strategy, and possibly combined it with an information management or intellectual asset management strategy, provided a more supportive internal knowledge environment than the two other groupings.

The implication is that a service business' formal knowledge strategy and the characteristics of the internal knowledge environment are closely linked. This implies that either: (i) the creation of a co-ordinated and integrated approach to knowledge management in a service business, incorporating a supportive internal knowledge environment, is closely associated with the development of knowledge strategy grounded in the existence of a formal knowledge management strategy; (ii) a supportive internal knowledge environment leads to the presence of a complementary emergent knowledge strategy (Mintzberg 1987). These findings follow the observations of Wiig (1997b) who observed that in adopting knowledge-based strategies, firms undertake specific programmes and activities, provide supporting infrastructure capabilities, and sometimes create incentives to motivate individual staff, teams, and even departments and business units to co-operate with the new objectives.

Performance of NSD Programmes by Knowledge Strategy Grouping

The three formal knowledge strategy groupings (i.e. information only, 'knowledge plus' and no strategy) were subsequently profiled against the four performance dimensions to explore whether the different groupings produced better, or different, NSD programme performance. These results are presented in Exhibit 6-13.

	F- Values ³	No Strategies (48)	Information Only (30)	Knowledge only/ Knowledge & Information or IAM (26)
<i>Performance Measures</i>				
New Opportunities	F = 3.320 Sig.= 0.040	-0.278	0.303	-0.099
Customer Responsiveness	F = 1.738 Sig.= 0.181	-0.153	0.246	0.117
Financial Performance	F = 3.418 Sig.= 0.037	-0.268	0.342	0.004
Innovative Performance	F = 3.909 Sig.= 0.023	-0.282	0.277	0.266
<i>Other Performance Measures²</i>				
Overall Success	n/s	4.75	4.80	5.00
Success of NSD programmes vs. competition	F = 2.705 Sig.= 0.072	4.17	4.77	4.88
Success of NSD programme making business competitive	F = 2.628 Sig.= 0.077	5.06	5.77	5.58
¹ . Number of respondents in group; ² . Factor scores with mean value = 0; ³ . One-way ANOVA statistic; ⁴ . Measured on a 1-7 Likert scale.				

Exhibit 6-13: Impact of Knowledge Climate on NSD Programme Performance

In comparison to the two other groupings, this research found that NSD programmes operating in service firms with no formal knowledge strategies were the least innovative ($t = -0.282$; Sig.= 0.023), the least able at identifying new opportunities ($t = -0.278$; Sig.= 0.040), possessed the worst financial performance ($t = -2.268$; Sig.= 0.037), and managed client relationships less successfully ($t = -0.153$; Sig.= 0.018). They also delivered less competitiveness to the business. The fact that service firms which have not adopted at least one formal knowledge strategy have the least successful NSD programmes is not surprising. By failing to formally identify its existing and value-creating knowledge assets, the business is poorly equipped to leverage those assets more effectively. It is also less able to address

the knowledge "gaps" which prevent it from improving its NSD performance even further. Internal environments which fail to be supportive of the knowledge requirements of a NSD programme are more likely to result in poorer performing NSD programmes. This confirms the thinking of Whitehall (1977) who posited that firms adopting a knowledge-based strategy will develop competitive advantage, i.e. the business may learn faster, will not need to re-engineer as often and therefore lose vital knowledge, and will save on organisational costs.

Interestingly, in this research those service firms which had only established an information management were more successful than those which had established a knowledge management strategy (often in parallel with an information or an asset management strategy). The explanation may be that such firms are pursuing a deliberate strategy (they scored equally as well as the other groupings on 'overall success') where the management of information is the primary focus. The implication may also be that, at this stage, such an approach is more easily channelled into the creation of better NSD performance. However, the concern would be that their internal environment provides a much less supportive internal knowledge environment - and this may have consequences in the future.

In addition to identifying the existence of a *formal* knowledge strategy, future research on formal and emergent knowledge strategies might seek to clarify a number of related issues: (i) the objectives of the knowledge strategies adopted; (ii) the specific content of those strategies; (iii) how those knowledge strategies are integrated with other business strategies, e.g. knowledge strategy and innovation strategy. The results of this thesis would seem to indicate that managers responsible for innovation in service firms need to integrate the work of management teams responsible for other business strategies in order to better leverage the business' knowledge assets.

6.6 Control Measures

The final step in researching the characteristics of the NKE was to explore the impact of external environmental turbulence, industrial setting, and business size on the nature of the service firms' NKE. In investigating the characteristics of the

service business' NKE under varying degrees of change, the sensitivity of the NKE to variations in each three variables could be analysed.

6.6.1 Impact of External Turbulence on the NKE

The data was also analysed to investigate the impact of external environmental turbulence on the NKE.

Firstly, the sample of NSD programmes were clustered into two groups: (i) those operating in a highly turbulent external environment; (ii) those NSD programmes operating in a less turbulent external environment. The results are presented in Exhibit 6-14.

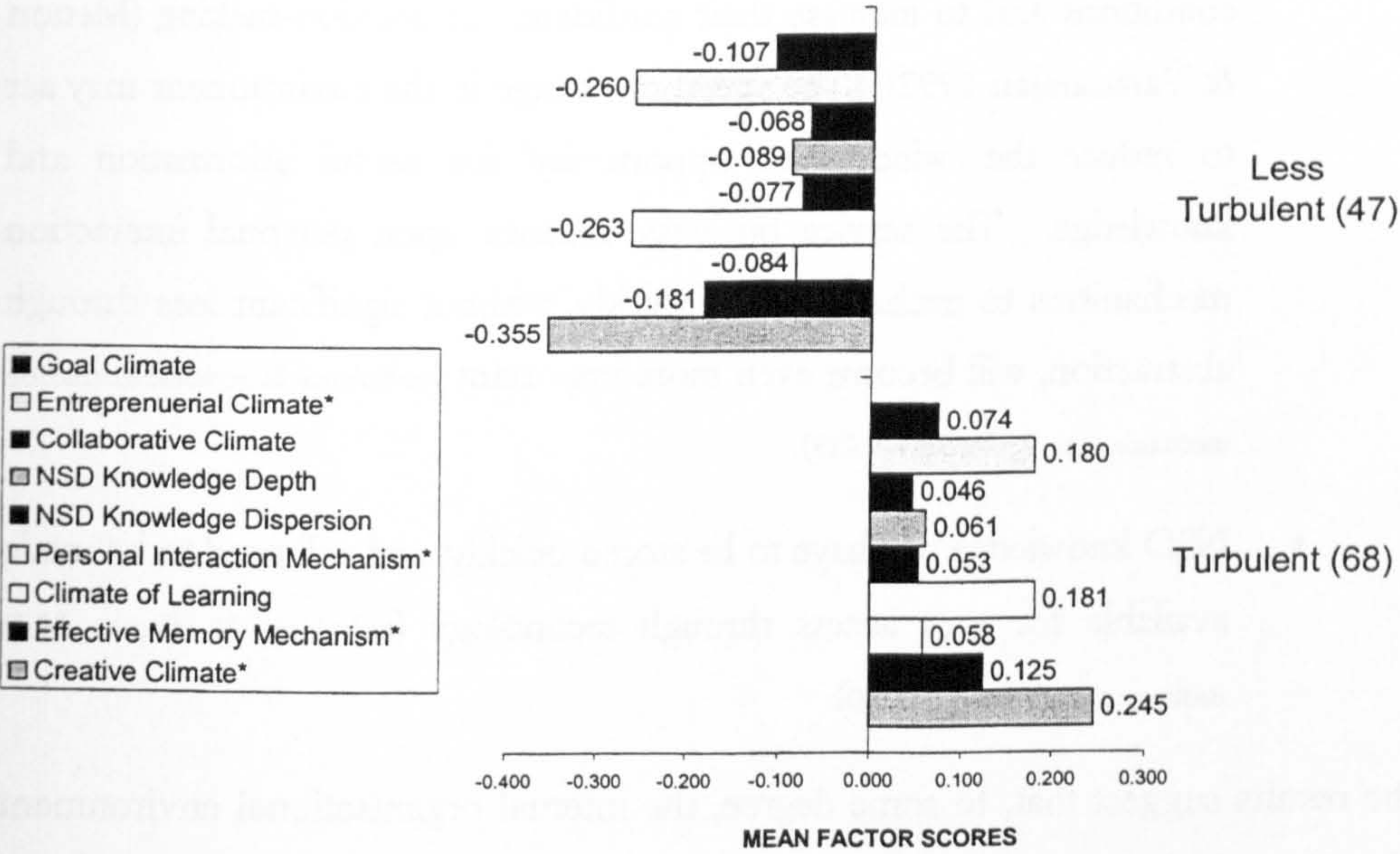


Exhibit 6-14: Impact of External Turbulence on the NKE¹⁰⁴

It was found that NSD programmes operating in more turbulent environments reported high mean factor scores on all nine NKE factors, although only four of the variables exhibited significant differences: (i) entrepreneurial climate; (ii)

¹⁰⁴ The notation “*” indicates the presence of a significant relationship.

personal interaction mechanism; (iii) memory mechanism; (iv) creative climate. For NSD programmes operating in highly turbulent external environments the existence of four significant relationships implies:

- Service firms may need to become even more of a 'prospector', but being first to market will require the active support of senior management in encouraging innovative activity (turbulence & entrepreneurial climate: $t = 2.415$; Sig. = 0.017).
- The service business will need to support/reward new ideas and initiatives to a greater extent (turbulence & creative climate: $t = 3.190$; Sig. = 0.002).
- Managers may have to seek more, or different, information in order to develop greater understanding of the evolving market and technological conditions and to increase their confidence in decision-making (Menon & Varadarajan 1992). The speed of change in the environment may act to reduce the 'window of opportunity' for useful information and knowledge. The service business' reliance upon personal interaction mechanisms to exchange ideas quickly, without significant loss through abstraction, will become even more important (turbulence & personal interaction mechanism: $t = 2.376$; Sig. = 0.019).
- NSD knowledge will have to be stored quickly, and will need to be made available for easy access through technology (turbulence & effective NSD memory: $t = 1.661$; Sig. = 0.100).

The results suggest that, to some degree, the internal organisational environment takes a new form as a result of fluctuations in the information originating from the external environment. This follows from Nonaka (1988b) who suggested that in such circumstances an organisational "new order" embraces physical patterns of organisational structures and systems, as well as new mental models such as visions, concepts, or values. In highly turbulent environments, firms are more creative and entrepreneurial, pass information around through face-to-face contact and share knowledge for future use.

Impact of NKE on NSD Performance in Highly Turbulent External Environments

Correlations were computed between the NKE factors and the measurement of overall success during highly turbulent and less turbulent times. The results are presented in Exhibit 6-15.

NSD Performance Factors					
NKE Factor	¹⁰⁵	Overall Success ¹	New Opportunities	Customer Responsiveness	Financial Performance
Climate of	All	0.267***	0.232**	0.172*	0.322***
Learning	HT	n/s ²	n/s	n/s	n/s
	LT	0.334**	0.450***	n/s	0.539***
Creative	All	0.249***	0.161*	0.273***	0.246***
Climate	HT	n/s	n/s	n/s	0.216*
	LT	n/s	n/s	0.302**	n/s
NSD Knowledge	All	0.450***	0.302***	0.350***	0.293***
Depth	HT	0.418***	0.339***	0.290**	0.389***
	LT	0.480***	n/s	0.409***	n/s
Entrepreneurial	All	0.388***	0.362***	0.223**	0.351***
Climate	HT	0.396***	0.367***	0.252**	0.255**
	LT	0.321**	0.293***	n/s	0.430***
Collaborative Climate	All	0.375***	0.326***	0.476***	0.265***
	HT	0.311***	0.314***	0.395***	n/s
	LT	0.434***	0.333**	0.546***	0.353***
Goal Climate	All	0.330***	0.352***	0.326***	0.307***
	HT	0.312***	0.406***	0.282**	0.314***
	LT	0.338**	0.247*	0.375***	0.280*
Effective	All	n/s	0.226**	0.169*	0.236**
NSD	HT	n/s	n/s	n/s	n/s
Memory	LT	n/s	0.389***	n/s	0.316**
Personal	All	0.215***	0.170*	0.244***	0.285***
Interaction	HT	n/s	n/s	n/s	0.214*
Mechanism	LT	n/s	n/s	0.280*	0.310**
NSD Knowledge	All	0.364***	n/s	0.180*	0.304***
Dispersion	HT	0.296**	n/s	0.390***	0.268**
	LT	0.435***	n/s	n/s	0.335**
¹ . Likert scale 1-7; ² . Not a significant relationship at 10% level; ***. Correlation is significant at the 1% level; **. Correlations significant at the 5% level; *. Correlations significant at the 10% level.					

Exhibit 6-15: Correlations Between NKE and NSD Programme Performance in Varying Turbulent External Environments

¹⁰⁵ All = All businesses, irrespective of turbulence; HT = Firms operating in highly turbulent markets; LT = Firms operating in low turbulence.

An examination of the correlations from Exhibit 6-15 indicates that external environmental turbulence can have both positive and negative impacts on NSD performance. Significant relationships are identified in the text below.

From the Performance Perspective

From the perspective of overall success, the correlations between the NKE factors and overall success in meeting the objectives of the NSD programme are not, in general, influenced by turbulence in the external environment. Only a climate of learning becomes less advantageous when turbulence is higher, i.e. previous mental models may need to be discarded or refined in the light of the "new order".

From a new opportunities perspective, in a highly turbulent external environment the correlation with NSD knowledge depth is higher ($r = 0.339$; $\text{Sig.} = 0.000$). This suggests that the importance of a service business' NSD knowledge depth increases, i.e. the value of what you know is more important in seeking new market opportunities in more turbulent times. A strong climate of learning is more advantageous in winning new clients and new markets in less turbulent external environments, i.e. commitment to learning offers greater rewards because prior learning remains a useful guide to future states ($r = 0.450$; $\text{Sig.} = 0.000$). Similarly, in less turbulent times an effective NSD memory increases in importance when winning new opportunities as prior learning and knowledge becomes more valuable ($r = 0.389$; $\text{Sig.} = 0.000$).

From a customer responsiveness perspective, a highly turbulent external environment results in a stronger correlation with entrepreneurial climate ($r = 0.252$; $\text{Sig.} = 0.05$), and NSD knowledge dispersion ($r = 0.390$; $\text{Sig.} = 0.000$), and a change from significant correlation to no correlation with creative climate ($r = n/s$) and personal interaction mechanism ($r = n/s$). The implication is that in situations of low external environmental turbulence, the importance of a creative climate and a personal interaction mechanism in serving existing customers becomes more advantageous, i.e. creativity becomes more beneficial as it becomes more difficult for a business to create differentiation. Conversely, the importance of an entrepreneurial climate and a dispersed NSD knowledge increases in more turbulent times, thus

suggesting as volatility increases the need to act quickly and share knowledge broadly also increases.

From a financial performance perspective, a highly turbulent external environment results in a stronger correlation with creative climate ($r = 0.216$; $\text{Sig.} = 0.10$), and NSD knowledge depth ($r = 0.389$; $\text{Sig.} = 0.000$). Conversely, the significance of climate of learning ($r = n/s$), collaborative climate ($r = n/s$) and effective NSD memory ($r = n/s$) decreases.

From the NKE Perspective

The importance of NSD knowledge depth may increase in highly turbulent environments because staff and management need to spend less time seeking new knowledge, and can therefore concentrate their efforts on applying that knowledge to the development of new services. Similarly, in highly turbulent environments a creative climate may assist staff and management identify new ideas and projects which better leverage the business' resources.

The implication of the results is that in situations with a highly turbulent external environment, the importance of climate of learning and effective NSD memory is less advantageous to financial performance because they do not increase sales and profits significantly, possibly because prior knowledge has become less advantageous. A collaborative climate may become more advantageous in a low turbulent external environment because as potential market and technological opportunities decrease in number, team working and communication will be needed to combine and more effectively leverage the business' knowledge assets to produce differentiation.

The Relationship Between Strategy Selection and External Environmental Turbulence

The data was also investigated to determine whether differences existed between the strategies adopted by service firms when operating in external environments characterised by varying levels of market and technological turbulence. The

results indicating the nature of the relationship between innovation strategy and external environmental turbulence are presented in Exhibit 6-16.

	Turbulent Environment	Less Turbulent Environment	Total
Prospector Strategy (37)	27 ¹ (21.9) ²	10 (15.1)	37
Analyser Strategy (51)	30 (30.2)	21 (20.8)	51
Defender Strategy (16)	7 (9.5)	9 (6.5)	16
Reactor Strategy (11)	4 (6.5)	7 (4.5)	11
Total	68	47	115
Pearson Chi-Squared = 6.861 (Sig.= 0.076); Likelihood Ratio = 6.931 (Sig.= 0.074) Linear-by-Linear Association (Sig.=0.010). ¹ = Observed count; ² = Expected count			

Exhibit 6-16: Innovation Strategy and Turbulence in External Environment Cross tabulation

Using a Chi-Squared statistical test, although statistical differences were observed between the innovation strategy adopted by the service business and the degree of external environmental turbulence in which the service business operated, they were not significant at the 0.05 level¹⁰⁶. Similarly, no statistically significant relationship was identified between the degree of external environmental turbulence in which the service business operated and the presence of a formal knowledge management strategy¹⁰⁷. Independence can therefore not be assumed.

¹⁰⁶ It has been observed that only when the observed significance level is small enough (i.e. 0.05 or 0.01) can the hypotheses that two variables are independent be rejected (SPSS for Windows Base System User's Guide Release 6.0).

¹⁰⁷ The test used the three categories of knowledge strategy defined earlier in this chapter, i.e. those service businesses with: (i) none of the three formal knowledge strategies; (ii) only an information management strategy; (iii) a knowledge management strategy alone or a knowledge management strategy alongside an information management OR intellectual asset management strategy.

Overall Implications for NSD Programmes in Turbulent Environments

The findings of this thesis suggest that as the external environment changes, more opportunities emerge for new technologies, markets and services. Rapid change, in particular, creates uncertainty which destroys competences (Anderson & Tushman 1990; Tushman & Anderson 1990; Leonard-Barton 1992a). During highly turbulent times it will become increasingly difficult for managers to map their environments (Fiol & Lyles 1985; March & Olsen 1975) accurately, and previous knowledge may only begin to stand in the way of effective action in the "new order" (Moorman & Miner 1997). When attempting to commercialise new services in a highly turbulent environment, a service business may discover that traditional models of learning are incomplete, and action needs to be taken on developing and redefining innovative market, technical, and economic models (Lynn et al. 1998), i.e. adopting a more prospector approach. This may well be driven by top management, since it is primarily they who interpret the importance of environmental events and who communicate their view of the importance of knowledge management activity through speeches and statements (Lyles & Schwenk 1992).

6.6.2 NKE and Industrial Setting

The NKE data was additionally explored to determine whether any significant differences in the characteristics of the NKE existed as a consequence of the NSD programmes' industrial setting. The results are presented in Exhibit 6-17.

Industry	F- Values ³	Financial Services (41) ¹	Travel, Retail, Utilities (25)	Telecos & IT (28)	Professional Services & Media (21)
Climate of Learning	n/s	0.148	-0.004	-0.259	0.061
Creative Climate	n/s	-0.058	-0.139	0.034	0.233
NSD Knowledge Depth	n/s	0.154	-0.130	-0.230	0.161
Entrepreneurial Climate	n/s	-0.110	-0.238	0.186	0.252
Collaborative Climate	n/s	0.092	0.139	0.043	-0.403
Goal Climate	n/s	0.067	-0.030	-0.156	0.112
Effective NSD Memory	F = 4.121 Sig.= 0.008	-0.021 ²	-0.512	0.154	0.445
Personal Interaction Mechanism	n/s	-0.142	-0.071	0.195	0.103
NSD Knowledge Dispersion	F = 2.911 Sig.= 0.038	0.349	-0.191	-0.284	-0.075
¹ . Number of respondents in group; ² . Factor scores with mean value = 0; ³ . One-way ANOVA statistic;					

Exhibit 6-17: NKE & Industrial Setting

Although the results indicate there are differences in the mean factor NKE scores achieved by service firms in the different industrial settings, only two were found to be statistically significant: (i) effective NSD memory; (ii) NSD knowledge dispersion.

PS&M firms report relatively high mean factor scores on the effective NSD memory dimension (\bar{x} = 0.445), T&IT above average (\bar{x} = 0.154), FS near average scores (\bar{x} = -0.021), and TR&U below average (\bar{x} = -0.512). This seems to indicate that PS&M and IT&T firms are making extensive use of routines and advanced information technology to store NSD knowledge for use on subsequent projects, whilst TR&U firms are less proactive. The implication may be that PS&M firms are more knowledge-intensive firms, and that their competitive advantage in the marketplace is *more* reliant upon their management of knowledge assets than other industrial groups, and IT&T firms are experimenting with technology.

created in their own sector. Conversely, FS firms achieve relatively higher mean factor scores on the NSD knowledge dispersion dimension ($\bar{x} = 0.349$), PS&M report near average scores ($\bar{x} = -0.075$), while TR&U ($\bar{x} = -0.191$) and T&IT ($\bar{x} = -0.284$) score relatively poorly. This may indicate that FS firms are very active in team-based NSD (Storey & Easingwood 1994), and that staff and management actively spend time discussing the way in which NSD is carried out. The poor performance of T&IT service firms is somewhat surprising, and may suggest that the lessons learned from the development of tangible goods (Barczak 1995; Lapierre & Henault 1996; Saghafi et al. 1990) is not being adopted by those involved in the development of services.

The data was also investigated to determine whether differences existed between the strategies adopted by services firms in different industrial markets, i.e. is the choice of industrial market associated with the strategy adopted.

Using a Chi-Squared statistical test, no significant statistical differences were observed between the innovation strategy adopted by the service business and the industrial market in which the service business operated. Similarly, no statistically significant relationship was identified between the industrial market and the presence of a formal knowledge management strategy. Independence can therefore be assumed.

6.6.3 NKE and Business Size

The data was additionally explored to determine whether there were any significant differences in the characteristics of the NKE according to the size of the business.

Although the data indicates there are variations in the average mean NKE factor scores achieved by different sized firms, none of these differences were found to be statistically significant. Although this is the first study which attempts to empirically test the impact of an internal environment on knowledge transfer and NSD programme performance, previous research has indicated that business size is important in building a supportive internal culture (Markides 1998). De

Brentani (1995a) asserted that: "In both large and small service companies, managers who succeed in creating such a 'culture' reap significant rewards in the form of greater new product success" (p. 220).

The data was also investigated to determine whether differences existed between the strategies adopted by different sized service firms, i.e. is the choice of strategy adopted associated with the size of the business. Using a Chi-Squared statistical test, no significant statistical differences were observed between the innovation strategy or the formal knowledge strategies adopted and the size, in turnover, of the service business.

Further implications of business size are reviewed in Appendix K.

6.7 Conclusions

It has been identified that a primary influencing issue in the development of successful new services is the creation of an innovative NSD environment, where ideas and open communication are encouraged by supportive management (De Brentani 1993a). It is therefore in the business' interest to strive to establish the appropriate culture, structure, incentives, systems, and processes that somehow allow innovation to happen as part of daily business (Markides 1997).

In adopting a knowledge-based view of a service business, this thesis conceptualised a notion of a NKE to represent the characteristics of the internal corporate environment which support the business' ability to develop new services. Factor analysis distinguished nine dimensions in the data which represented the organisational systems, values and structures. The nine dimensions were: (i) NSD knowledge depth; (ii) NSD knowledge dispersion; (iii) personal interaction mechanism; (iv) effective NSD memory; (v) climate of learning; (vi) creative climate; (vii) entrepreneurial climate; (viii) collaborative climate; (ix) goal climate.

The NKE was found to have a significant impact upon a number of NSD programme performance measures, e.g. the overall success of the service business in achieving its NSD programme objectives, the three NSD programme

performance dimensions (financial, customer responsiveness, new opportunities), and NSD activity rates (e.g. success rate). Additionally, the NKE was discovered to have a significant impact on the service business' overall innovativeness, i.e. of both its processes and outcomes.

Using the existence of formal knowledge strategies, three groups of NSD programmes were identified: (i) NSD programmes operating in service firms where none of the three formal knowledge strategies had been established; (ii) NSD programmes operating in service firms where only an information management strategy had been established; (iii) NSD programmes operating in service firms which had established a knowledge management strategy (and/or an information or intellectual asset management strategy). The NSD programmes operating in service firms with no formal strategies possessed less supportive internal knowledge environments than the two other groupings (i.e. they returned significantly lower mean NKE factor scores). Additionally, they were found to be significantly less successful on most performance measures.

NSD programmes operating in more turbulent external environments, as defined by technology and market volatility, were discovered to possess higher NKE scores than those operating in less turbulent environments. Similarly, external environmental turbulence was found to have a moderating affect upon the strength of the relationship between the NKE and NSD programme performance.

Although the results of this thesis indicate there are differences in the mean factor NKE scores achieved by service firms in different industrial settings, only two were found to be statistically significant: (i) effective NSD memory; (ii) NSD knowledge dispersion.

Similarly, although the data indicates there are variations in the average mean NKE factor scores achieved by different sized firms, none of these differences were found to be statistically significant.

7 NSD PROCESS PROFICIENCY

This chapter is the third of three chapters which analyse the results of this research. It builds on the understanding gained in the previous two chapters by exploring the importance of executing the NSD process proficiently.

7.1 Introduction to the Results on NSD Proficiency

Three main issues are explored in this chapter: (i) the extent to which service firms are proficient at executing stages of a NSD process; (ii) the impact of proficient execution of the NSD process on NSD programme performance; (iii) the impact of the NKE upon proficiency of execution.

Initially, each respondent was required to rate the proficiency with which the service business executed the nine steps identified as comprising the NSD process. It is recognised that these steps may not be performed sequentially, and may indeed be part of an iterative process, which has more to do with inter-organisational relationships than any logic of development process (Scarborough & Lannon 1989). The proficiency of the NSD process was measured on a 1 - 7 Likert scale, anchored by "strongly disagree" (1) and "strongly agree" (7).

The measurement of NSD process activities in this way has regularly been used as a measure of NSD process proficiency in studies of new products and services (e.g. Storey & Easingwood 1996; Edgett 1996). While an accepted gauge of NSD process proficiency, evaluating NSD process performance in such a way has some limitations: (i) it provides no absolute indication of proficiency, only relative values; (ii) those relative values are ascertained from a sample of firms where the respondent may apply different value systems to determined proficiency; (iii) no further insight is gained into the practices of the firm when completing NSD projects. Therefore, one may conclude that the NSD literature may benefit greatly from further research into more effective methods of determining NSD proficiency.

7.2 Are Service Firms Proficient at NSD Process Execution?

The mean proficiency scores are presented in Exhibit 7-1. Significance tests were computed for all mean proficiency scores (i.e. mean scores for all stages against mean score of individual stages) to identify those activities which are being executed proficiently and those which are being executed poorly.

Proficiency Dimension	Mean Score ¹	T-test	Significance
<i>Overall Mean Value for All Stages</i>	4.64		
<i>Early Stages</i>			
Idea generation	5.40	5.770	0.000
Concept development and evaluation	5.17	4.095	0.000
Business analysis	4.97	2.143	0.034
<i>Later Stages</i>			
Service development & evaluation	4.69	0.209	n/s
Market testing	3.91	-4.849	0.000
Implementation	4.54	-0.851	n/s
Commercialisation	4.59	-0.484	n/s
Post-launch audit & review	3.99	-4.221	0.000
<i>Overall Project Management</i>			
Project Management of NSD	4.53	-0.869	n/s

¹ Likert scale 1-7;

Exhibit 7-1: Mean Scores for Proficiency of NSD Process Execution

The results indicate that respondents perceive their firms to be executing the stages of the NSD process proficiently in only a small number of instances (a NSD stage was deemed to be proficiently executed if a score of 5 is achieved on a the 7-point Likert scale). Five significant relationships were identified between the overall mean value for the NSD steps and the individual stages : (i) idea generation; (ii) concept development & testing; (iii) business analysis; (iv) market testing; (v) post-launch audit & review. These significant relationships are now discussed.

Stages Executed Proficiently

The mean scores for the idea generation ($\bar{x} = 5.40$) and concept development / evaluation ($\bar{x} = 5.17$) stages were found to be executed proficiently, and their scores were significantly different from the overall mean scores reported for all the stages. Although Easingwood (1986) identified that many service firms find it relatively easy to generate new service *ideas*, many services markets are characteristic of an overall lack of radical innovation (Chan, Go & Pine 1998), and there is often a dangerous focus on 'me-too' products, with most developments being reactive and defensive in nature (Piercy & Morgan 1989). These findings are at odds with previous research which suggests that *concept testing* is often carried out imperfectly in NSD because it is both difficult to develop accurate concept descriptions. Customers therefore have difficulties in articulating which precise benefits they prefer, which increases organisational uncertainty as to the accuracy of the research results (Langeard, Reffait & Eiglier 1986; Mohammed-Salleh & Easingwood 1993; Edvardsson, Haglund & Mattsson 1995).

Stages Not Executed Proficiently

Associating a score of five as the threshold for determining a NSD step to be executed proficiently results in seven of the nine stages being considered poorly performed. It has been suggested previously that some stages of the NSD process, while carried out by service firms, are executed less than proficiently, even though evidence indicates these stages have a high impact on project outcomes (Easingwood 1986). In this research, two NSD stages were found to be executed particularly inefficiently: (i) market testing ($\bar{x} = 3.89$; $t = -4.849$; Sig.= 0.000); (ii) post-launch review ($\bar{x} = 3.99$; $t = -4.221$; Sig.= 0.00). The fact that these two stages were not generally performed well supports the observations of previous academic researchers (Edgett 1994; Easingwood 1986).

The use of *market testing* is widely advocated because it is easier and cheaper to correct mistakes in the design of a service, and in service support systems, at this stage than after a formal launch (Johne & Storey 1998). Langeard, Reffait and

Eiglier (1986) even consider market testing, and test marketing in general, to be more important than market research, as the latter is often not a reliable means of assessing consumer acceptance of new services. Although market research can provide broad customer reactions to new service concepts, it is important to create a service experience that the consumer can evaluate, thus enabling the business to make sure the service is operating correctly. It has been observed that market testing, of all the steps in the NSD process, is by far the most omitted of all NSD stages and, on those infrequent occasions when it is performed, is not done well (Mohammed-Salleh & Easingwood 1993). A number of other issues have been cited as reasons for the widespread lack of market testing by services firms (Easingwood 1986; Reidenbach & Moak 1986; Davison, Watkins & Wright 1989; Mohammed-Salleh & Easingwood 1993).

The fact that service firms do not conduct proficient *post-launch audits and reviews* supports the findings of Easingwood (1986) who observed that only 60% of firms carry out a formal post-launch assessment. Feedback as an organisational learning principle is needed to detect and correct error and reinforce particular responses. A business that does not use the knowledge generated in the development of a new service loses many of the benefits that a NSD process brings. It has been suggested that some key monitor indicators should be established to measure the progress made, i.e. in deciding what to change and how to change it, the progress of the NSD process should be evaluated (Day 1994a). In a NPD context, Wheelwright & Clark (1992) assert that learning for product development goes beyond changing procedures, methods, or models, and requires careful systematic effort. The authors report that using a "project audit" - a formal review conducted by a cross-functional team appears to be of great help to organise the learning process.

NSD Project Management

An additional question was added to the eight steps on the questionnaire to explore whether respondents perceived that, in general, they were proficient at

project managing the whole NSD project¹⁰⁸. The mean scores reported for project management ($\bar{x} = 4.53$), indicates scope for a service business to develop greater expertise in NSD.

Differences Between Early and Later Stages

Additionally, a paired comparison t-test was conducted on the proficiency data to determine if there were differences in the proficiency with which the early and later stages of the NSD process were conducted. Constructs were formed for the early and later stages by summing and averaging the mean scores for stages 1-3 and 4-8. The results are presented in Exhibit 7-2.

Paired Comparison ¹	Mean	T-test	Significance
NSD Early Stages (stages 1 - 3) - NSD Later Stages (stages 4-8)	5.18 4.34	8.046	0.000
¹ Based on a Likert scale 1-7;			

Exhibit 7-2: Paired Samples Comparison Between Early & Later Stages

The results suggest there is a significant difference in the proficiency with which the early and later stages of the NSD process are executed. Further analysis indicated that service firms who more proficiently execute stages of the NSD project process are more successful at NSD at the programme level¹⁰⁹. The importance of the pre-development stages has also been reported in tangible product development studies (Cooper 1988a).

¹⁰⁸ When each of the 8 stages was correlated with the NSD project management measure, it was found that while all were significantly correlated, idea generation was less significantly resulted than all other measures (i.e. $r = 0.323$, Sig. = 0.000).

¹⁰⁹ When clustering cases by the nine proficiency measures into 2 groupings (those highly proficient at all nine activities and those not) it was found that the most highly proficient scored significantly more highly on the overall success measure.

7.3 Impact of NSD Process Proficiency on NSD Programme Performance

In a survey of commercial financial services firms, Edgett (1996) observed a strong link between the quality of execution of the stages of the NSD process and the overall performance of NSD projects. In particular, the author noted that the NSD activities which strongly distinguished the high performers were the "pre-development" stages of the NSD process. While Edgett (1996) found that top performers are more proficient in the execution of the stages of the NSD process, the conclusion was arrived at by aggregating the scores for all respondents' individual NSD *projects*. This thesis research seeks to confirm Edgett's findings, but in terms of NSD programmes from a cross section of industries. The research question posed was:

Q3: Are service firms who more proficiently execute the NSD process more successful at NSD?

7.3.1 Identifying the Relationship Between NSD Proficiency and NSD Programme Performance

To investigate the relationship between the proficiency with which the stages of the NSD process are executed and the performance of the NSD programme, correlations were computed between NSD proficiency and the four performance dimensions (as well as the measure of overall success). The results are presented in Exhibit 7-3.

NSD Performance Factors					
Proficiency Dimension ¹	Overall Success ¹	Innovative Performance	New Opportunities	Customer Responsiveness	Financial Performance
Early Stages²	0.368 ^{***}	0.486 ^{***}	0.343 ^{***}	0.318 ^{***}	0.429 ^{***}
Idea generation	0.249 ^{***}	0.458 ^{***}	0.400 ^{***}	0.279 ^{***}	0.326 ^{***}
Concept development and evaluation	0.297 ^{***}	0.469 ^{***}	0.256 ^{***}	0.259 ^{***}	0.372 ^{***}
Business analysis	0.358 ^{***}	0.288 ^{***}	0.202 ^{**}	0.250 ^{***}	0.362 ^{***}
Later Stages²	0.462 ^{***}	0.451 ^{***}	0.245 ^{***}	0.358 ^{***}	0.315 ^{***}
Service development & evaluation	0.352 ^{***}	0.323 ^{***}	0.201 ^{**}	0.352 ^{***}	0.241 ^{***}
Market testing	0.335 ^{***}	0.278 ^{***}	0.221 ^{**}	0.348 ^{***}	0.268 ^{***}
Implementation	0.312 ^{***}	0.323 ^{***}	0.129	0.212 ^{***}	0.172 [*]
Commercialisation	0.360 ^{***}	0.450 ^{***}	0.176 [*]	0.141	0.303 ^{***}
Post-launch audit & review	0.366 ^{***}	0.316 ^{***}	0.190 ^{**}	0.286 ^{***}	0.195 ^{**}
Overall Management					
Project Management of NSD	0.517 ^{***}	0.480 ^{***}	0.274 ^{***}	0.417 ^{***}	0.375 ^{***}
¹ . Likert scale 1-7; ² . Computed measure; ^{***} . Correlation is significant at the 1% level; ^{**} . Correlations significant at the 5% level; [*] . Correlations significant at the 10% level.					

Exhibit 7-3: NSD Proficiency & Programme Performance

Relationships between NSD proficiency and NSD programme performance were identified which supports the findings of research from the tangible product development area. Kleinschmidt & Cooper (1991) observed that, in addition to product innovativeness having a 'strong, statistically significant, dramatic and consistent impact on new product performance' (P. 250), more innovative products and NSD proficiency are closely related.

7.3.1.1 OBSERVATIONS FROM THE RELATIONSHIPS

A number of significant observations were identified in the data, and these are discussed in the text below.

Less Significant Relationships

In general, the proficiency with which NSD activities were executed and the performance of the NSD programme were strongly and positively correlated, regardless of the performance measures adopted. Two exceptions were observed where correlations were not significant: (i) commercialisation; (ii) implementation.

A weaker relationship existed between the proficiency with which new services were commercialised and the measure for customer responsiveness ($r = 0.141$, Sig. = n/s). This might indicate that the proficiency with which new services are commercialised into the existing client base is a relatively less important issue in achieving better performance than in situations where new services are commercialised into new markets and to new customers who have less knowledge of the service business. A service business will better understand the needs of its existing customers, rather than new customers in new markets, where the needs of the population are less clear. This follows from previous research which found that service firms can speed up the adoption of new services by lowering the degree of service newness to customers. If new services have concepts that customers find difficult to comprehend (likely where the needs of the target customer are uncertain), this will require a major learning effort on the part of the customer, and will necessitate the service business having to carefully plan for the adoption process (Atuahene-Gima 1996b; Lievens, Moenaert & S'Jegers 1997b).

The weaker correlation between service implementation and new opportunities ($r = 0.129$, Sig. = n/s) may be explained in two ways: (i) the *establishment* of new markets is much more reliant upon other variables, e.g. the attractiveness of the idea or the speed of getting the new service to market; (ii) potential ambiguity in the respondents' understanding of the term, although this was not identified as an issue in the pilot study.

Less Performed Stages

While the market testing and post-launch review stages are not executed particularly proficiently, they were, in relative terms, found to be closely associated with NSD programme performance.

As reviewed earlier, this research found that the market testing stage was executed less proficiently than all other stages ($\bar{x} = 3.91$). However, its impact on NSD programme performance is significant: overall success ($\bar{x} = 0.335$; Sig.= 0.000); innovative performance ($\bar{x} = 0.278$; Sig.= 0.000); new opportunities ($\bar{x} = 0.221$; Sig.= 0.00); customer responsiveness ($\bar{x} = 0.348$; Sig.= 0.000); financial performance ($\bar{x} = 0.268$; Sig.= 0.000). The tendency of service firms not to perform the market testing stage, or to do so less than adequately, has long been regarded as a potential source failure (Mohammed-Salleh & Easingwood 1993).

As reviewed earlier, this research found that the post-launch review stage was executed less proficiently than all other stages ($\bar{x} = 3.99$), with the exception of market testing. However, its impact on NSD programme performance is significant: overall success ($\bar{x} = 0.366$; Sig.= 0.000); innovative performance ($\bar{x} = 0.316$; Sig.= 0.000); new opportunities ($\bar{x} = 0.190$; Sig.= 0.00); customer responsiveness ($\bar{x} = 0.286$; Sig.= 0.000); financial performance ($\bar{x} = 0.195$; Sig.= 0.00). The presence of post-launch reviews is not always tested for in NSD research, however, when researchers have investigated the impact on performance, the relationship has been observed to be significant (De Brentani 1995b). In the context of a NSD programme, the post-launch review is vital for consolidating the knowledge gained from the recently completed project, and making it available to those involved in the NSD programme (McKee 1992; Cahill 1995).

Overall Project Management

The proficiency of managing NSD projects was highly correlated with all five performance measures, suggesting that NSD project management is a potentially insightful measure to adopt when exploring the importance of NSD management in the context of a NSD programme: overall success ($\bar{x} = 0.517$; Sig.= 0.000); innovative performance ($\bar{x} = 0.480$; Sig.= 0.000); new opportunities ($\bar{x} = 0.274$; Sig.= 0.00);

customer responsiveness ($\bar{x} = 0.417$; Sig.= 0.000); financial performance ($\bar{x} = 0.375$; Sig.= 0.000). Because the innovative performance dimension captures both process-driven and outcome measures, it is not surprising that it is highly and significantly correlated with many of the individual proficiency measures, i.e. being proficient at managing the NSD project is likely to lead to a service business being an innovative idea generator, good at commercialising, being first to market with new services, and likely to be perceived as innovative by customers.

Early vs. Later Stages

Exhibit 7-3 also presented correlations between the proficiency with which the early and later stages of the NSD are executed. It was found that the proficiency with which the later stages of the NSD process is executed (overall success: $\bar{x} = 0.462$; Sig.= 0.000) is more closely associated with the overall success of the NSD programme than the early stages (overall success: $\bar{x} = 0.368$; Sig.= 0.000). Although both the early and later stages of the NSD were highly correlated with overall success, this research confirms the findings of previous researchers that the early stages are particularly influential. For example, a survey of commercial financial service firms by Edgett (1996) found that the NSD activities which strongly distinguished the high performers were the "pre-development" stages of the NSD process.

7.4 NKE and NSD Process Proficiency

NSD activities, and stages of the NSD process, are important vehicles through which knowledge is captured, integrated, stored during a NSD project, and then shared across a NSD programme. The next stage of this thesis was to explore the extent to which the NKE influences the proficiency with which the stages of the NSD process are executed, i.e. is a supportive internal environment associated with more proficient execution of the NSD process? The research question posed was:

Q4-a: Which elements of the NKE influence the proficiency with which the stages of the NSD process are executed?

7.4.1 An Analysis of the Influence of the NKE Factors on NSD Process Proficiency

Researchers have identified that the early and later stages of the NSD process are two closely related, but individually distinct, stages (e.g. de Brentani 1993a; Cooper & Kleinschmidt 1986). In NPD studies, Cooper (1988) identified that the pre-development stages of the NPD process are often ignored, even though success or failure is often decided before the product even enters the product development phase. In this research, two new measures were therefore created from eight of the nine variables representing the stages of the NSD process. Mean values from the first three stages were aggregated, and their aggregated scores averaged, to produce a new measure. Similarly, mean values for stages 4 - 8 were aggregated and their computed scores averaged to form a new measure. The final stage (NSD project management) had already been identified as an insightful measure of the overall management of the NSD process, and was therefore used as the third measure of proficiency. Correlations were computed between the three proficiency measures and the nine NKE dimensions to investigate the significance of the relationships. The results are presented in Exhibit 7-4, and the particular research questions posed in the conceptual model are subsequently discussed in the light of this data.

	Early Stages of NSD Process ²	Later Stages of NSD Process ³	Project Management of NSD Process
NKE Dimension ¹			
Climate of Learning	0.352***	0.256***	0.230**
Creative Climate	0.254***	0.332***	0.205**
NSD Knowledge (Depth)	0.388***	0.497***	0.527***
Entrepreneurial Climate	0.435***	0.232**	0.284***
Collaborative Climate	0.328***	0.387***	0.380***
Goal Climate	0.230**	0.133	0.173*
Effective NSD Memory	0.325***	0.310***	0.381***
Personal Interaction Mechanism	0.313***	0.294***	0.188**
NSD Knowledge (Dispersion)	0.143	0.305***	0.346***
¹ . Likert scale 1-7; ² . Cronbach alpha = 0.7621; ³ . Cronbach alpha = 0.8014; ***. Correlation is significant at the 1% level; **. Correlations significant at the 5% level; *. Correlations significant at the 10% level.			

Exhibit 7-4: NKE Factors and NSD Process Proficiency

In general, it was found that all nine NKE dimensions are positively correlated with the proficiency with which the NSD process is executed. The nature of these relationships is now discussed.

7.4.1.1 DEPTH OF NSD KNOWLEDGE

Depth of NSD knowledge found in the service business's NSD programme is highly and significantly correlated with all three measures of NSD proficiency: early stages ($r = 0.388$, $\text{Sig.} = 0.000$); later stages ($r = 0.497$, $\text{Sig.} = 0.000$); NSD project management ($r = 0.527$, $\text{Sig.} = 0.000$). The implication is that a greater depth of NSD knowledge will result in more proficient execution of the NSD process, largely as staff begin to 'internalise' their knowledge in new organisational routines. The findings of this research follow the observations of previous tangible product development research which found that a deeper understanding of the skills required to implement the development process is likely to result in a higher quality process (Cooper & Kleinschmidt 1995b). The implication for management is that to be proficient at developing new services, service firms should invest heavily in the development of the knowledge sets required to

execute the NSD process. This knowledge then needs to be embedded into organisational routines so that learning can take place across time and space (McKee 1992).

7.4.1.2 NSD KNOWLEDGE DISPERSION

Whilst the depth of a service business' NSD knowledge has been found to be important in achieving greater NSD proficiency, this research also identified a highly significant relationship between proficiency and NSD knowledge dispersion. In particular, it was found that the proficiency with which a business manages its NSD projects ($r = 0.346$; $\text{Sig.} = 0.000$) and the later stages of the NSD process ($r = 0.305$, $\text{Sig.} = 0.000$) are significantly correlated with NSD knowledge dispersion. The development of a new service tends to be largely reliant upon cross-functional communication and co-operation. In many circumstances, the knowledge required to execute the NSD process is dispersed across both full-time and part-time, non-professional marketers (Gummesson 1991b; Gronroos 1984; George 1990). Even in the establishment of small venture teams, where fewer staff are involved in managing a single NSD project, it is important that NSD knowledge does not remain solely in the possession of one individual, or a small group of individuals. The findings of this research build upon the observations of Rochford & Rudelius (1992) who discovered that certain phases of the NPD process benefited from the contribution of information from a larger number of sources.

Conversely, the early stages of the NSD process and NSD knowledge dispersion are not significantly correlated ($r = 0.143$, $\text{Sig.} = \text{n/s}$)¹¹⁰. This suggests that the creative outcomes required at the beginning of the NSD process, i.e. during the idea generation, concept development and business analysis phases, are more likely to result when heterogeneity exists (Moorman & Miner 1997). A high degree of homogeneity has been found to lead in some circumstances to 'group-think'. This

¹¹⁰ When analysing the data more closely, it was found that of the three variables loading most heavily on the NSD knowledge dispersion dimension, the correlation between the all three and the early stages were significant, albeit at very low levels.

view is supported by Hedlund (1994) who posits that one of the reasons for the innovation problems of large, Western organisation lies in the inflexibility of tightly specified and articulated systems of knowledge, which makes it difficult to be consistent and to engage in projects not perceived to fit 'what the company is all about'. One may also conclude that because the early stages of the NSD process are more of an art than a science, i.e. decisions are often based on management intuition, the dispersion of NSD knowledge may not be as important as in the later stages, where the NSD process requires a more convergent approach to decision-making. This follows from Leonard-Barton & Sensiper (1998) who found that while divergence in the early stages results in highly creative behaviour (i.e. new ideas), convergence in the later stages is demonstrated in overlapping specific knowledge (i.e. knowledge of specific steps in the NPD process), collective system knowledge (i.e. knowledge of the overall NPD process), and guiding tacit knowledge (i.e. the guiding metaphor).

7.4.1.3 EFFECTIVE NSD MEMORY

Investing in the development of NSD knowledge, and having it made widely *available* to the staff and management involved in the NSD programme, may not be sufficient, in itself, to achieve proficient execution of the NSD process. This research also found highly correlated and significant relationships between the storage of NSD knowledge and: (i) the proficiency with which a business manages its NSD projects ($r = 0.381$, $\text{Sig.} = 0.000$); (ii) the execution of both the early ($r = 0.325$, $\text{Sig.} = 0.000$) and later stages ($r = 0.310$, $\text{Sig.} = 0.05$) of the NSD process. The implication is that service firms need to establish mechanisms to *store* NSD knowledge in a form which makes it more easily retrievable by those involved in the decision-making processes of the NSD process. If a service business is to reuse the knowledge created over time, the knowledge and learning literatures suggest that it is important the business selects the appropriate knowledge vectors to focus upon, maintains them appropriately, and is able to reactive them when required (Porac & Thomas 1990; Garud & Nayyar 1994). The harder it is for individuals to uncover the whereabouts of pertinent and relevant knowledge within the business, the more likely it is that lower levels of proficiency will

result. The implication is that managers need to examine mechanisms for embedding NSD knowledge into knowledge-based technology, or organisational processes (Nelson & Winter 1982), where it can be retrieved and reused by staff and management, thus creating the knowledge spirals referred to by Nonaka (1994).

7.4.1.4 PERSONAL INTERACTION MECHANISM

While using technology to store NSD knowledge has been demonstrated to have an important impact on NSD, the use of more personal mechanisms to transfer ideas was also observed to be a key issue related to increased NSD proficiency. The use of personal interaction mechanisms was significantly correlated with the later stages ($r = 0.294$, $\text{Sig.} = 0.000$), the overall project management of the NSD process ($r = 0.188$, $\text{Sig.} = 0.05$), and particularly with the early stages ($r = 0.313$, $\text{Sig.} = 0.000$).

The inference is that the mechanisms which enable staff and management to engage in a face-to-face or voice-based idea exchange, and which also allow complexity of meaning to be conveyed in an effective way, positively influence the proficiency with which a service business executes the early stages of the NSD process. However, one would expect new forms of technology to become increasingly influential as sophistication increases and users' confidence in its reliability and effectiveness increases, e.g. teleconferencing, web-based dialogue¹¹¹. This follows from Leonard-Barton & Sensiper (1998) who observed that tacit knowledge may be potentially exercised through problem-solving, problem finding, prediction and anticipation. Such divergence is particularly important in the early stages of the NSD process, and results in highly creative behaviour (i.e. new ideas).

¹¹¹ Of the direct personal mechanisms identified in the interviews, but not included in the factor dimensions, teleconferencing was closely associated with proficiency on all three measures, and scheduled group meetings were supportive of proficiency only in the early stages.

7.4.1.5 CLIMATE OF LEARNING

The climate of learning dimension is closely related to the proficiency with which the NSD process is executed. While climate of learning was found to be highly correlated with the overall management of the NSD project ($r = 0.230$, $\text{Sig.} = 0.05$) and the later stages of the NSD process ($r = 0.256$, $\text{Sig.} = 0.000$), it was particularly significantly correlated with the early stages of the process ($r = 0.352$, $\text{Sig.} = 0.000$). This would appear to support the findings of previous research (e.g. Cooper & Kleinschmidt 1986; Edgett 1996) which suggests that service firms need to pay more, and closer, attention to the activities constituting the early stages of the NSD process, and to ensure that they are carried out capably because they are closely associated with the success of individual NSD projects. The implication is that successful service innovators are committed to learning the lessons from the pre-development phases of prior projects, and then to use this knowledge to influence future project successes.

However, to perpetuate an organisational learning environment, the business needs to institutionalise a formal learning system (Shrivastava 1983). Institutionalisation may take two forms: (i) the first element of that system may be a recognition on behalf of the staff and management that learning is important; (ii) the second is the creation of a process to guide that learning, e.g. a NSD process which links multiple NSD projects through post-launch reviews. An understanding of why learning is important has been posited to focus the attention of staff and management onto those activities which will help facilitate its development, and McKee (1992) observes that to be effective over the long-run an organisation must learn from the innovation process. However, this research has also identified that services firms are not proficiently executing the post-launch phase of the NSD process, despite its impact on performance.

7.4.1.6 ENTREPRENEURIAL CLIMATE

The presence of an entrepreneurial climate in a service business forms a close relationship with NSD proficiency. While an entrepreneurial climate is highly correlated with both the overall management of the NSD project ($r = 0.284$, $\text{Sig.} = 0.000$)

and the later stages of the NSD process ($r = 0.232$, $\text{Sig.} = 0.05$), it was particularly strongly correlated with the early stages, where the degree of correlation and level of significance were high ($r = 0.435$, $\text{Sig.} = 0.000$).

The importance, and impact, of an entrepreneurial climate on tangible product development has been reported previously (Cooper & Kleinschmidt 1995b). Entrepreneurial cultures have long been demonstrated to thrive on information acquisition (Slater & Narver 1994). This would suggest a close relationship between an entrepreneurial style and the proficiency with which the stages of the NSD process are executed in a service business (i.e. because information acquisition is so important). In a NSD project, entrepreneurial individuals and groups are also likely to be more proficient at identifying new market and technological trends and creating new options and directions which the business can pursue.

Previous research has also indicated that top management has an influential role in facilitating entrepreneurial activity and NSD proficiency. In particular, they can advance the cause of innovation by offering encouragement of entrepreneurial behaviour, which endows employees with clearly defined discretionary powers to carry out their innovation work (Edgett 1994; Edgett & Parkinson 1994). The stimulation, motivation and establishment of a clear entrepreneurial climate, ultimately embedded in the business' culture, results in staff become more aware of the impact proficient execution of certain stages has on the performance of the innovation process.

7.4.1.7 COLLABORATIVE CLIMATE

The collaboration achieved during the development of a new service is closely associated with the proficient execution of the early stages ($r = 0.328$; $\text{Sig.} = 0.000$), later stages ($r = 0.387$; $\text{Sig.} = 0.000$) and overall project management of the NSD process ($r = 0.380$; $\text{Sig.} = 0.000$). It is one of the most consistent NKE influencers of all round NSD process proficiency. Collaborative climate suggests that staff and management are able to communicate and co-operate effectively, whereas the personal

interaction mechanism dimension indicates the characteristics of the communication vehicles which enable that collaboration to take place.

The concepts surrounding collaborative climate have long been identified in the literature as representing dimensions which exert a significant impact on the degree to which the interdepartmental integration required for effective group-based innovation takes place. Previous research into NPD has found that greater proficiency of NPD process execution is facilitated through creative co-operation, collaborative involvement of cross-functional teams, and the resolution of interdepartmental rivalries and conflicts (Dwyer & Mellor 1991a; 1991b). This research extends the findings to NSD, where Drew (1994) has also reported that a high level of interdepartmental co-ordination among the people and departments is required in successful NSD.

7.4.1.8 GOAL CLIMATE

Vision & purpose is required to establish the goals and direction for the NSD project and its management. In this research, goal climate was found to be significantly correlated with the proficiency with which both the early stages of the NSD process ($r = 0.230$; $\text{Sig.} = 0.000$) and overall project management are executed ($r = 0.173$; $\text{Sig.} = 0.05$). Without a clear purpose, staff and management are unlikely to understand, and to invest in, the kinds of knowledge which are critical for achieving business success and in improving the proficiency of the NSD process¹¹². The relationship between goal climate and the later stages of the NSD process is less significant ($r = 0.133$; $\text{Sig.} = 0.16$). An analysis of the correlations between the individual variables comprising the goal climate dimension and the later stages of the NSD process, indicates that the correlation between 'total agreement' (a constituent variable of the goal dimension) and the later stages is not significant, although it is in the early stages¹¹³. One explanation may be that

¹¹² Deshpande et al. (1993) found that "market" based cultures emphasise goal achievement, productivity and efficiency.

¹¹³ In the early stages the common agreement correlation is not significant ($r = 0.166$, $\text{Sig.} = \text{n/s}$), while in the later stages it is significant ($r = 0.213$, $\text{Sig.} = 0.00$).

as the development proposition is crystallised, staff and management's dissatisfaction with the project increases as flexibility, experimentation and informality is replaced by formalisation and control (Johns & Snelson 1988). Collaborations on tangible product development projects have been demonstrated to be especially susceptible to divergent views (Clark & Fujimoto 1990; Day 1994c). The implication for management is that divergence undermines the ability of the management team to develop a focused response to market trends or environmental shocks (Sinkula et al. 1997).

7.4.1.9 CREATIVE CLIMATE

This research found that a supportive creative climate is closely associated with proficiency in the early stages ($r = 0.254$, $\text{Sig.} = 0.000$), NSD project management ($r = 0.205$; $\text{Sig.} = 0.05$), and the proficiency of the later stages of the NSD process ($r = 0.332$; $\text{Sig.} = 0.000$). The implication is that in order to achieve effective decision-making during the NSD process, management needs to create a climate which encourages and rewards the search for new information, supports a diversity of beliefs, free exchange of information, open questioning and interaction (Kimberley & Evanisko 1981; Amabile 1988; Kanter 1988; Woodman et al. 1993). Rather than being just supportive of the NSD team, management may engage in "subtle control" (Brown & Eisenhardt 1995) whereby the performance goal is achieved through balancing empowered creativity and management control.

It is interesting to note that while research often highlights importance of informal processes in executing the early stages of the development process (Leonard-Barton & Sensiper 1998), there are few references to the importance of a creative climate in achieving proficient execution in the later stages, where more formal and rigid controls are likely to be used. Crawford (1994) noted that techniques for stimulating ideas for new services must be created and maintained on an on-going basis to keep generating innovations because ideas for new products can arise almost anywhere (Robinson & Stern 1997; Vandermerwe 1987). This research appears to suggest that creativity is being leveraged effectively by most service firms, but greater competitive advantage may lie in development of the later

stages, where the disparity between the high and moderate performers is that much greater.

7.4.2 The Influence of NSD Structures on NSD Process Proficiency

A number of questions were included in the questionnaire to explore whether particular project structures were more effective than others at achieving proficient execution of the NSD process. The research question posed was:

Q4-b: Which organising structures are more effective at achieving proficient execution of the NSD process?

Each respondent was asked to rate the extent to which their business adopted particular structures, and the degree to which each structure was deemed to be *effective* in managing NSD projects, i.e. replies were self-rated effectiveness measures. Effectiveness was measured on a 1 - 7 Likert scale: "strongly disagree" (1) to "strongly agree" (7). The results are presented in Exhibit 7-5.

Effective NSD Structures ¹	Percentage Used ²	Mean Scores (Effective Structures)
Line of Business Manager	87.0%	4.87
Marketing Manager	72.2%	4.71
Venture Team	70.4%	5.09
NSD Group	54.8%	5.02
Brand / Product Manager	54.8%	4.54
Committee	49.6%	4.68
No formal organisation	47.0%	3.45
Partner	24.3%	3.63
¹ Likert scale 1-7; ² Percentage of service firms mentioning that they used the following structures during a NSD project.		

Exhibit 7-5: NSD Project Structures and NSD Process Proficiency

7.4.2.1 STRUCTURES MOST OFTEN USED IN MANAGING NSD PROJECTS

The NSD process may be viewed as consisting of a number of task groups whose members are chosen from functionally differentiated firms or departments. It must therefore be organised to provide the integrating mechanism, while continuing to enable individuals to maintain their functional specialisation (Grant 1996; Gupta, Raj & Wilemon 1986; Moenaert & Souder 1990a; 1990b; Demsetz 1988). The composition, group process, and work organisation of the project team will therefore affect the information, resources, and problem-solving style of the team.

This research found that the *line of business manager* is the most likely organising structure to be adopted to implement a NSD project. The finding follows the observations by Gronroos (1996) that marketing is increasingly becoming a business orientation, and not purely a functional discipline, i.e. responsibility for marketing is being devolved to the *front-line*. Other structures used extensively include: (i) marketing managers ($\bar{x} = 72.2\%$); (ii) venture teams ($\bar{x} = 70.4\%$). While the importance of using marketing managers to control development projects is supported by prior research (Barczak 1995), that of venture teams is less common (Bart 1988). The omnipresence of marketing managers as managers of NSD projects may reflect the perception among service firms that managers need to co-ordinate a large number of products, and that the dedicated marketing manager is the most effective mechanism at present.

7.4.2.2 EFFECTIVE STRUCTURES

In a services context, de Brentani & Ragot (1996) observed that "only by closely interconnecting the specialised roles of the product development function can excellent communication and the real sharing of ideas and visions take place" (p. 525). NSD researchers have posited that the required co-ordination for NSD projects can be achieved through the use of formal multi-functional development teams (Drew 1995a; Edgett 1994; Edgett & Parkinson 1994; Atuahene-Gima 1995, 1996a, 1996b). However, was this borne out in this research? The results to answer this question are presented in Exhibit 7-5 above.

The results suggest that the formal structures adopted to execute the NSD process is likely to have a major influence on the effectiveness with which the NSD process is executed. Most notably, the most *effective* NSD structures in implementing a NSD project are liable to be those where control and co-ordination is the overt responsibility of a team: venture team ($\bar{x} = 5.09$); NSD group ($\bar{x} = 5.02$). The finding that service firms achieve a relatively high degree of effectiveness in implementing NSD projects through using *venture teams* is at odds with previous research which found that venture team projects tend to be poorly executed (Bart 1988). Although a NSD Group is effective at managing a NSD project, it is used only 54.8% of the time.

7.4.3 The Influence of Strategy on NSD Process Proficiency

Respondents were also invited to respond to a number of questions which explored the nature of the relationship between the existence of formal knowledge strategies and the proficiency with which the NSD process is executed.

7.4.3.1 NSD STRATEGY

The first question posed by the research was:

Q4-c: Do the characteristics of the NSD strategy adopted influence the proficiency with which the service firms executes stages of the NSD process?

Firstly, the mean scores for each of the NSD strategy groupings were computed across the three proficiency stages. The significance of the differences found were evaluated using F-Values in ANOVA tests. The results are presented in Exhibit 7-6.

NSD Process Proficiency	Prospector Strategy	Analysers Strategy	Defender Strategy	Reactor Strategy
Early Stages of NSD	5.44	5.34	5.00	3.78 ¹
Later Stages of NSD	4.51	4.50	3.96	3.54 ²
NSD Project Management	5.05	4.65	3.88 ⁴	3.18 ³
Reads: "the mean proficiency score for the early stages of the NSD process is 5.44 for NSD programmes operating prospector strategies"				
¹ Significant relationships between reactor strategies and the other three; ² Significant relationships between reactor strategies and prospector/analysers strategies; ³ Significant relationships between reactor strategies and prospector/analysers strategies and between a defender strategy and a prospector strategy; ⁴ Significant relationship between a defender strategy and a prospector strategy;				

Exhibit 7-6: NSD Strategy and NSD Process Proficiency

In general, it was found that the relationship between NSD strategy and the proficiency with which the NSD process is executed is significant if the strategy adopted is proactive one, i.e. a decision is made to be a prospector, an analyst or a defender.

A service business pursuing a reactor strategy is likely to be significantly less proficient in executing the NSD process (evaluated across all proficiency measures) than service firms following prospector, analyst or defender strategies, i.e. firms with reactor strategies in NSD are likely respond to service and market changes only when forced to do so by environmental pressures. A NSD programme's dependence upon a reactor plan will inevitably make it difficult to capture the knowledge and expertise required to learn the lessons of previous projects.

The only other statistically significant relationship between NSD strategy and NSD process proficiency was found between prospector and defender strategies in the overall management of the NSD project (Sig.= 0.000). This suggests that prospectors are more likely than defenders and reactors to be proficient at managing the NSD project. The proficiency with which prospectors and analysts execute the early and later stages of the NSD process are very similar. The strategies of both groupings requires them to establish a deliberate and proactive approaches to delivering new, and potentially innovative, services to market more

effectively that competition adopting similar approaches. That is, while prospectors wish to be first, analysers are fast-followers with more cost-efficient or innovative offerings.

7.4.3.2 KNOWLEDGE STRATEGIES

The thesis also sought to identify:

Q4-d: Does the existence of a formal knowledge strategy influence the proficiency with which the service business executes the NSD process?

To test the impact the existence of a formal knowledge strategy has upon the proficiency with which the NSD process is executed, t-tests were computed. The results are presented in Exhibit 7-7.

		Early Stages		Later Stages		NSD Project Management	
Strategy		Mean	Sig.	Mean	Sig.	Mean	Sig.
Information Management Strategy	Yes (63)	5.46	0.004 ¹	4.45	n/s	4.79	0.02
	No (47)	4.83		4.21		4.21	
Knowledge Management Strategy	Yes (26)	5.55	0.06	4.53	n/s	4.88	0.10
	No (89)	5.07		4.28		4.43	
Intellectual Asset Management Strategy	Yes (22)	5.71	0.01	4.51	n/s	5.00	0.03
	No (93)	5.05		4.30		4.42	
Note: Significance tested using t-test of Equality of Means (t-test); n/s= not significant; ¹ . Significance level;							

Exhibit 7-7: Knowledge Strategy and NSD Process Proficiency

In general, for all three knowledge strategies, significant relationships were reported for the proficiency of the NSD in both the early stages and the overall project management of the NSD process. However, across all three formal strategies, no significant relationship existed for the later stages. The explanation may be that the three formal knowledge strategies identify the existing information and knowledge which is to provide added-value to the business, i.e. in

identifying the most appropriate technologies, markets and processes, but they do not seek to guide the implementation of the NSD process. Guidance in the latter stages of the NSD process may be the responsibility of the NSD strategy.

In future research, it would be interesting to explore the actual content of the formal knowledge strategies adopted by service firms. Further investigation will also enable a more direct comparison to be made between the effects of a formal and an emergent strategy (Mintzberg 1994).

7.5 Control Measures

The final step was to investigate the impact of external environmental turbulence, industrial setting and business size on the proficiency with which the service business executes the NSD process. In investigating the proficiency of NSD execution under varying degrees of change in each of these environments, the sensitivity of proficiency to changes could be analysed.

7.5.1 Impact of External Turbulence on NSD Process Proficiency

The same procedure used to explore the impact of external environmental turbulence on NSD programme performance and the NKE was employed to investigate the impact of external environmental turbulence on the proficiency with which the NSD process was executed. The results are presented in Exhibit 7-8.

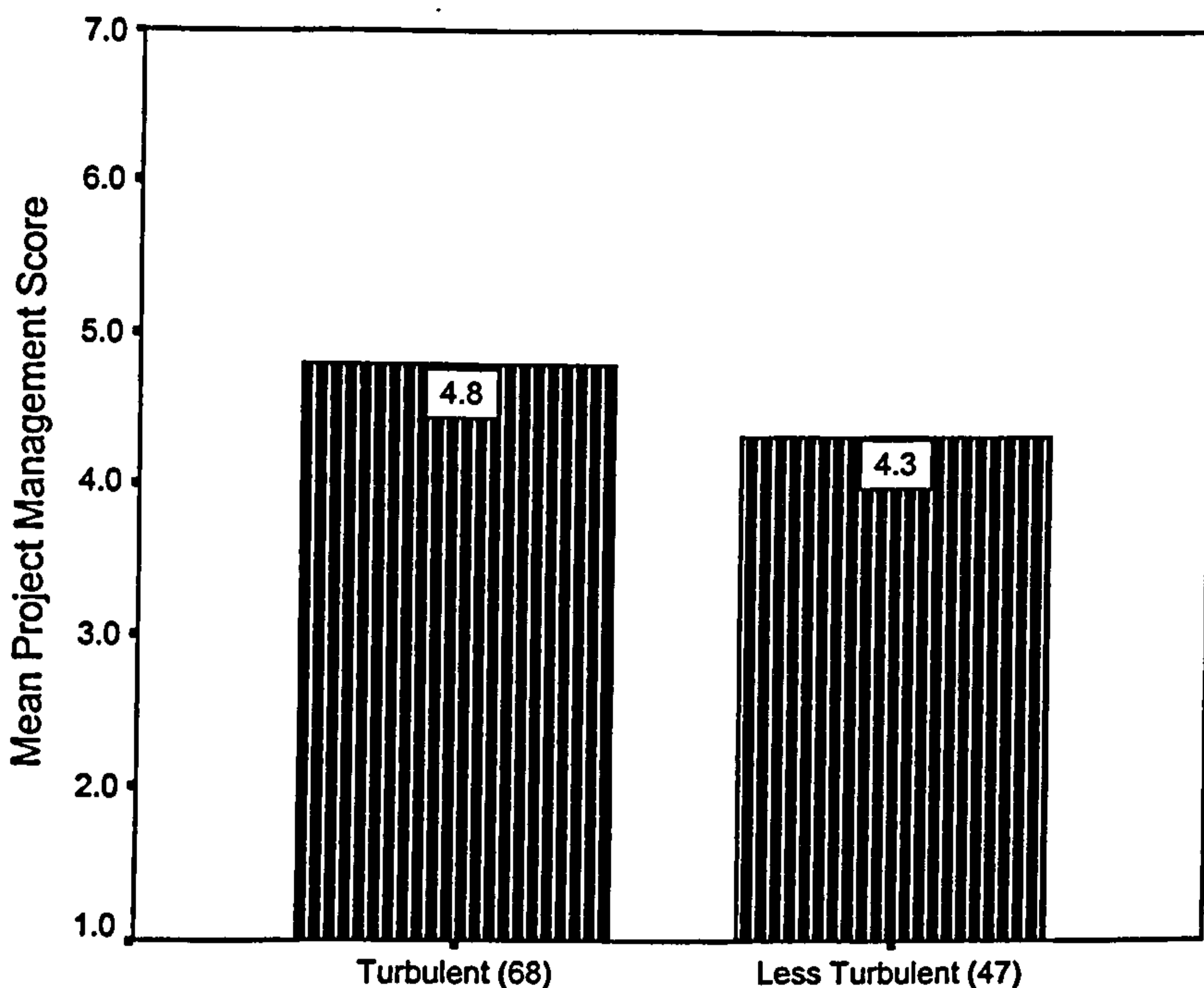


Exhibit 7-8: Affect of External Turbulence on NSD Process Proficiency

The results indicate that NSD programmes which managers perceive to be operating in particularly turbulent external environments, are more likely to comprise NSD processes which are proficiently managed, than those NSD programmes operating in less turbulent external environments. The relationship between external turbulence and NSD project management was found to be statistically significant ($t=1.825$; $\text{Sig.}=0.071$). This suggests that in turbulent times, the service business needs to attend more closely to the information requirements of the environment, and in doing so may adopt the more flexible development models cited by Iansiti (1995) which establish tighter integration between the concept and development stages¹¹⁴. It may well be that under conditions of high external environmental uncertainty it is not helpful to plan as much as one would do so in conditions of lower uncertainty. Maintaining flexibility, and learning

¹¹⁴ Karl Weick (1987) has argued that it may be necessary for the organisational process to become chaotic in order to match accurately the chaotic nature of the environment. However, this research did not attempt to measure the characteristics or degree of change which take place in the NSD process. This would be an interesting area of study in future services research.

quickly, is only likely to yield effective performance when the NSD process is executed proficiently. This research confirms the findings of the NPD literature¹¹⁵, that the capability to adapt to external uncertainties is a critical source of competitive advantage. Firms operating in highly turbulent external environments must establish NSD practices that can mitigate risk, manage uncertainty, and increase the likelihood of success (also Mullins & Sutherland 1998).

7.5.2 Proficiency & Industrial Setting

The data was additionally explored to determine whether there were any notable differences in the proficiency with which stages of the NSD process were executed across NSD programmes operating in different industrial sectors. Although the results found variations in the degree of proficiency achieved by the service firms in different industrial sectors, none of these differences were statistically significant. This supports the observations of previous research. For example, Cooper (1982) indicated that the industrial setting of the business had "little impact on new product activities" (p. 219).

7.5.3 Proficiency and Firm Size

Finally, the data was explored to determine whether the differences in the proficiency with which service firms executed their NSD projects could be explained by the size of the service business. The results are presented in Exhibit 7-9.

¹¹⁵ Iansiti (1995) found that the ability to adapt more effectively than the competition in turbulent external markets is linked to higher R&D productivity, shorter development lead time, and a higher degree of leverage of technological potential into system performance.

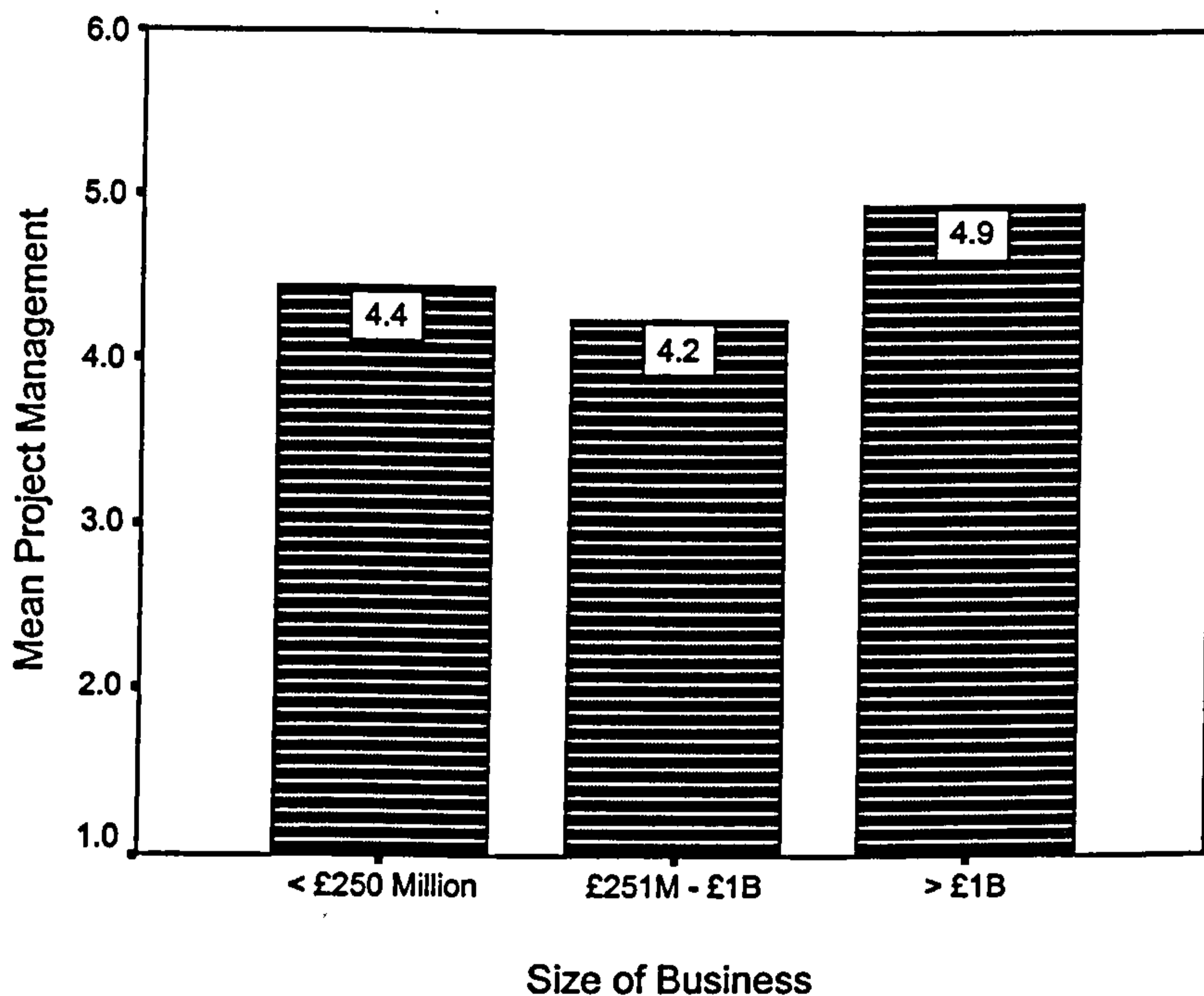


Exhibit 7-9: Business Size & NSD Proficiency

Although it was found that there are variations in the mean proficiency scores achieved by different sized firms, only the scores of NSD project management were statistically significant ($F= 2.492$, $Sig.= 0.087$). The largest service business were statistically more likely to execute their NSD process more proficiently than small or medium-sized firms. It is interesting to note that, once again, the implication is that a U-shaped relationship exists between proficiency and business size. The largest service firms are likely to possess the resources to be able to develop the skills and expertise of their staff. This skills advantage may then lead to more proficient execution of the NSD process. This finding supports previous research observations. De Brentani (1995a), for example, found that the more complex and hierarchical very large nation-wide firms adopt a more formal NSD process. The author states: "New service development is a complex, on-going, corporate endeavour. Effective NSD management, and a proficient and market-driven new service development process is a must, particularly for large industrial service firms" (p. 219).

7.6 Conclusions

The results of this chapter indicate that respondents perceive their firms to be executing the stages of the NSD process proficiency. However, two exceptions exist, market testing and post-launch review. The fact that these two stages were not generally performed well by service firms supports the observations of previous academic researchers (e.g. Edgett 1994¹¹⁶).

Significant differences were found in the proficiency with which the early and later stages of the NSD process are executed. Once again, this supports the observations of Edgett (1996) who asserted that the early stages of the development process are particularly important in the NSD project.

In general, the proficiency with which NSD activities were executed, and the performance of the NSD programme, were strongly and positively correlated, regardless of the performance measures adopted. Two exceptions were reported where correlations were not significant: (i) commercialisation; (ii) implementation. Similarly, Edgett (1996) observed a strong link between the quality of execution of the stages of the NSD process and the overall performance of NSD projects, i.e. the NSD activities which strongly distinguished the high performers were the "pre-development" stages of the NSD process.

The proficiency with which the later stages of the NSD process are executed is more closely associated with the overall success of the NSD programme than the early stages. Although both the early and later stages of the NSD process were highly correlated with the overall success of the NSD programme in meeting its performance objectives, this research confirms the findings of previous researchers that the early stages are particularly influential. Edgett (1996) found that the NSD activities which strongly distinguished the high performers were the "pre-development" stages of the NSD process.

In general, the dimensions of the NKE are positively correlated with the proficiency with which the NSD process is executed. The only factors not

¹¹⁶ Edgett (1996) adopted a 13 stage NSD process and excluded the idea generation stage.

exhibiting significant relationships were between: (i) the proficiency with which the later stages of the NSD process are executed and goal climate; (ii) the proficiency with which the early stages of the NSD process are executed and NSD knowledge dispersion. The former may be a consequence of as the development proposition is crystallised, dissatisfaction increases as flexibility, experimentation and informality is replaced by formalisation and control (Johne & Snelson 1988). The latter may be due to the lack of heterogeneity (Moorman & Miner 1997), resulting in a high degree of homogeneous 'group-think'.

The research found that the *line of business manager* is the most likely organising structure to be adopted to implement a NSD project. Although a NSD Group is highly effective in managing NSD projects, it is used only half of the time.

The relationship, in general, between NSD strategy and the proficiency with which the NSD process is executed is significant if the strategy adopted is proactive one, i.e. a decision is made to be a prospector, an analyser or a defender. Reacting to external events is likely to result in significantly poorer proficiency.

For all three knowledge strategies, significant relationships were reported for the proficiency of the NSD in both the early stages and the overall project management of the NSD process. However, across all three formal strategies, no significant relationship existed for the later stages. The explanation may be that the three formal knowledge strategies identify the existing information and knowledge which is to provide added-value to the business, i.e. in identifying the most appropriate technologies, markets and processes, but they do not seek to guide the implementation of the NSD process. Guidance in the latter stages of the NSD process may be the responsibility of the NSD strategy.

The results indicate that NSD programmes which managers perceive to be operating in particularly turbulent external environments, are more likely to be comprise NSD processes which are proficiently executed, than those NSD programmes operating in less turbulent external environments.

Although the results found variations in the degree of proficiency achieved by the service firms in different industrial sectors, none of these differences were

statistically significant. Similarly, although it was found that there are variations in the mean proficiency scores achieved by different sized firms, only the scores of NSD project management were statistically significant. The largest service business were statistically more likely to execute their NSD process more proficiently than small or medium-sized firms. It is interesting to note that, once again, the implication is that a U-shaped relationship exists between proficiency and business size.

In summary, one may suggest that NSD process proficiency is an insightful variable measure with which to measure both the performance of the NSD programme and the proficiency with which the service business manages the knowledge required to develop new services.

8 CONCLUSIONS

This chapter summarises the findings of the research, discusses the implications for management, identifies potential limitations in the research results, and finally proposes areas for future investigation. But first, the aims and objectives of the research are restated.

8.1 Aims of the Research

In the past two decades, UK and world economies have been marked by a steady shift away from the production of tangible goods toward a greater emphasis on services. The increasing importance of services has been driven by deregulation, industry restructuring, privatisation, technology development, and increased competition (Iacobucci 1998). The management literature widely agrees that the service sector contributes two-thirds to 80% of national and global economies, depending upon the measure used (Quinn, Doorley & Paquette 1990a), although this figure varies by geographical region. The probability, therefore, is that the development of services, and the service element in supplying products – not the management of physical resources – will be the key to growth for most firms, as well as industries and nations. For these reasons it is a subject worthy of research.

Building on a diverse stream of literature, knowledge strategy and NSD in particular, the theory investigated in this research is that service firms can use knowledge strategy to improve the innovation performance of their business. From the discussion of the literature in Chapter 2, a conceptual model was developed. The model represented a set of empirical relationships that could be tested empirically – i.e. it operationalised the theory that knowledge strategy impacts innovation performance in services firms.

Specifically this research sought to advance the body of academic knowledge in four main areas: (i) to identify the characteristics of the internal environment which influence the management of knowledge in a NSD programme; (ii) to determine whether these factors influence the success of a service business' NSD

programme and the proficiency with which its NSD process is executed; (iii) to identify whether the proficiency with which the NSD process is executed influences the performance of the NSD programme; (iv) to explore the nature of the relationship between innovativeness in service firms and the commercial success achieved by NSD programmes. Two primary and four secondary research questions were posed.

8.2 Key Research Findings

In adopting a knowledge-based view of a service business, this research conceptualised a notion of NSD Knowledge Environment (NKE) to represent the way in which knowledge is managed to support the business' ability to develop new services across a NSD programme. This is presented in Exhibit 8-1.

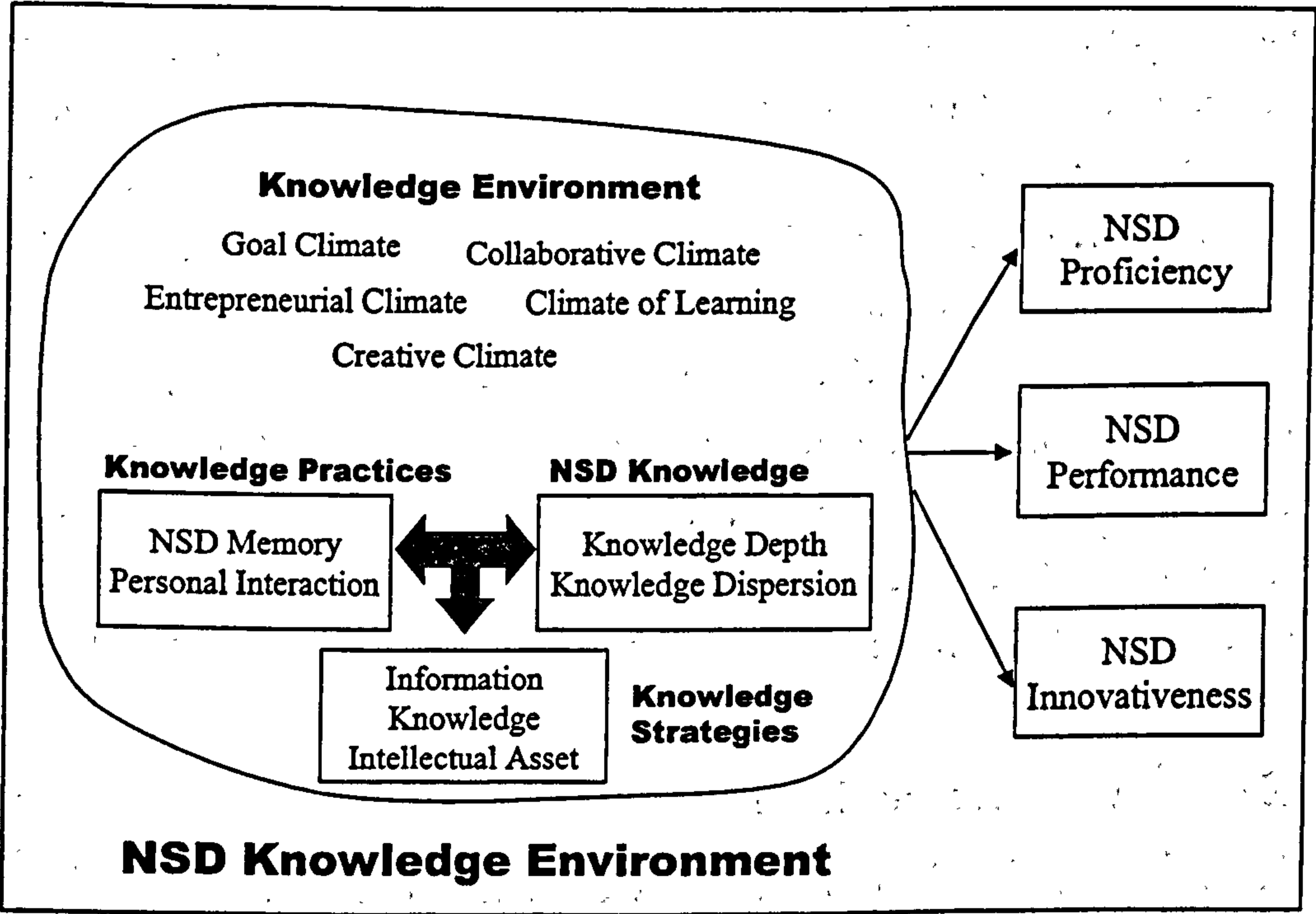


Exhibit 8-1: The New Service Development Environment (NKE)

The nine dimensions produced through factor analysis represent: (i) **NSD knowledge**, as represented by knowledge depth and knowledge dispersion; (ii) **NSD knowledge management practices**, as represented by personal interaction mechanism and effective NSD memory; (iii) **NSD knowledge environment**, as represented by climate of learning, creative climate, entrepreneurial climate, collaborative climate and goal climate; (iv) **NSD knowledge strategy**, as represented by information management, knowledge management and intellectual asset management strategy.

Robust research results were achieved as a consequence of adopting proven research methodologies and through the use of qualitative and quantitative research instruments to collect the data. Qualitative data was collected by interviewing senior executives from seven firms involved in the development of new service offerings in UK service firms. Two major advantages were gained from conducting the interviews: (i) identifying and qualifying the key variables which needed to be included in the survey instrument; (ii) determining the most appropriate style and format for the questionnaire to gain maximum response rates. Quantitative data was then subsequently collected using a questionnaire consisting of 127 attributes relating to the conceptual model. A sample of 385 UK-based service businesses was identified from leading service companies in the financial services, travel/transportation, professional services, retail, telecommunications & computing, and media sectors. In each business the Marketing Director or the director in charge of NSD was identified and sent the questionnaire. A total of 115 completed questionnaires were returned which equated to a 30% response rate.

8.3 Management Implications

The research results have both theoretical and practical applications that make valuable contributions to the services, new service development, and knowledge management literatures. Additionally, a number of important implications exist for management involved in the development of new services.

8.3.1 The New Service Development Knowledge Environment

This research has conceptualised the service business' internal organisational environment as the NSD Knowledge Environment (NKE). To create successful NSD programmes service firms need to ensure that the dimensions comprising the NKE are supportive of the NSD process and contribute significantly to making the NSD programme successful. In this research, it was found that what differentiates between the NSD programme performance of different service firms is the way in which each "packages" the dimensions comprising the NKE.

Management theorists have long attempted to prove the link between culture, climate and performance (e.g. Peters & Waterman 1982). In services, Thwaites (1992) posited that the only way for a service business to achieve long-term competitive advantage is through the development of "an organisational climate that is responsive to change and supportive of new product initiatives" (p. 303), and de Brentani (1993a) suggested that the primary factor in the development of successful new services is the creation of an innovative NSD environment encouraged by supportive management practices.

This research found that a failure to establish a sympathetic internal organisational environment may account for much of the variance found in the performance of UK service business' NSD programmes. Specifically, the NKE was found to exert a significant influence upon: the overall success of the service business in achieving its NSD programme objectives; three key NSD programme performance dimensions (financial, customer responsiveness, new opportunities); the innovativeness of the service business' NSD programme, i.e. of both its processes and outcomes; the overall success rate of the NSD programme.

The implication, therefore, is that executives of UK service firms must establish the appropriate culture, structure, incentives, systems, and processes that allow knowledge management and NSD innovation to occur as part of daily business.

8.3.1.1 THE DIMENSIONS OF THE NKE

Understanding the characteristics of the dimensions comprising the NKE should enable management in a service business to plan NSD programmes more effectively, and to focus on those areas of the business where they are currently deficient. The dimensions which management needs to be cognisant are reviewed below:

NSD Knowledge

The need for a business to develop specialised knowledge in order to effectively execute the activities of the NSD process is recognised in the product innovation literature (Johne & Snelson 1988). Conceptually, the NSD knowledge identified in this research is closely related to the know-what, know-how, know-why and care-why referred to in the knowledge literature (Garvin 1993). The fact that the depth of a business' NSD knowledge is closely related to the overall success of its NSD programme, and its ability to generate innovative new products, indicates the critical importance of developing and maintaining such skills over the long-term.

This research also confirms previous findings from the NPD field which posited that high levels of knowledge dispersion can increase the effectiveness and efficiency of decision-making and implementation and impact NPD financial performance (Moorman & Miner 1997). As dispersion levels increase, a NSD team's shared mental models are likely to become unified, cross-functional understanding and co-operation will be enhanced, resulting in timely, cost-effective decisions that improve the short-term financial performance of NSD activities (Day 1994a).

The Knowledge Environment

The knowledge environment in which NSD operates was found to have a strong and significant relationship with a number of NSD programme performance measures, e.g. the overall success of the service business in achieving its NSD programme objectives, sales, innovative new products, and success rate. In confirming that a primary influencing dimension in the development of successful

new services is the creation of an innovative NSD environment, where ideas and open communication are encouraged by supportive management, this research supports the work of de Brentani (1993a). We can therefore strongly encourage businesses' interest to strive to establish appropriate cultures, structure, incentives, systems, and processes that somehow allow innovation to happen as part of daily business (Markides 1997). Service businesses are heavily dependent upon the knowledge and ideas of their staff, and if a service business is to achieve long-term competitive advantage it must establish an organisational climate that is responsive to change and supportive of new product initiatives.

Knowledge Management Practices

Staff and management will seek to use a diversity of mechanisms to transfer ideas about improving the NSD process, depending on the characteristics of the knowledge individuals are seeking to communicate. The knowledge required to execute the NSD process is likely to be complex and multi-dimensional, i.e. tacit, and, as opposed to explicit knowledge, ideas for improving the NSD process will need to convey the more complex meaning of a situation or an activity. While information gains in complexity, so its diffusion and integration becomes more limited (Polanyi 1958), and it is only as complexity is mastered and reduced – this often calls for capacity to “abstract” – that the knowledge that one carries in one's head can be structured and either set down on paper or embedded in objects – i.e. codified. Once information has been transposed from individual brains into documents or physical objects it can be diffused quite rapidly (Boisot 1995b). However, in reducing complexity, some of the original value of the idea may be lost. The creation of new knowledge has been found to be a direct outcome of experiences, reflection and dialogue – three activities which are more likely to be shared in face-to-face contact (Fahey & Prusak 1998).

A service business which can develop an effective NSD memory, where the lessons from NSD best practice are stored, is likely to make such knowledge more easily retrievable by staff and management working on parallel or subsequent NSD projects. This has a significant impact upon the overall success of the NSD

programme, the innovative nature of the new services developed, and the level of sales achieved. Service businesses are therefore advised to find the most appropriate vehicles for establishing a long-term corporate memory.

NSD Knowledge Strategy

This research has observed that the development of one of more knowledge-related strategies (information, knowledge, intellectual asset) is likely to result in a more supportive internal environment and better NSD programme performance. This supports early findings from the knowledge literature. To be insightful, and to form the basis of a theory of the business as some researchers seek, knowledge must be defined precisely enough to facilitate a determination of which businesses have the more significant knowledge, and to explain how that knowledge leads to competitive advantage - a task currently being addressed by strategy researchers (Grant 1996; 1996b; Spender 1996a; 1996b). Similarly, because many different classifications of knowledge are perceived to exist, it has been posited that the business may need to develop a strategy for each classification of knowledge in order to promote its efficient and effective dissemination, measurement, growth and protection (Wiig 1997a).

8.3.2 NSD Process Proficiency

The importance of a high quality NSD process has long been associated with achieving NSD success. However, in general, the levels of sophistication demonstrated in the development of tangible goods has yet to be attained in many fields of new service development, i.e. service suppliers do not, in general, use sophisticated and formal development procedures (Martin & Horne 1993).

This research found that only a handful of service firms are executing the stages of their NSD process proficiently, even though the proficiency with which NSD activities are executed is strongly and positively correlated with the performance of the NSD programme, regardless of which measures of NSD programme performance are used. As a consequence, it is likely that during the NSD programme, knowledge is not being leveraged as effectively as it possibly could.

The implication is that management seeking to improve the performance of the NSD programme in service firms should: (i) focus on the degree to which the business has, or is, being successful in establishing some form of NSD process, with recognisable steps, which are executed proficiently; (ii) ensure the internal NKE is supportive of the NSD process; (iii) equally, managers aspiring to improve the knowledge management capability of the business might well adopt a NSD process as the vehicle by which to prove that knowledge management activity has significant business benefits.

The Impact of NKE Dimensions on NSD Process Proficiency

In general, it was found that the dimensions of the NKE are positively correlated with the proficiency with which the NSD process is executed. The implications for management are that:

- A deeper understanding of the skills required to implement the development process is likely to result in a higher quality process (Johns & Snelson 1988), i.e. to be proficient at developing new services, service firms should invest heavily in the development of the knowledge sets required to execute the NSD process.
- The development of a new service tends to be largely reliant upon cross-functional communication and collaboration, it is therefore important that NSD knowledge does not remain solely in the possession of one individual, or a small group of individuals¹¹⁷. This supports Grant's (1996) view that the "primary role of the business is the integration of knowledge" (p. 377).
- Managers need to explore vehicles for embedding knowledge into knowledge-based technology, or organisational processes where it can be retrieved and reused by staff and management, thus creating the knowledge spirals referred to in the literature (Nonaka 1994).

- The mechanisms which enable staff and management to engage in face-to-face or voice-based idea exchange, and which also allow complexity of meaning to be conveyed in an effective way, positively influence the proficiency with which a service business executes the early stages of the NSD process (Fahey & Prusak 1998). However, one would expect new forms of technology to become increasingly influential as sophistication increases and users' confidence in its reliability and effectiveness increases, e.g. teleconferencing, web-based dialogue.
- Service firms need to institutionalise a formal learning system whereby staff and management recognise that learning is important, and a process is created to guide that learning, e.g. a NSD process which links multiple NSD projects through post-launch reviews. An understanding of why learning is important has been posited to focus the attention of staff and management onto those activities which help facilitate its development. McKee (1992) observes that to be effective over the long-run an organisation must learn from the success and failure with its chosen innovation process.
- Previous research has also indicated that top management has an influential role in facilitating entrepreneurial activity and NSD proficiency. In particular, they can advance the cause of innovation by offering encouragement of entrepreneurial behaviour, which endows employees with clearly defined discretionary powers to carry out their innovation work (Edgett 1994; Edgett & Parkinson 1994).
- Without a clear purpose, staff and management are unlikely to understand, and to invest in, the kinds of knowledge which are critical for achieving business success and in improving the proficiency of the NSD process. Whilst it may be true that as the development proposition is crystallised, staff and management's dissatisfaction with the project increases as flexibility,

¹¹⁷ Conversely, the early stages of the NSD process and NSD knowledge dispersion are not significantly correlated. This suggests that the creative outcomes required at the beginning of the NSD process, i.e. during the idea generation, concept development and business analysis phases, are more likely to result when heterogeneity exists (Moorman & Miner 1997).

experimentation and informality is replaced by formalisation and control (Johne & Snelson 1988), divergence ultimately is likely to undermine the ability of the management team to develop a focused response to market trends or environmental shocks (Sinkula et al. 1997).

- To achieve effective decision-making during the NSD process, management needs to create a climate which encourages and rewards the search for new information, supports a diversity of beliefs, free exchange of information, open questioning and interaction. Rather than just being sensitive to the needs of the NSD team, management must engage in "subtle control" (Brown & Eisenhardt 1995) whereby performance goals are achieved through balancing empowered creativity and management control.

NSD Process Proficiency Impacts NSD Programme Performance

In general, the proficiency with which NSD activities were executed, and the performance of the NSD programme, were strongly and positively correlated, regardless of the performance measures adopted. Similarly, Edgett (1996) observed a strong link between the quality of execution of the stages of the NSD process and the overall performance of NSD projects, i.e. the NSD activities which strongly distinguished the high performers were the "pre-development" stages of the NSD process.

8.3.3 NSD Performance

Based on this research, a number of important observations may be made regarding NSD programme performance in UK service firms: (i) NSD is a vital capability for service firms seeking to achieve long-term success; (ii) UK service firms achieve different types of performance; (iii) UK service firms pursue different types of NSD strategy which are characterised by varying degrees of knowledge management proficiency, by the characteristics of their internal NKE and by their overall NSD performance. The implications of each of these issues for management are now discussed.

UK Service Firms are Active in NSD

The service firms sampled in this research were found to release an average of six new services per year, which is slightly higher than those figures reported by previous studies (e.g. Storey 1994). However, the findings highlight the extent to which UK service firms are active in the development of new services. The mean failure rate of approximately 26% is higher than that reported by previous studies (Edgett 1996), suggesting that competition is getting increasingly fierce.

NSD is Important to UK Service Firms

The importance of developing new services for UK service firms is unquestionable. Nearly 30% of the sales and over 27% of the profits of UK service firms in this research originate from new services launched in the previous three years. Respondents universally agreed that their NSD programme has been successful in making the business more competitive. The contribution made by new services as observed in this research is higher than that reported by similar studies and, in many instances, is higher than the figure reported by previous tangible product development research. However, as competition in the services sector increases, and external market and technological turbulence becomes more volatile, it is to be anticipated that this trend will be maintained, and may even intensify. The findings of this research are consistent with those of previous NSD studies. Drew (1995a) reported that "successful financial institutions obtained on average 15% of current year's revenues from new products launched within the previous two years...[while] successful firms projected over 30% of revenues from new products in five years".

Different Types of NSD Performance Exist

But how do service firms evaluate whether they are being successful or not? In this research, four dimensions of NSD programme performance were identified. The four comprise:

- Financial performance, which indicates the success of the NSD programme in achieving sales and profits.

- New opportunities which identifies the success of the NSD programme in innovating in markets.
- Customer responsiveness which measures the ability of the business to retain existing customers.
- The research also identified a multi-dimensional concept of innovative performance, comprising both measures of innovative outcome and process.

Innovativeness as Performance Measure

When segmenting the sample of NSD programmes according to their overall level of innovativeness, it was observed that the more innovative NSD programmes were more successful on other performance dimensions (financial and non-financial) than their counterparts, i.e. innovative NSD programmes were more successful than their competition on all three performance dimensions. Additionally, they achieved a very high percentage of sales and profits from new services introduced in the last three years. The implication for management is that being an innovative developer of new services may be a profitable stance to take in many instances. In contrast, previous NSD research has posited that the advantages of being first in the market with a new service are lower than those for tangible goods because services are inherently intangible, and therefore cannot be protected by patents (Bitner & Zeithaml 1987). However, this research indicates that 'breaking the rules of the game' offers the potential for long-term success.

'Be an All-Round Performer'

When analysing the data further, five clusters of NSD programmes were distinguishable: (i) All-round performers; (ii) market innovators; (iii) asset protectors; (iv) underachievers; (v) poor performers. All-round performers constitute the second smallest grouping with 18 cases (15% of the sample responses), and they comprise the most successful group of NSD programmes. The research results suggest that this small group of service firms have identified

a way of achieving both greater financial and non-financial success for their NSD programmes. All-round performers:

- Achieve the highest mean factor scores on two of the three performance dimensions (customer responsiveness & financial performance).
- Are more likely to be perceived by their managers to have largely met the overall objectives set for the NSD programme.
- Make 83% of the new services they launch successful.
- Generate the second largest percentage of sales from new services introduced in the last three years.
- AND do so most profitably, i.e. 41% of profits came from new services introduced in the last three years.

The implication, therefore, is that the management of a service business needs to focus its attention on developing balanced NSD programme performance, as opposed to excelling only in a limited number of areas. To some extent, this confirms the findings of Cooper & Kleinschmidt (1995c) who found that “balanced stars” were similarly likely to be the most successful at NPD. This observation would seem to support the findings of Kaplan & Norton (1996) who propose the use of the ‘balanced scorecard’ for evaluating the success of the overall business.

The Importance of the Service Business’ NSD Strategy

This research found that the majority of respondents, i.e. 76.52%, perceived that their firms pursued either *prospector* or *analyser* strategies, as opposed to *defender* or *reactor* strategies (Miles & Snow 1978).

A service business pursuing a reactor strategy is likely to be significantly less proficient at knowledge management, i.e. executing the NSD process, than service firms following prospector, analyser or defender strategies. In general, the relationship between NSD strategy and the proficiency with which the NSD process is executed is such that adopting a proactive strategy, i.e. a decision is

made to be a prospector, an analyser or a defender, is likely to result in significantly greater proficiency in knowledge management activity.

The characteristics of the NSD strategy pursued has significant implications for the nature of the internal NKE environment established within the service business. *Prospector* strategies report high mean factor scores on all nine NKE dimensions, *analysers* above mean scores on eight out of nine, *defenders* four out of nine, and *reactors* zero from nine. The implication is that prospectors and analysers have supportive internal environments, whilst defenders and reactors are failing to create an environment which is favourable towards knowledge management activity and innovation.

The strategic posture adopted by the service business was found to significantly impact the service business' NSD programme performance. This confirms the findings of previous NSD studies (e.g. Griffin & Page 1996). Prospectors, the second largest strategic grouping with 37 cases: (i) report the highest mean factor scores on all four performance factor dimensions; (ii) receive over 40% of their sales and profits from new services introduced in the previous 3 years; (iii) achieve the highest overall success and success rate ratings. To some extent, the results of this study support previous NPD research findings which indicate that the first entrant into a market is likely to witness high returns if he is successful (Lilien & Yoon 1990).

The implication for management is that a service business which pursues a NSD reactor strategy, and which reacts to environmental changes, will under-perform the competition on most performance measures. In contrast, being a prospector is more likely to lead to a supportive internal organisational environment and better NSD programme performance.

8.3.4 Further Implications of the Research

The research also has implications for service firms of different sizes, those operating in different markets, and for service firms faced by varying degrees of external environmental turbulence.

8.3.4.1 IMPLICATIONS FOR DIFFERENT BUSINESS MARKETS

Much of the previous NSD and NPD research has focused on the financial services sector. Less attention has been given to other business markets. In contrast, this research investigated a cross-section of different UK service markets, and found, in general, that the business market in which the NSD programme operated did not significantly impact NSD programme performance, the characteristics of the NKE or the proficiency of knowledge management activity (i.e. NSD process proficiency)¹¹⁸. This supports the observations of previous research, e.g. Cooper (1982), which indicated that the industrial setting of the business had "little impact on new product activities" (p. 219).

The implication for the management of UK service firms, i.e. that the market in which the business operates does not, in general, significantly impact the performance of NSD programmes, the characteristics of the internal NKE, or the way in which knowledge is managed in the NSD process, is that the responsibility for establishing successful NSD programmes lies in the action of management action. Additionally, one may suggest that many of the findings from research into UK financial service firms (the large part of academic research in this area) are generalisable across business markets.

8.3.4.2 IMPLICATIONS FOR DIFFERENT SIZED FIRMS

This research also investigated the implications for different sized firms (analysed by gross turnover). In general, significant relationships between business size and a number of variables were identified.

Although the largest service business were statistically more likely to manage NSD knowledge more proficiently than small or medium-sized firms, it is interesting to note that a U-shaped relationship exists between proficiency and business size. The implication is that the largest service firms are likely to possess the resources to be able to develop the skills and expertise of their staff.

¹¹⁸ From a NKE perspective, although the results indicate there are differences in the mean factor NKE scores achieved by service businesses in the different industrial markets, only two were found to be statistically significant: (i) effective NSD memory; (ii) NSD knowledge dispersion.

This 'skills advantage' may then lead to better knowledge management, i.e. more proficient execution of the NSD process. This finding supports the research observations of de Brentani (1995a), who found that the more complex and hierarchical large nation-wide firms adopt a more formal NSD process, "effective NSD management, and a proficient and market-driven new service development process is a must, particularly for large industrial service firms" (p. 219).

The data also indicates there are variations in the mean NKE factor scores achieved by different sized firms, but none of these differences were found to be statistically significant. Although this is the first study which attempts to empirically test the impact of a service business' internal organisational environment on knowledge management activity and NSD programme performance, previous general management research has hypothesised that business size is important in building a supportive internal culture (Markides 1998). Similarly, de Brentani (1995a) has asserted that in both large and small service companies, managers who succeed in creating a supportive 'culture' reap significant rewards in the form of greater new product success.

From a NSD programme performance perspective, the results of this research imply the existence of a U-shaped relationship between business size and NSD programme performance. The indication is that the largest firms with the greatest resources, or the smallest firms with a tendency to operate more closely to the market (Crane 1993), are the most successful at NSD. This supports previous research findings which hypothesised that business size has an indirect impact on NSD success (Ettlie & Rubenstein 1987), that smaller firms are more innovative than larger ones (Quinn 1985), and that smaller firms operate more sophisticated marketing activities (Colgate 1998).

The implication of these findings for management is that NSD programmes operating in the largest or the smallest group of service firms are likely to be better at managing the knowledge of the business, and consequentially more likely to be more successful.

8.3.4.3 IMPLICATIONS IN DIFFERENT EXTERNAL TURBULENCE

This research also investigated the impact of external environmental turbulence (market and technology) on the proficiency of knowledge management activity, the internal organisational environment and NSD programme performance emerged. A number of interesting findings emerged.

- NSD programmes operating in more turbulent external environments report higher mean factor scores on all nine NKE factors. This suggests that rapid change in the external environment may: (i) create uncertainty within the business which makes it difficult for managers to map their environments accurately, and therefore acts to destroy competences (Leonard-Barton 1992a); (ii) result in previous knowledge standing in the way of effective action in the "new order" (Nonaka 1988b), where new patterns of organisational structures, systems, and mental models need to be embraced in order to develop and redefine innovative market, technical, and economic models (Lynn et al. 1998).
- The results indicate that NSD programmes which managers perceive to be operating in particularly turbulent external environments, are more likely to comprise NSD processes where knowledge is more proficiently managed, than in those NSD programmes operating in less turbulent external environments. This suggests that in turbulent times, the service business need to attend more closely to the information requirements of the environment and, in doing so, may adopt the more flexible development models cited by Iansiti (1995) which establish tighter integration between the concept and development stages. Firms operating in highly turbulent external environments must establish NSD practices that can mitigate risk, manage uncertainty, and increase the likelihood of success (also Mullins & Sutherland 1998).
- NSD programmes operating in more turbulent external environments have significantly better NSD programme performance than those operating in less turbulent external environments. The implication for management is that as external markets and technologies change, more opportunities to develop new

services emerge. In less volatile external environments, it may be difficult for service firms to differentiate their offerings from those of their competition, and the pressure on profits is therefore greater. For NSD programmes operating in more turbulent external environments, the mean profit level from new services introduced in the last three years was 33.86%, whereas the profit in NSD programmes operating in less turbulent external environments was 16.84%.

- An even more interesting implication is that top management may wish to act aggressively in order to proactively destabilise the external environments. Doing so may well act to: (i) establish creative chaos within the firm which stimulates more favourable conditions for knowledge creation (Nonaka 1994); (ii) destabilise the external markets in order to promote more new service opportunity, as found earlier. Top management need to take the lead because it is they who interpret the importance of environmental events and who communicate their view of the importance of knowledge management activity through speeches and statements (Lyles & Schwenk 1992).

8.4 Limitations of the Research

The design of any research project naturally places limitations on the conclusions that can be drawn. The limitations imposed by this research are discussed below. In the case of this research, the limitations can be stated as either methodological or conceptual.

Claims for Causality

In designing the research, some previous criticisms of product innovation research are acknowledged and addressed. Brown & Eisenhardt (1995) assert that because the results of rational plan studies are often empirically observed correlations with success (as is this research), the theoretical understanding of relationships usually is quite limited, and non significant findings are often not reported. Though relationships between many of the variables have been demonstrated to be significant in this research, causal claims about the associations between, for

example, the internal organisational environment (NKE) and knowledge management activity (NSD proficiency) and NSD programme performance cannot be made. Confidence in the results is permissible, however, due to the strong significance levels of the various statistical checks used. Nevertheless, caution is always advised.

Measurement of NSD Process Proficiency

The measurement of NSD process activities, through asking respondent to reply to a scale question, has regularly been used as a measure of NSD process proficiency in studies of new products and services (e.g. Storey & Easingwood 1996; Edgett 1996). While an accepted gauge of NSD process proficiency, evaluating NSD process performance in such a way has some limitations: (i) it provides no absolute indication of proficiency, only relative values; (ii) those relative values are ascertained from a sample of firms where the respondent may apply different value systems to determined proficiency; (iii) no further insight is gained into the practices of the firm when completing NSD projects. Therefore, one may conclude that the NSD literature may benefit greatly from further research into more effective methods of determining NSD proficiency.

Missing Variables

NSD involves an intricate interaction of resources and competences. The proposed predictive model is the first of its kind exploring internal organisational characteristics and knowledge management activity in the NSD programme. It would, therefore, not be unexpected to find some unexplained variance, e.g. due to the possibility of excluded internal organisational factors that may be influencing both knowledge management activity and NSD programme performance. For example, although not included in the original list of variables, it is possible that certain characteristics or styles of the top management team may be influencing knowledge management activity in the NSD process. Nonetheless, the extensive review of the knowledge, services and NSD literatures conducted goes some way to protecting against this danger.

Respondent Issues

This study used a single-respondent approach to data collection, which has been observed by some academics to preclude a rigorous assessment of the validity of the informants' reports (Philips 1981). For each service business sampled, the questionnaire was completed by a senior manager or director responsible, or involved in, the development of new services for the business. While it was expected that each respondent had intimate knowledge of all the activities relevant to developing services in the selected new service programme, resource limitations meant that this could not be ensured with any great precision. Although multiple informant designs remain the exception in marketing and organisational research, such an approach has been identified to be a stronger test of the theory proposed and one which would eliminate the concern that results are simply picking up a "giant halo-effect" across the measures (Moorman 1995). Therefore, further research might attempt to verify the findings by using a multi-respondent study.

Similarly, certain of the questions presented in this research necessarily required subjective judgements to be made by respondents on issues regarding the degree of NSD success achieved, the proficiency of knowledge management tasks performed, and the impact of certain organisational characteristics. Different individuals may have had different perceptions of such matters.

Sampling Errors

Limitations may also be detected in the composition of the sample frame selected. Although the research adopted a broad-based approach, and included service firms from a number of different business markets, the data analysed were gathered from UK firms only. Because management principles, standards and styles differ around the world, certain responses may be influenced by the geographical source of the data (Langerak et al. 1998). Conversely, it was found that many of the characteristics of the UK firms sampled were homogenous.

Problems with the Survey Instrument

The organisation of the survey itself suggests some possible concerns. Firstly, in a questionnaire of this size, there may be a response bias due to the ambiguity of some variables. Secondly, the large number of interrelated variables presented together on this survey could generate a response consistency problem. However, no evidence of this potential bias appears in the data¹¹⁹.

8.5 Indications of Further Research

This research, having been pioneering in nature, has established that there are certain characteristics of the internal organisational environment which act to influence both knowledge management activity and NSD programme success. Strong potential for future research exists in this subject area.

Confirmatory Research of the Model Proposed

The academic literature in this area may benefit from testing the proposed model of knowledge management activity in NSD against a new data set. This may involve the design and implementation of confirmatory factor approach performed with a structural equation modelling technique such as SPSS' AMOS, where two new samples of data are created verification of the foregoing factor structure and unidimensionality is attempted.

Confirmatory Case Studies of Proposed Model

- To further explore the validity of the relationships identified between the variables in this research, a set of qualitative case studies may be developed. The advantage of such an approach would lie in explaining in more detail the reasons behind the existence of many of the relationships presented in this research.

¹¹⁹ For example, in the analysis of the internal organisational environment.

Investigation of the NSD Process

This research has identified the importance of the NSD process in managing the knowledge of a service business. However, only the execution of a representative list of stages was investigated. Although specific process models for controlling a new service development project have emerged from research (e.g. Bowers 1986; Johnson, Scheuing & Gaida 1986; Donnelly, Berry & Thompson 1985), it has been found that service suppliers do not, in general, use sophisticated and formal development procedures (Bowers 1989; Scheuing & Johnson 1989a; Martin & Horne 1993). Further research would benefit from exploring the "reality" behind the adoption of NSD process models, as opposed to the adoption of particular stages or activities.

8.6 Conclusions

While due consideration of the conceptual and methodological limitations must be given, it is posited that the empirical results of this study have significant merit for marketing academics, knowledge management theorists, and new product development academics in particular. This research has also provided valuable guidelines for managers in charge of NSD in many market sectors.

Some of this research has confirmed existing results, e.g. the relationship between the proficiency with which the NSD process is executed and NSD performance, but this is the first time that associations between factors have been interpreted in the context of knowledge management activity and NSD programme performance at the programme level.

This is the first time that the NSD Knowledge Environment (NKE) has been conceptualised within the context of the services market. It is a particularly important area of research, and the internal organisational environment, in general, has received little attention in the context of NSD success. It is also the first time, that the relationship between the internal organisational environment and knowledge management activity (in the form of NSD process proficiency) has been explored.

Until recently there has been little significant support from academic and management research, and no general approach to managing knowledge has been commonly accepted. Although scholars are now beginning to organise their research agendas around a set of explicit hypotheses concerning the causes and effects of knowledge-intensive environments (Glazer 1998), knowledge management has only recently emerged as an explicit area of pursuit for managing firms, and even more recently as a topic of serious academic study (Wiig 1997a). Previously, each business tends to be regarded as unique and options for managing knowledge are legion. Furthermore, since knowledge management is still relatively new, the availability of standardised or "off-the-shelf" approaches is limited. Consequently, firms have been observed to devise customised approaches to provide the enterprise with the best and most applicable solutions, and this adds further to the complexity of managing knowledge (Wiig 1997a). This research has empirically investigated knowledge management activity in the context of NSD, and as such has provided insight into a subject area previously lacking in rigorous empirical studies.

Finally, previous research in the field of NSD has tended to concentrate its focus on the financial services market. This research has identified that many of the findings appear to be generalisable across a number of business markets, both in a consumer and business-to-business context.

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A: CREATIVITY LITERATURE

Increasingly, researchers are writing about the issues surrounding creativity in the organisational setting. However, much of it is fragmented, and observes the practices adopted in a small number of industries (Kao 1988), creativity in emerging industries (Porter 1980), Kaizen teian systems in Japanese firms (Robinson & Stern 1997), chemical industry (Felberg & DeMarco (1992). Little discussion has taken place on the role creativity plays in services firms. The absence of such debate results in little direct guidance being offered to executives involved in developing new services in these sectors.

Many industrial sectors still seem reluctant to embrace creativity. This may be the result of the difficulty some firms have in understanding what creativity is, and how it is fostered. For some firms, the term "creative people" may conjure up images of clever but impractical dreamers, "creative problem-solving" may smack of encounter groups that lack direction, and "creative climates" may be regarded as cloudy concepts which, although probably important, seem hard to capture in specific terms (Gryskiewicz et al. 1985).

To date, creativity has been regarded as a subject particularly relevant to the entrepreneurial start-up and high-tech business, but increasingly managers in larger firms are beginning to value the importance of creativity to the business in general, and it is becoming regarded as an important source of competitive strength for all firms concerned with growth and change. For example, in the act of interpreting environmental signals, the business may be at once developing new services and products, and establishing new business procedures to address those signals. Creativity, therefore, becomes a central preoccupation for managers, irrespective of their industrial setting, e.g. biotechnology firms where 50 per cent of the staff are scientists, financial services firms needing to constantly innovate their market strategies, and consulting firms needing to continuously strive to develop new analytical tools.

Creativity & Innovation

There is a generally held belief that creativity and innovation are good for firms. Unfortunately, it is rare to find both in firms (Getz 1997). Creativity is generally regarded as the individual psychological phenomenon of idea generation. In contrast, innovation, defined as generation, acceptance and implementation of new ideas, processes, products, or services, is viewed as an organisational social phenomenon (Getz 1997). Put simply, creativity refers to the generation of novel ideas - whilst innovation to exploiting those ideas commercially. Although some authors often treat the two synonymously, insightful business literature demonstrates that the two concepts are different, but inextricably interrelated. Organisational creativity may therefore be regarded as a subset of the broader domain of innovation. Although organisational creativity may produce the new product, service, idea, or process that is implemented through innovation, innovation can also include the adaptation of pre-existing products or processes, or those created outside of the organisation (Woodman et al. 1993).

The Characteristics of Organisational Creativity

Organisational creativity is the creation of a valuable, useful new product, service, idea, procedure, or process by individuals working together in a complex social system (Woodman et al. 1993). Any holistic investigation of organisational creativity would necessarily need to take account of the four components proposed to affect a creative system, i.e. the creative process, the creative product, the creative person, the creative situation, and the way in which each of those interacts, i.e. the "press".

Although new products and services are the lifeblood of a business, the bulk of most firms' earnings come from well-established products. One of the most significant factors affecting the profitability of such products is the extent to which they are meaningfully differentiated from competing alternatives. Over time, even strong positions of differentiation can be eroded by competing forces. However, it has been observed that the ongoing development of creative

marketing initiatives can set a product apart from the competition in a meaningful way (Andrew & Smith 1996).

Psychologists indicate that creative individuals do exist. They are risk-takers, non-conformists, and persevering. Only a minority of individuals are believed to possess these traits, and most will adopt patterns of habitual thinking and behaviour. However, two observations qualify the importance and influence of individual creativity. Firstly, all individuals need not be creative in order for the organisation to achieve satisfactory levels of creativity. March (1981) suggests that a minority of creative individuals together with a recruitment policy focusing on the capture of individuals with creative traits may be sufficient. Secondly, creative individuals may not always demonstrate creative behaviour (Getz 1997). For example, it has been suggested that to transform creative traits into creative behaviour it is necessary for the individual to have intrinsic motivation, the availability of 'enough' but 'not too much' domain knowledge, a level of problem-solving skills, and attention to any associations between the problem-knowledge and other knowledge items (Amabile et al. 1997; Getz 1997).

The Factors Impacting Creative Outcomes in the Firm

A review of the creativity literature identifies a number of factors which have been found to influence the creative outcomes at the business processes, groups, individual and industry level. It is hypothesised that many of these factors will play an influential role in shaping the development of creative services in a service business.

Strategy

The development of a corporate strategy which directs the business' capabilities and resources towards new opportunities and markets has been found to foster high levels of creativity, e.g. CNN's commitment to being "first with the news".

In investigating methods by which creativity can be injected into a firm's business strategy, Majaro (1992) refers to 'strategy search', a creative planning process

aimed at identifying alternative options facing the business in its search for the most appropriate future direction.

Structure

It has been observed that the probability of creative outcomes is more likely when the organisational structure is organic, adaptive and flexible rather than mechanistic (King & Andersen 1990).

Systems

Evidence suggests that information is a crucial variable in the creative process. Osborn (1963) found that idea generation increases as exposure to other potentially useful relevant ideas increases, and constraints on information and communication flows would therefore be expected to have a negative effect on creativity (Kanter 1988). In particular, information exchange with the external environment is likely to influence idea generation (Cummings & O'Connell 1978), and the ability of the organisation to absorb that information will be crucial for innovation to take place (Cohen & Levinthal 1990).

A number of firms have developed systems and procedures which encourage staff to contribute new ideas (Majaro 1992; Robinson & Stern 1997), and some firms offer resources by which attractive ideas may be developed, sometimes by their originator, to a greater level of completion (Felberg & DeMarco 1992). These systems include the employee suggestion systems used by firms like American Airlines, the workgroup systems used to connect "interested" groups together, and the Kaizen teian systems designed to involve 100% of the business' staff.

Resource allocation in development projects has been found by a number of researchers to be directly related to the project's overall creativity levels (Tushman & Nelson 1990). For example, the absence of physical resources may lead to beliefs about the intrinsic value of the projects undertaken, and therefore reduce creativity levels. It has also been demonstrated that slack resources are positively associated with high rates of innovation and creativity (Cohen & Levinthal 1990).

Findings are inconclusive regarding the effect of time pressures on creative outcomes. Time pressures that are perceived as a necessary concomitant of an important, urgent project may add to the perception of challenge in the work that positively correlates with intrinsic motivation and creativity. However, excessive pressures may well undermine creativity (Amabile 1996).

An emphasis on employee involvement practices encourages problem-solving activity at all levels of the business and more opportunities are likely to be created, particularly by staff who work directly with customers. Having gained staff's commitment to become more involved, it is important to develop a fair and supportive evaluation of any new ideas which emerge. The expectation of threatening, highly critical evaluation of new ideas is likely to undermine the possibility of future involvement (Amabile 1979).

Shared Values & Style

When staff perceive that management values goals related to creativity, a goal emphasis element of a creative climate is said to exist (Tesluk et al. 1997). A goal climate with associated performance targets, has been demonstrated to provide staff with greater awareness of the standards being used to evaluate their creative outcomes and to lead to greater creative outcomes (Cummings & O'Connell 1978). Amabile (1988) suggests that goal setting should be tighter and more specific at the level of missions and outcomes, but should become more flexible when addressing the methods and procedures used to reach these goals. Although engaging in an activity only to obtain a contracted-for-reward can undermine creativity (Amabile et al. 1986), creativity can be enhanced by accepting a reward that is perceived as a "bonus", i.e. a confirmation of one's competence.

Nonaka (1998b) suggests that the two main functions of top management is to: (i) create a vision that gives meaning to the employees' jobs; (ii) constantly convey a sense of crisis to their employees. Some form of crisis is often needed to generate an entirely new, innovative service concept or to abolish a business' existing patterns and replace them with a new order.

Management can also directly nurture and influence the development of cultures which encourage the search for new ideas and opportunities by:

- Instilling values and a normative system that supports a diversity of beliefs, free exchange of information, open questioning and interaction (Kimberley & Evanisko 1981).
- Promoting change (Amabile 1988; Kanter 1988; Woodman et al. 1993).
- Challenging staff to continuously re-examine their assumptions through the use of metaphors, symbols, and concepts (Nonaka 1991).
- Goal clarity (Bailyn 1985).
- Supporting a team's work and ideas (Delbecq & Mills 1985).
- Similarly, it has been observed that the probability of creative outcomes is more likely when leadership is democratic and collaborative (King & Andersen 1990).

A number of factors have been found to influence the creative output of groups within the organisation. It has been identified that the group size, diversity in team members' background, a mutual openness to ideas, the constructive challenging of ideas, and a shared commitment to the project are all crucial factors in determining creative outcomes (Payne 1990; Monge et al. 1992). Nystrom (1979) also found some evidence that a curvilinear relationship exists between group cohesiveness and creative performance, i.e. too much or too little cohesiveness may lead to less creative outcomes. High levels of creativity have been found to be more susceptible to social influence than were perceptions of structure routine tasks requiring little creativity.

Majaro (1992) uses the Exhibit A-1 to suggest that top management do not have to 'run' each of the activities encompassed in the satellites shown, but they must reflect upon and initiate and mastermind the appropriate development programmes of work envisaged by each of them. However, the author suggests that there is often a gap between what management believes is actually happening in and what actually happens at lower levels of the organisation.

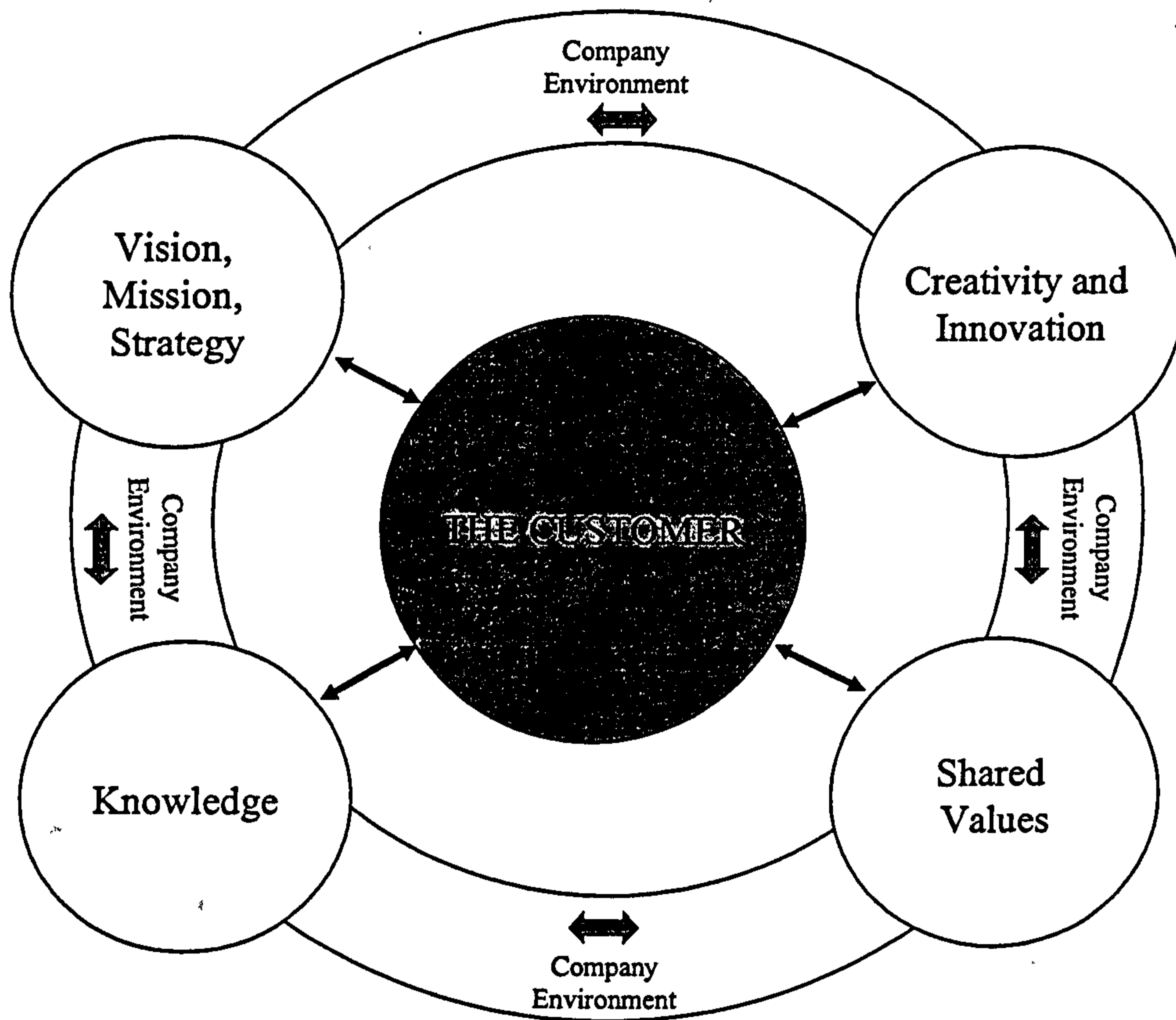


Exhibit A-1: Creative Management Philosophy (Source: Majaro 1992)

A culture that communicates to business staff that they are a highly competent can serve to build general self-esteem and may even enhance feelings of task-efficacy, a characteristic associated with creativity (Woodman et al. 1993). Consequently, several researchers have posited that creativity is fostered when individuals and teams have relatively high freedom and autonomy over the day-to-day conduct of the work and a sense of ownership and control over their own work and their own ideas (West 1986).

Skills & Staff

Creativity researchers traditionally focused on the differences in creativity characteristics between individuals. More recently, new theories have begun to be developed.

The interactionist model of individual creativity developed by Woodman et al. (1993) states that "individual creativity is a function of antecedent conditions, cognitive styles and abilities, personality, motivation factors and knowledge" (p. 301). Similarly, the componential theory reported by Amabile (1997) suggests that creativity is most likely to occur when people's skills overlap with their strongest intrinsic interests, and that creativity will be higher, the higher of each of the three components, the *creativity intersection* (see Exhibit A-2).

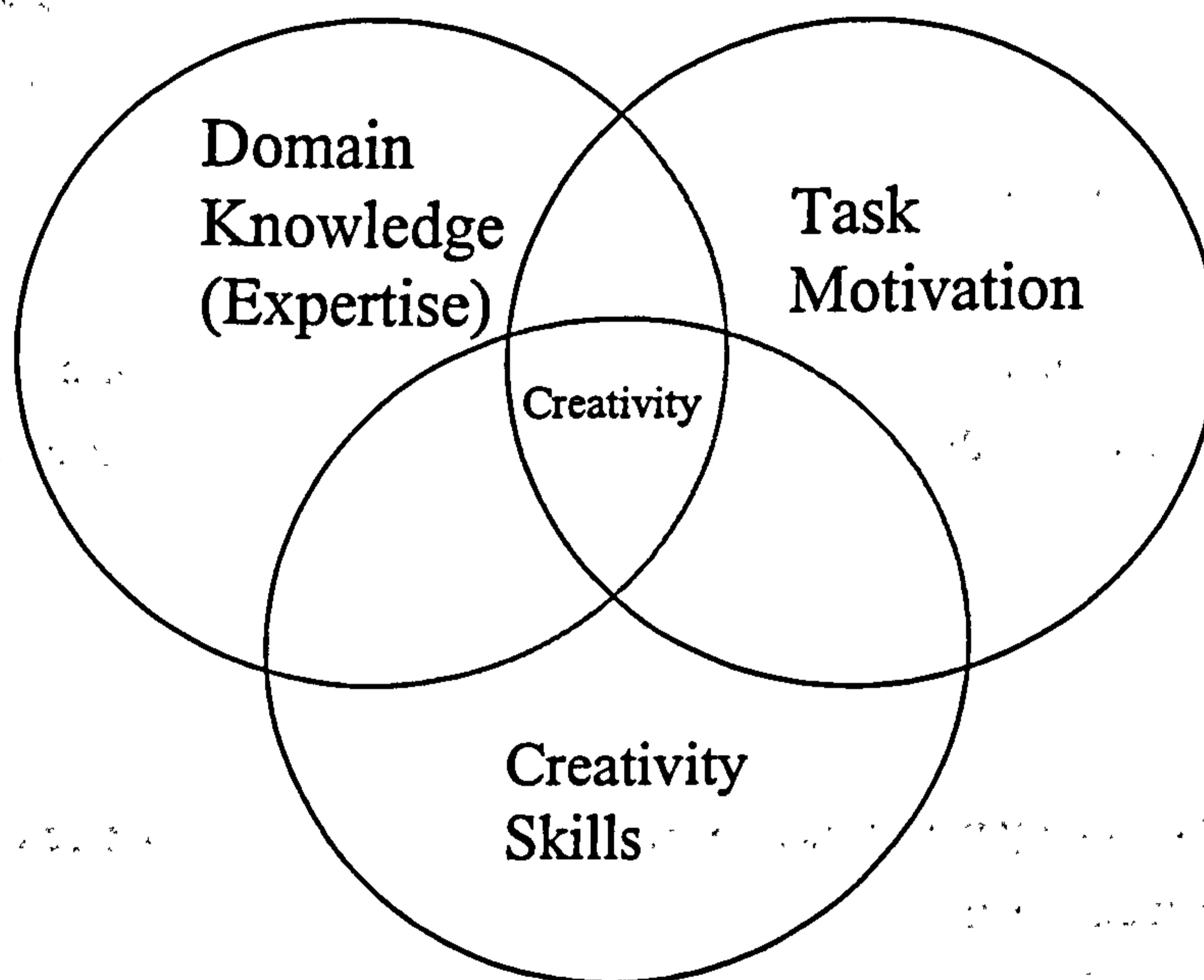


Exhibit A-2: Component Model of Creativity (Amabile 1997)

The componential model suggests that the individual will not exhibit creative thinking skills if creative thinking skills are lacking. These skills include: (i) a cognitive style favourable to taking new perspectives on problems; (ii) an application of techniques (or "heuristics") for the exploration of new cognitive pathways; (iii) and a working style conducive to persistent energetic pursuit of one's work.

Creative thinking also depends to some extent on personality characteristics related to: (i) independence; (ii) self-discipline; (iii) orientation towards risk-

taking; (iv) tolerance for ambiguity; (v) perseverance in the face of frustration; (vi) and a relative lack of concern for social approval (CMR, p.43).

Much literature has been developed around the subject of creative problem-solving, especially by Isaksen (1987) and Basadur (e.g. Basadur & Finkbeiner 1985). The conclusion to be drawn is that problem-solving groups can be made more effective by training individuals and groups in problem-solving skills.

Expertise is the foundation for all creative work. It includes: (i) memory for factual knowledge; (ii) technical proficiency; (iii) special talents in the target work domain.

Whereas the other two components indicate what an individual *can* do, it is **task motivation** that determiners what they will *actually* do. Motivation can be intrinsic or extrinsic. A number of studies have found that primarily intrinsic motivation will be more conducive to creativity than a primarily extrinsic motivation.

Conclusions

An understanding of creativity is important in attempting to explore the nature of NSD and knowledge management.

Amabile (1988) identified the importance of “domain-relevant skills” and “creativity-relevant skills” as being important for creativity. Stein (1997) identified both positive and negative effects that previous experience and learning had on creativity. Even though previous experience or knowledge could lead to *functional fixedness* that prevents individuals from producing creative solutions, on balance it is hard to conceive of any creative behaviour that is somehow *knowledge free*. This finding has been so widely recognised that for so long that that the crucial role played by knowledge and information may sometimes be overlooked.

It is also clear that creativity is important in the development of ideas for new products, services, processes and technologies. The fact that creativity

significantly impacts on development performance has been identified by Moorman & Miner (1997).

B: INTEGRATION IN NPD

This research examines the importance of knowledge management activity in NSD. As such, it addresses issues of communication, co-operation and integration at the project and programme levels. Integration can be defined in terms of communication and co-operation.

What is Communication?

Communication has been defined as the oral or written "handing over" of information and knowledge from one person to another (Kerssens-Van Drongelen et al. 1996). This "handing over" of information may be stimulated by the communication of a need which is then followed by a search for information about a technical means to meet that need (Utterback 1971). Rogers and Agarwala-Rogers (1976, p.9) define communication as "the process by which an idea is transferred from a source to a receiver with the intention of changing his or her behaviour". Such changes may involve changes in knowledge, changes in attitudes or changes in overt behaviour (Rogers & Agarwala-Rogers 1976; Rogers & Shoemaker 1971).

The literature on "communication" emphasises the use of communication in the form of meetings and information flows between departments (Griffin & Hauser 1992; Ruekert & Walker 1987).

In general, communication research characterises integration between personnel in different functional areas in terms of: (i) both its amount; (ii) the degree of difficulty the parties have in communicating with one another. The *amount of communication* reflects the frequency of contact between functional areas through the various modes of communication available, including written reports, letters, telephone calls, face-to-face discussions, or group meetings (Ruekert & Walker 1987). *Communication difficulty* refers to the effort required, and problems involved, in getting in contact with or in getting ideas across to the other party. Both the amount of communication and communication difficulty are influenced

by the similarity of the domains of network members (Ruekert & Walker 1987). However, Fisher, Maltz & Jaworski (1997) suggest the addition of bi-directionality (the nature of the two-way process) and coerciveness of influence (the degree to which communication mediates negative consequences for non-compliance) provides a more thorough understanding of interfunctional communication behaviours.

The NPD literature suggests that there is a positive relationship between communication and product development success (Carlsson 1991; Griffin & Hauser 1992; Urban & Hauser 1993). Carlsson (1991) observed that communication, by way of task forces, is an important integration mechanism during the start-up and final stages of product development.

Collaboration

The literature on "collaboration" portrays interdepartmental integration as collaboration, where departments work collectively under common goals (Kahn 1996). For example, Souder defined integration as "a state of high degrees of shared values, mutual goal commitments, and collaborative behaviours". Lawrence & Lorsch (1967) defined integration as the process of achieving unity of effort among the various subsystems in the accomplishment of business tasks, which does not specifically imply communication.

Another group of literature offers a more multidimensional perspective of integration (Clark & Fujimoto 1991). Gupta, Raj & Wilemon (1985; 1986) and Song & Parry (1992; 1993) characterised, and operationally defined, interdepartmental integration as information sharing and involvement.

In Exhibit A-3 Kahn (1996) proposes a definition of integration as a multidimensional process that embodies interaction and collaboration. He suggests that conceptualising integration in this way can assist managers to better integrate their departments because it forces them to realise that successful performance cannot be predicated on one type of integration activity.

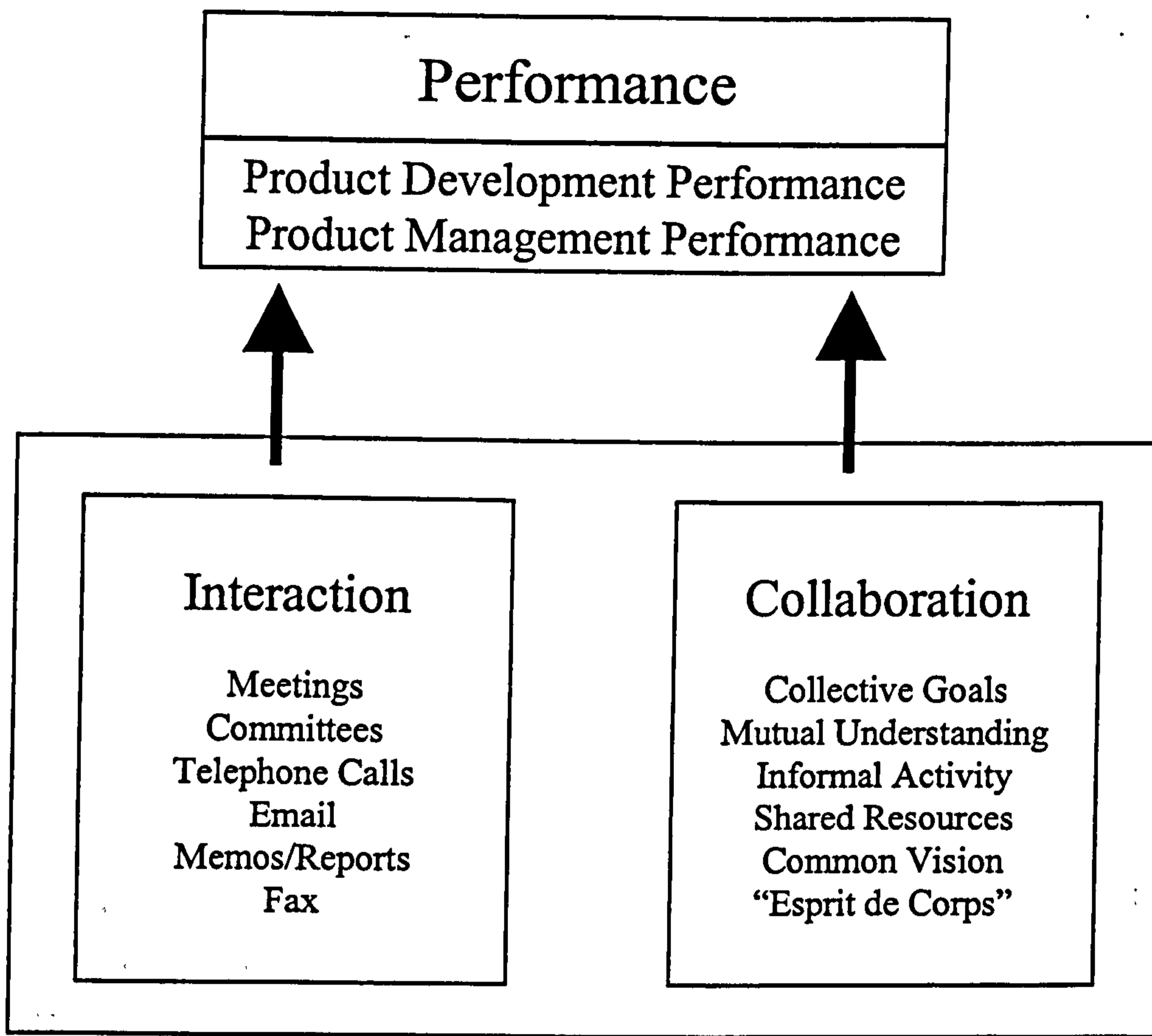


Exhibit A-3: A Model of Interdepartmental Integration (Kahn 1996)

Empirical research has supported a strong relationship between collaboration and performance. Collaboration was highlighted by Lawrence & Lorsch (1967) as a good predictor of performance, and Souder (1987) found that harmony between departments (high levels of collaboration) resulted in significantly more successful projects. Tjosvold (1988) reported that collaboration between departments promoted the winning of contracts, greater satisfaction, improved morale, and department confidence.

Based on his research, Kahn (1996) found that while collaboration represents a major factor for success in product development, most interaction activities do not. Such findings suggest that managers should use interaction to establish contact and familiarity between departments and then to let collaboration drive the interaction process.

Integration Research in NPD

This section addresses a number of the most pertinent themes in integration theory in NPD research: integration & communication; impact of integration on NPD performance; types of integration research; integration methods in NPD; and integrating R&D & marketing.

NPD Requires Integration, Not Just Communication

NPD is a radical act which introduces a new element or a new combination of old elements (Schumpeter, 1934). It may also be viewed as a process with contributions being made by a number of task groups whose members are chosen from functionally differentiated firms or departments. Within such a task group every individual may perform a functionally specified role. For example, modern-day drug discovery requires the integration of knowledge from a broad array of disciplines (Henderson 1994), and the efficient transfer of information across functions requires greater co-ordination between functions within the business (Moenaert & Souder 1990a).

Impact on Integration on NPD Performance

Interfunctional communication is linked to a variety of positive outcomes, including increased understanding and harmony between functions (Souder 1988), interfunctional integration (Gupta, Raj & Wilemon 1985), stronger market orientation (Kohli & Jaworski 1990), an increased ability to cope with complex dynamic environments (Huber 1982), and greater new product success (Cooper 1984; Pinto & Pinto 1990).

Types of Integration Research

Pinto & Pinto (1990) have identified two streams of research in NPD cross-functional communication and co-operation.

The first analyses one function's (e.g. marketing's) specific relationship with another functional area. It examines both the dynamics of these relationships as well as that function's specific responsibilities regarding new product implementation (Bondra & David 1996; Wind 1981). Many researchers have examined the interaction between: (i) Marketing and R&D (Gupta & Wilemon 1988; Souder 1988); (ii) Marketing & Production (Dutton & Walton 1966); (iii) Marketing and Engineering (Wilemon 1989); (iv) Marketing and Finance (Anderson 1981); (v) R&D and production (Ginn & Rubenstein 1986). While revealing much of the functional interdependencies within a business and the inter-functional nature of many organisational disciplines, the research fails to examine these activities within their natural setting, i.e. within the context of a larger cross-functional team (Pinto & Pinto 1990). It is therefore difficult to generalise across other functions (Ruekert & Walker 1987).

The other stream of communication research addresses behavioural or organisational issues that have practical implications for managers involved in cross-functional interactions and ultimately, the implementation process itself (Lucas & Bush 1988). For example, Ruekert & Walker (1987) examine the impact a variety of organisational constructs have on the quality of marketing's interaction with other functional units.

To date very little research attention has been awarded to communication in a service context. However, an emerging stream of research has begun to explore the importance of communication in services firms (e.g. Mahajan et al. 1994). Lievens, Moenaert & S'Jegers (1997a) have noted "although we know that effective communication is essential to new financial service success, we still lack a solid understanding of the role of effective communication during the innovation process of financial services".

Integration Methods in NPD

Research suggests that firms might improve new product development performance by integrating the process across the functions involved (Cooper 1983b; Souder 1988). Other writing suggests that treating the product

development process as a holistic process produces products successful in the marketplace and reduces time to market (Hayes, Wheelwright & Clark 1988; Takeuchi & Nonaka 1986). Several processes stressing cross-functional integration have been implemented with recently by US firms, including Cooper's (1990) stage-gate process and QFD (Hauser & Clausing 1988).

QFD is a formal management process for product development that US firms are implementing. It is an industry-initiated process, whose primary aim is to capture and convert the 'voice of the customer' (Griffin & Hauser 1991) into the product and process requirements that profitably deliver customer needs and wants (Griffin 1992). QFD manages across individual functional aspects of new product development (market research, engineering design), providing mechanisms that weave the functional tasks into a coherent process (Hauser & Clausing 1988). It allows development teams to bring together and manage all the elements needed to define, design and deliver a product. In QFD, cross-functional teams use a series of interaction matrices to translate from customer needs to process step specifications (Griffin 1992). QFD has been applied to the service sector. In such a context it has been defined as "a system and procedures to aid the plan and development of services and assure that they will meet or exceed customer expectations" (Mazur 1993a, p. 4).

The 'stage-gate' term was coined by Cooper (1993). They were proposed to 'break' the innovation process into a pre-determined set of stages, each consisting of a set of cross-functional and parallel activities. The entrance to each stage is a gate: these gates control the process and serve as the quality control and go/kill points.

Integrating R&D & Marketing

The most reported integration relationship in NPD research is that between the marketing function and the R&D function. Although functional interfaces are important in the product development process, the R&D-marketing interface is one of the most critical ones. Griffin & Hauser (1996) have observed that over the last 20 years, numerous studies have explored the R&D-Marketing interface,

and its role in the development of new products. Exhibit A-4 summarises their research findings.

Research by Wind (1982) and Cooper (1983a) have emphasised the importance of the effective integration of R&D and marketing in achieving NPD. Supporting the conclusions of these authors, several studies have noted that the failure to integrate R&D and marketing early in the innovation process is one of the biggest contributors to new product failure (Souder 1981). However, Gupta, Raj & Wilemon (1986a) hypothesise that the level of R&D-marketing integration an organisation needs to achieve should be commensurate with its innovation strategy and perceived environmental uncertainty.

Researchers	Sample & Type of Firm	Evidence (Partial List)
Cooper (1983b)	58 projects (Industrial)	Projects that balance marketing & R&D inputs have a higher rate of success
Cooper (1984a)	122 firms (Electronic, heavy equipment, chemicals, materials)	Management strategies that balance marketing & R&D have a greater percentage of new product success and greater percentage of their sales coming from new products
Cooper & de Brentani (1991)	106 projects (Financial services)	Synergy (e.g. fit with the business' expertise, management skills, and market research resources) was the number one correlate of success.
Cooper & Kleinschmidt (1987b)	125 firms, 203 projects (Manufacturing)	Market synergy and technological synergy are both significantly related to success.
de Brentani (1989)	115 firms, 276 projects (Services, transport, communication)	Sales, communication between functions. (Correlation with sales and market share = 0.38, correlation with reduced cost = 0.29).
Dougherty (1990)	5 firms, 18 projects (Industrial, consumer and services)	More communication and communication on all relevant topics separated successful projects from unsuccessful projects.
Gupta et al. (1985)	167 firms, 107 R&D & 109 marketing managers (Hi-tech)	Lack of communication was listed as the number one barrier to achieving integration among marketing and R&D.
Hise et al. (1990)	252 Marketing VPs (Large manufacturing firms)	High level of joint effort in new product design is a significant factor in determining success. This is true for both Ind. & Cons. goods firms.
Moenaert & Souder (1990)	Literature review (Products and services)	Function integration positively relates to innovation success.
Pinto & Pinto (1990)	72 hospital firms, 262 team members (Health services)	Strong relationship between cross-functional co-operation and the success (perceived task outcomes and psychological outcomes) of the project. (Correlation = 0.71).
Souder (1988)	56 firms, 289 projects (Cons. & Ind.)	The greater the harmony between marketing and R&D, the greater the likelihood of success.
Souder & Chakrabarti (1978)	18 firms, 117 projects (Consumer & industrial)	Interaction, integration, and information exchange significantly differentiate between technical and commercial success and failure.
Takeuchi & Nonaka (1986)	6 projects, US & Japan (Cons. & Ind.)	Cross-fertilisation and self-organising teams led to success.
Moenaert, et al. (1994)	40 Belgian firms (Technology innovative firms)	Significant correlation between commercial success and (i) interfunctional climate, (ii) information received by R&D.

Exhibit A-4: Integration Among Marketing and R&D Enhances New Product Success (from Griffin & Hauser 1996)

Empirical research indicates that the disharmony between marketing and R&D in the development of new products is the rule, rather than the exception" (Moenaert & Souder 1990, p.96). A number of themes in the research can be identified.

Organisational Structures

Organisational structures have been found to facilitate as well as to hinder R&D-marketing integration. Zaltman, Duncan & Holbek (1973) noted that conflicting demands may be placed on the structure, depending on the stage of the innovation process. The organisational structure is therefore a critical determinant of innovation activities in particular (Lievens et al 1997). A match between the communication structure and the information requirements has been shown by a number of researchers to be related to higher performance (Galbraith 1974; Tushman & Nadler 1978).

Formalisation, the emphasis placed upon following rules and procedures, has been demonstrated to be both a facilitator as well as a barrier to integration. For example, Deshpande (1982) found that less formalised firms were more likely to make greater use of market research, while John & Martin observed that the credibility and utilisation of plan output increased with the increase in the degree of formalisation of market planning.

In general, decentralisation, the delegation of decision-making authority throughout a business, has been found to be associated with higher levels of interfunctional integration (Larson & Gobeli 1988), while centralised structures have been observed to cause integration problems (Wind 1982).

Physical barriers frequently isolate marketing from R&D (Griffin & Hauser 1996). For example, Allen (1977) found a decline in communications as physical distance between researchers lengthened. The physical separation of R&D and marketing decreases the opportunity for chance meetings, "lucky" information transfer or problem clarification in the hallways of the business (Dixon 1997). Isolation can reinforce separate thought worlds, encourage jargon-filled language development, and heighten perceptions of personality differences (Allen 1970).

Management Style

Senior management can establish an environment that is either conducive or inhibitive to the development of a productive R&D - marketing interface (Souder

1977). Souder & Chakrabarti (1978) found that the most effective integration involved: (i) a joint reward system for R&D and marketing (see also Hauser, Simester & Wernerfelt 19xx); (ii) both groups felt that the business valued co-operation and collaboration. A related literature highlights the importance of senior management encouraging innovation by supporting new ideas and risk-taking (Slocum, McGill & Lei 1994; Simonin 1997; Wind 1982), tolerating failure (McKee 1992; Gupta & Wilemon 1990).

Socio-Cultural

Marketing and R&D personnel often differ in training and background (Griffin & Hauser 1996), and their world views and organisational routines are often reinforced in the cultures of the business' functional departments (Dougherty 1990). These cultural differences have been well documented (Dougherty 1990; Gupta, Raj & Wilemon 1986a). Although both functions work for the same organisation and share the same goals, "the lens through which each function interprets these goals differs" (Griffin & Hauser 1996, quoting Souder).

However, Gupta, Raj & Wilemon (1986a) suggest that given the body of literature that indicates the general existence of socio-cultural differences between R&D and marketing managers, it is not clear which of these differences specifically acts to undermine effective integration.

Strategy

It has been hypothesised that if a business' NPD strategy involves being "first in" with new products, markets, and technologies, it is likely to require a greater degree of R&D-marketing integration (Gupta, Raj & Wilemon 1986a). A business that ventures into totally new and unfamiliar products, markets, and technologies is likely to have greater need for information about the market and technology to reduce the risk of new product failure (Gupta, Raj & Wilemon 1986a).

Functional success measures need to be supportive of integration efforts (Souder 1993),

Environmental Uncertainty

The studies of Burns & Stalker (1961), and others, suggest that the greater the degree of environmental uncertainty, the greater the specialisation or differentiation within the organisation. As a consequence, the greater information processing requirements caused by high external environmental turbulence, are likely to necessitate integration among organisational subsystems.

Language

Language barriers naturally evolve and develop as a consequence of the different cultural identities. Subtle differences in the language used by R&D and marketing can often imply different solutions to customer problems, thus making the difference between a successful and an unsuccessful NPD project (Griffin & Hauser 1993). For example, if each group does not understand customer needs at the level of detail that they need to do their job, they can become frustrated with the communication process (Griffin 1992).

Not only do different firms have distinctive values, norms, language and coding schemes, but these differences also apply to various sub-units within a business. "The greater the mismatch in language and cognitive orientation, the greater the difficulties of communicating" (Tushman & Katz 1980, p. 1072).

Systems

In a study by Gupta, Raj & Wilemon (1985) most respondents blamed the lack of formal rules and procedures regulating the interactions between R&D and Marketing for the inadequate information transfer, e.g. the need for formalisation of the NPD process through design review boards, and the higher the initiating structure of the team leader, the more productive the transfer of information between R&D and marketing.

High co-operation teams differ from low co-operation teams both in terms of their increased use of informal methods for communication as well as their reasons for communicating. Moenaert & Souder (1990a) found widespread agreement among technologists and marketers on the importance of interpersonal communication, although R&D were suspicious of the validity of information coming from their marketing colleagues in the form of face-to-face meetings.

It has also been hypothesised that the extent of R&D-marketing involvement and information sharing, in particular, may vary during the different stages of the new product development process, and could be used as measures for the level of integration achieved (Gupta, Raj & Wilemon 1986a).

Personality

Inherent personality differences have been found between marketing and R&D personnel in American corporations (Griffin & Hauser 1996). Other research indicates that differences exist, mainly in time orientation (Gupta, Raj & Wilemon 1986a), but the barrier may be related to cultural stereotypes rather than inherent personality differences.

C: INFORMATION PROCESSING IN THE NPD LITERATURE

Information is defined as data which have been placed in context, thus having been endowed with meaning (Glazer 1991). Information offers a new point of view for interpreting events or objects, and sheds light on unexpected connections.

General systems theory views firms as information processing social structures (Daft & Weick 1984; Moenaert & Souder 1990a; 1990b). This perspective appears to have empirical support in the product development literature where the success and failure of industrial new products have been found to be closely related to the effectiveness, or ineffectiveness, of information processing activities (Cooper 1979; Maidique & Zirger 1984).

Central to the information processing paradigm is the assumption that the fundamental task of the organisation is to effectively deal with information and decisions in an uncertain environment. The paradigm suggests that the solution lies in the “input-process-output” sequence of hierarchical information processing. In viewing information processing as a problem-solving activity, researchers have criticised its use in NPD because it fails to give due consideration to what is created by the process (Nonaka 1994).

It has been suggested that previous research has not provided empirical results regarding how organisational information processes affect marketing performance. While, Jaworski & Kohli (1993), and other conceptual work, have assessed overall business performance, Moorman (1995) empirically investigated the effects of organisational information processes on several new product outcomes.

Organisational Information Processes

The extant literature has consistently conceptualised information activities as being comprised of a series of processes. These views are found in literature

concerned with: (i) adoption of innovations; (ii) information processing models; (iii) information utilisation activities; (iv) organisational learning; (v) the sociology of science (Moorman 1995). The following text identifies the information processing paradigm in terms of: acquisition; transmission; usage; storage. Each of these is now discussed.

Information Acquisition

Many formal and informal activities in firms are aimed at acquiring information. According to Huber (1991), four constituent processes can be distinguished, which can each serve as a source of information acquisition: (i) congenital information; (ii) direct experiences; (iii) experiences of others; (iv) strategic actions. The four processes of information acquisition are to some extent substitutes, and to some extent complementary (Romme & Dillen 1997). Each process has characteristics which make it relevant in some situations, but not in others, e.g. Moorman examines the role of information acquisition in market information processes.

Information Transmission (Diffusion, Sharing, Dissemination)

The processes of information transmission refer to the way in which information is diffused among relevant users within the business. It may be top-down, bottom-up, or horizontal (Moorman 1995). The processes may be formal or informal. Formal transmission is any type of organised or structured dissemination, including policies and training sessions. Informal transmission occurs during interpersonal interactions, such as casual conversations.

The development of new services may be viewed as consisting of a number of task groups whose members are chosen from functionally differentiated firms or departments. Within such a task group every individual performs a functionally specified role, each contributing specialised knowledge and resources. For example, modern-day drug discovery requires the integration of knowledge from a broad array of disciplines (Henderson 1994). The efficient transfer of information in this way encourages greater co-ordination between functions

within the business (see also Moenaert & Souder 1990a; 1990b) and reduces uncertainty about the resources available to the business to complete their innovation task. Similarly, sharing market information across functional areas, whilst problematic for many firms (Clark & Fujimoto 1991; Slater & Narver 1994; Jaworski & Kohli 1993) is critical to success (Ottum & Moore 1997; Moorman 1995).

At the departmental level, Lapierre and Henault (1996) found although that technicians and marketers shared the same opinion when it came to prioritising the importance of bi-directional information transfer, marketing were less happy with the current levels of transfer in comparison to the network personnel (Saghafi, Gupta and Sheth 1990).

The failure to share (market) information between R&D and marketing in the early stages of product development is a major cause for concern, particularly for R&D (Saghafi, Gupta & Sheth 1990). Information transfer occurs through, and between, individuals but importantly, Moenaert & Souder (1990a) assert "it is precisely at the level of the individual that we are ignorant of the variables that determine the acquisition and the use of information from other function" (pp. 214).

In examining interdepartmental information transfer, Rochford & Rudelius (1992) found that: (i) rarely do more than 50% of the firms involved in that stage report seeing two or more groups contributing information to a particular stage; (ii) management and R&D emerge as the heaviest users of information across all stages of the NPD process; (iii) developing information from a larger number of sources was found to have a significant relationship with new product performance; (iv) information from a larger number of sources appears to have an effect on new product performance particularly during the early, predevelopment stages of the new product process; (v) it is very likely that firms feel that it is much more important to obtain more information for the later stages of the new product process; (vi) the number of functional areas utilising information at the various stages of the new product process had a significant relationship with new product performance in four of the 12 stages (preliminary technical assessment,

preliminary financial analysis, market study, and market testing); (vii) exchange of preliminary technical assessment information among large numbers of functional areas had a strong linear relationship with new product performance.

During less successful new product development projects, it has been found that market information moves out of the marketing department only in infrequent batches (Ottum & Moore 1997). On the other hand, developers of successful new products transfer more information of all types across the functional interfaces in a continuous manner (Clark & Fujimoto 1991; Rochford & Rudelius 1992; Takeuchi & Nonaka 1986).

A number of factors have been reported as affecting the efficient transfer of information in the business. A number of these are presented in Exhibit A-5.

Influencing Factor	References
Common language	A number of tools and approaches have been found helpful in the development of a common language and therefore the transfer of information within projects, such as (co-located) multifunctional project teams (Wheelwright & Clark 1992), Quality Functional Deployment diagrams (Hauser & Clausing 1988; Griffin & Hauser 1996) and periodic prototyping (Wheelwright & Clark 1992).
Communication mechanism	An inverted U-shaped relationship was found between dissemination formality and perceived intelligence quality. This supports the findings of Kohli & Jaworski (1990) who propose greater use be made of informal communication of information.
Distance	Social exchange theory suggests that interfunctional distance is likely to raise the costs of interfunctional dissemination and, hence, lower the motivation to disseminate (Maltz & Kohli 1996).
Frequency	Research suggests that the more frequent sharing of market intelligence, represents a more superior dissemination process (Kohli & Jaworski 1990).
Inter-functional climate	Before a piece of external or internalised information is actually applied, it will be evaluated by a user on its relevance, novelty, comprehensibility and credibility. For internal sources of information, this evaluation is largely determined by the interfunctional climate (Moenaert et al. 1994).
Manpower transfers	Manpower flow can be effective in the diffusion of inter-functional information, e.g. the assignment of a technologically educated and experienced person to the marketing function (Moenaert & Souder 1990a; 1990b).
Timing	R&D personnel, for example, are reluctant to accept novel information outside of the planning stage, because during development information is more critically reviewed.
Trust	Trust is a prerequisite for the transfer of information across functional boundaries and its subsequent use (see also Moenaert & Souder 1990a; 1990b; Moorman 1995).
Volume of Information	Maltz & Kohli (1996) found that cross-functional interactions must go beyond a significant minimum threshold level before learning takes place and that too frequent communications can hurt that perceived intelligence quality.

Exhibit A-5: Factors Influencing the Transfer of Information in NPD
(Source: Literature Review)

Information Usage

Competitive advantage associated with information depends upon a business' ability to use its information and intelligence, not so much in its access to information and intelligence (Menon & Varadarajan 1992; Moorman, Zaltman &

Deshpande 1992; Glazer 1991). Information usage in NPD largely refers to the use of information in strategy-related actions (Menon & Varadarajan 1992).

TYPES OF INFORMATION USAGE

Researchers sometimes draw a distinction between instrumental versus conceptual use of intelligence or knowledge (Deshpande & Zaltman 1982; Moorman 1995).

Conceptual utilisation refers to using information to change thinking processes, but without leading to immediate concrete actions (Menon & Varadarajan 1992).

The focus is upon influencing the way firms *process* information or their *commitment* to it. Commitment is revealed in the value an organisation places upon information in decision-making (an informal process). Information processing refers to processes "through which information is given meaning" (Daft & Weick 1984, p. 294). Meaning is the result of: "sensemaking"; comprehending; interpreting; categorising; or elaborating on evoked information using an organisation's memory, collective schema, or shared mental model (Moorman 1995).

Instrumental utilisation refers to the use of information to solve a particular problem or to make a particular decision. Moorman (1995) identifies three sub-processes in instrumental information use: (i) making decisions; (ii) implementing decisions; (iii) evaluating decisions. Use of information in *decision-making* refers to the processes involving the integration of information sources and the selection among strategy alternatives. Use of information in *implementation* refers to the role of information in the realisation of decisions. Information use in *evaluation* refers to processes for using information to determine positive and negative performance outcomes. Performance feedback has been described as crucial to successful organisational adaptation (Fiol & Lyles 1985) and change (Argyris 1976).

Surprisingly, very few studies have examined the use, and importance, of information for decision-making at the various *stages* of the NPD process (Rochford & Rudelius 1992).

INFORMATION FOR UNCERTAINTY REDUCTION

In the product development literature, two key themes related to information usage can be observed: (i) information for uncertainty reduction; (ii) information for decision-making.

Environments serve as a source of uncertainty (Galbraith 1973). The acquisition of information about events occurring outside the business is one strategy that a business may employ in order to reduce the uncertainty faced by a business' decision-makers. Uncertainty reduction is therefore achieved through a change in knowledge.

At the project-level, product innovation activities have been termed "discrete information processing activities aimed at reducing uncertainty" (Moenaert & Souder 1990a; 1990b; Souder & Moenaert 1992; Craig & Hart 1992b). Uncertainty is the difference between the amount of information required to perform a particular task and the amount of information already possessed by the business (Galbraith 1973). The NPD process has also been reported, not as a process of reducing uncertainty, rather a process whereby uncertainty is intentionally increased when circumstances demand the generation of chaos from which new meaning can be created from the available information (Nonaka 1988).

The amount and kind of integration required between departments in a project depends upon specific situations such as the phase of the project (Dwyer & Mellor 1991; Moenaert & Souder 1990a; 1990b), the inherent project uncertainty (Gupta, Ray & Wilemon 1986a; Ruekert & Walker 1987). Higher project uncertainties lead to a greater need for information integration (Griffin & Hauser 1996). This has been operationalised at the business level as the strategic product direction emphasised by the business (Gupta, Ray & Wilemon 1986a). However, uncertainties vary across projects, regardless of the overall strategic direction of the business. Project uncertainties can be broken into market (customers & competitors) and technological (technical & resource) aspects (Moenaert & Souder 1990a; 1990b).

During periods of low environmental uncertainty, Montoya-Weiss & Calantone (1992) found that firms take a defensive or reactive strategic posture. The

organisation structure may be characterised as bureaucratic or mechanistic. The nature of the communication is more indirect and hierarchical, and leadership tends to be centralised and external to the individual. Firms are less innovative.

In periods of high environmental uncertainty, firms take a proactive strategic posture and follow a "leader" philosophy. The organisational structure may be characterised as organic and more freely structured. The nature of communication is direct and egalitarian, and leadership tends to be centralised and internal to the individual. Firms are generally innovative.

Consumer & Competitive Uncertainties

Consumer and competitive uncertainties refer to a shortfall in information about consumers and competitors. Numerous studies have shown that the processing of certain types of (market) information - such as data on customer needs, market size, and segment characteristics - is critical to new product success (Ottum & Moore 1997). In the case of new product failures, market information is often not gathered at all, or at least, an inadequate job of gathering information is performed (Cooper 1979; Cooper & Kleinschmidt 1986; Moore 1993).

Market information processing has been divided by researchers into three categories (Ottum & Moore 1997): (i) gathering; (ii) sharing; (iii) using. This is similar to Kohli & Jaworski's (1990) definition of market orientation as "the organisation-wide generation of market intelligence pertaining to current and future customer needs, dissemination of the intelligence across departments, and organisation-wide responsiveness to it".

Customer Needs

Customers often have difficulties in articulating which precise benefits they prefer, which increases the uncertainty as to the accuracy of research results (Langeard, Reffait & Eiglier 1986; Mohammed-Salleh & Easingwood 1993; Edvardsson, Haglund & Mattsson 1995; Daft, Sormunen & Parks 1988). It is of interest that simulations and prototypes have been employed successfully in the hotel sector (Davis 1988), and that new technology in the form of virtual reality is

likely to be used in future to reduce uncertainty (Rosenberger & de Chernatony 1995).

Competitor's Actions

Due to the ease of copying, competitors have until recently been identified as a more important source of ideas for new products than customers (e.g. Easingwood 1986; Hooley & Mann 1988; Scheuing & Johnson 1989a). Teixeira and Ziskin (1993) found that approximately 80% of banks view their competitors as the main source of new product ideas. As a result, there is often a dangerous focus on 'me-too' products, with most development being reactive and defensive in nature (Piercy & Morgan 1989). The greater use of sophisticated market research information in NSD (Gupta et al 1990; Edgett & Thwaites 1990; Edgett 1993) could improve the business' ability to recognise new consumer demands more quickly and reduce the time to market.

Technology & Resources

As technological environments become more turbulent, they serve as a source of project uncertainty (Galbraith 1973; Clark & Fujimoto 1991). The acquisition of information about these events occurring outside the business is one strategy that a business may employ in order to reduce the uncertainty faced by a business' decision-makers. The efficient transfer of information internally can therefore encourage greater co-ordination between functions within the business (see also Moenaert & Souder 1990a; 1990b) and reduce the uncertainty related to technological change.

Improving R&D around NPD processes will mainly have to do with either improving the quality of the information input, or improving the capacity or capability of the R&D function to transform information into valuable output (Kerssens-Van Drongelen et al. 1996). These processes can be seen primarily as information transformation processes (Clark & Fujimoto 1991; Moenaert & Souder 1990; 1990b), transforming information about clients, market demands and technological advancements into product and process designs.

Work-Related Uncertainty

Within innovation studies, the concept of work-related uncertainty has also been used (Lievens, Moenaert & S'Jegers 1997a). Work-related uncertainty can be the result of: task characteristics; (ii) task environment; (iii) task interdependencies.

Information Storage

If we regard firms as information processing systems, there must be a sort of organisational memory in which information can be stored (Cyert & March 1963; Argyris & Schon 1978). Although organisational memory (see section on Knowledge and organisational learning literature) can be important for decreasing the deterioration risk, over the longer term, it can lead to a loss of effectiveness and become a barrier to change (Romme & Dillen 1997; Leonard-Barton 1992a).

According to Walsh and Ungson (1991), organisational memory consists of: (i) the structure of its storage possibilities; (ii) the information which it stores; (iii) and the processes by which this information can be stored and retrieved. The structure of the storage possibilities is the primary component, and the distribution over different storage locations is the key parameter of this structure. See Exhibit A-6.

Storage Place	Description and References
Individual memories	In which information about personal experiences and observations is stored.
Organisational culture	In which, in particular, knowledge about possible solutions to problems is stored (Schein 1993).
Transformations	Involving the guidelines with which work processes are managed (standard procedures, planning systems, budget systems).
Organisational structure	As a framework for individual behaviour.
Physical structure of workplaces	Reflects the status within the hierarchy, resulting in many behaviour codes.

Exhibit A-6: Internal Information Storage Places (Walsh and Ungson 1991)

In addition to these five internal storage places, external storage places can also be of importance, e.g. former staff, competitors, regulatory authorities. However, these external storage places are not strictly regarded as a component of organisational memory.

D: INTRODUCTION TO THE SERVICES LITERATURE

This section reviews three aspects of the services literature: categorisation of services; characteristics of services; internal marketing of services. All three literatures were used to formulate an understanding of the nature of services.

Categorisation of Services

Much of the work on the classification of individual types of services and service firms has focused on the similarities and differences among services, ignoring the comparison with tangible goods. A number of these are reviewed in Exhibit A-7, and discussed in the subsequent text.

Classification Variable	Reference
Production-oriented	Sasser et al. (1982)
Equipment-oriented	Kotler (1980)
People-oriented	Kotler (1980)
Contact-oriented	Chase (1978)
Customisation	Maister & Lovelock (1982); Johnston & Morris (1985); Maister (1983)
Operational complexity & organisational structure	Haynes (1990)
Customer contact & Routinsation	Wemmerlov (1990)
Demand & supply fluctuations	Lovelock (1983)
Combined approaches (with volume of customer transactions)	Silvestro et al. (1992)
Producer/consumer services	Grosse (1996)
Interface between clients-customers and service firms	Mills & Margulies (1980)

Exhibit A-7: Classifications of Services from the Literature

Sasser et al. (1982) have attempted to re-use traditional *production-oriented* classification systems, but these have been criticised on the grounds that they are insufficient for diagnosing and thinking about service systems (Chase 1978). They tend not to take into account the inherent variability created by the existence of the customer within the system (Morris & Johnston 1987).

In distinguishing between *equipment-based* and *people-based* services, Kotler (1980) attempts to encourage managers to think about services and the characteristics which make them unique. Equipment-based services might include the use of ATMs to deliver financial services, while people-based service might incorporate the provision of accounting services by a professional services business.

Chase (1978) suggests classifying services along a continuum from *high to low contact*, where contact refers to the length of time the customer is in contact with the service, e.g. in a management consultancy practice there is likely to be a high degree of interaction between the customer and the processes of service delivery, while the transactional relationship between some retail outlets and their customers is characterised by very short periods of contact, e.g. newspaper purchase.

Maister & Lovelock (1982) propose a *customisation* classification. Customisation can refer to the extent to which the characteristics of the service and its delivery system lend themselves to customisation. It can also relate to how much judgement customer contact personnel are able to exercise in defining the nature of the service received by individual customers. Yet customisation has its costs. Service management often represents an on-going struggle between the desires of marketing managers to add value, and the goals of operations managers to reduce costs through standardisation. Resolving such disputes requires a good understanding of consumer choice criteria, particularly as these relate to price/value trade-offs and competitive positioning strategy (Lovelock 1983). Maister (1983) has also made an attempt to distinguish between *value added in the front or back office*. In doing so, he maps it against the degree of customisation. Similarly, Johnston & Morris (1985) contrast the degree of product or process focus against the degree of customisation.

More recently, Haynes (1990) has contrasted operational complexity with the degree to which the operation is mechanistic or organic. Another 'two-by-two' is proposed by Wemmerlov (1990) who uses the axes of customer contact (based on

Chase's definition) and the degree of "routinisation" of the service operation, ranging from fluid to rigid.

Lovelock (1983) noted the importance of examining the relationship between the extent to which supply is constrained, and the extent to which demand fluctuates over time. He observes that "for a substantial group of service organisations, successfully managing demand fluctuations through marketing actions is the key to profitability" (p. 29).

Grosse (1996) characterises services industries as either producer services, where users are primarily other firms - e.g. accounting, management consulting, advertising, and consumer services - such as retail stores. Industries such as commercial banking and hotels were observed to cross the boundaries between the two.

In an attempt to unify the classification literature, Silvestro et al. (1992) clustered six of the main service classification schema (see bullets below) against the volume of customers per unit per day to identify three service archetypes. This is presented in Exhibit A-8. The authors anticipate that service strategy, control and performance measurement will differ significantly between each of the three classification categories.

- Equipment-focused services are those where the provision of certain equipment is the core element in the service delivery. People-focused services are those where the provision of contact staff is the core element in service delivery.
- High customer contact is where the customer spends hours, days or weeks in the service system, per transaction. Low customer contact is where the contact with the service system is a few minutes.
- A high degree of customisation is where the service process can be adapted to suit the needs of individual customers. A low degree of customisation is where there is a non-varying standardised process; the customer may be offered several routes but the availability of routines is pre-determined.

- A high degree of discretion is where front-office personnel can exercise judgement in altering the service package or process without referring to supervisors. A low degree of discretion is where changes to service provision can be made only with authorisation from superiors.
- A back-office-oriented service is where the proportion of front-office (customer contact) staff to total staff is small. A front-office-oriented service is where the proportion of front-office staff to total staff is large.
- A product-oriented service is where the emphasis is on what the customer buys. A process-oriented service is where the emphasis is on how the service is delivered to the customer.

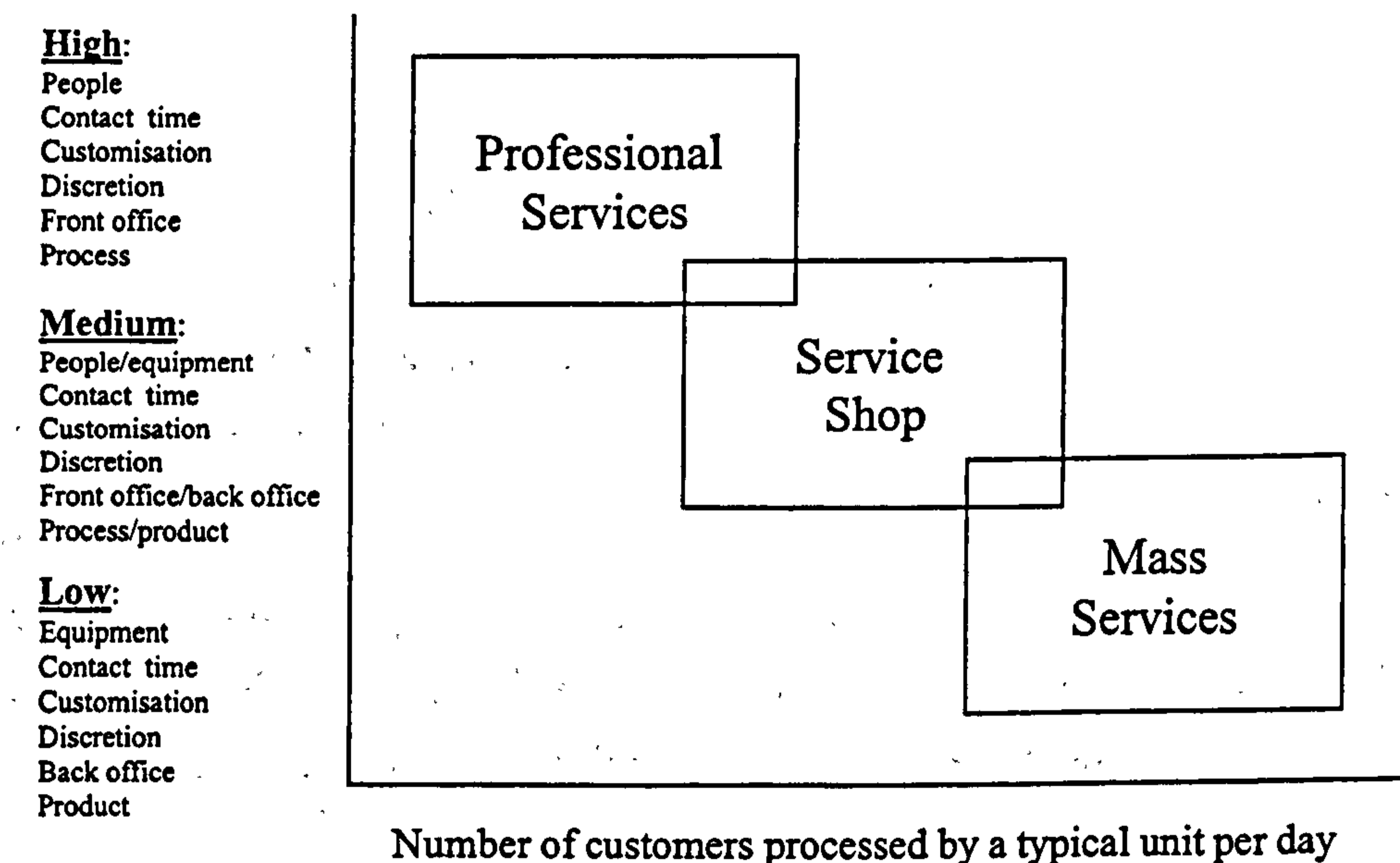


Exhibit A-8 Service Processes Model (Silvestro et al. 1992)

Mills & Margulies (1980) have developed a core typology for service firms based on seven underlying dimensions of the interface between clients-customers and service firms. Interestingly for this research, the classification proposed includes information as a key variable. The success of the interaction between the employee and the customer in the *maintenance-interactive* organisation rests on the organisation's ability to subject service-delivery activities to few changes and

the tendency to routinise service delivery, e.g. bank account transactions. The focus in *task-interactive* industries is on the tasks to be performed, e.g. the development of a new advertising campaign. The focus of the *personal-interactive* is on the improvement of the client/customer's direct and intimate well-being, e.g. professional services, and is notable for the importance of the employee in converting client information into knowledge.

Dimension	Maintenance-Interactive	Task-Interactive	Personal-Interactive
Examples	Bank	Advertising	Accountant
Information: <ul style="list-style-type: none"> Information quantity Information quality Confidentiality 	Low High Low	Moderate Moderate Moderate	High Low High
Decision: <ul style="list-style-type: none"> Employee decisions Importance Feedback (client to staff) 	Simple Low Immediate	Complex Moderate Slow	Complex High Slow
Time: <ul style="list-style-type: none"> Interface duration Total time in direct contact 	Brief High	Moderate Moderate	High High
Problem Awareness: <ul style="list-style-type: none"> Client knowledge about problems Client ability to evaluate services Client expectations vs. Service capabilities 	High High High	Moderate Moderate Moderate	Low Low Low
Transferability: <ul style="list-style-type: none"> Substitutability of employee 	High	Moderate	Low
Power: <ul style="list-style-type: none"> Perceived power of employee with client Employee status to client Employee authority with client 	Low Low Low	Moderate High High	High High High
Attachment: <ul style="list-style-type: none"> Employee identification with client Conflict potential 	Low Low	Moderate Moderate	High High

Exhibit A-9 A Typology of Service Firms (Mills & Margulies 1980)

Characteristics of Services

The commonly cited characteristics of services that distinguish them from tangible goods are intangibility, separability, heterogeneity and perishability. These features of services have important implications for their marketing (Shostack 1977; Lovelock 1984a; 1984b; Zeithaml et al. 1985; Edgett & Jones 1991). The following sections offer a *brief* description of the common characteristics of services, and their possible effect on the marketing approaches adopted.

Inseparability/Simultaneity

Services are processes and are therefore sold, produced and consumed simultaneously (Berry 1980). It is likely that the people involved in selling the service will often be those who also produce it, e.g. management consultants often sell, produce and deliver their own service offering, while a windsurfing lesson may be sold by a hotel and delivered by a sports instructor. This indicates that the domain of the marketer in services should be expanded beyond the traditional realms of the product marketer to include both the production of the service and its consumption (Frisk et al. 1983). Hence the specific identification of "process of service assembly" as an element of the marketing mix (Booms & Bitner 1981). As a consequence, it has been observed that greater importance should be placed on management of the service encounter (Suprenant & Solomon 1987).

Quality Issues

The fact that the process by which a service is provided will be the visible part of the service product it will be important in influencing consumers' assessment of service quality (Ennew & Watkins 1992; Chan, Go & Pine 1998). Since the quality of the service is inseparable from the quality of the service provider (Chase 1978), customer contact personnel have a key role in achieving enhanced customer loyalty (Davidson 1978).

Internal Communication

Unlike manufacturing firms, it is impossible to decouple production and marketing activities in the delivery of services. This may explain the important position internal communications has assumed within the services marketing literature (Lievens, Moenaert & S'Jegers 1997a; Gronroos 1990). The participation and active involvement of front-line personnel, in particular, is crucial to the success of service innovation, especially as they are likely to possess very valuable knowledge about the needs of the target market and the use of current products. Employees as a source of ideas for new services was identified in the research of Easingwood (1986). This has led to the development of internal marketing plans to co-ordinate information flows between staff and management (Berry 1980; Gronroos 1981a, 1981b). Thus, the inseparability of production and consumption introduces uncertainty because of the difficulty and complexity in managing the customer/employee interface (Lievens, Moenaert & S'Jegers 1997a).

External Communication

Customer participation in the production process increases the degree of task interdependence between marketing and operations as it becomes impossible to buffer the technical core of the production processes of the business from relevant environmental influences (Mahajan et al. 1994). Often the consumer will be actively engaged in the production of the service (Winch & Schneider 1993; Bostrom 1995; Booms & Bitner 1981). The consumers' knowledge, skills and mood can have an effect on the transaction process, customer's expectations, and ultimate satisfaction. Customer involvement also provides opportunities for immediate feedback (Middleton 1983), and the immediate customisation of a service offering in response to that feedback (Berry 1980). Not all services require the presence of the customer, e.g. 'mail services' just require the customer to initiate the service. Similarly, postal insurance service only require the customer to be involved when a claim is necessary. In these cases, it is the service outcome which is important, not so much the process.

Time Considerations

In a number of services industries, both production and consumption will often take place over a long period of time, e.g. the provision of accounting services. The maintenance of this long-term relationship, e.g. through stressing continually high service quality, is an important influencing factor in overall service success.

Process Flow

Customers experience service as a series of “moments of truth” (Gronroos 1990). In all likelihood these will be experienced through interaction with a number of different front-line personnel. Thus, the management of process flow is of considerable interest to the services marketer. A number of approaches to analysing process flow are evident in the services literature: flowcharting (Shostack 1982); dramaturgy (Fisk & Grove 1995); structured analysis and design technique (Congram & Epelman 1995).

Heterogeneity

A service business' dependence upon the human element means that the process of developing and delivering a service is much less amenable to the process controls used by manufacturers of tangible goods to keep product defects within an acceptable tolerance (Booms & Bitner 1981). This may lead to greater variability in service quality. It is the variability of services which triggers a perception of risk, and it is this which introduces task uncertainty. The variability of services depends upon the uniformity and number of exceptions encountered in developing an innovation. The higher the variability of a task, the higher the uncertainty of this task. The heterogeneity of services has given way to the formulation of many ‘two-dimensional service categorisation systems’ (de Brentani 1993b, p.277).

Heterogeneity has been explained by Iacobucci (1998) in terms of heterogeneity due to “people” or to “place” (i.e. multi-site locations). These are examined.

Due to People

Because services often require the interaction of clients and staff, they are less uniform than tangible goods (Berry 1980). This makes it more difficult to develop consistent performance standards, and is a source of perceived consumer risk (Zeithaml 1981). Zeithaml et al. (1985) observe that the quality of a service is typically dependent on how customers perceive the interaction with the service provider and this "can vary from producer, from customer to customer and from day to day" (p.34). Gronroos (1983) proposes the use of internal marketing to promote the concept of consistent service quality throughout the organisation. Heterogeneity problems can be minimised by more closely controlling the service encounter (Berry 1980; Suprenant & Solomon 1987). Levitt (1972; 1976) writes of the 'industrialisation of services'. Berry (1980) suggests greater standardisation may be achieved in a number of ways, e.g. introducing technology and thereby reducing employee-customer contact.

Schlesinger & Heskett (1991) developed a conceptual model of the relationship between employee and customer satisfaction and retention called the 'cycle of success' which argued that staff who are hired and trained well will be relatively satisfied with their jobs, and remain in employment with the business. Being happier and retaining appropriate knowledge will contribute to a better quality of customer service and, ultimately, towards more loyal and profitable customers. Iacobucci (1998) observes that other research on the associations among the components of the model are supportive of Schlesinger & Heskett's theories. For example, job performance and satisfaction have been found to be related to business performance (Lusch & Serpkenci 1990), firms' concerns for staff and customers are often correlated (Burke et al. 1992), selection and training is related to employee retention (Bankston 1995), and the quality of a business' personnel is correlated to sales growth (Mayo & Jarvis 1992). Employee satisfaction is related to pay and perks, e.g. availability of healthcare plans (Hoffman et al 1993). Leadership from top management therefore becomes a critical facilitator of quality customer service programmes (Arnold 1995).

Professional services staff have been found to be resistant to what they believe to be 'marketing', resulting in a more heterogeneous service delivery. It has been posited that in these situations staff must be persuaded that the development of effective marketing programmes will free them to provide even higher quality service to clients (Graham 1994). Also in the professional services sector, customer satisfaction and customer service are pervasive concerns, particularly to enhance workflow and advice quality (Stauss 1995).

Due to Place

An issue most relevant to service managers, in general, is how to provide consistent service across multiple locations, e.g. the operation of franchises within a country or the delivery of service, across international franchises. Darr et al. (1995) describe how organisational learning can occur within a franchise but not between franchises, thus impacting the quality of the service developed and delivered in different locations. Gal-Or (1995) argues the importance of monitoring the quality at franchise stores which serve smaller markets and which are therefore more likely to be subject to greater levels of inconsistency. The major challenges faced in the internationalisation of services include the heterogeneity inherent in consumer expectations and in operations.

Intangibility

A service is a deed or performance and can therefore be consumed but not touched, tasted, smelt or seen. Typically, a customer has nothing physical to show after purchase, i.e. the benefit is intangible. This makes it difficult for the consumer to define the service and also makes it difficult for them to evaluate it accurately (Berry 1980). Material benefits may only be realised in the long-term and, in the case of some financial services, the benefits may never be experienced, e.g. insurance. Intangibility is considered the most important factor in distinguishing between services and tangible goods. In putting services marketing into context, Shostack (1977) stated "the greater the weight of intangible elements in a market entity, the greater will be the divergence from product marketing in priorities and approach".

Many authors stress the need to offer tangible clues to the nature and quality of the service offered, e.g. the credit card is tangible evidence of the service of credit and a payment system (Levitt 1981). Tangibility can be offered in the customer interaction process itself (Gronroos 1978). This includes the ease of use of physical production facilities (e.g. ATMs), the appearance of staff, and the ambience of the environment in which the customer interaction takes place (Berry 1980). Many authors stress the importance of building a strong brand-image for the service, or organisation, which the customer can use as a cue for quality, e.g. M&S in the UK retail market (Berry 1980). Bharadwaj & Menon (1993) found that strong service image and business reputation were positively associated with market share. Because the intangible nature of services means that they cannot be protected by patents, the advantages of being first in the market with a new service have been posited to be lower than for tangible goods (Bitner & Zeithaml 1987). This has led to the importance of branding, which is afforded a degree of legal protection.

Service guarantees have become an important tangible vehicle for communicating a quality signal to customers. Hart (1995) applies the concept to interdepartmental service guarantees. Such internal guarantees, it is suggested, allow firms to standardise internal service quality and provide a vehicle for internal communication of ideas.

The absence of tangible evidence with which to make purchase decisions has been found to lead customers into making more use of personal sources of information and advice when purchasing a service (Zeithaml et al. 1985). Therefore, personal selling is considered more important in services marketing than in physical product marketing (Booms & Bitner 1981).

As service firms must assist the customer in conceptualising and evaluating the service by providing tangible clues, this makes the effectiveness of the communication between buyer and seller even more critical in order to convince the customer of the benefits of the service (Gronroos 1990). The more intangible, or non-standardised, the object of communication, the more difficult the communication about such objects become (March & Simon 1958; Moenaert &

Souder 1990b). Thus, in order to be successful, the firms must reduce perceived risk through communication (Lievens, Moenaert & S'Jegers 1997a).

Perishability

Services are perishable, i.e. they cannot be separated either from the person providing the service or from the time at which the service is provided. Any unused capacity is lost forever (e.g. airline seats) and this leads to important supply and demand considerations in the marketing of services (Gronroos 1978; Lovelock 1981; Lovelock 1984b).

The perishability of services also introduces uncertainty due to the task characteristics and task interdependencies (Lievens, Moenaert & S'Jegers 1997a).

Internal Communication

An important implication of perishability is the requirement for greater cross-functional communication in the design of the new service and its associated delivery system. Communication among marketing, operations and human resources has been found to be important in the development of an effective and efficient delivery system (Swartz et al. 1992) which minimises lost capacity.

Information technology can facilitate greater interdepartmental communication and, consequently, better service provision and more effective relationship management, particularly in circumstances where specialised knowledge needs to be communicated. Quinn, Doorley & Paquette (1990a) observed that this approach may be a particular need for multi-site service operations.

External Communications

The higher the service variability, the more difficult it becomes to manage capacity and demand. By standardising service processes the problems associated with the inherent perishability of services can be diminished.

In some instances, technology can adjust supply and demand fluctuations more quickly (e.g. the provision of legal services over the Internet), while at other times

(e.g. face-to-face legal consultations), co-ordination of supply and demand is more difficult. It is, therefore, important to synchronise supply and demand through a number of different methods (Berry 1980; Bitner & Zeithaml 1987).

While demand fluctuations can be addressed through pricing and promotion mechanisms, e.g. telecommunications services, this will only be possible when customers control their own demand patterns. Supply can be reshaped by using part-time workers, cross-functional training, or by substituting more productive equipment for labour, e.g. ATMs. However, in some instances this is not an issue for many services, e.g. the supply of a Unit Trust is practically limited (Lovelock 1983).

ADDRESSING PROBLEMS CAUSED BY SERVICE CHARACTERISTICS

The fact that services are intangible means that the people who supply the service, the process by which it is supplied, and the associated physical evidence will be key factors in creating customer satisfaction. The heterogeneity of services requires that considerable emphasis is attached to the service provided and the process of provision to ensure quality, while inseparability requires that the service provider emphasises both the people and processes to ensure customer satisfaction (Ennew & Watkins 1992).

The characteristics of each of the four service dimensions are explored in Exhibit A-10, along with an identification of the inherent problems caused and solutions offered to marketers.

Intangibility		Inseparability	
<ul style="list-style-type: none"> ▪ Increase the degree of tangibility ▪ Develop cues, images and brands ▪ Enhance client relationship ▪ Engage in post-purchase communication ▪ Control the delivery process ▪ Ensure access and availability of distribution systems ▪ Manage consumer problems in evaluating quality ▪ Develop appropriate price/quality relationships ▪ Develop personal sources of communication ▪ Create a strong organisational image 		<ul style="list-style-type: none"> ▪ Address the issue of instantaneous production and consumption ▪ Use multi-site locations ▪ Integrate consumers in the production process ▪ Market a service before consumer experiences it ▪ Co-ordinate demand and supply problems ▪ Address internal marketing issues ▪ Manage continuous/immediate consumer feedback ▪ Address issue of sales and production people being 	
Heterogeneity		Perishability	
<ul style="list-style-type: none"> ▪ Control the service encounter ▪ Standardise service offerings ▪ Determine appropriate level of automation ▪ Develop performance standards ▪ Reduce consumer's perception of risk ▪ Develop multi-distribution channels 		<ul style="list-style-type: none"> ▪ Deal with demand fluctuations ▪ Manage capacity restrictions ▪ Deal with lack of inventories ▪ Determine appropriate pricing strategy ▪ Develop a level of efficiency ▪ Address distribution restrictions 	

Exhibit A-10: Service Features & Marketing Problems (from Zeithaml et al. 1985)

Internal Marketing

A number of themes explaining the concept of internal marketing have emerged from the marketing literature. Internal marketing was proposed as an approach to service management, entailing the application of the traditional marketing mix, by marketers, within the organisation. Staff were regarded as customers of the business, and corporate effectiveness was enhanced by improving internal marketing relationships (Berry 1981).

However, a number of researchers began to posit that it did not make sense to treat internal marketing as a specialist functional approach. Rather, it was suggested that internal marketing represented the convergence of a number of

previously separate management technologies, such as human resource development, employee relations, organisational development, strategic management, quality management and macro-marketing (Varey 1995), and that the concept applied to all aspects of the business. A number of the more discernible internal marketing themes emerging from the research are reviewed in the following text.

Service Quality and Business Performance

Internal service quality is necessary for the achievement of superior external service quality. A number of researchers have suggested linkages between internal service quality, employee satisfaction, personal and collective productivity, external customer satisfaction, and ultimately business performance (e.g. Heskett 1994). George (1990) regarded internal marketing as a 'strategic weapon' to help to achieve excellent service quality and thereby greater customer satisfaction. Other writers simply suggested that if the staff employed by the business are regarded, and treated, as internal customers, then good service will be more likely for external customers through effective marketing behaviour by customer-oriented and sales-minded people (Gronroos 1981). Internal service quality was therefore a key variable. Gummesson (1987) observed that quality was a satisfied external customer, the road to which is paved by satisfied internal customers.

Marketing Strategy & Marketing Orientation

Researchers have observed the difficulties faced by firms in the effective implementation of major new plans which inevitably require change (Varey 1995a; 1995b), e.g. market orientation. The formulation and co-ordination of internal marketing plans has been proposed as a way of creating knowledge, understanding, involvement and consensus in the formulation and implementation of marketing strategy and plans (Christopher et al. 1991). Varey (1995a; 1995b), however, suggests that in internal marketing the "product" is not simply a given plan supplied by managers to their internal customers. Rather, internal marketing

is a mechanism through which internal customers get the resources and support they need in order to best serve their customers, but only if they are inclined to do so. It is a "two-way communication" of needs and wants and feedback on performance.

Christopher et al. (1991) applied the term "internal marketing" to any form of marketing within a business which focuses attention to the internal activities that need to be changed in order that marketing plans may be formulated. Ballantyne et al. (1995) refined this view to add: "internal marketing is any form of marketing within an organisation which focuses staff attention on the internal activities that need to be changed in order to enhance external market place performance".

Ruekert & Walker (1987) assert that 'marketers' specifically may have different roles in different parts of the organisation, which should be market-driven, i.e. responsive to customers, but not necessarily always marketing-driven, i.e. controlled by marketers using marketing tools such as advertising. Essentially, internal marketing may be regarded as engendering market-oriented management in all staff of the business (Gronroos 1983), including "non-professional marketers" (Gronroos 1984) and "part-time marketers" (George 1990).

Human Resource Management

Building on the theme of internal marketing as an important vehicle for all members of the business, several authors identify the convergence of the human resource management (HRM) and marketing literatures in internal marketing.

Collins & Payne (1991) stress the need for training, recruitment, motivation and reward. Berry & Parasuraman (1991) combine the issues of marketing and human resource management in their assertion that: "internal marketing is attracting, developing, motivating, and retaining qualified staff through job-products that satisfy their needs. Internal marketing is the philosophy of treating staff as customers - indeed, "wooing" staff...- and is the strategy of shaping job-products to fit human needs" (Berry & Parasuraman 1991, p.151). Similarly, Bak et al.

(1994, p.38) define internal marketing as using "a marketing perspective for managing an organisation's human resources". George (1990) emphasises the interdependence of internal marketing, and HRM and describes internal marketing as "a philosophy for managing the organisation's human resources as a holistic management process to integrate the multiple functions of the organisation". In integrating HRM and marketing research themes, Berry & Parasuraman (1991, p. 171) observe that firms which practice internal marketing effectively will: (i) compete aggressively for talent; (ii) offer a vision that brings purpose and meaning to the workplace; (iii) equip people with the skills and knowledge to perform their roles excellently; (iv) bring people together to benefit from the fruits of team play; (v) leverage the freedom factor; (vi) nurture achievement through measurement and rewards; (vii) base job design decisions on research.

Internal Marketing as Organisational Learning

Cahill (1995) posits that both the human resource and traditional marketing definitions of internal marketing are too exclusive, to the point that they miss several opportunities to present the subject as a central aspect to all firms, i.e. internal marketing is not simply the marketing concept applied internally to large firms. A new paradigm of employee-employer relations has been suggested in which organisational competence and capability are deliberately developed through the establishment of internal structures and processes which influence members of the organisation to act to ensure that competitive advantage is created and maintained. The metamorphosis of a business into a learning organisation is a necessary step in the correct performance of internal marketing (Cahill 1995):

Without this core of learning - and the ability to pass that learning on from generation to generation (and in some firms, with annual employee and supervisor turnover rates of 25% or more being considered "normal", not to mention the rise of "leased" and temporary staff as long-term staffing solutions, an employee generation is two or three years at best) - the organisation cannot provide its services to its customers with more competence and understanding (p. 48).

Foddy (1994) supports the view that a business-wide process and mechanism which speedily applies knowledge from experience, provides a capability for learning and competitive advantage. The internal marketing process provides a mechanism for developing and continuously updating this capability.

Internal Marketing as Innovation

Innovation may be viewed as consisting of a number of task groups whose members are chosen from functionally differentiated firms or departments to participate in the development of new products or processes. Considerable literature exists on the problems of integrating the various departmentalised functions of the organisation during the course of innovation activity. As this literature is reviewed in depth in later chapters, it is not proposed to reproduce it in detail here.

Edgett & Jones (1991) found that in their study of the development of a successful new financial service product, internal marketing played a significant role in developing awareness of the product within the company and in maintaining its momentum throughout the development process. This suggests that the organisational elements of the project are as important as the development process, to the success of a new financial service at least.

The Internal Marketing Processes

Following Ramm-Schmidt (1984), Gronroos (1985, p.47) identifies three stages to the development of an internal marketing programme: (i) a profound analysis of the nature of the service business, including attitudes among staff and customers; (ii) getting people to understand what it is all about to be customer-oriented and to have an excellent interactive marketing function; (iii) achieving continuous customer-oriented operations and continuous high perceived service quality. Ballantyne (1997) identifies internal marketing as a process:

a relationship development process in which staff autonomy and know-how combine to create and circulate new organisational knowledge that will

challenge internal activities which need to be changed to enhance quality in marketplace relationships.

Based on research at ANZ Bank, Ballantyne (1997) proffers a view of internal marketing as a knowledge discovery process, with its own inputs, throughputs and outputs. His model is presented in Exhibit A-11: *Energising* is seeking and receiving the willing commitment of staff to work towards a given goal within or outside the boundaries of their job description. At ANZ, Ballantyne observed that work activity increased staff sense of self-worth and purpose, and it stretched their capabilities. *Code Breaking* involves translating known customer requirements into an agenda for detailed changes in a production or delivery systems with new "know-how". At ANZ, Ballantyne observed that seeking operational solutions to customers' problems required the development of new "know-how". *Border Crossing* involves dealing with dysfunctional processes which cross departmental borders by circulating new knowledge across those borders.

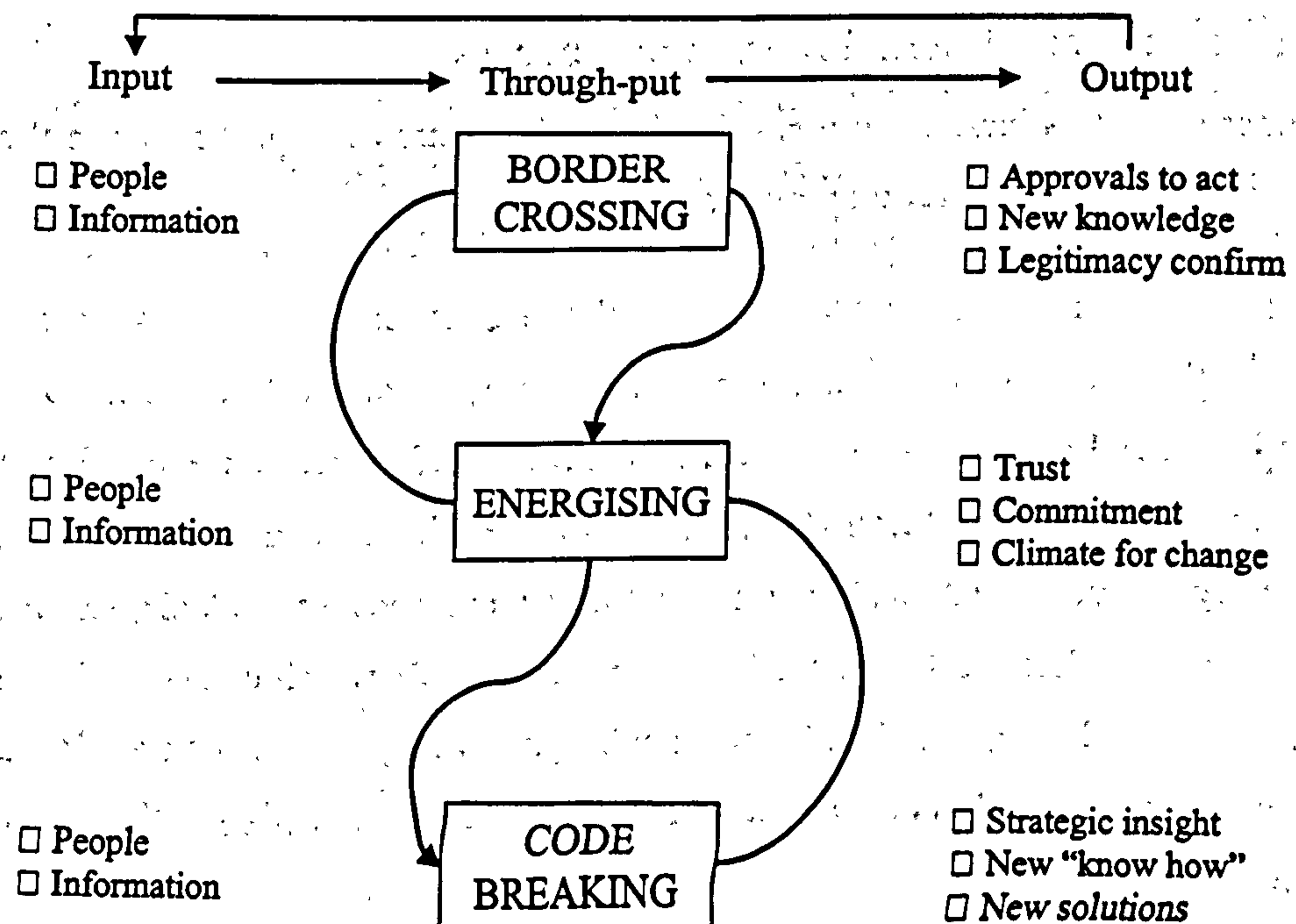


Exhibit A-11: ANZ's Internal Marketing as a Knowledge Discovery Process (Ballantyne 1997)

Varey (1995a; 1995b) presents a model of internal marketing as a process for change management and for integrating market-oriented management. The model does not assume the pre-existence of structures or organisation. The effect of the process modelled, the author observes, would depend on a holistic application, rather than a piecemeal adoption of individual elements which would destroy the emergent properties of the system by breaking the complex interconnectedness. This "capability enhancement" process is supported implicitly by Parasuraman et al. (1985).

Service can be improved only through a systematic, step-by-step journey that enhances employees' ability and willingness to provide service by creating an organisation that supports quality service in every area...A long-term view is essential for service quality. There are no ways to change habits, knowledge and skills of human beings quickly. It is more useful to think in terms of organisational evolution than revolution.

Factors Influencing Internal Marketing Success

A number of factors have been identified in the literature as impacting upon the success of an internal marketing programme.

People Issues

People issues and organisational issues have been identified within the context of the culture of the organisation (Thomson 1990). The former are concerned with maximising relationships within the organisation where individuals, teams, managers and leaders are the target customers with needs which can be satisfied with products and services. The latter includes practices, plans, structure, vision, mission and values, and is concerned with maximising the effective utilisation of resources.

Management Involvement

It has been recommended that internal marketing be viewed as a managerial philosophy, and therefore the first target group of internal marketing programmes should be top management, not contact personnel (Gronroos 1985). If internal marketing is not accepted as an important business philosophy at this level, the strategic direction of the business may make implementation of internal marketing impossible (Gronroos 1985). George (1990) suggests that management must demonstrate how subordinates can combine new ideas and routines concerning customer service and marketing with their everyday jobs. Their responsibility is to create an open internal climate where marketing and customer service aspects of their subordinates' jobs are considered important, regular feedback is used as a powerful motivating tool, and staff are encouraged to take risks to improve the quality of the service offered.

Education and Training

It has been observed that internal training, sometimes in combination with external training, is perhaps the most important single internal marketing activity. Training is an important contributor to the management of employee attitudes, the mechanism by which the "total view" is shared with staff, and the way in which improved communication and sales skills may be passed on to contact persons (Gronroos 1985). However, a training programme alone is not enough to support an internal marketing process. Service training must support the development of an open information climate, and the continual internal interactive communication between managers and their subordinates (Gronroos 1985). In support of internal training and integrative communication, Gronroos (1985) seeks the support of internal and external mass communication, personnel administration tools, market research and market segmentation.

Knowledge

From an internal marketing perspective, an understanding of employee capabilities - their attitudes, know-how, and skills required to participate in an

internal marketing strategy - is vital if the business is to be able to improve the range and quality of services offered to its customers.

E: PRODUCT DEVELOPMENT RESEARCH

Although this thesis explores NSD in UK service business, it still draws heavily at times on NPD literature, where NSD literature presents “gaps”. For this reason, a summary of the NPD literature is presented in this appendix.

The most recent NPD literature review has been offered by Brown & Eisenhardt (1995). The authors distinguish between three forms of product development research: (i) product development as a rational plan; (ii) NPD as a communication web; (iii) NPD as disciplined problem-solving. Exhibit A-12 presents the Rational plan perspective, A-8 the Communications web perspective, and A-13 the Disciplined problem-solving perspective as indicated by Brown & Eisenhardt (1995).

Study	Sample	Performance Measure (Dep. Variable)	Key Results (Independent Variable)
Myers & Marquis (1969)	567 successes	Product revenue or savings in production costs	Market (market pull) Communication (x-functional)
SAPPHO	43 success/failure product pairs	Profitability & market share of product	Market (understand user needs) Senior management (involved)
NewProd (Cooper 1979)	102 successful & 93 failed products	Profitability of product	Product (unique/superior in customer's eyes) Market (High growth, not satisfied, not competitive) Communication (Synergy across different functions)
Cooper & Kleinschmidt (1987)	123 successful & 80 failed products	11 financial measures	Product (Clear concept; better cost, quality, unique) Market (Attractive in size & growth potential) Senior management (supportive) Organisation of work (pre-development planning)
Stanford Innovation Project (Maidique & Zirger 1984; 1985; Zirger & Maidique 1990)	86 success/failure product pairs	Profitability of product	Product (Synergy with competencies; better cost, quality, unique) Market (Large & growing) Communication (High internal communication) Senior management (Supportive)

Exhibit A-12: Rational Plan Perspective: Selected Studies (Source: Brown & Eisenhardt 1995)

Study	Sample	Performance Measure (Dependent Variable)	Key Results (Independent Variable)
Allen (1971; 1977); Katz & Tushman (1981)	R&D professionals (345 in 60 projects (K&T))	Management rated overall technical performance	Communication (technology gatekeeper, frequent external communication) Project leader (as politician)
Katz (1982)	50 R&D project groups	Team & management rating for overall team performance)	Communication (Curvilinear relationship with group longevity, mediated by external communication)
Katz & Allen (1985)	86 R&D project teams	Mgmt rated team performance	Project leader (as powerful small group manager; functional manager as manager as inward- & technology-focused leader)
Keller (1986)	32 R&D project groups	T&M rated performance for quality, budget, schedule	Communication (Internal communication as group cohesiveness)
Ancona & Caldwell (1990; 1992a; 1992b)	45 product development teams	T&M rated performance for innovation, schedule, efficiency, budgets & conflict.	Communication (External communication combining ambassadorial & task co-ordination; Internal communication as defined goals, workable plan, & prioritised work).
Dougherty (1990; 1992); Dougherty & Corse (in press at time)	40 product development projects	Failure (cancellation) & success as rated by management.	Communication (Overcome "thought world" barriers through interactive & iterative communication, concrete experiences, and violating organisational routines).

Exhibit A-13: Communication Web Perspective: Selected Studies (Source: Brown & Eisenhardt 1995)

Study	Sample	Performance Measure (Dependent Variable)	Key Results (Independent Variable)
Imai et al. (1985); Takeuchi & Nonaka (1986)	7 successful development projects	Speed, flexibility	Senior management (Subtle control) Communication (High internal team communication, multi-level learning) Organisation of work (x-functional teams, overlapping phases) Suppliers (High involvement)
Harvard Auto Study (Clark et al. 1987; Clark & Fujimoto 1991; Hayes et al. 1988)	29 development projects	Quality, speed, productivity	Product (Product integrity) Communication (High internal team communication) Organisation of work (x-functional teams, overlapping phases; pre-development planning) Project leader (Heavy weight project manager) Supplier (High involvement)
MIT Auto Study (Womack et al. 1990)	Same as Harvard study +	Operational variables (including quality, speed, productivity)	Communication (High internal team communication) Organisation of work (x-functional teams, overlapping, pre-development planning)
Iansiti (1992; 1993)	27 development projects	Speed, productivity	Product (Product integrity) Organisation of work (Pre-development planning)
Eisenhardt & Tabrizi (In press at time)	72 development projects	Speed	Organisation of work (x-functional teams, iterative prototype & test processes, limited planning and use of CAD, don't reward for schedule)

Exhibit A-14: Disciplined Problem-Solving: Selected Studies (Source: Brown & Eisenhardt 1995)

However, although an important addition to the product development literature, the reader is left to develop their own insights vis-à-vis new service development.

F: SUMMARY OF NPD BEST PRACTICE STUDIES

Sponsor	Sample	Findings
Booz et al. (1968)	50 firms	6-stage process, 58 ideas/success NPD success rate = 67%
Booz et al. (1982)	150 interviews 700 survey responses Broad manufacturing	Add strategic planning step to NPD process 7 ideas/success NPD success rate = 65%
Page, PDMA (1993)	189 survey responses Broad industry 79% goods	Measure NPD performance Use multi-functional teams Best practice is context specific 11 ideas/success, NPD success rate = 58%
Arthur D. Little (1991)	701 survey responses 9 manufacturing industries	Use multi-functional teams Provide top management attention Early supplier involvement
Kuczmarski (1994)	77 fax survey responses Broad industry	Tangible & visible top management support Provide adequate resources Spend more time on up-front steps Focus on newer products
Mercer Management Consulting (1994)	193 R&D managers Broad industry	Customer-centred disciplined NPD process Cultivate a supportive NPD infrastructure Manage the NPD portfolio Use a planning stage
Product Development Consulting (1994)	129 survey responses	Distinguish between features and needs NPD scope includes entire augmented product
Group EFO (1995)	103 marketers /83 firms Consumer packaged goods	25 ideas/success Lack of NPD commitment
Mitchell Madison Group (1995)	15 service firms	Actively manage the NPD portfolio Provide adequate resources Use an empowered team Dedicated NPD team members
Pittiglio Rabin Todd & McGrath (1995)	Over 200 participants Many high-tech industries	Measure both project performance and development effectiveness Use multi-functional teams Structured process, action-oriented phase reviews Manage product strategy and the NPD pipeline 9.5% cycle time reduction
Southwestern Bell (Fact Finders) (1996)	134 respondents, 7 industries 32-item fax survey Services and goods	57% use a formal NPD process 58% have reduced cycle time For 80%, team membership is a part-time responsibility

Exhibit A-15: Summary of NPD Best Practice Studies (Source: Griffin 1997)

G: **SUCCESS & FAILURE LITERATURE IN NSD**

1. OPPORTUNITY ANALYSIS			
Product synergy: fit with existing product line, business image, corporate strategy [1, 2, 5] Marketing synergy: fit with existing resources/expertise in terms of delivery systems, operations, sales force, advertising, market research, customer service [1, 3, 4, 5, 6] Managerial synergy: fit with organisational structure, financial resources [1, 3, 4, 5] (Diversification): product was a diversification, product new to the business, new technology, new production process, customers new to the business [4, 5, 6, 7]		Market knowledge: customer needs & behaviour understood, clearly identified target segment, competitors understood [2, 3, 5] Market orientation: Use of market research, market-oriented strategy, customer service orientation [6] Product of high importance: [5] Market attractiveness: size, growth, mass market [2, 4, 5, 6, 7] Market synergy: customer need for product, responds to changes in marketplace [2, 3, 4, 5]	
2. PROJECT DEVELOPMENT			
Innovation orientation: top management support for innovation, NSD important variable in HRM [4, 6] Effective NSD management: well-planned, well-executed, formal process, sufficient resources, experienced staff [2, 3, 4, 5] Speed of development: [1, 5] Co-ordination: inter-functional communication & co-ordination, involvement of front-line staff; formal development team [2, 6, 7]		Organisational support: top management support, product champion, commitment of people involved [2, 6] Extensive testing: [2, 4, 5] Launch preparation: internal marketing, internal communications, training [1, 2, 3, 4, 5, 6, 7] Formal & effective launch: formal launch, full-scale, well co-ordinated, well-targeted, post-launch evaluation [2, 4, 5, 6]	
3. SERVICE PRODUCT PLUS AUGMENTATION (OFFER FORMULATION)			
Product advantage: differentiated product, unique benefits, significant improvement, better value, brand image, difficult to copy [1, 2, 3, 4, 5, 6, 7] Customer knowledge: product familiar to customers, complex product, no learning effort required, easy to understand [4, 5, 6] Highly innovative: [1, 4, 6, 7] Product quality: higher quality, reliability, quality image [1, 3, 4, 5, 6] Customer participation in delivery: [7]		Quality of service experience: delivery quality, customer service, friendly/courteous, prompt/efficient [1, 3, 4, 5] Effective communications: extensive, raises awareness, explains benefits, builds brand image, distinct position, consistent with marketing strategy [1, 2, 3, 5] Front-line expertise: knowledge, marketing skills, commitment, enthusiasm, experts [2, 3, 4, 5, 7] Extensive distribution systems: [5]	
SUCCESS FACTORS ADAPTED FROM:			
1	Easingwood & Storey (1991, 1993) / Storey &	5	Storey & Easingwood
2	Easingwood (1993)	6	(1994, 1996a)
3	Edgett (1994) / Edgett & Parkinson (1994)	7	Atuahene-Gima (1995,
4	Cooper et al. (1994)		1996a, 1996b)
	de Brentani (1991, 1993a) / Cooper & de		de Brentani & Ragot
	Brentani (1991)		(1996)
	de Brentani & Cooper (1992)		

Exhibit A-16: Source: Success / Failure Factors in NSD (Johne & Storey 1998)

H: MCKINSEY'S 7-S FRAMEWORK

Category	Description
Organisational "Hardware"	
Strategy	Is there a service development strategy which defines the sort of new products to be developed and the resources to be released for this purpose?
Structure	What types of formal organisation structures are used to implement new service development tasks?
Organisational "Software"	
Shared Values	Is there a shared belief in the need to pursue service development for the purpose of growing the business?
Style (see note below)	Does top management provide active support for those involved in key service development tasks, or is a 'divide and rule' management style practised in which individual functions are left to slog it out between themselves?
Skills	What specialist knowledge and techniques are applied for executing new service development tasks?
Staff	What types of functional specialists are there for executing new service development tasks?
Systems	What type of control and co-ordination mechanisms are used for executing new service development tasks?

Exhibit A-17: Principal Factors Underlying Product Development in the Form of Relevant Questions? (Adapted from Johnes & Snelson 1990)

Note: Moorman (1995) uses an information process paradigm identify four cultural styles in a organisation: adhocracy; markets; hierarchy; clan. Entrepreneurial cultures such as adhocracies thrive on information acquisition; markets emphasise goal achievement, productivity and efficiency; hierarchies emphasis order, uniformity, efficiency, certainty, stability, and control; clans stress participation, teamwork, and cohesiveness. A number of measures from this research were used as inputs into exploring the NKE entity

I: CULTURE & CLIMATE

This *Culture and Climate* appendix addresses the issues of culture and climate. It is not intended to be exhaustive, rather to present the assumptions made by this thesis in the handling of the dimensions of culture and climate. It's relevance lies particularly in the treatment of the NKE dimensions.

The effective translation of the insights developed from this research are very much dependent upon the interpretation, and use of, a vocabulary which managers use to describe the organisational context. Otherwise, the true value of the research will be remain hidden. The issue of culture and climate is an area where definitions can be somewhat misleading.

Culture

Deshpande & Webster (1989) observed that the development of interest in the concept of culture applied to organisational functioning was due to the realisation that traditional models of organisations did not always help in the understanding of the disparities between organisational goals, strategies, implementation and actual outcomes. Most formal models of organisation had traditionally incorporated tasks, structure, technology and people, but not culture. Culture is now becoming an increasingly important factor in the management literature as a whole. It has been employed in the contexts of studies exploring: selling effectiveness; managerial effectiveness; marketing strategy; and customer orientation.

Some researchers view organisational culture as a property of the group or organisation, i.e. like structure. Others regard it as something that resides in each individual as a function of cognitive and learning processes.

Deshpande & Webster (1989) observe that culture has been generally viewed as:

- An exogenous environmental variable to be accommodated

- An endogenous variable mediating the way in which the organisation responds to environmental stimuli and change.
- Both a process and an outcome because it shapes human interaction and is also the outcome of those interactions (Jelinek et al. 1983).

A number of definitions have been offered as to the nature of culture. These are presented in Exhibit A-18.

Author	Culture
Deshpande & Webster (1989); Schein (1990).	Culture is the deeply rooted set of <i>values</i> and <i>beliefs</i> that provide norms for behaviour in organisations
Denison (1996)	Culture refers to the deep structure of organisations, which is rooted in the <i>values</i> , <i>beliefs</i> , and <i>assumptions</i> held by organisation members. Meaning is established through socialisation to a variety of identity groups that converge in the workplace. Interaction reproduces a symbolic world that gives culture both a great stability and a certain precarious and fragile nature rooted in the dependence of the system on individual cognition and action.
Schein (1985)	A pattern of shared basic <i>assumptions</i> that the group learned as it solved its problems of external adaptation and internal integration, that has worked well enough to be considered valid and, therefore, to be taught to new members.

Exhibit A-18: Definitions of Culture

Climate

The concept of climate has received considerable attention from applied psychologists and organisational sociologists over the last three decades. Numerous empirical studies have been conducted and regular reviews of the research findings have appeared (e.g. Joyce & Slocum 1984; Rentsch 1990; Schneider 1990). Many definitions of climate have been put forward, but two approaches have received particular attention: (i) the patronage schema approach; (ii) the shared perceptions approach. The former conceptualises climates as individual's constructive representations or cognitive schema of their work environments, and the latter emphasises the importance of shared perceptions as

underpinning the notion of climate (Anderson & West 1998). A number of important definitions of the concept of climate are presented in Exhibit A-19.

Author	Climate
Deshpande & Webster 1989; Schein 1990	Climate describes how the organisation <i>operationalises its culture</i> , the structures and processes that facilitate the achievement of the desired behaviours
Denison (1996)	Climate...portrays organisational environments as being rooted in the organisation's value system, but tends to present these social environments in relatively static terms, describing them in terms of a fixed (and broadly applicable) set of dimensions. Thus, climate is often considered as relatively temporary, subject to direct control, and largely limited to those aspects of the social environment that are consciously perceived by organisational members (p. 624).
Tagiuri & Litwin (1968: 25)	Climate is "the relatively enduring quality of the total [organisational] environment that: (a) is <i>experienced</i> by the occupants; (b) <i>influences</i> their behaviour; (c) can be <i>described</i> in terms of the values of a particular set of characteristics (or attributes) of the environment".

Exhibit A-19: Definitions of Climate

Comparing the Culture & Climate Literatures

The most dominant perspectives on the culture and climate debate presents the two literatures as contrasting perspectives with little overlap in style or substance. Several authors have attempted to compare the two literatures and to explore areas of integration (e.g. Pettigrew 1990). Denison (1996), in particular, has asserted that the primary difference between the culture and climate literatures is not a substantive difference between the phenomena under investigation, but rather it is a difference in the perspective *taken* on the phenomenon. Exhibit A-20 presents Denison's exploration of the areas of convergence in the two literatures.

Areas of Convergence	Examples of Convergence Between Culture & Climate
Definition of the phenomenon	Both focus on the internal social psychological environment as a holistic, collectively defined social context.
Central theoretical issues	Shared dilemma: context is created by interaction, but context determines interaction. Definition of domain varies greatly by individual theorist Dynamics between the whole and the part - Multiple layers of analysis - Dimensions vs. holistic analysis - Subcultures vs. unitary culture
Content & substance	There is a high overlap between the dimensions studied by the quantitative culture researcher and earlier studies by climate researchers.
Epistemology & methods	Emergence of quantitative culture studies and qualitative climate studies, further blurs the distinction.
Theoretical foundations	Roots of culture research are in social constructionism. Roots of climate studies are in Lewinian field theory Many recent studies have crossed or combined these traditions.

Exhibit A-20: Areas of Convergence in the Culture & Climate Literature
(Source: Denison 1996)

The widely accepted view of the two literatures can be further explored through highlighting the contrasts in epistemology, point of view, methodology, level of analysis, temporal orientation, theoretical foundations, and disciplinary base of the culture and climate perspectives.

Differences	Culture Literature	Climate Literature
Epistemology	Contextualised and idiographic	Comparative & nomothetic
Point of View	Emic (native point of view)	Etic (researcher's viewpoint)
Methodology	Qualitative field of observation	Quantitative survey data
Temporal Orientation	Historical evolution	A historical snapshot
Theoretical Foundations	Social construction; Critical theory	Lewinian field theory
Discipline	Sociology & anthropology	Psychology

Exhibit A-21: Contrasting Organisational Culture and Organisational Climate Research Perspectives (Source: Dennison)

Traditionally, the study of culture has been regarded as requiring qualitative methods, and an appreciation of for the unique aspects of individual social settings. In contrast, studying organisational climate required quantitative methods and the assumption that generalisation across social settings not only was warranted but also was the primary objective of the research. However, this has changed and quantitative techniques are now being used to study culture, and qualitative techniques to study climate.

A controversial issue in climate research has been the meaning of the construct itself and its operationalisation in applied research. Deconstructing climate as a generic term embracing multiple facets has been a valuable way of clarifying some of the confusion over the precise meaning of the term, e.g. climate for change, climate for quality, climate for innovation. However, it remains unclear whether certain dimensions of climate are predictive of just one facet-specific outcome or numerous outcomes. Most researchers measures of climate take the organisation as the unit of analysis (Anderson & West 1998).

Implications for this Research

This research is a quantitative exploration of the internal organisational environment which influences the management of knowledge in the NSD programme. As such, it is a historical snapshot. It therefore draws from the climate research in an attempt to identify and explain the dimensions of the internal organisational environment distinguished. Following the work of Schneider & Rentsch (1988), this thesis interprets climate (in relation to culture) as:

“the ways organisations operationalise the themes that pervade everyday behaviour – the routines of organisations and the behaviours that get rewarded, supported and expected by organisations (the ‘what happens around here’). Culture refers to the history and norms and values that members believe underlie climate (the ‘why do things happen the way they do’) and the meanings organisational members share about the organisation’s imperative” (p 5).

The labelling of the NKE dimensions as climate, follows the evidence of previous research. For example, Nicholson (1998) introduced the concept of 'climate for innovation' which exists at 3M. At 3M, four things are encouraged in order to promote the climate for innovation:

- Set a goal for innovators to achieve
- Encourage innovators
- Recognise innovators
- Reward innovators

J: QUESTIONNAIRE

[See next pages]



***The Impact of Knowledge Management Strategy
on the Successful Development of New Services***

**An Academic Survey
by City University Business School**

January 1998

Sponsored by
**|Coopers
&Lybrand**

I Background to the questionnaire

This questionnaire has been developed by David Kelly, under the supervision of Dr. Chris Storey of City University Business School. It has been designed to collect data to be used in the submission of a doctoral thesis. Coopers & Lybrand have provided commercial guidance and partial funding for the project.

Based in the heart of the City of London, City University Business School is a leading provider of business and management education at undergraduate, postgraduate and post-experience levels. The University's Business School has extensive research experience in the field of Knowledge and Innovation.

Coopers & Lybrand is a leading global supplier of integrated management consulting services, working in partnership with some of the world's top companies and public services organisations. The firm contains a large knowledge practice, and recently received the Economist Information Strategy 97 Knowledge Management Award. The firm recognises the importance of academic research and is happy to sponsor City University Business School's research.

II Instructions

Directions: Listed on the following pages are statements concerning services innovation, knowledge management, organisational learning, organisational structures & cultures. This survey is interested in the extent to which each statement applies to your business' programme of developing new services.

For each statement, please tick the appropriate box on the scale provided, e.g. "strongly disagree", through "neutral", to "strongly agree". Please note that some questions use different scales to the example given above. Definitions are provided on the back page.

Timing: The questionnaire has been designed to be completed in approximately twenty five minutes.

Confidentiality: All returned questionnaires will be treated in the strictest confidence and only aggregated data will be used for analysis.

Questionnaire return: To assist our analysis, it would be appreciated if you could return the completed questionnaire in the reply-paid envelope provided, by 13th February, to the following address:

Dr. Chris Storey
Marketing Department (8th Floor)
City University Business School
Frobisher Crescent
Barbican Centre
London EC2Y 8HB
Telephone: 0171 477 8728
Email: c.d.storey@city.ac.uk

Thank you for your co-operation in completing this questionnaire

1 Knowledge Management Strategy

Does your business have a formal:		Yes	No
1	Knowledge management strategy?	<input type="checkbox"/>	<input type="checkbox"/>
2	Information management strategy?	<input type="checkbox"/>	<input type="checkbox"/>
3	Intellectual asset management strategy?	<input type="checkbox"/>	<input type="checkbox"/>

2 Innovation Strategy

Which one term best describes your business' approach to service innovation?

1	<i>Prospector:</i>	Values being “first” with new services, markets and technologies	<input type="checkbox"/>
2	<i>Analyser:</i>	Seldom first to market, but frequently a fast follower with a more cost-efficient or innovative service	<input type="checkbox"/>
3	<i>Defender:</i>	Locates and maintains a secure niche by protecting position in a relatively stable service area	<input type="checkbox"/>
4	<i>Reactor:</i>	Responds to service and market changes only when forced by environmental pressures	<input type="checkbox"/>

3 Knowledge required to complete NSD Tasks

This business is proficient at executing the following NSD tasks.

		Strongly Disagree		Neutral		Strongly Agree	
1	Idea generation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2	Concept development and evaluation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3	Business analysis	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4	Service development and evaluation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5	Market testing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6	Implementation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7	Commercialisation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8	Post-launch audit / review	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		Strongly Disagree		Neutral		Strongly Agree	
9	This business is proficient at project managing NSD projects	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

4 Shared Values and Style

In this business:		Strongly Disagree		Neutral		Strongly Agree	
1	Staff and management basically agree that the ability to learn is key to its competitive advantage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2	The basic values include learning as key to improvement	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3	Learning is seen as a key process necessary for guaranteeing organisational survival	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4	There is a commonality of purpose	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

		Strongly Disagree			Neutral			Strongly Agree
5	There is total agreement on the business vision cross all levels, functions, and divisions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6	Staff and management involve themselves as "associates" in charting future business direction	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7	Staff and management are not afraid to question the assumptions made about its customers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8	Management realise that the way they perceive the marketplace must be continually questioned	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9	Staff continually question their own beliefs about the customers they serve	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

This business is very:

		Strongly Disagree			Neutral			Strongly Agree
10	<i>Personal:</i> It's like an extended family. Staff and management seem to share a lot of themselves	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11	<i>Dynamic & entrepreneurial:</i> Staff and management are willing to stick their necks out and take risks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12	<i>Production oriented:</i> The major concern is with getting the job done. Staff and management are not very personally involved	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

The head of this business (e.g. CEO/MD) is generally considered to be:

		Strongly Disagree			Neutral			Strongly Agree
13	A mentor, a sage, or a father or mother figure	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14	An entrepreneur, an innovator, or a risk-taker	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15	A co-ordinator, an organiser, or an administrator	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16	A producer, a technician, or a hard-driver	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

The "glue" that holds this business together is:

		Strongly Disagree			Neutral			Strongly Agree
17	Loyalty & tradition (commitment to the business runs high)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18	A commitment to innovation (there is an emphasis on being first)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19	Formal rules and policies (maintaining a smooth-running institution is important)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20	An emphasis on task and goal accomplishment (a production orientated culture is shared by all)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

5 Systems

In this business:

		Strongly Disagree			Neutral			Strongly Agree
1	Formal procedures exist for documenting the "lessons learned" from completed NSD projects	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2	It is likely that a mistake made in executing an NSD task in one project will be made by members of a subsequent NSD project	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3	Experienced NSD staff are regularly transferred from one project to another where their NSD task knowledge will be advantageous	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

		<i>Strongly Disagree</i>			<i>Neutral</i>		<i>Strongly Agree</i>
4	There is a high degree of consensus on the best method of executing NSD tasks among staff involved in the development of new services	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5	Staff involved in NSD projects spend time discussing how best to carry out particular NSD tasks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6	Staff involved in NSD projects are slow to transfer potentially useful NSD task knowledge to staff from other projects	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7	Front line staff are actively encouraged to contribute ideas to the NSD process	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8	New ideas for NSD improvement from front line staff are not treated seriously by management	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9	No matter what function they are in, staff get recognised for contributing task knowledge to the NSD process, e.g. ideas	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10	Innovative ideas that work are often rewarded by management, irrespective of the source	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11	New staff and management are encouraged to question the way NSD is carried out	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12	Managers encourage staff to experiment in order to improve the NSD process	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

The following methods are used extensively to transfer ideas for improving NSD between staff and management

		<i>Strongly Disagree</i>			<i>Neutral</i>		<i>Strongly Agree</i>
13	Written Memos	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14	Written Reports	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15	Formal group meetings	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16	Impromptu face-to-face conversations	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17	Scheduled one-to-one meetings (face-to-face)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18	Scheduled one-to-one phone conversations	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19	Impromptu one-to-one phone conversations	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20	Voice mail	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
21	Teleconferencing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
22	E-Mail	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
23	Electronic GroupWare / Intranets	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Compared to competitive businesses, this business has:

		<i>Strongly Disagree</i>			<i>Neutral</i>		<i>Strongly Agree</i>
24	Greater knowledge of NSD tasks and activities	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
25	A great deal of practical experience in implementing NSD tasks and activities	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
26	Invested more time and money in its NSD task knowledge	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

The following are used to store NSD task knowledge for subsequent use on other NSD projects.

		<i>Strongly Disagree</i>			<i>Neutral</i>		<i>Strongly Agree</i>
27	Document management systems	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
28	Expert, knowledge-based, systems	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
29	GroupWare, e.g. Lotus Notes, Microsoft Exchange	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
30	Intranets	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

		Strongly Disagree			Neutral			Strongly Agree
31	Paper-based documents, e.g. manuals, memos	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
32	NSD task knowledge is generally 'stored' as new processes and routines immediately after project completion	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
33	NSD task knowledge generally remains "in the heads" of those individuals executing the activities of the NSD project	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

6 Structures

In this business:

		Strongly Disagree			Neutral			Strongly Agree
1	There are high levels of communication in different directions between staff and management at all levels	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2	Organisational problems are solved by teams drawn from various departments	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3	Co-operation between departments is very high	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4	The organisational structure is simple, well-documented and understood	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5	Even small matters have to be referred to someone higher up the organisation for a final answer	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6	Current organisational practice encourages staff to solve problems together before discussing them with management	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7	We cannot usually form informal groups to solve organisational problems	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

In this business, which of the following are used to manage the NSD process?

		Yes	No
8	Line-of-Business Manager	<input type="checkbox"/>	<input type="checkbox"/>
9	Partner	<input type="checkbox"/>	<input type="checkbox"/>
10	Marketing Manager	<input type="checkbox"/>	<input type="checkbox"/>
11	New Service Product Group	<input type="checkbox"/>	<input type="checkbox"/>
12	New Product or Brand Manager	<input type="checkbox"/>	<input type="checkbox"/>
13	New Product Committee	<input type="checkbox"/>	<input type="checkbox"/>
14	Temporary New Venture Team	<input type="checkbox"/>	<input type="checkbox"/>
15	Ad-Hoc tasks, no formal organisation	<input type="checkbox"/>	<input type="checkbox"/>

The following are effective at managing the NSD process

		Strongly Disagree			Neutral			Strongly Agree
16	Line-of-Business Manager	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17	Partner	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18	Marketing Manager	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19	New Service Product Group	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20	Brand Manager	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
21	New Product Committee	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
22	Temporary New Venture Team Established	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
23	Ad-Hoc tasks, no formal organisation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

7 NSD Programme Performance

In the business over the last three years, what is your estimation of the:

- 1 Total *number* of new services which have been launched?
- 2 *Number* of new services which succeeded?
- 3 *Number* of new services which have failed after launch?

How would you rate :

- | | | <i>Very
Unsuccessful</i> | | <i>Neutral</i> | | <i>Very
Successful</i> |
|---|--|------------------------------|--------------------------|--------------------------|--------------------------|----------------------------|
| 4 | The overall success of the business' NSD programme in meeting its performance objectives | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

In the business, what is your estimation of the:

- 5 The percentage of sales coming from new services introduced in the last three years?
- 6 The percentage of profit coming from new services introduced in the last three years?

 %
 %

In the business, what is your estimation of the:

- 7 Percentage of new service development projects which have been killed-off before launch?

 %

The business' NSD programme has been successful in:

- | | | <i>Strongly
Disagree</i> | | <i>Neutral</i> | | <i>Strongly
Agree</i> |
|----|---|------------------------------|--------------------------|--------------------------|--------------------------|---------------------------|
| 8 | Bringing new clients to the business | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 9 | Establishing new markets | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 10 | Retaining existing customers | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 11 | Leveraging sales of other products and services | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 12 | Ensuring the long-term viability of the business | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 13 | Making the business more competitive | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 14 | Achieving better utilisation of resources | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 15 | Creating new market opportunities | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 16 | Making the business more flexible in responding to customer needs | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 17 | Developing innovative new services | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

How would you rate:

- | | | <i>Very
Unsuccessful</i> | | <i>Neutral</i> | | <i>Very
Successful</i> |
|----|--|------------------------------|--------------------------|--------------------------|--------------------------|----------------------------|
| 18 | The success of the business' NSD programme in generating sales | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 19 | The success of the business' NSD programme in generating profits | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 20 | The success of the business' NSD programme vs. competitors | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

How would you rate the extent to which the business is good at:

- | | | <i>Very
Unsuccessful</i> | | <i>Neutral</i> | | <i>Very
Successful</i> |
|----|--------------------------------------|------------------------------|--------------------------|--------------------------|--------------------------|----------------------------|
| 21 | Idea generation | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 22 | Commercialising of new service ideas | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

Relative to competition, to what extent do you believe the business is:

- | | | <i>Very
Unsuccessful</i> | | <i>Neutral</i> | | <i>Very
Successful</i> |
|----|---|------------------------------|--------------------------|--------------------------|--------------------------|----------------------------|
| 23 | Faster at commercialising new service ideas | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 24 | Perceived by customers to be innovative | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

8 *Turbulence*

In the markets in which this business operates:

*Strongly
Disagree*

Neutral

*Strongly
Agree*

- 1 It is very difficult to forecast where the technology will be in the next five years
- 2 A large number of new service ideas have been made possible through technological breakthroughs
- 3 Customer's service preferences change quite a lot over time
- 4 Customers tend to look for new services all the time

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

9 *Controls*

In this business:

*Strongly
Disagree*

Neutral

*Strongly
Agree*

- 1 The services can be changed easily to meet the individual requirements of each customer
- 2 Efforts are constantly being made to standardise (as opposed to customise) service offerings

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

In which industry does your business operate?

- 1 Financial Services
- 2 Telecommunications / Computing
- 3 Retail
- 4 Professional Services
- 5 Travel / Transportation
- 6 Media and Communications
- 7 Utilities
- 8 Travel
- 9 Other (please specify)

<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>

What is your position in the business?

- 1 Managing Director, Chief Executive Officer, Chief Operational Officer
- 2 Marketing Director or Sales Director
- 3 General Manager
- 4 Marketing Manager or "Product" Manager
- 5 Strategy or Planning Manager
- 6 Line of Business Director or Line of Business Manager
- 7 Information or Knowledge Manager
- 8 Other (please specify)

<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>

What is the annual sales revenue of the business?

- A Greater than £1 billion
- B £500 million - £1 billion
- C £250 million - £500 million
- D £50 million - £250 million
- E Less than £50 million

<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>

Thank you

Thank you for completing this questionnaire, and contributing to a major research project. The results of this survey will be aggregated and not used for any other purposes.

In gratitude for your support, we would like to offer you the opportunity to receive a summary of the research results.

**Yes, I would like to be sent the results of this research project
(PLEASE ATTACH COMPLIMENT SLIP OR BUSINESS CARD**

No, I do not wish to receive the results of this research project

Other Comments

Please feel free to add any other comments you deem appropriate.

This image shows a single sheet of white paper with horizontal black ruling lines. The lines are evenly spaced and run across the width of the page. There are approximately 20 lines visible. The paper appears slightly aged or off-white. There is no handwriting or printed text on the page.

Definitions

THE BUSINESS	The business unit in which you, as the respondent, have whole or part, directorial responsibility
SERVICES	The products which the company sells which are predominately intangible
NEW SERVICES	The services which customers purchase, and which are <u>new to the business</u> . This is distinct from improving or making modifications to existing services
NEW SERVICE DEVELOPMENT (NSD)	The <u>process</u> of developing service products which are new to the business
NSD PROGRAMME	The totality of the business' NSD tasks. The NSD Programme is concerned with getting a series of NSDs right, usually over a longer time span
NSD PROGRAMME PERFORMANCE	The success of the NSD Programme, as measured by the business
NSD TASK KNOWLEDGE	The knowledge required to carry out the numerous <u>tasks and activities</u> involved in NSD, e.g. idea generation, screening, market testing...
KNOWLEDGE	Knowledge is information that changes something or somebody – either by becoming grounds for action, or by making an individual (or institution) capable of different and more effective action
SERVICES INNOVATION	The development of new service products in the business
LEARNING	The process whereby knowledge is created through the transformation of experience
STAFF	The people employed by the business, but excluding all management positions
INTELLECTUAL ASSET MANAGEMENT	Management of all the firm's intangible assets

K: CORRELATIONS BETWEEN ALL PERFORMANCE VARIABLES

NKE Dimensions	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
NKE Dimensions																		
Overall success (1)	0.000	0.000	0.011	0.000	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000
New clients (2)	0.011		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000
New markets (3)	0.000	0.000		0.008	0.000	0.000	0.000	0.000	0.000	0.005	0.000	0.000	0.000	0.000	0.026	0.019	0.006	0.001
Retain existing (4)	0.004	0.000	0.008		0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.028	0.034	0.002	0.001
Leverage other (5)	0.000	0.004	0.000	0.000		0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.001	0.070	0.001	0.001
L-T viability (6)	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
More competitive (7)	0.000	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.042
Utilisation (8)	0.000	0.000	0.000	0.002	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000	0.000	0.043	0.004	0.000	0.006
New market opportunity (9)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.006	0.000
More flexible (10)	0.000	0.000	0.005	0.000	0.001	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.025
Innovative services (11)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000	0.000	0.000
Success in sales (12)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000	0.000
Success in profits (13)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000
Success vs. Comp (14)	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
Idea generation (15)	0.000	0.001	0.006	0.028	0.001	0.000	0.000	0.043	0.000	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000
Good at commercialisation (16)	0.000	0.000	0.019	0.034	0.070	0.000	0.000	0.004	0.000	0.001	0.000	0.000	0.000	0.000	0.000		0.000	0.000
Faster at commercialisation (17)	0.000	0.000	0.006	0.002	0.001	0.000	0.001	0.000	0.000	0.006	0.000	0.000	0.000	0.000	0.000	0.000		0.000
Perceived innovativeness (18)	0.000	0.000	0.001	0.001	0.001	0.000	0.042	0.006	0.000	0.025	0.000	0.000	0.000	0.000	0.000	0.000	0.000	

Note: Sig. (2-tailed)

Exhibit A-22: Correlations Between All Performance Variables (Likert Scales)

L: BUSINESS SIZE

It interpreting the data of this thesis, the results chapters discussed the impact of organisational size on the internal organisational environment, NSD performance, and NSD process proficiency.

The following exhibit, taken from a 1985 article by Quinn, identifies some of the approaches adopted by firms to minimise, or indeed maximise, the advantages or disadvantages of organisational size. Quinn summarises:

“executives need to understand and accept the tumultuous realities of innovation, learn from the experiences of other companies, and adapt the most relevant features of these others to their own management practices and cultures. Many features of small company innovators are also applicable in big companies. With top-level understanding, vision, a commitment to customers and solutions, a genuine portfolio strategy, a flexible entrepreneurial atmosphere, and proper incentives for innovative champions, many more large companies can innovate to meet the severe demands of global competition” (p. 84).

Quinn identifies the advantages of the smaller firms and the obstacles and approaches adopted by the larger firms.

Topic	Criteria
Advantages of smaller firms	<p>Need or achievement oriented;</p> <p>Pioneers in their technologies and their founders 'fanatical';</p> <p>Able to more closely control costs, i.e. limited funds go straight into their projects;</p> <p>Committed and focused and more able to cope with the 'chaos'</p> <p>Associated with the insights achieved via intuition and often random experimentation;</p> <p>More flexible in their response to environmental changes;</p> <p>Rewards and incentives are more tangible.</p>
Obstacles to larger firms	<p>Top management isolation;</p> <p>Intolerance of the creative or intrapreneur;</p> <p>Inappropriate or inadequate measurement metrics;</p> <p>Short time horizons;</p> <p>Excessive rationalisation;</p> <p>Excessive bureaucracy;</p> <p>Inappropriate incentives</p>
Techniques developed by the larger firm	<p>Atmosphere and vision (supported by top management);</p> <p>Visions are connected to the realities of the marketplace;</p> <p>Size of the total organisation and project teams are kept as Small as possible;</p> <p>Leverage resources to apply multiple approaches;</p> <p>Development 'shootouts'</p> <p>'Skunkworks'</p> <p>Interactive learning with customers;</p>

Exhibit A-23: Impact of Company Size on Performance and Innovativeness (Quinn 1985)

M: NKE FACTORS & PERFORMANCE CORRELATIONS

A number of cultural characteristics of a service business were identified in the literature as being likely to affect the performance of the NSD programme. Respondents were asked questions related to the cultural style of the organisation on a scale of 1 (strongly disagree) to 7 (strongly agree). Responses were profiled against the performance characteristics of the NSD programme to identify significant relationships. These are presented in Exhibit A-24.

Values and Cultural Style

Measure	Mean	Overall Success ¹
Management realise that the way they perceive the marketplace must be continually questioned	4.96	0.521***
The glue that holds the business together is a commitment to innovation. There is an emphasis on being first.	4.11	0.430***
There is a commonality of purpose	4.63	0.427***
Staff continually question their own beliefs about the customers they serve	4.17	0.416***
Staff and management are not afraid to question the assumptions made about its customers	4.88	0.384***
Staff and management basically agree that the ability to learn is key to its competitive advantage	5.12	0.382***
The head of the business (HOB) is an entrepreneur, an innovator, or a risk-taker	4.30	0.351***
Staff and management involve themselves as "associates" in charting future business direction	3.89	0.324***
The business is dynamic & entrepreneurial. Staff and management are willing to stick their necks out and take risks.	4.16	0.317***
There is total agreement on the business vision across all levels, functions, and divisions	4.01	0.306***
Learning is seen as a key process necessary for guaranteeing organisational survival	5.09	0.305***
The basic values include learning as key to improvement	5.18	0.299***
The glue that holds the business together is an emphasis on task and goal accomplishment. A production oriented culture is shared by all.	5.02	0.179*
The HOB is a producer, a technician, or a hard-driver	4.21	0.161*
The business is production-oriented. The major concern is with getting the job done. Staff and management are not very personally involved	4.15	-0.157*
The business is very personal. It's like an extended family. Staff and management seem to share a lot of themselves.	4.35	0.075
The HOB is a mentor, a sage, or a father or mother figure	3.97	-0.071
The glue that holds the business together is loyalty and tradition. Commitment to the business runs high	5.17	0.070
The glue that holds the business together is formal rules and policies. Maintaining a smooth-running institution is important.	4.20	0.054
The HOB is a co-ordinator, an organiser, or an administrator	3.94	0.053

¹ Likert scale 1-7; ***. Correlation is significant at the 1% level; **. Correlations significant at the 5% level; *. Correlations significant at the 10% level.

Exhibit A-24: Correlations of Shared Value/Style Scores & Overall Success

Systems

Respondents were also asked questions on a number of issues related to the systems implemented by the business on a scale of 1 (strongly disagree) to 7 (strongly agree). Responses were profiled against the performance characteristics of the NSD programme to identify significant relationships. These are presented in Exhibit A-25.

Measure	Mean	Overall Success ¹
Compared to other firms this business has invested more time and money in its NSD task knowledge	3.97	0.483 ^{***}
Compared to other firms this business has greater knowledge of NSD tasks and activities	4.15	0.476 ^{***}
No matter what function they are in, staff get recognised for contributing task knowledge to the NSD process, e.g. ideas.	4.51	0.416 ^{***}
There is a high consensus on the best method of executing NSD tasks among staff involved in the development of new services	4.07	0.406 ^{***}
Experienced NSD staff are regularly transferred from one project to another where their NSD task knowledge will be advantageous	4.41	0.401 ^{***}
Staff involved in NSD projects spend time discussing how best to carry out particular NSD tasks	4.77	0.395 ^{***}
Staff involved in NSD projects are slow to transfer potentially useful task knowledge to staff from other projects	3.99	-0.378 ^{***}
Compared to other firms this business has a great deal of practical experience in implementing NSD tasks and activities	4.54	0.377 ^{***}
Innovative ideas that work are often rewarded by management, irrespective of the source	4.34	0.376 ^{***}
Managers encourage staff to experiment in order to improve the NSD process	4.02	0.369 ^{***}
New staff and management are encouraged to question the way NSD is carried out	4.02	0.367 ^{***}
NSD knowledge generally remains 'in the heads' of those individuals executing the activities of the NSD project	4.79	-0.344 ^{***}
It is likely that a mistake made in executing a NSD task in one project will be made by members of a subsequent NSD project	4.24	-0.318 ^{***}
Formal procedures exist for documenting the lessons learned from completed NSD projects	5.12	0.307 ^{***}
New ideas for NSD improvement from front-line staff are not treated seriously by management	3.06	-0.301 ^{***}

Measure	Mean	Overall Success ¹
Expert systems are used to store task knowledge for subsequent use on other NSD projects	3.15	0.299***
Transfer ideas - Scheduled one-to-one face-to-face	5.00	0.279***
Transfer ideas - Scheduled one-to-one (phone)	4.11	0.275***
Front line staff are actively encouraged to contribute ideas to the NSD process	4.95	0.238**
Transfer ideas - Impromptu one-to-one (phone)	5.05	0.218**
Transfer ideas - Impromptu face-to-face	5.33	0.208**
Document management systems are used to store task knowledge for subsequent use on other NSD projects	4.04	0.194**
Intranets are used to store task knowledge for subsequent use on other NSD projects	3.69	0.191**
NSD task knowledge is generally 'stored' as new processes and routines immediately after project completion	4.27	0.163*
GroupWare systems are used to store task knowledge for subsequent use on other NSD projects	3.69	0.156*
Transfer ideas - Teleconferencing	2.83	0.129
Transfer ideas - Formal group meetings	5.11	0.128
Transfer ideas - Written memos	4.50	0.115
Transfer ideas - Written reports	4.77	0.102
Transfer ideas - GroupWare/Intranet	3.38	0.059
Transfer ideas - e-mail	4.93	0.058
Paper-based documents are used to store task knowledge for subsequent use on other NSD projects	5.17	0.053
Transfer ideas - Voice mail	2.97	-0.045
1. Likert scale 1-7; ***. Correlation is significant at the 1% level; **. Correlations significant at the 5% level; *. Correlations significant at the 10% level.		

Exhibit A-25: Correlations Between Shared Value & Style Scores & Overall Success

Structures

Similarly, respondents were asked a number of questions related to the structures and organisational style of the business on a scale of 1 (strongly disagree) to 7 (strongly agree). Responses were profiled against the performance characteristics of the NSD programme to identify significant relationships. These are presented in Exhibit A-26.

Measure	Mean	Overall Success ¹
Co-operation between departments is very high	4.50	0.430 ^{***}
Organisational problems are solved by teams drawn from various departments	5.18	0.342 ^{***}
We cannot usually form informal groups to solve organisational problems	3.11	-0.267 ^{***}
The organisational structure is simple, well-documented and understood	4.18	0.250 ^{***}
There are high levels of communication in different directions between staff and management at all levels	4.60	0.238 ^{**}
Even small matters have to be referred to someone higher up the organisation for a final answer	3.52	-0.229 ^{**}
Current organisational practice encourages staff to solve problems together before discussing them with management	4.40	0.213 ^{**}
¹ Likert scale 1-7; ^{***} . Correlation is significant at the 1% level; ^{**} . Correlations significant at the 5% level; [*] . Correlations significant at the 10% level.		

Exhibit A-26: Correlations Between Structural Style & Overall Success

N: VARIABLES EXCLUDED FROM NKE FACTOR ANALYSIS

Measure	Mean	Overall Success ¹
The glue that holds the business together is an emphasis on task and goal accomplishment. A production oriented culture is shared by all.	5.02	0.179*
The head of the business is a producer, a technician, or a hard-driver	4.21	0.161*
The business is production-oriented. The major concern is with getting the job done. Staff and management are not very personally involved	4.15	-0.157*
The business is very personal. It's like an extended family. Staff and management seem to share a lot of themselves.	4.35	0.075
The head of the business is a mentor, a sage, or a father or mother figure	3.97	-0.071
The glue that holds the business together is loyalty and tradition. Commitment to the business runs high	5.17	0.070
The glue that holds the business together is formal rules and policies. Maintaining a smooth-running institution is important.	4.20	0.054
The head of the business is a co-ordinator, an organiser, or an administrator	3.94	0.053

Exhibit A-27: Variables Excluded from Factor Analysis

Measure	Mean	Overall Success ¹
We cannot usually form informal groups to solve organisational problems	3.11	-0.267***
The organisational structure is simple, well-documented and understood	4.18	0.250***
Even small matters have to be referred to someone higher up the organisation for a final answer	3.52	-0.229**
¹ Likert scale 1-7; ***. Correlation is significant at the 1% level; **. Correlations significant at the 5% level; *. Correlations significant at the 10% level.		

Exhibit A-28: Variables Excluded from Factor Analysis

Systems

Measure	Mean	Overall Success ¹
Experienced NSD staff are regularly transferred from one project to another where their NSD task knowledge will be advantageous	4.41	0.401***
Staff involved in NSD projects are slow to transfer potentially useful task knowledge to staff from other projects	3.99	-0.378***
It is likely that a mistake made in executing a NSD task in one project will be made by members of a subsequent NSD project	4.24	-0.318***
New ideas for NSD improvement from front-line staff are not treated seriously by management	3.06	-0.301***
Transfer ideas - Scheduled one-to-one (phone)	4.11	0.275***
Document management systems are used to store task knowledge for subsequent use on other NSD projects	4.04	0.194**
Transfer ideas - Teleconferencing	2.83	0.129
Transfer ideas - Formal group meetings	5.11	0.128
Transfer ideas - Written memos	4.50	0.115
Transfer ideas - Written reports	4.77	0.102
Transfer ideas - GroupWare/Intranet	3.38	0.059
Transfer ideas - e-mail	4.93	0.058
Paper-based documents are used to store task knowledge for subsequent use on other NSD projects	5.17	0.053
Transfer ideas - Voice mail	2.97	-0.045
¹ Likert scale 1-7; ***. Correlation is significant at the 1% level; **. Correlations significant at the 5% level; *. Correlations significant at the 10% level.		

Exhibit A-29: Variables Excluded from Factor Analysis

O: NKE & EXTERNAL TURBULENCE

NSD Performance Factors						
NKE Factor		Overall Success ¹	Innovative Capability	New Opportunities	Client Performance	Financial Performance
	All	0.267***	0.356***	0.232**	0.172*	0.322***
Climate of	HT	n/s ²	0.203*	n/s	n/s	n/s
Learning	LT	0.334**	0.537***	0.450***	n/s	0.539***
Creative	All	0.249***	0.357***	0.161*	0.273***	0.246***
Climate	HT	n/s	0.358***	n/s	n/s	0.216*
	LT	n/s	n/s	n/s	0.302**	n/s
NSD	All	0.450***	0.450***	0.302***	0.350***	0.293***
Knowledge Depth	HT	0.418***	0.256**	0.339***	0.290**	0.389***
	LT	0.480***	0.402***	n/s	0.409***	n/s
Entrepreneurial	All	0.388***	0.627***	0.362***	0.223**	0.351***
Climate	HT	0.396***	0.628***	0.367***	0.252**	0.255**
	LT	0.321**	0.572***	0.293***	n/s	0.430***
	All	0.375***	0.460***	0.326***	0.476***	0.265***
Collaborative	HT	0.311***	0.416***	0.314***	0.395***	n/s
Climate	LT	0.434***	0.526***	0.333**	0.546***	0.353***
	All	0.330***	0.373***	0.352***	0.326***	0.307***
Goal	HT	0.312***	0.347***	0.406***	0.282**	0.314***
Climate	LT	0.338**	0.397***	0.247*	0.375***	0.280*
Effective	All	n/s	0.362***	0.226**	0.169*	0.236**
NSD	HT	n/s	0.264**	n/s	n/s	n/s
Memory	LT	n/s	0.449***	0.389***	n/s	0.316**
Personal	All	0.215***	0.412***	0.170*	0.244***	0.285***
Interaction Mechanism	HT	n/s	0.318***	n/s	n/s	0.214*
	LT	n/s	0.440***	n/s	0.280*	0.310**
	All	0.364***	0.268***	n/s	0.180*	0.304***
NSD Knowledge Dispersion	HT	0.296**	0.256**	n/s	0.390***	0.268**
	LT	0.435***	0.270*	n/s	n/s	0.335**

¹. Likert scale 1-7; ². Not a significant relationship at 10% level;
 ***. Correlation is significant at the 1% level; **. Correlations significant at the 5% level;
 *. Correlations significant at the 10% level.

Exhibit A-30: NKE and Performance Factors in Turbulent Environments

P: NKE AND NSD PROCESS PROFICIENCY

Proficiency Dimension ¹	Idea Generation	Concept Development	Business Analysis	Service Development	Market Testing	Implement	Commercialise	Post-launch Audit & Review	Project Management of NSD
NKE Dimension ²									
Learning Orientation	0.254***	0.390***	0.236**	0.286***	0.100	0.141***	0.259***	0.188**	0.230***
Creative Climate	0.157*	0.275***	0.199*	0.286***	0.127	0.280***	0.238**	0.317***	0.205**
NSD Knowledge (Depth)	0.286***	0.362***	0.312***	0.321***	0.389***	0.380***	0.374***	0.386***	0.527***
Entrepreneurial Climate	0.422***	0.411***	0.256***	0.205**	0.069	0.154*	0.279***	0.174*	0.284***
Collaboration	0.335***	0.250***	0.231***	0.316***	0.327***	0.232**	0.221**	0.346***	0.380***
Vision & Purpose	0.217**	0.186**	0.168*	0.084	0.113	0.084	0.182*	0.038	0.173*
Storage Mechanism	0.252***	0.274***	0.278***	0.231**	0.223***	0.182*	0.207**	0.310***	0.381***
Personal Transfer Mechanism	0.245***	0.341***	0.196*	0.179*	0.138	0.181*	0.336***	0.266***	0.188**
NSD Knowledge (Dispersion)	0.058	0.126	0.164*	0.245***	0.182*	0.181*	0.190**	0.335***	0.346***

1. Likert scale 1-7; 2. Factor scores
 ***. Correlation is significant at the 1% level; **. Correlations significant at the 5% level;
 *. Correlations significant at the 10% level.

Exhibit A-31: Correlations Between NKE and NSD Process Proficiency

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