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Configurational Analysis and Organization Design: Toward a Theory of Structural Heterogeneity

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Abstract

This paper reconstructs the roots of configurational analysis in organization theory and organizational economics, focusing on the elements of configurational thinking that are particularly relevant to organizational design; and outlining some future prospects for a configurational theory of organization design. We detect the presence of configurational ideas in many organization theories and organizational economics approaches. We argue that this, seldom acknowledged, continuity extends and enriches the implications of configurational analysis for organization design. In addition, we define and identify "structural heterogeneity" as an organizational property that can be distinctively studied by configurational analysis, distinguishing between internal heterogeneity –diversity of organizational attributes within one configuration- and external heterogeneity –diversity of organizational configurations under the same environmental conditions. Some of the insights that can be gained through a configurational analysis of structural heterogeneity are illustrated through a fs/QCA study of a multi-industry sample of firms.

Keywords: organizational configurations; contingency theory; organizational economics; heterogeneity; QCA

Introduction

This chapter focuses on the conceptual and methodological contributions of a configurational approach to organization design. Although much work in configurational analysis (CA) has been descriptive, the way in which organizational forms are described in CA is conducive to contributing significantly to a (much called for) renewal of organization design (OD). To distinguish and develop these implications of CA, the chapter revisits the configurational elements already present in classic approaches to OD, especially in structural contingency theory (SCT) and in more recent and economic approaches such as transaction cost economics (TCE) and complementarity-based approaches. This excursus leads to disclosing greater continuity and knowledge accumulation with respect to earlier OT than formerly acknowledged. Although researchers in CA have frequently stressed the differences and 'rivalry' of CA as an approach with respect to other approaches (according to a very common but not particularly fruitful custom in OT), the continuity disclosed is not a '*diminutio*' but the opposite: distinctive strengths, added value and possible further developments of CA emerge more clearly. Configurationism is clarified as a type of 'analysis' rather than substantive approach or theory that can however greatly contribute to renewing OD theories, also in terms of content. The chapter will demonstrate how the features of this analytic approach, including theoretical elements such as the definition of units of analysis as well as the methods for analyzing interactions, affect the content of theoretical developments. Indeed, one of these possible developments is proposed in the second part of the chapter. CA could lead to constructing a significant 'missing piece' in OT. The missing piece is a *theory* of structural heterogeneity - intended as an explanation of the existence and effectiveness of different configurations under the same conditions –i.e. a theory of the "equifinality of forms". The model of structural heterogeneity developed in the chapter includes this form of heterogeneity as well as another form that has thus far been conceptually dismissed or neglected, namely, the heterogeneity of organizational features within a configuration: what are the 'conceptual differences' among the variety of 'conceptually distinct' organizational elements clustered within configurations? What are the possible or impossible, necessary or optional, combinations of organizational elements in relation to performance outcomes? Should the 'syndromes of attributes' defining a configuration be 'consistent', 'coherent',

'similar in kind' as conventional wisdom would have it, or are there greater degrees of freedom?

The chapter is organized as follows. The first section reviews the presence and features of CA elements in OT and OE approaches to organization design. The second section constructs a typology of approaches to CA relevant to organization design: a 'map of configurationism' along the two dimensions of internal and external 'structural heterogeneity'. The third section presents an empirical analysis featuring the construction of new Structural Heterogeneity Indexes, of hypotheses on their variations, and propositions on the qualitative compositions of high-performing combinations of organizational elements and contingencies.

Configurationism in Organization Design Theories

A widely shared view of 'organization forms' is that these are collections of attributes (Polos et al., 2002). This view perhaps first emerged with Weber's notion of bureaucracy. In fact, as these last authors noted, "If any approach to defining organizational forms can be regarded as the standard, it is one that regards forms as particular *clusters of features*. The example *par excellence* is Weber's specification of rational-legal bureaucracy in terms of the nature of authority (..), procedures (..), and the employment relation of the official (..)." (ibidem 2002: 87; emphasis in original). This feature-based conceptualization and operationalization of organization forms remained a central feature in almost all perspectives on organization forms and design, and is the root of a 'configurational' notion of forms as combinations of attributed, that has been more common than usually acknowledged.

SCT, to start with, considered Weberian attributes and rendered them contingent. Methodologically, however, those attributes were considered to contribute to some 'dimensions' in an additive way. For example, in Aston operationalization (e.g. Pugh et al., 1969), the dimension of 'formalization' was constructed by asking whether a series of elements such as organization charts, job descriptions, written operation manuals and procedures were present or absent, and summing up the 1's (indicating present). Likewise, in

Lawrence and Lorsch (1967) the dimension of the 'structuring of activities' was constructed by summing up scales measuring the span and frequency of control, the detail of procedures and job descriptions, the number of hierarchical levels, while the dimension of integration was constructed by summing up the presence of practices ranging from procedures and programs to hierarchical coordination, to team coordination, to dedicated integration units.

What precisely is then the difference between these approaches and a 'configurational approach' as an analysis of the 'multidimensional constellation of conceptually distinct characteristics that commonly occur together' (Meyer et al., 1993)?

A core and much emphasized difference is both substantive and methodological: the unit of analysis shifts from 'dimensions' (e.g. 'degrees of' formalization, centralization, standardization, differentiation, integration) to 'qualitatively different', 'conceptually distinct' attributes. Mintzberg, (1979; 1983) for example, gave an explicitly configurational version of SCT. He considered the main coordination mechanisms identified by structural contingency theory studies as core elements of organizing that are found in different combinations in different 'forms'.

This type of CA was denoted by a 'taxonomic' and empirical approach. Any 'commonly occurring cluster' is a configuration. Examples of archetypes defined in this way – de facto clustering of some array of organizational practices – include, in addition to Mintzberg's five forms, Miles and Snow's (1978) strategic and organizational types (prospectors, defenders, adaptors) (Doty et al., 1993), Pugh et al.'s (1969) empirical taxonomy of bureaucracies, Child's analysis of international JV configurations (2002) and many others (e.g. Miller and Friesen, 1984).

However, there is also an 'ideal-type' or 'typological' configurationism, where Weber's notion of the bureaucratic ideal-type can be considered the forerunner. In typological configurationism there is more pronounced theoretical effort in defining both why the constitutive elements are 'conceptually distinct' and the principle according to which they are expected to cluster. In contingency versions, this perspective appeared in mature contingency views (Drazin and Van de Ven, 1985). In this case, an ideal association of traits that is theoretically expected to work is defined, and real types of combinations are presumed to be

more effective the closer they are to the ideal type. Drazin and Van de Ven (1985) called it a 'systemic fit' notion, matured after earlier selection-based views (e.g. technology 'determines' the structure, i.e., unfit forms are selected out) and bi-variate interaction views of fit (e.g. co-variance between technology and structure increases performance). In 'systemic fit' and 'typological' configurationism, the study of 'internal fit' among elements emerged in addition to the classic contingency theory concerning 'external fit'. However, as Drazin and Van de Ven pointed out at the time, a methodological 'gap' prevented studying the interactions between 'internal' and 'external' fit (wherefore they used a stage-wise procedure). In addition, 'coherence' remains s the underlying hypothesis on how the attributes should cluster, as per the traditional SCT view: 'bureaucratic'/'systematized' organizational mechanisms are supposed to cluster together in one ideal-type configuration; alternative configurations are informed by alternative logics such as 'organic'/'developmental', and are internally homogeneous.

More recent configurational studies have highlighted at least two other important properties of configurations: the possibility that relations among the constitutive elements of configurations are *'non-linear'* and that two or more configurations may be '*equifinal'* in generating performance in certain given circumstances (Meyer et al., 1993).

The notion of equifinality actually has a long history in organizational thought. Originally defined by the open system biologist Ludwig von Bertalanffy (1968), and widely utilized in some organizational approaches such as socio-technical studies (Trist et al., 1963), equifinality has been analyzed empirically in a configurational perspective. For example, Gresov (1989) identified multiple, equifinal organization designs of work units under specific combinations of conflicting contingencies, such as when units face low task uncertainty and high dependence; Galunic and Eisenhardt (1994) reported that different forms of compensation systems are equally effective in specialized retail stores, in contrast with agency theory predictions. Equifinality introduces more variety in possible combinations, while earlier taxonomic configurationism emphasized that organizational configurations are 'surprisingly' few in number (Meyer et al., 1993; Miller and Friesen 1984)

'Non-linearity' in relations among organizational traits, or between these and contextual dimensions, are also non-distinctive of CA per se. Examples are any hypothesis and findings

of U-shaped relations. However, non-linearity assumes a stronger meaning in CA. For example, it means, "variables found to be positively related in one configuration may be unrelated or even inversely related in another" (Meyer et al., 1993: 1178). Alternatively, non-linearity may derive from positive or negative complementarities among elements and multiple interaction effects that go beyond bi-variate interaction effects traditionally analyzed in organization studies (Delery & Doty, 1996; Miller, 1990).

In sum, CA have resurrected and extended important concepts in OT, such as equifinality, multi-finality and non-linearity, which had somehow become forgotten as a central concern in organizational analysis and design, perhaps also due to the lack of powerful methods to study these phenomena. CA revitalized theorizing about these phenomena also due to new combinatorial, qualitative comparative analysis methods.

In conclusion, in our reconstruction, greater continuity than generally recognized is revealed between organizational configurational studies and earlier organizational studies. Rather than being a sort of 'weakness' this can be seen as a strength: CA contributed new insights to organizational analyses accruing previous knowledge in a cumulative way, thus extending previous theory rather than proposing the *n*-th new theory.

Together with those steps forward, modern CA in OT has been marked by some limitations.

Theoretically, the 'conceptual distinctions' among elements are have been progressively lost, for increasingly adopting an empirical stance of analyzing any 'organizational practice' that can be observed in practice. The central task of 'contingency' theory - i.e. the substantive specification, in theoretical terms, of which types of configurations are effective under what circumstances - has been rather abandoned. Finally, the laws behind the effective clustering of attributes have not actually been worked out. The principle of 'coherence' among organizational attributes has typically been invoked, implicitly or explicitly, but this principle has always been rather opaque.

Empirically, CA 'manifestos' typically start out with the idea that effective configurations are 'few', and this is seen as a puzzling fact to be explained. However, this 'fact' actually depends heavily on the type of categorization employed. Empirical research has often shown that possible configurations may in fact be 'many', almost a continuum, if the analysis is

fine-grained enough (e.g. many attributes are considered). For example, Child (2002) classified international JV organizational profiles into three groups on the single attribute of ownership (majority, parity, minority position of the international versus domestic partner) but within each group, there are almost as many configurations as cases. Other studies (Letremy and Cottrell, 2003), using connectionist methods based on distance among vectors of attributes, detected tens of configurations rather than 'a few': for example, labour contract provisions (such as open ended/fixed term, presence of shifts, flexible schedule, part-time, etc), ending up with 10 configurations (groups of contracts characterized by similar patterns and frequencies close to 100% in the presence of different provisions).

Methodologically, the simultaneous analysis of internal and external fit remained a task for future research, arguably due to a time lag in the maturation of proper statistical methods. The properties of 'equifinality' and 'non-linearity' were more proclaimed rather than actually studied, arguably for much the same reason (Fiss, 2007). In addition, the mere 'qualitative' operationalization of organizational elements or practices, and their measurement as 'present' or 'absent', is not conducive to disclosing whether relations among them are linear or non-linear; a simultaneous consideration of 'quantitative' variations in their intensity or level of application would be needed.

The strand of research in organizational economics based on 'complementarity' is seldom considered in reviews of configurational studies , but it is remarkably configurational in approach, and it actually shares many of the advantages and limitations of OT configurationism. It intended to address the problem of 'internal fit' and to clarify what's behind it. With the notion of complementarity, OE has contributed to configurational analysis by defining internal fit and coherence more precisely. Milgrom and Roberts' influential paper on complementarity and fit launched an entire stream of configurational studies based on the complementarity hypothesis, thereafter also influencing OT and HR studies (Delery et al., 1996; Ichniowski et al., 1997; Whittington et al., 1999; Volker and Manke, 2002). Milgrom and Roberts applied Edgeworth's classic notion of complementarity among goods and services to strategic and organizational attributes. They stated that 'attributes are complementary if doing (more of) any one of them increases the returns to

doing (more of) the others' (Milgrom and Roberts, 1995). Hence, complementarity has been defined as 'supermodularity' in the performance function

$f(Dx + Dy) > f(Dx) + f(Dy)$

where x and y are any two complementary elements (e.g. goods and services, or organizational and strategic practices).

In empirical research, 'attributes' have been operationalized as 'practices' and have included attributes that in OT would be classified in part as organizational - e.g. 'pay for performance', Taylorization of work, horizontal communication - in part as 'contextual' - e.g. long-linked vs. intensive technologies, mass market vs. niche strategies. This approach may be seen more as a strength than a weakness from a configurational perspective. In fact, the distinction between 'independent' and 'contextual' variables versus 'organizational' variables should lose relevance in a configurational approach: not only fit among organizational mechanism but also fit between these and strategic, technological or institutional practices can be studied, explained and clarified in terms of complementarity.

Beyond these achievements, it should be noticed that some of the problems and limitations of CA in OT have remained or became even more prominent. First and foremost, the origins of 'complementarity' are no clearer than the origins of 'coherence' or 'synergy'. This statement can be supported by examining the original illustrations of the complementarity framework given by Milgrom and Roberts - a comparison between 'mass production' and 'flexible production' practices, and an analysis of the Lincoln Electrics case.

The 'mass production' array of attributes is claimed to be based on 'the transfer line, interchangeable parts, and economies of scale', and to include practices such as specialized machinery, long production runs, specialized skill jobs, central coordination and hierarchical planning, high inventories, vertical integration. The 'flexible production' array was characterized, by contrast, by a logic of 'flexibility, speed, economies of scope and core competencies', and identified by practices as flexible machines, short production runs, highly skilled cross-trained workers, worker initiative, horizontal communication and cross-functional teams, low inventories, reliance on outside suppliers. Hence, in this first example, complementarity and fit seem to stem from the 'similarity in logic' among practices.

Another example is given next, the organization of Lincoln Electrics. The case was deemed famous for having revived 'Taylorist' practices as piece rate compensation based on time and motion studies, but able to offset and correct all the (in)famous problems of these systems by extensive employee ownership, a permanent employment policy with no layoffs even during severe crises, wide reliance on make rather than buy, the use of cross functional teams at a time when they were extremely rare in American manufacturing, flexible work rules and extensive firm specific training. The authors argue that these distinctive features are complementary, but they do not notice that they are so for a different reason to 'similarity in logic': actually, some traits are drawn from a hard-nosed 'Fordist' capitalistic firm model and some traits from a flexible collective enterprise model; and it is thanks to their 'difference in logic' that they are able to balance, actually to counter-balance, each other.

In subsequent research and in the main statements of the perspective, 'consistency' among organizational attributes or practices, in the sense of 'congruence', 'similarity' and 'alignment', hence on the homogeneity of attributes has been emphasized. This assumption is also prevalent in OT, as we have argued (see also Doty et al., 1993). In OE, Williamson (2004) addressed the issue openly and clearly, referring to the conceptual (Simonian) notion of similarity and difference 'in kind' among organizational attributes as an explanation of why we find them clustered in 'coherent syndromes'. However, the notion of complementarity as homogeneity faces many counterexamples and counterarguments, as the Lincoln case, suggesting that both similarity and difference in kind as well as homogeneity and heterogeneity in traits can actually be sources of complementarity (Grandori and Furnari, 2009). In fact, there are many important and widely studied organization forms whose main advantage is precisely 'incoherence' or 'diversity' among the constitutive elements. Examples include all notions of external and internal 'hybrids' as forms mixing attributes drawn from different homogeneous 'syndromes' (such as 'markets', 'hierarchies' and collectives') to improve the response to multiple/contrasting design requisites (e.g. Grandori, 1997; Zenger and Hesterly, 1997; Hennart, 1998; Cohendet, 2004; Lindkvist, 2004)[1] and notions as organizational 'ambidexterity' (O'Reilly and Tushman 2004) and 'bimodality'

[1] These notions of 'hybrids' are configurational as they envisage the combination of mechanisms belonging to different structural alternatives, while Williamson's notion (1991) of hybrids is not configurational since these forms are defined as 'intermediate' between markets and hierarchies, characterized by intermediate values of organizational traits typical of the extremes of the continuum.

(Baharami 1992): forms with simultaneously 'opposite' traits - centralization and decentralization, high regulation and high autonomy, individualism and collectivism - to foster performance in dynamic competitive conditions;

Hence, the principle of complementarity as homogeneity is too simple, at best a particular case, since the association of organizational practices may add value precisely due to their *heterogeneity rather than homogeneity*.

On the 'theory loss' issue, an empiricist approach to the definition of both practices and their possible combinations prevailed in OE to a greater extent than in OT, and the 'list' of practices became even more pronouncedly a 'laundry list'. This is likely to 'leave resources on the table', i.e., to concentrate on configurations that are all 'sub-optimal': what about outperforming outliers? Or even untried combinations? Where do the lists of practices come from? Are all the practices considered actually relevant? Responses to these questions would impart a much greater design power to CA.

On methodological issues, CA in OE has indeed applied sophisticated methods and tools to test truly interactive effects among organizational traits. However, the math available has thus far not allowed including more than a few attributes (Athley and Stern, 1997), typically operationalized in binary terms (presence/absence of a practice). These methodological limits have prevented studying complementarities on wide clusters of attributes (if not through standard correlation-based methods).

The rest of this chapter is an effort to provide some advances on all the open issues identified in the conclusions of the reviews of CA both in OT and in OE.

A Map of Organizational Configurationism

Building on the above analysis of previous studies, we identify two important dimensions that can be used to characterize different approaches to configurational analysis as well as the different organizational configurations themselves. There are two types of *structural heterogeneity (SH)*: the heterogeneity of organizational elements within a configuration ('internal structural heterogeneity') (ISH), and the heterogeneity of configurations effective

under the same 'contingencies' ('external structural heterogeneity') (ESH). These two dimensions are used here to construct a 'map of organizational configurationism'[2] , which in turn will be useful in identifying the gaps/challenges for future research.

Table 1 - A map of organizational configurationism

		Internal Heterogeneity *(of attributes in the same configuration)*	
		No	Yes
External Heterogeneity *(of configurations under the same conditions)*	No	**A – One 'internally homogeneous' configuration is effective under each configuration of conditions** (e.g. Classic SCT e.g. Organic vs. Mechanistic Systems; Classic TCE e.g. Bureaucracies vs. Clans)	**B – An 'internally heterogeneous' configuration can be effective under a specified configuration of conditions** (e.g., Ambidexterity, 'Bimodality')
	Yes	**C – More than one 'internally homogeneous' configuration can be effective under each configuration of conditions** (e.g. 'Systemic fit' approaches; Complementary-based CA)	**D – More than one 'internally heterogeneous' configuration can be effective under each configuration of conditions** (e.g. Organizational Chemistry; Fuzzy-set configurationism)

Cell A describes 'the best way to organize in each given circumstance' approach. In addition, that 'best way' is defined by a 'coherent syndrome' in which all elements are 'of the same kind'. This approach was typical of early SCT, the most salient template being the 'mechanistic' versus 'organic' systems partition, with the effectiveness of each system contingent on the uncertainty of the system's task environments. Forms are therefore attributed the property of *'structurally unifinality'*: each of these does well in one context and for one purpose.

[2] We are very grateful to Peer Fiss for his constructive comments on a former version of this matrix.

Cell B is more novel in that it points to the advantages of internal structural variety. Two different types of advantages have been highlighted in different models. In a simpler and early version, the heterogeneity of organizational attributes within the same organizational entity simply stems from its 'differentiation' into parts in turn adapted to their different task environments (as in Lawrence and Lorsch's and Thompson's SCT works). A more configurational notion of blending and mixing traits was that of '*ambidexterity'* (O'Reilly and Tushman, 2004). This reformulation enriched classic contingency arguments especially in considering the contingency of forms on two qualitatively different types of organizational results that could be interesting to achieve simultaneously: efficiency and innovation, exploitation and exploration. While 'ambidexterity' has been analyzed mainly in the context of large firms, and assumed to be realized by means of specializing and dedicating different parts of a structure to these different purposes, others have noted that in radically innovative contexts, and new entrepreneurial firms, the entire structure tends to exhibit 'opposite' characteristics at the same time: it is both centralized *and* decentralized, both formal *and* informal, both individualistic *and* communitarian – in a word it is 'bi-modal' (Bahrami 1992). In one way or another, these forms have the property of *'structural multifinality'*, i.e., they are able to achieve multiple purposes.

Cell C defines a locus in which configurations are thought/found to be 'coherent' (internally homogeneous) clusters of attributes, but there may be more than one effective combination under the same 'external' circumstances, i.e., there can be *equifinality* among forms. Roberts (2004) indicated examples of the 'puzzle' of different arrangements appearing to be equally effective under the same circumstances: for example, the 'disaggregated', 'let one thousand flowers bloom' approach of BP versus the 'planned micro-economy' approach of other successful firms in the petroleum industry, or the contrasting approaches adopted in organizing for innovation: a communitarian approach as, say, at Nokia, versus the 'highly powerful incentives' found in other innovative firms.

Cell C and Cell B is where most of CA has lived thus far. However, the map mentions, as examples in these Cells, only those contributions that have specified/modelled the type of heterogeneity envisaged, and hence useful from a design perspective. A limitation of many CA studies has been the lack of this kind of modelling whereas from an empiricist stance, a

set of empirically observable practices were analyzed in terms of clustering regularities and (eventually) in relation to contingencies and performance. In this way, it could just happen by chance that some heterogeneous elements are found to be combined in a configuration, or that more than one configuration is effective in multiple circumstances, but these types of regularities – if detected at all – remain under-conceptualized, unexplained and are therefore scarcely applicable in design.
Cell D is the most complex and novel, and the most fully configurational, in the sense that it takes into account both internal and external interaction effects among heterogeneous attributes of organization and context. Both the external and internal heterogeneity of forms is admitted. In this cell, *both the possible equifinality of different configurations and the possible multifinality of each single configuration are admitted and enquired*.

On the basis of this wider picture, we note that the map can be interpreted as implying *increasing degrees of freedom in design* in moving from Cell A to Cell D. In other words, in all Cells the organizational configurations are contingent to the configuration of conditions, but there is a *'degree' in contingency* – namely, different types of conditions constrain organizational solutions to a different extent. This notion is novel. In Cells A and B there is a one-to-one correspondence between structures and context. Greater degrees of freedom emerge when we move to Cell C, and even more so when we shift to Cell D. On the basis of this observation, new research questions and conjectures can thus be formulated: are these different degrees of contingency actually present in reality, rather than only being differences among approaches? That is to say, can internal and external heterogeneity vary under specifiable conditions? Which are they?

In the next section some propositions on the expected variations of external and internal heterogeneity of high-performing organizational configurations, are developed, and some exploratory empirical evidence is provided.

An Analysis of Internal and External Heterogeneity

The hypotheses on the nature and predictors of internal and external heterogeneity advanced here are grounded in the configurational approach to organization design that we have

developed in a series of previous studies (Grandori and Furnari 2008; 2009). The explorative empirical evidence reported here comes from a data base on the adoption of a set of organizational practices that was also used in our previous research[3]. The practices considered in the survey were identified and classified with the use of a theory-based typology of organizational elements (Grandori and Furnari 2008): 1) market-like elements (M), such as individual- or team-based pay for performance systems; 2) bureaucratic elements (B), such as formal rules and procedures for human resource evaluation and monitoring; 3) communitarian elements (C), such as teamwork and knowledge sharing systems[4]. The intensity of use of each type of element was then measured on a scale based on the number of organizational practices adopted for each type.[5] We refer to this number as the "dose" at which each type of element is infused in the organizational system.

For the present analysis, new measures and data have been considered, and new hypotheses on how heterogeneity should vary with some important contingences have been developed.

First, two indexes of structural heterogeneity have been constructed. An **Internal Structural Heterogeneity Index (ISHI)** is constructed as the number of types of elements (1, 2 or 3) represented in a given configuration over the total possible types of elements (which in our case is 3), multiplied by the sum of the doses at which the type of elements are used. For example, a configuration featuring 2 doses of only one type of element, say market, will have a ISHI = (1/3)*2 = 0.66. Only doses equal or greater than 2 are considered here as an internal heterogeneity at level 1 is a necessary condition for any type of high performance in this

[3] The sample includes 75 firms drawn from the largest 600 independent organizations in Italy. Details on the measures of organizational practices and organizational performance (efficiency and innovation) are fully reported in Grandori and Furnari (2008).

[4] Our original classification included a fourth class of 'democratic elements' (Grandori and Furnari, 2008). However, we do not consider this category here for reasons of analytical tractability.

[5] More specifically, for each type of element, we identified 4 practices, measuring each of them with 4 sub-practices. For example, one of the 4 practices used to measure market-like elements (M) was "pay for performance", a practice which was in turn measured with the presence/absence of 4 sub-practices (e.g. individual, team-based, firm-based, stock options type of pay for performance). We then consider a practice to be present in an organization (with the value of "1") only if that organization adopted one sub-practice above the average number of sub-practices adopted for the corresponding practice. This average level has been found to have an important property: the presence of all types of elements (M, B and C) at least at that level was found to be a necessary condition for high performance of any sort (either efficiency or innovation) in our previous QCA analysis (Grandori and Furnari 2008).

sample (see Grandori and Furnari 2008 for empirical evidence on this finding). Hence this index ranges from 0.66 to 12. The index takes the maximum value of 12 when all three types of elements are presented in a configuration, each used with the maximum intensity, i.e. 4 doses. An **External Structural Heterogeneity Index (ESHI)** is easier to devise. A simple ESHI is provided by the number of different effective organizational configurations under a given configuration of contingencies.

Second, the data base has been integrated with additional data on 'contingencies', such as the size of the organizational system (SME versus large firms) and the uncertainty of the task-environment (high-tech/low-tech sectors) (see Appendix). This extension allows exploring two sets of research questions in a 'contingent configurationism' approach, bringing together the study of internal and external fit. Those questions and hypotheses are illustrated next, together with pertinent evidence.

'Contingent heterogeneity'. A first type of questions defines a problem of 'contingent heterogeneity': When structural heterogeneity among the relevant organizational elements is higher or lower? Does the 'degree of freedom' in designing configurations vary across circumstances? Which circumstances? Building on previous theoretical development (Grandori, 2001), we advance a hypothesis that has never been explored before:

HP1: *Higher degrees of complexity (system size, task uncertainty and innovation outcomes) are associated with lower equifinality (i.e. lower external heterogeneity), and with higher multi-functionality (i.e. higher internal heterogeneity) of organizational configurations.*

The rationale is that in 'simple' situations essentially anything can work (albeit at a different cost): rules, authority, communitarian coordination, incentives. It is when information complexity enters the picture that some begin to 'fail': if systems are large and computational complexity grows, centralized organization fails; if task-environments are highly variable the applicability domain of rule-like governance reduces; if problems are unstructured and innovation is crucial, price and exit governance is put under strain. Hence, the set of feasible configurations should narrow down as size increases, task become more uncertain and innovation is the relevant outcome to be reached.

This HP is innovative with respect to classic OD, according to which only forms enriched in bureaucratic elements should be effective in less uncertain/simpler conditions, and only communitarian and 'organic' governance should be effective under uncertain/complex conditions.

Figures 1 to 4 plot the average values of the internal heterogeneity index in different combinations of conditions (types of outcomes to be achieved, size and sector contingencies).

Figure 1 - Internal heterogeneity of efficient configurations in low-tech and high-tech sectors

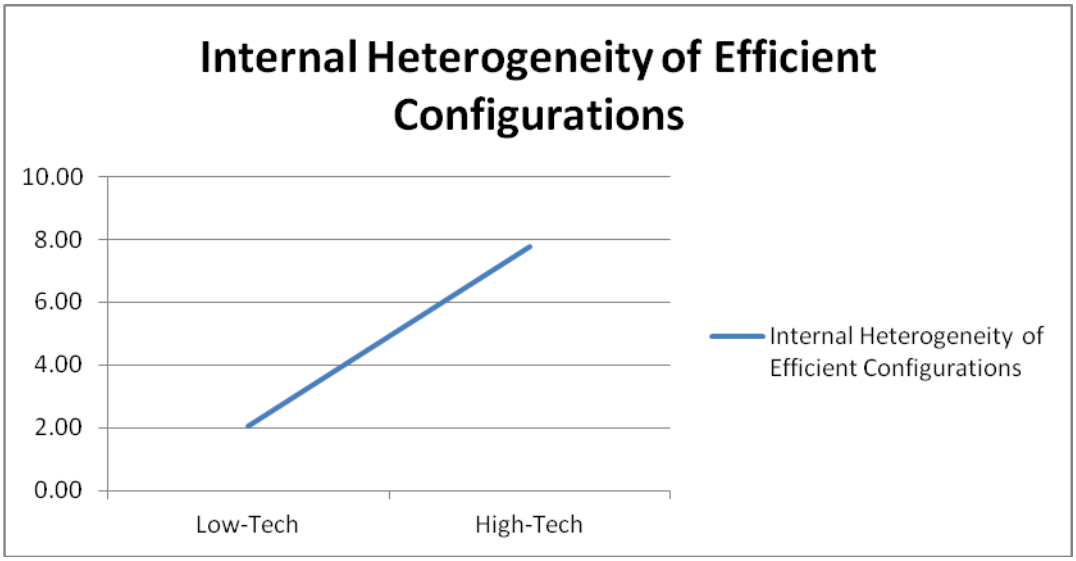


Figure 2 - Internal heterogeneity of efficient configurations in small-medium and large organizations

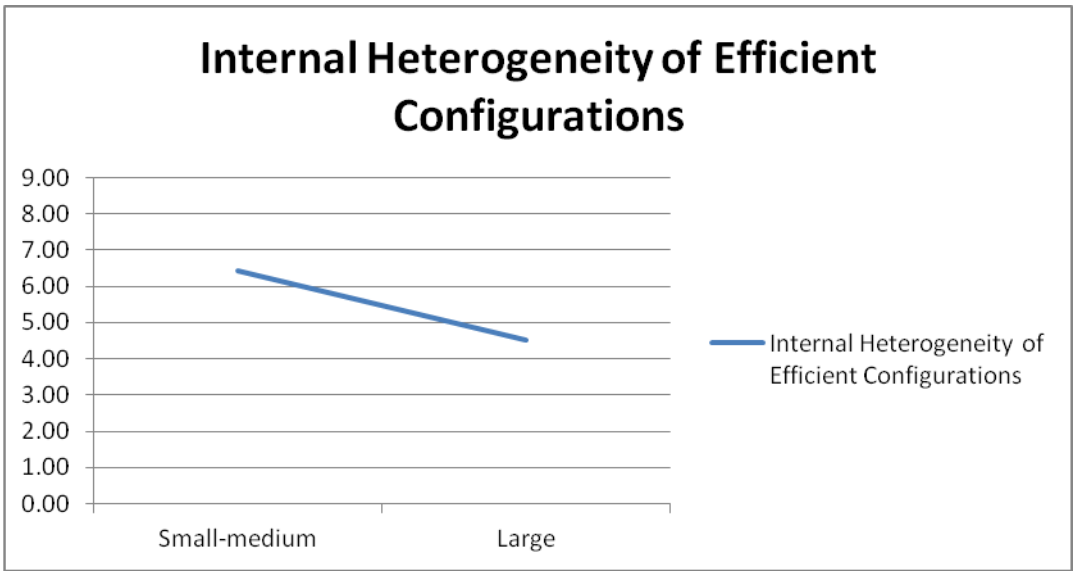


Figure 3 - Internal heterogeneity of innovative configurations in low-tech and high-tech sectors

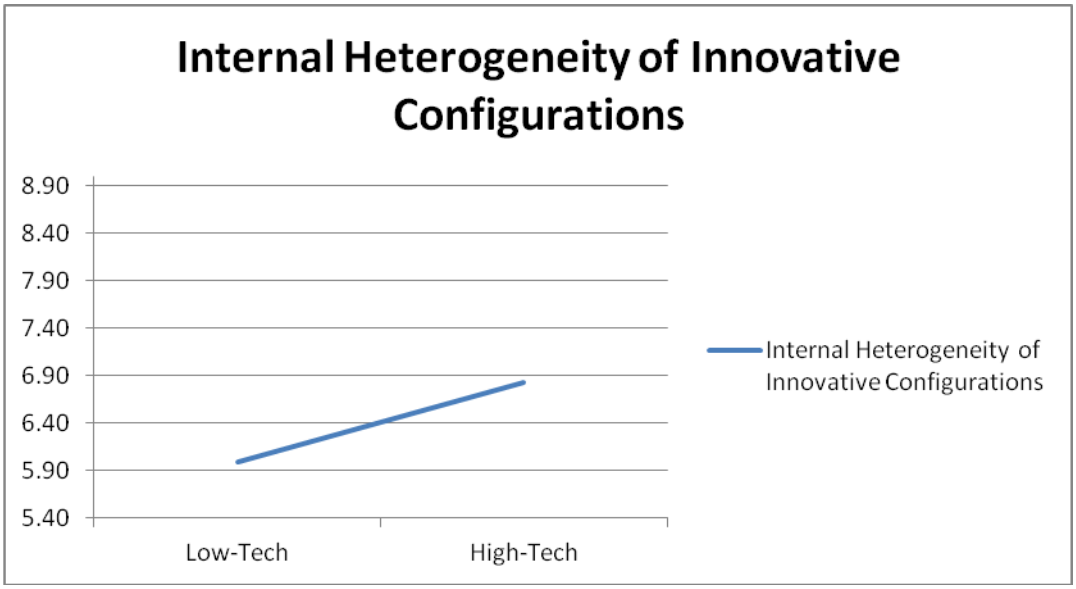
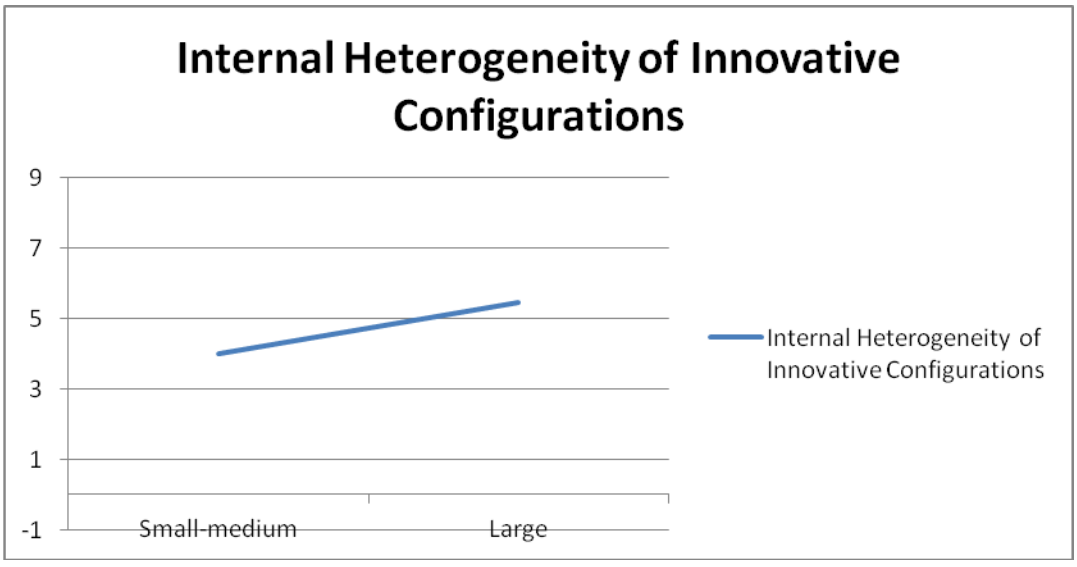


Figure 4 - Internal heterogeneity of innovative configurations in small-medium and large organizations



As expected, ISHI generally increases in combination with more 'complex' contingencies, represented by shifts from low-tech to high-tech, and from smaller to larger size, both in the achievement of efficiency and innovation, with some unexpected differences in the absolute levels of the Indexes and some signal that firm size does not behave as an indicator of complexity (Fig.2).

As to the unexpected levels of ISHI, comparing Figs.1 and 3, we note that *ISHI is higher for efficiency* (*than for innovation in high-tech*. This suggests an interesting possible explanation/refinement of Hypothesis 1 as concerns internal SH. It is possible that the *heterogeneity of contingencies* matters. The data behave as if a lower ISHI is needed if *the contingencies faced are themselves more homogeneous*, although more uncertain/difficult: i.e., generating innovation in uncertain/high-tech sectors poses more homogenous demands on structure than achieving efficiency in high-tech/uncertain conditions.

Second, the downwards sloping line in Figure 2 indicates that the *ISHI for efficiency is lower in large sized firms* rather than small sized. It seems that large firms competing on efficiency *have to* specialize their structure in one or a maximum of two directions. The second part of this analysis, on the qualitative composition of configurations, will specify which these directions are. The shape of the relation in Fig. 2 per se, can be interpreted with a cost argument. If competition is on costs and efficiency, the cost of investing in varied organizational practices as size grows may be weighted more, thereby pushing internal heterogeneity down. Efficient SMEs can afford and seem to require higher ISHI than efficient large firms. In competing for innovation, although ISHI is somewhat lower for SME, its value is nevertheless high. In this case, the explanation may be that it may be particularly difficult for smaller firms to keep up with innovation, substantive investments may be required in information and monitoring systems and a higher structural articulation than in less innovative SME may be required (some converging qualitative evidence that small firms that are particularly innovative have a particularly articulated structure has been found in research on entrepreneurial firms). All in all, in any case, it seems that smaller size 'complicates' rather than 'simplifies' things.

The analysis of External Heterogeneity also confirms HP 1, with some qualification on the role of firm size.

Figures A1 to A4 in the Appendix show the results of a Qualitative Comparative Analysis (QCA) of the configurations for high efficiency and high innovation, incorporating respectively uncertainty and size as two relevant contingencies[6]. They indicate that the number of high performing configurations is much higher for efficiency (18 configurations) than for innovation (10 configurations), as expected. If we add size and high technology as 'contingencies', the number of high performing configurations, which we take as an indicator of ESHI, necessarily decreases, but not by the same amount in all conditions.
Considering size as a relevant contingency, ESHI is higher for larger organizations (7 configurations for efficiency, 3 for innovation) than for smaller firms (3 configurations for efficiency, 1 for innovation, see Figures A1 and A3 in appendix). In other words, *larger firms enjoy greater degrees of freedom in organizing than smaller firms*. This contrasts with the idea that size is a source of 'complexity' or otherwise of difficulty in organizing and further supports the finding and the interpretation emerging on ISHI: smaller size complicates business life and organization.
When considering sectors, the number of high performing configurations reduces from 5 in low-tech sectors to 3 in high-tech sectors. This is consistent with our hypothesis that higher task complexity narrows the portfolio of possible effective configurations. However, unexpectedly, this is valid only for efficiency outcomes. For innovation outcomes under uncertainty, instead, heterogeneity reappears, with the number of configurations expanding from 2 to 4 as we move from innovative low-tech firms to innovative high-tech firms (see Appendix, Figure A4). Again it seems that the presence of 'heterogeneous contingencies' represents a particular difficulty by itself, reducing the degrees of freedom by posing constraints that are 'different in kind'. Hence, we find lower ESHI and higher ISHI more frequently where contingencies are heterogeneous, rather than when they all point towards the pole that is generally presumed to be more complex, namely, the larger size/high-tech/innovation pursuit combination.

Therefore, the 'contingent heterogeneity HP' is supported in its general terms: there is variance in the degree of heterogeneity of forms across conditions. The more specific HP that

[6] The relatively low unique coverage scores of the organizational configurations detected may be due to the small sample size and to the multi-industry nature of the sample. Therefore, the empirical evidence reported in these tables can be interpreted as illustrative and exploratory.

states that external heterogeneity is lower in organizing for innovation than for efficiency is also supported. However, adding further contingencies suggests that further refinements are possible. Putting together these findings on ESHI with those on ISHI, we note an interesting symmetry that would have been difficult to predict without QCA: maximal ISHI is detected for efficiency in high-tech, and minimal ESHI is observed in the opposite conditions: innovation in low-tech (and small size).

These patterns suggest that a qualitative, *configurational view of contingencies or situational variables, and not only of organizational variables*, is useful. What makes a situation 'difficult' is not so much a high value of a 'situational' variable per se. Their combination is what could generate difficulties; and difficult combinations may not correspond to 'high' (or 'low') values of the variables per se. Difficulties seem to stem from *lower levels of complementary among the conditions themselves.* This would respond to the problem of 'contrasting contingencies' – early noted but never really addressed in SCT. It is in these combinations that the degrees of freedom especially decrease: since there are multiple non-redundant constraints (constraints that do not put the same demands on structures) the number of equifinal combinations is reduced – in some cases to one, as in achieving innovation in lower size conditions.

Contingent complementarities. A second type of questions defines a problem of 'contingent complementarities': *Which* strings of 'internally' complementary organizational traits are complementary to *which* strings of 'external' conditions? Methodologically, a possible way to achieve this simultaneous specification of the 'external' and 'internal' fit is to include 'contextual' variables such as technology and sector uncertainty, size/complexity of activities, etc, in the 'strings' of elements whose complementarity is going to be assessed. Substantively, building on organization theory and previous theoretical development (Grandori and Furnari, 2009), a second group of hypotheses are advanced and summarized in Table 3.

Table 3 – HP 2 on contingent complementarities

		Outcomes	
		Efficiency	*Innovation*
Conditions	*Low Technology&Size*	HP 2.1 Equifinal enrichments in either B, **or** C, **or** M	HP 2.2 Equifinal enrichments in either C **or** M
	High Technology&Size	HP 2.3 Multifunctional enrichments in both B **and** M	HP 2.4 Multifunctional enrichments in all elements: B, **and** C, **and** M

HP 2.1: *Configurations enriched in any element - **either** C **or** M **or** B – are associated with high efficiency in smaller and less uncertain activity systems* .

According to the theory behind HP 1, no type of element – M, B or C – faces conditions of 'failure' as long as system size is kept small, and uncertainty is not high. If all elements are viable, it is sensible to let the data reveal which type of element prevails, if any, in the specific sample studied.

HP 2.2 – *Configurations enriched in **either** M **or** C elements are associated with high innovation in smaller and less uncertain activity systems*

Is has been observed that there are at least two types of organizational logics that could sustain the innovativeness of economic behaviours (Roberts 2004): one is the knowledge sharing and goal sharing 'clan-like' or 'communitarian logic (Ouchi 1979, 1980), the other is the 'highly powered incentives' logic (Zenger and Hesterly, 1997). Here, we add the observation that those configurations may be mutually exclusive only under conditions of small size and low task complexity, due to a principle of coordination cost saving.

HP 2.3 – *Configurations enriched in **both** M **and** B are associated with high efficiency in larger and more uncertain activity systems.*

The combination between high efficiency and high-tech/high uncertainty is seldom studied or even conceived; it is presumed that firms in these conditions should necessarily strive for innovation. However, the combination interestingly seems to represent situations of 'routinized' innovation, characterized by highly specialized tasks with known patterns of effective connections to systematically generating new products (pharmaceutical firms are brought as examples); especially in large firms.

HP 2.4 – *Configurations enriched in **all** B, M **and** C simultaneously are associated with high innovation in larger and more uncertain activity systems*

The combination between high innovation outcomes and complex conditions - high-tech/high size - is the most difficult to manage. According to the theory behind our hypotheses most mechanisms – B, M and C alike – face problems, if not failures, if employed in a stand alone fashion. Hence, we hypothesize that configurations should converge to few, even a single high performing configuration, with maximal internal heterogeneity.

These HPs summarize the broad trend that can be theoretically anticipated. This predictive effort leads to seeing a clearer and general expected pattern: *as 'contingencies', broadly intended to include both the types of tasks to be mastered and the types of outcomes to be reached, become more challenging, the links between organizational elements pass from an **'or'** link to an **'and'** link among elements.* Including also a specification of the identity of elements in configurations, the formulation of those HPs is going to be useful in interpreting results, and to detect and explain 'unexpected' results. In fact, in a sense, in configurational analysis one should always expect to find some unexpected results, since the combinations are so many that developing predictions for all of them seems either too costly for the marginal returns, or even logically impossible. Hence, it seems fair to admit that, while we made a point on the usefulness of theoretical prediction in CA, that type of analysis has an unavoidable empiricist aspect due to the number of possible combinations. Figures A1 to A4 in the Appendix contain information also on the components of configurations and can therefore be used for discussing the 'contingent complementarities' hypothesis, as follows.

In organizing for efficiency, infusions of further elements (beyond the core) are necessary, but their quality (M, C or B) does not matter so much. This squares well with our hypothesis 2.1 - *there are more ways of achieving efficiency than of achieving innovation*. The results further suggest that this external heterogeneity is especially high for large sized firms striving for efficiency that should however limit their internal structural heterogeneity.

In *organizing for innovation*, the *identity of mechanisms matters more*. In addition to fit to contingencies, high performing infusions of elements seem to depend on complementarity with the elements that are already diffused in the initial/average conditions: in this sample (but this is likely to be common), B elements abound in large firms, whereby *infusions of M and/or C* are called for. This situation is likely to be common, and in fact those infusions are typically the recommended cure to make large bureaucratic firms more 'flexible' (e.g. Zenger and Hesterly, 1997). By the same logic, a much less noted and conceptualized recommendation emerges: *in lower size, infusions of M and/or B* are beneficial. In fact, in smaller sized firms 'communitarian' and informal practices abound on average, hence investments in C have low marginal returns there; rather, innovation is better served by investing in M and B practices, also taking into account that smaller size in combination with innovation is a 'heterogeneous contingency set', hence a difficult set.

As to the HP that states the complexity of conditions and outcomes should drive configurations toward a high ISHI structure (HP 2.4) with intense enrichments in all elements, M and B and C, some refinements emerge. Fully-fledged multimodal structures are rare. This confirms a result obtained in previous analyses (Grandori and Furnari, 2008): there is a ceiling to ISH, arguably due to decreasing marginal returns to investments in coordination in general and in the variety of coordination mechanisms in particular. However, the general HP that more stringent/difficult conditions should drive ISHI up – hence produce a more stringent 'and' (rather than 'or') link among elements – squares well with the observations. Still, those more stringent/difficult conditions seem to be chiefly represented by situations of *'heterogeneous contingencies'* rather than contingencies of any one type that we are used to consider more complex (e.g. large organizational size, high task complexity, innovation).

Conclusions

The chapter reviewed and revealed the roots and constant presence of elements of configurational analysis (CA) in almost all the main approaches to organization analysis and design in OT and OE. This view of CA is a contribution in itself, as it has seldom been noted since the efforts of its proponents have been devoted more to stressing differences and discontinuities with other 'approaches'. However, CA is more an analytic approach than a substantive approach or theory, an 'alternative' to other approaches and theories. The consequence of this interpretation is not a reduction but an expansion of its heuristic power, both in terms of its application domain and in terms of its potential to renew organization theory in its merits.

The chapter also offers a 'map' of configurational studies relevant for organization design. The map is a typology of approaches within CA based on two dimensions that emerged as key from the literature review. In fact, while all CA is based on the identification of 'conceptually distinct elements' and how they can be combined, there have been different ways of modelling the 'laws of clustering': some of the studies hypothesize that only 'coherent' and 'similar' elements can cluster, some envisage complementarities among elements that 'differ in kind', some hypothesize a one-to-one correspondence between one configuration of contextual contingencies and one effective organizational configuration, some envisage multiple effective configurations in the same conditions. A distinctive methodological contribution of this chapter has been to measure 'structural heterogeneity' and to advance and empirically explore some propositions on how it varies across contexts characterized by different levels of task uncertainty and complexity/size of the organized system. A new empirical application of QCA has been presented to demonstrate how this type of analysis can lead to substantive contributions, such as the positive relation between the heterogeneity of contingencies and the internal heterogeneity of structure, the higher equifinality of different configurations in large firms competing on efficiency (with respect to other conditions) and the substantive specification of which organizational elements are complementary under what conditions.

Other methodological contributions of the type of CA proposed here reside in analytical options that can overcome some of the main limitations of previous CA studies identified in

the course of the literature review. They include an analysis oriented to detecting effective strings of elements, rather than just 'traits commonly occurring together'; and a simultaneous analysis of external and internal fit, reconnecting contingency theory and complementarity theory. In addition, the notion of 'fit' is made more precise by distinguishing 'necessary and/or sufficient causes' for observing performance outcomes; and by starting to specify what types of elements are expected to be complementary and when. Performance and 'situational' variables have also been analyzed as configurations of elements that 'differ in kind' (e.g. efficiency vs innovation, high tech vs mature industries) as much as organizational elements.

These advances should contribute to taking a significant step forward in a configurational analysis towards a more fine-grained, chemistry-like, organization design, based on the combination and infusion of ingredients with specified effects and purposes.

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Appendix

To measure firm size (as a proxy of organizational complexity), we used the European Union enterprise size-classes. Specifically, firms with 250 or more employees were coded as large (1), while firms with fewer than 250 employees were coded as small (0). To measure environmental uncertainty, we classified the sectors in which the firms in our sample operated in the two groups illustrated in Table A1 below: more research intensive and technology intensive sectors; and more traditional and mature sectors, with relatively known technologies.

TABLE A1 - 'High-tech' and 'low-tech' Sectors

Industries grouped as 'Low-tech'	Industries grouped as 'High-tech'
• Banking and Finance • Construction • Grocery Distribution • Steel • Food and Beverages	• High-tech Automotive • Chemistry • Energy and Utilities • Pharmaceuticals and Bio-tech • Software

We used the truth table algorithm in the fs/QCA (2.5) software as described by Ragin (2005; 2008). A minimum threshold frequency of one case per configuration and a minimum consistency value of 0.66 were used to generate the truth table. The results reported in Figure A1 to A4 refer only to the 'intermediate solution' – i.e. those solutions that only include simplifying assumptions based on "easy" counterfactuals because in this analysis we are not interested in distinguishing between core and peripheral solutions as in previous QCA studies (e.g. Fiss 2011)

Figure A1 - Configurations for high efficiency in small-medium and large organizations

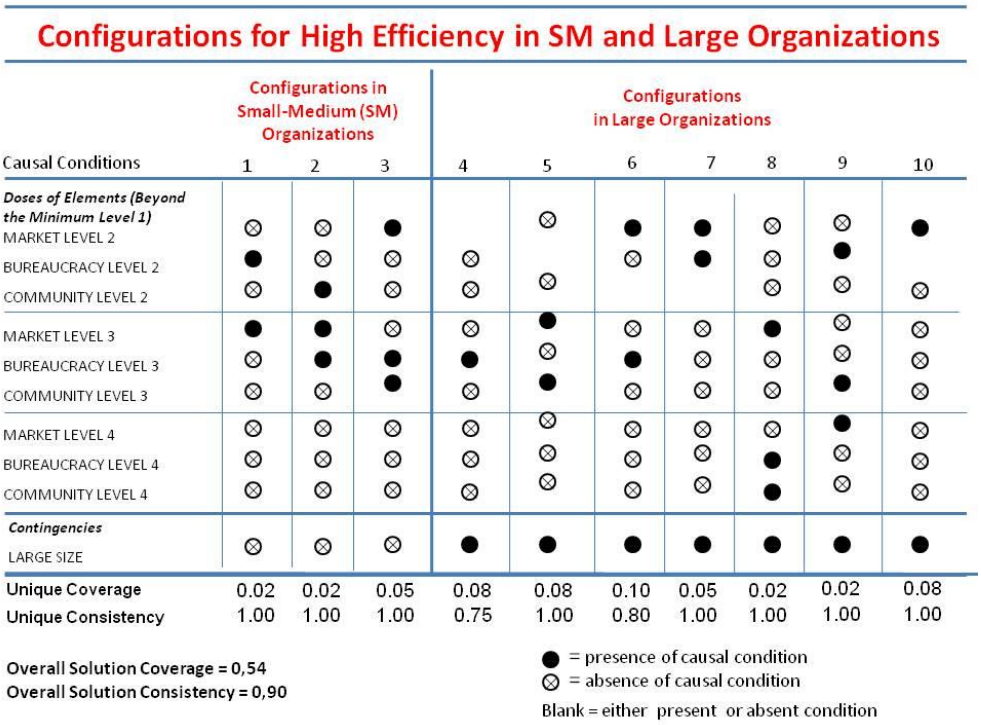

Figure A2 - Configurations for high efficiency in low-tech and high-tech sectors

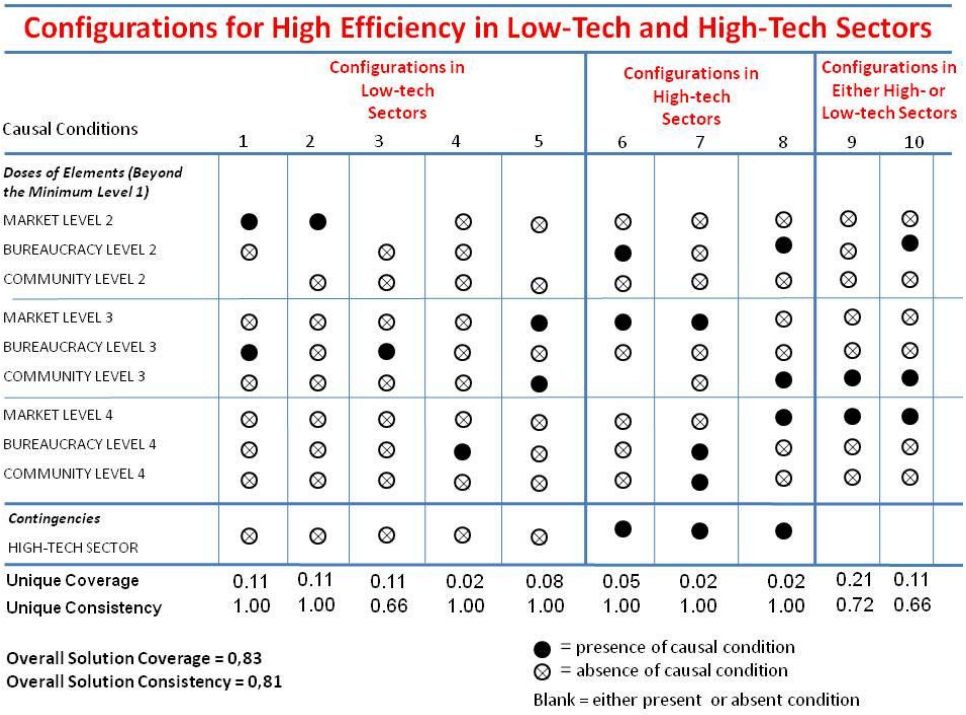

Figure A3 - Configurations for high innovation in small-medium and large organizations

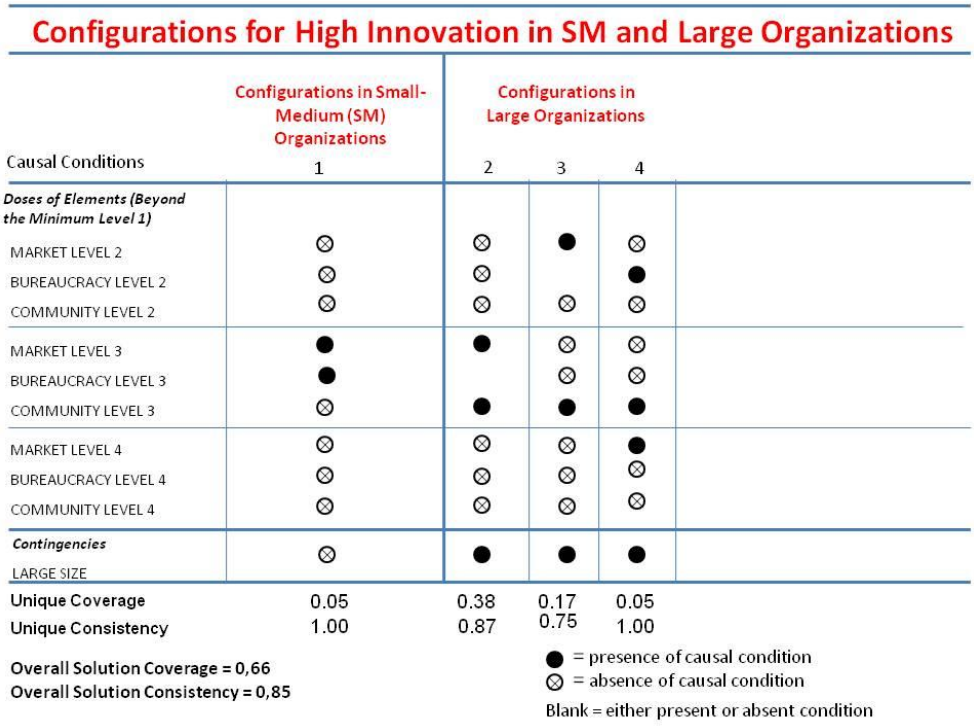
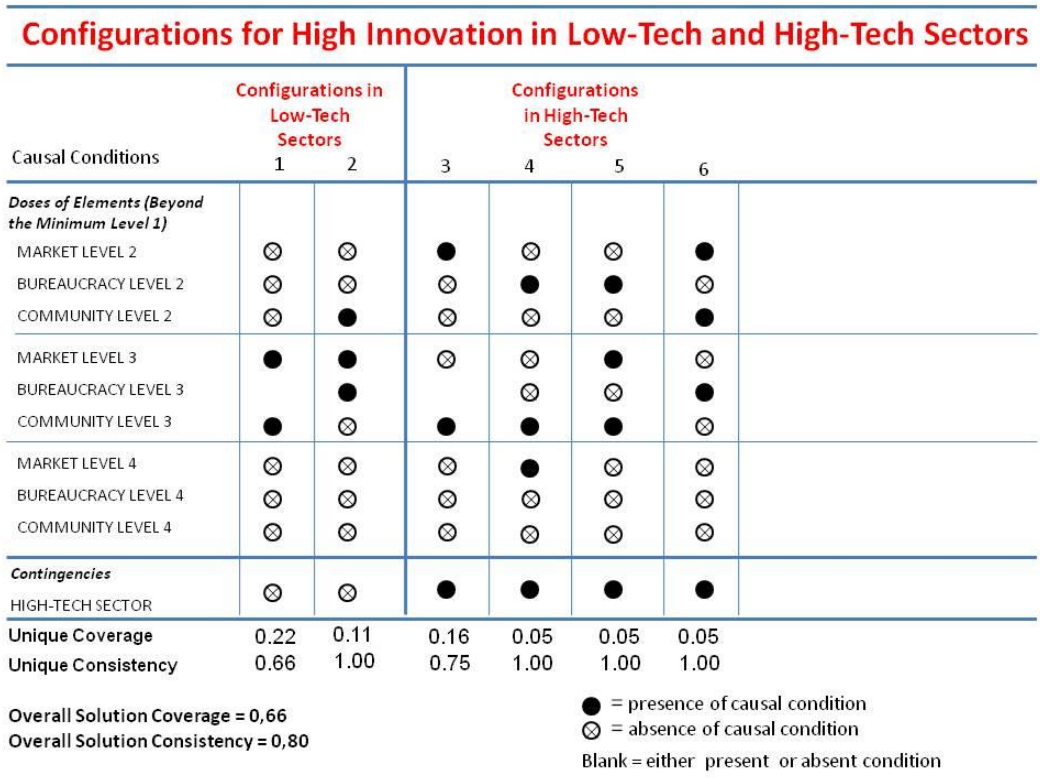
Figure A4 - Configurations for high innovation in low-tech and high-tech sectors