Paths to IT Performance: A Configurational Analysis of IT Capabilities

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Abstract: This study seeks to describe and explain the manner by which the environmental uncertainty, IT strategic orientation and IT capabilities of manufacturing SMEs contribute to their IT performance, that is, to their realization of benefits from the use of IT. A qualitative comparative analysis (QCA) allows to unveil three IT capability configurations associated to high-IT performance firms. Dependent upon the configuration, the core causal conditions involve an IT Defender strategic orientation, and various combinations of IT managerial, functional, informational and technological capabilities. These results support the idea of a *gestalt* alignment threshold for the IT capabilities of high-IT performance firms, that is, the idea that different IT capability configurations can be equally effective.

1 INTRODUCTION

The need for information technology (IT) investment in business enterprises keeps increasing and makes growing demands on the information and communication function of these organizations. This is particularly true of manufacturing SMEs, who recognize the challenge of investing in information systems that provide the capacity to process the data and generate the information that derive from their dealings with their customers and other business partners (Raymond et al., 2015). Many SMEs are aware that investing in IT enables their survival and competitiveness in a global, knowledge-based economy, and allows them to benefit from their product and process innovations (Marbert et al., 2003). While IT-based solutions have considerably increased the productivity and improved the manufacturing process of these firms, they have also provided them with greater flexibility by removing the constraints of space and time, and by reinventing organizational ways of doing business (Dibrell et al., 2018)

With the opening of worldwide markets, SMEs are affected by ongoing changes resulting in greater environmental uncertainty and turbulence. If flexible enough, IT can be a major change agent, allowing SMEs to face uncertainty and quickly adapt to changing market needs (Henderson and Venkatraman, 1999). However, given the inherently fragile nature of SMEs, the strategic role of IT is not always fully exploited, giving rise to new managerial challenges for these firms (Cragg, 2010). The barriers to entry into emerging or existing markets are now lower due to online offers and to customers being more demanding and informed. In this context, IT investments may quickly become obsolete (Riemenschneider and Mykytyn, 2000).

Given the extensive investments in IT made by a number of manufacturing SMEs, it is necessary to anticipate the opportunities and threats that are associated with these technologies, to discover the mechanisms best suited to control and operate IT, and to analyze their importance for the efficiency and profitability of these enterprises (Kohli and Grover, 2008). The increasingly strategic role of IT within the organization may give rise to problems related to the management of IT that are not merely technical, but also strategic and organizational in nature (Caldeira and Ward, 2003). Therefore, it is of critical importance for SMEs to have an understanding of how their IT capabilities can provide them with the

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most business value from their investment in IT (Clark et al., 1997, 2010).

In this regard, various configurations of IT managerial, functional, informational and technological capabilities (Raymond et al., 1995, Sanders and Premus, 2005) should emanate from the uncertainty perceived by an SME in its business environment and the strategic role it assigns to IT, that is, its IT strategic orientation (Philip and Booth, 2001, Venkatraman, 1994). Therefore, our research question is the following: *what are the appropriate configurations of IT capabilities that allow SMEs to be IT performing in various contexts of environmental uncertainty and various types of IT strategic orientation?*

2 CONCEPTUAL FRAMEWORK

Given our research question, the conceptual framework of this study combines theoretical elements that underlie and integrate the following notions in a configurational approach: IT sophistication, to which are related environmental uncertainty, IT strategic orientation and IT performance. The theoretical background of this study emanates first and foremost from Henderson and Venkatraman's conceptualization of the *strategic alignment of IT* which means that the dynamic coherence of the added-value obtained from IT is due to an interplay between an organization's business strategy, organizational infrastructure, IT strategy and IT infrastructure (Henderson and Venkatraman, 1999). These authors' strategic alignment model (SAM) emphasizes the need for coherence between internal and external business activities in order to meet the firm's strategic objectives and improve its organizational performance. While it has been demonstrated that coherence between business strategy and IT strategy contributes to both IT performance and organizational performance (Croteau and Bergeron, 2001, Kyobe, 2008), few empirical studies have taken contextual factors into account, i.e. factors that relate to the firm itself, its business environmental, and its technological context, that is, the well-known "TOE" framework emanating from Tornatsky and Fleischer's (1990) work. While a number of empirical studies have provided an understanding of the various contexts in which the strategic alignment of IT contributes to the attainment of business value from IT and to organizational performance, many aspects of this alignment have yet to be explored, such as the alignment at the managerial, functional, informational and technological levels (Bergeron et al., 2004). Such a specific study of the alignment of the IT capabilities has not been researched in the past and filling this research gap will contribute to a better management and use of IT in SMEs.

Our research aims to find efficient configurations of IT capabilities, environmental uncertainty, and IT strategic orientation that allow SMEs to attain business value from IT. Hence, our main research objective is *to discover the various IT capability configurations appropriate for various IT strategic orientation of SMEs in contexts of high and low environmental uncertainty that allow SMEs to realize benefits from their use of IT, that is, to achieve IT-business value.*

2.1 IT Sophistication

The notion of IT sophistication refers to the way IT is managed and used by an organization, including the manner by which IT is aligned with the firm's strategic objectives (Henderson and Venkatraman, 1999). Raymond, Paré and Bergeron (1995) were among the first to define the concept of IT sophistication and validate its measurement. Their conceptualization of IT sophistication was subsequently used by other researchers (Iacovou et al., 1995, Pflughoest et al., 2003, Rai et al., 2006). IT sophistication is a notion that is meant here to encompass the diverse nature and interrelationships of the SME's *IT capabilities* (Bharadwaj, 2000, p. 171). Within this conceptualization, IT sophistication addresses four complementary IT capabilities: the managerial, functional, informational, and technological capabilities.

The firm's *IT managerial capability* comprises the planning, control and evaluation mechanisms required to manage its IT-based applications portfolio (Raymond et al., 1995). For its part, the *IT functional capability* is related to the autonomy of the IT function and the location of this function within the organization (Blili and Raymond, 1993).

The firm's *IT informational capability* refers to the transactional and managerial nature of the implemented applications as well as its coverage of the functional organization areas. This capability also refers to the quality of the information, its use and its integration (Marbert et al., 2003). For its part, the *IT technological capability* refers to the number or variety of technologies used by manufacturing SMEs for operational and managerial purposes, its communication networks and the IT security mechanisms (Riemenschneider and Mykytyn, 2000).

While the concept of sophistication has been used

in earlier research on the IT function, it has not been used to measure the appropriateness of specific IT capabilities and to test for the fit of these IT capabilities in a context of environmental uncertainty and specific IT strategy orientation in manufacturing SMEs. This research intends to fill this knowledge gap.

2.2 Environmental Uncertainty

As an exogenous determinant of IT sophistication, environmental uncertainty increases an SME's need for external information (Christopher and Lee, 2004, Fiss, 2011, Liu et al., 2012, Raymond et al., 2015). To better understand the way organizations should handle such a need to maintain or even increase the business value of their IT investment, we refer to *information processing theory*, viewed initially as an integrating concept in organizational design (Tushman and Nadler, 1978). This theory posits that in a case of disequilibrium between information processing requirements and information processing capabilities, which can occur after a change in environmental uncertainty, performing firms must properly fulfil the information requirements by appropriate IT capabilities to keep an acceptable (or high) level of organizational performance (Dutot et al., 2014). Information processing theory also posits that as environmental uncertainty increases, information requirements intensify and thus the need to enhance the sophistication of the organization's IT capabilities. An organization will thus perform better when there is a "fit" between its information requirements and its response in terms of management and use of IT (Cegielski et al., 2012; Dutot et al., 2014). The information requirements of an organization thus rely on the level of uncertainty related to various internal and external factors. However, it is unknown what specific IT capabilities should be enhanced and to what extent they should be improved to respond to changes in environmental uncertainty.

2.3 IT Strategic Orientation

As an endogenous determinant of its IT sophistication, the IT strategic orientation of a SME refers to the centrality and criticality of IT in the achievement of its business goals and the implementation of its strategies (Philip and Booth, 2001). This notion is thus focused on the "core business" and success of these organizations (Venkatraman, 1994). In this regard, Ward, Taylor and Bond (1996) proposed that the firm's IT strategic orientation evolves in a three-period growth cycle: 1) operational efficiency, 2) management and control of the firm, and 3) strategic IS development. Similarly, in the evolutionary model of the strategic role of IT proposed by Philip and Booth (2001), each firm has specific expectations with regard to IT that are dependent upon its capacity to "align" these technologies with its strategic goals. This alignment may be difficult to attain given the ambidextrous resolution strategies opposing short- and long-term IT goals and IT project and program needs (Gregory, 2015). Although Miles and Snow (2003) suggest that Prospectors differ from Defenders in their low structure and low cost strategy (Fiss, 2011), it is still unknown which IT capabilities or combinations of IT capabilities should be enhanced to support Prospector versus Defender types of strategy.

2.4 IT Performance

The performance of the organization's IT function lies in its realization of business value from IT investments and is thus the expected outcome of its IT capabilities (Guillemette and Paré, 2012). Given the complexity of assessing the benefits gained from IT, specifically in relation to organizational performance, a SME must consider the technical obsolescence of software, the declining cost of work units and operating software, development flows, and operating costs when it evaluates its IT costs (Kan et al., 2016). In this regard, DeLone and McLean (2003) observed that user satisfaction is the dimension that remains most important to assess IT performance. The user here may be a SME manager or other employee. Furthermore, for SMEs in particular, user satisfaction is usually associated with managerial and organizational benefits, that is, to IT-business value (Pflughoest et al., 2003, Shi et al., 2005). Despite this possibility to measure performance, it is still a challenge for many enterprises to quantify the benefits obtained from organizational and infrastructural changes, better follow-up of customers or even improved internal and external communications (Guillemette and Paré, 2012).

3 RESEARCH MODEL

As illustrated in Figure 1, our research model views IT sophistication as an alignment ("fit") of IT managerial, functional, informational and technological capabilities, a *gestalt* perspective of alignment being taken here. In this perspective, different internally consistent capability

configurations may be equally effective (Bergeron et al., 2001). This is in line with Fiss's observation that in an organizational context, several causal paths to an outcome may lead to equifinal configurations, each resulting in effective performance. Following the developments presented in the conceptual framework, the environmental uncertainty and its strategic orientation with regard to IT are posited in this research to be critical components of this *gestalt*, while IT performance is posited to its outcome.

Consistent with the information processing theory (Dutot et al., 2014, Gattiker, 2007, Venkatraman, 1994), our research model assumes that the level of sophistication of IT capabilities is associated to the level of environmental uncertainty. In the context of high environmental uncertainty, be it market-related, technological or competitive, the ambiguity surrounding future increases in information requirements pushes firms to develop a more sophisticated management and usage of IT in order to meet these requirements. Uncertainty can cause actions, routines and practices to mutate (Miner, 1990). In the case of high uncertainty, a high IT sophistication of capabilities could be needed even with a high rate of change in the environment. In the case of low environmental uncertainty, a lower level of IT sophistication may be sufficient to meet information requirements, given the relative stability of the business environment. Based on literature, it is not clear however when precisely and under which circumstances a high or higher level of IT sophistication is needed and which specific IT capabilities should be altered in situations of high versus low environmental uncertainty. This research aims to clarify this specific research question by providing evidence to support the link between the sophistication of IT capabilities and the level of environmental uncertainty.

IT strategic orientation is defined by analogy to Miles and Snow's (2003) typology which is deemed to be the most appropriate to conceptualize and operationalize strategic orientation in the context of SMEs (Escribá-Esteve, 2009). At the core of this typology is the adaptive cycle through which a firm continuously realigns its decisions with regard to the entrepreneurial problem (the firm's product-market domain), to the engineering problem (technologies and processes for production and distribution), and to the administrative problem (establishment of roles, relationships, and business processes). To parallel Miles and Snow's typology, we label as IT Prospectors SMEs that are inclined to strategically consider IT as necessary means to enable their new product/market endeavours. In the same way, IT Defenders are SMEs that strategically conceive the role of IT as one of supporting activities directed towards satisfying the needs of current customers, and ensuring production and organizational efficiency. To some extent, the IT strategic orientation is related to the environment forces and is implemented through IT capabilities. Some gestalt configurations will therefore be more effective than others dependent upon the organizational context.

In the research model, we assume that a SME's IT strategic orientation will be associated to the sophistication of its IT capabilities. More precisely, IT Prospectors will be more likely to adopt or develop IT aligned with product innovation and organizational flexibility. By nature, IT Prospectors are expected to experiment with a greater number of technologies than IT Defenders, and to do so effectively, they will need to enhance their informational and technological capabilities. These enhancements would aim at offering an effective but not necessarily efficient response to the information requirements given the exploratory nature of IT Prospectors and the need to have short term effective solution since projects can change on a regular basis. Another point of view is that IT Prospectors should be more inclined to enhance their managerial and functional IT capabilities.

For a SME, the strategic alignment of IT informational and technological capabilities should be associated to the level of IT sophistication needed to attain IT performance. Evolving in stable markets in which they intend to reinforce their position, IT Defender SMEs will likely less venture beyond the IT solutions that have been well-proven within their markets. However, in their quest for reliability and efficiency with these IT solutions, they will need greater IT managerial and functional sophistication.

The research model also suggests that the SME's IT performance is associated to the sophistication of its IT capabilities. More precisely, the level of IT performance achieved is linked to the firm's development of an appropriate mix of IT managerial, functional, informational and technological capabilities in line with its IT strategic orientation and environment uncertainty. This calls upon the notion of alignment which has been central for decades in previous research on IT business value (e.g., Bergeron and Raymond, 1995, Charoensuk et al., 2014) but limited itself to the management and use of IT capabilities, without specifying which of the four IT capabilities should be enhanced under various organizational and extra-organizational conditions. Following previous studies that have mainly demonstrated the positive impact of IT strategic

alignment on IT business value, we surmise that SMEs will achieve higher levels of IT performance than the industry insofar as they develop the "right" combination of IT capabilities, befitting both their IT strategic orientation as well as their environmental uncertainty. Higher environmental uncertainty requires higher levels of IT sophistication, and we expect that SMEs operating in highly uncertain environments that have developed more sophisticated IT to meet their information requirements will achieve higher levels of IT performance than SMEs that have not responded positively to these new organizational needs. Independently of environment uncertainty, higher levels of IT performance are expected from IT Prospector SMEs that have developed higher levels of IT usage sophistication (i.e., informational and technological needs) in response to their IT strategic needs. Similarly, IT Defender SMEs that have developed higher levels of IT managerial and functional sophistication to match their IT strategic orientation are expected to achieve higher levels of IT performance than IT Defender SMEs that have not done so.

Synthesizing these considerations, it is expected that various causal relationships between organizational (environmental uncertainty and IT strategic orientation) and IT capabilities can be observed in SMEs whose attain high-IT performance. Earlier studies have not considered the interaction, moderation and mediation effects of all causal conditions simultaneously. This complex interplay can hardly be observed with conventional statistical approaches that assume linearity (Ganter and Hecker, 2014, Ragin, 2000). Thus, given our research question, objective and model, a QCA (qualitative comparative analysis) approach is appropriate and is used to unveil the gestalt of organizational and ITcapability configurations that characterize high-IT performance firms.

4 METHODOLOGY

4.1 QCA Approach

This study uses a set-theoretic approach based on QCA, an analytic technique that provides suitable means to accommodate complex complementarities and nonlinear relationships among constructs (Escribá-Esteve et al., 2009, Ragin, 2000, Rihoux and Ragin, 2009, Woodside, 2013). As reported by Kan, et al. (2016), scholars "now use QCA beyond its original purposes in political and sociological sciences and apply this method of analysis in the field of management". These authors add that "QCA

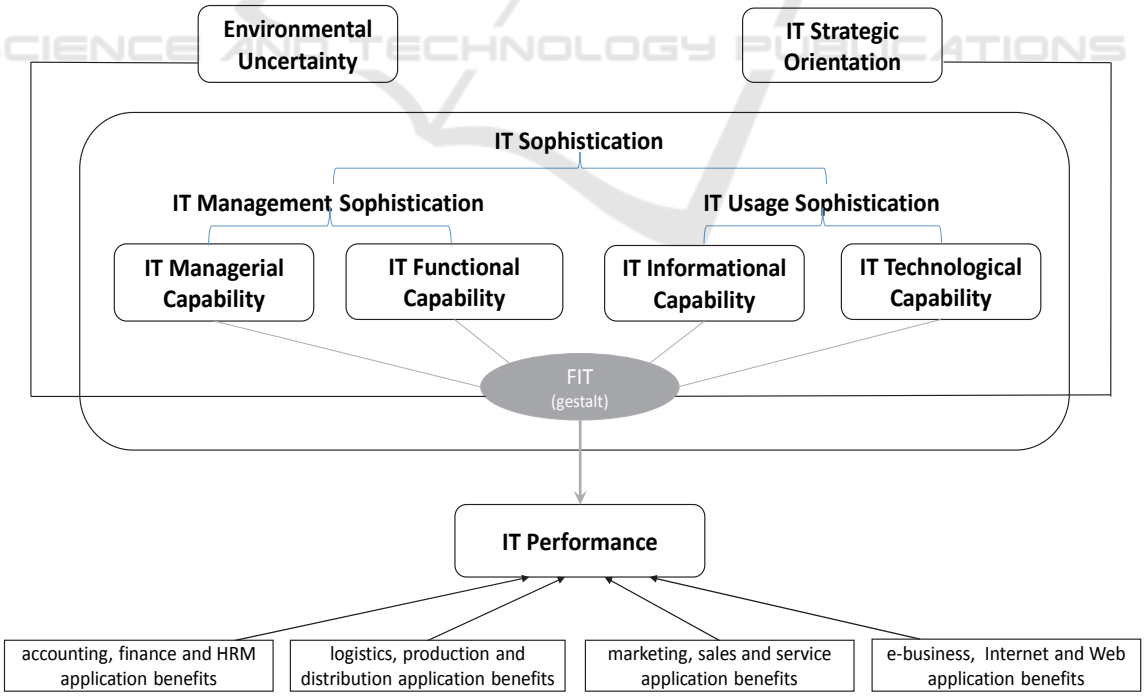

Figure 1: Research model.

extends beyond an empirical technique and this method offers a genuine formalization of qualitative analysis, which opens new ways of knowledge production in management scholarship". This type of analysis is based on a configurational understanding of how conditions or causes combine to produce a specific outcome. QCA uses an approach to solve causality that investigates an outcome as the product of how conditions combine together. In seeking to explain why certain cases have specific outcomes, QCA uses Boolean algebra and algorithms that change numerous complex causal conditions into a reduced set of configurations leading to an outcome. It combines the benefits of case-oriented and variable-based methods (such as regression techniques), and is particularly suited for small sample sizes (Ragin, 1987, 2000, 2008). In QCA terms, we report in this study the "parsimonious" solutions produced by this analysis, wherein "core" and "peripheral" conditions are presented. The truth table algorithm used is the one described by Ragin (2008), the originator of QCA. In terms of solution coverage, we consider all configurations characterized by one or more empirical observations.

The use of qualitative comparative analysis in management is relatively new. Most research using this method has been published since the year 2000. Although the bulk of research using QCA has been conducted in the fields of general management, marketing, innovation, strategy, human resources, and organization studies, only a few were applied to production & operations, and public management. Only one research addressed the sustainability issue (Rekik and Bergeron, 2017). As reported by Kan et al. (2016), the field of information systems, finance and operations research reported only one research each. Thus, it can still be considered as an innovation to use the QCA method of analysis in information systems. Since it is particularly appropriate for small to medium sample, it offers a worthy perspective to study IT capabilities configurations in an organizational setting.

4.2 Data Collection

Data was provided by a database developed by a SME research center for purposes of IT benchmarking and IT management research. This database was created in collaboration with business owner-managers belonging to chambers of commerce in the Rhône-Alpes region of France. These owner-managers as well as their management team were solicited to respond to a questionnaire on their firm's IT strategy, IT structure, IT management and usage practices, and IT performance. The database thus contains information gathered from forty-four SMEs whose main activity is in manufacturing. The survey was completed by the firms' CEO or CFO, operations manager, sales and marketing manager, and IT manager. In this study, a SME is determined to have more than 9 and less than 299 employees (median size =38 employees). Various industry sectors are represented, including metal products (27%), food products (16%), wood products (9.5%), plastics (8.5%), textile products (7%), mineral products (5%), and various others (27%).

4.3 Measures

IT sophistication. The assessment of the sophistication of IT capabilities emanates from previously validated measures of IT management sophistication and IT usage sophistication found in the extant literature (Pflughoest et al., 2003, Riemenschneider and Mykytyn, 2000). These measures have been refined and validated to refer to the sophistication of the SME's IT functional, managerial, informational and technological capabilities. The IT managerial capability is measured by six Likert-type items (see Table 1. The IT functional capability is based on two categorical items. The IT informational capability is measured with six items. The IT technological capability is formed of three Likert-type items (Riemenschneider and Mykytyn, 2000).

Environmental uncertainty. This variable was measured with 5 Likert-type items adapted from an instrument validated by Miller and Dröge (1986) evaluating the rate of change inside and outside the firm.

IT strategic orientation. The strategic orientation of the SME with regard to IT was assessed through a self-typing measure developed on the basis of Philip and Booth's (2001) and Venkatraman's (1994) stage models. The chief executives were asked to choose one statement among four that best describes their understanding of the role that is assigned to information technology-based applications (IT apps) in their firm. The scale used is as follows. For IT Defenders: IT applications are used to improve managerial control and monitoring of the firm's manufacturing operations (IT strategy 1), or IT applications are used to increase the flexibility of the firm's manufacturing operations and better respond to its customers' needs (IT strategy 2). For IT Prospectors: IT applications are used to accelerate and facilitate the firm's development of new products and to increase its market share (IT strategy 3), or IT

applications are used to increase the integration of the firm's manufacturing and business processes and to improve relations with its business partners (IT strategy 4). The statements were coded to form a "crisp set" (0,1) in QCA terms (47).

IT performance. This variable is measured by the level of attainment of the benefits associated with four types of IT-based applications, following a process-based approach wherein the respondents evaluate the business value of IT for their firm (Venkatraman, 1994). A list of expected benefits specific to each type of application is presented to the chief executive or to the concerned executive who indicates on a 5-point scale the extent to which the applications implemented contribute to the attainment of such benefits.

5 RESULTS

The descriptive statistics of the research variables are presented in Table 1. The discriminant validity of the IT sophistication constructs was confirmed by two principal component analysis (PCA). The first PCA was applied to IT managerial and functional capabilities as two sub-factors (constructs) grouped under the more general concept of IT management sophistication (Raymond et al., 1995). The second PCA was applied to IT informational and technological capabilities as two sub-factors grouped under the more general concept of IT use sophistication. In both cases, the two pairs of IT sophistication constructs revealed to be orthogonal, with each factor showing adequate reliability, unidimensionality and convergent validity.

IT performance is conceptualized here as a formative construct composed of four measures that relate to the average benefits obtained from each type of IT-based application. There was no multicollinearity among these formative measures, the highest correlation among them being equal to 0.19 ($p > 0.1$), thus confirming the last construct's validity. Furthermore, as presented in Table 2, Cronbach's α and intercorrelation values for the eight research constructs confirm their internal consistency and discriminant validity.

The aim of this study is to determine the causal conditions associated with high-IT performance, i.e. the IT capability configurations that, in line with the SME's perceived environmental uncertainty and IT strategic orientation, enable it to realize the most benefits from its investment in IT. In order to test the research model, the sample was divided in three tiers based on IT performance. The first tier represents the high-IT performance firms (n=15), and the third tier, the low-IT performance firms (n=15). The second-tier is not used in the tests. In this research, the high-IT performance firms are compared to low-IT performance firms. This approach to forming sub-samples is based on Fiss' (2011) approach to study organizational performance using QCA.

The variables were calibrated using crisp sets and

Table 1: Descriptive statistics of research variables.

Variable	mean	s.d.	range
Environmental Uncertainty	2.6	2.6	1.0 - 4.6
IT Strategic Orientation[a]	-	-	1 - 4
IT Functional Capability			
designated manager for IT[b]	.73	-	0 - 1
org. level of the IT function[c]	.55	-	0 - 1
IT Managerial Capability			
IT development	3.0	0.8	1.0 - 5.0
IT evaluation	2.8	1.2	0.0 - 5.0
user participation	2.9	0.9	1.0 - 5.0
IT resources and competencies	3.4	0.9	1.2 - 5.0
IT support and appropriation	3.7	0.8	1.7 - 5.0
external consultants	2.4	1.8	0.0 - 5.0
IT Technological Capability			
# of uses of IT	4.8	1.8	2 - 10
# of uses of e-bus/Internet/Web	6.0	3.3	0 - 15
quality of IT security	4.4	0.9	2.0 - 6.0
IT Informational Capability			
# of accounting/fin./HRM apps	6.0	2.8	0 - 11
# of logistics/prod./distrib. apps	7.0	3.1	2 - 16
# of mark./sales/cust.serv. apps	3.8	2.0	0 - 7
# of ERP system modules	2.8	2.5	0 - 7
information output quality	3.6	0.8	1.4 - 4.6
user-system interaction quality	3.5	0.9	1.5 - 5.0
IT Performance			
acc./fin./HRM app. benefits	3.3	1.2	0.0 - 5.0
log./prod./distrib. app. benefits	3.3	0.6	2.0 - 5.0
mark./sales/serv. app. benefits	3.0	1.1	0.0 - 5.0
e-bus./Net/Web app. benefits	2.6	0.7	0.0 - 4.1

[a]1: IT for control (n = 14) 2: IT for flexibility (n = 9)
3: IT for product and market development (n = 4)
4: IT for internal and external integration (n = 17)
[b]1: yes (n = 32) 0: no (n =12)
[c]1: supervised by the chief-executive (n = 24)
0: supervised by another manager (n = 20)

Table 2: Intercorrelations of the research constructs.

Construct (α)	2.	3.	4.	5.	6.	7.	8.
1. Env. Uncert. (0.68) IT Strateg. Orient.	.26	-.26	.00	.05	-.14	.03	-.04
2. *IT Defender* (-[a])	-	-1.0	-.18	-.08	.09	.06	-.16
3. *IT Prospector* (-[a])		-	.18	.08	-.09	-.06	.16
4. IT Manag. Cap. (0.67)			-	.00	.41	.15	.34
5. IT Func. Cap. (0.80)				-	.16	.27	.21
6. IT Inform. Cap. (0.69)					-	.00	.58
7. IT Techn. Cap. (0.63)						-	.43
8. IT Perform. (-[b])							-

[a] binary variable [b] inappropriate for formative constructs
Nota. Correlations greater than .25/.40/.45 are significant at $p < .05/.01/.001$.

the truth tables were generated using the fs/QCA software. The overall solution coverage indicates the proportion of cases that are covered by all reported configurations. The overall solution consistency assesses the degree to which capability configurations are subsets of the outcome (Ragin, 2008). In this study, the consistency cut-off point was set at 0.80 and the minimum frequency equal to 1. All configuration consistency values are equal to 1 and the overall solution consistency is equal to 1, satisfying the consistency threshold of 0.8 set by Ragin (2000). The overall solution coverage is equal to 0.93, indicating that these IT capability configurations (or gestalts) represent the large majority of SMEs that show a high level of IT performance. The presence or absence of each IT capability was determined by the level of sophistication of each IT capability split in two groups based on the median value and which was then used to form crisp sets (0,1). The IT strategic orientation used a crisp set classification: 1 for IT Prospectors; 0 for IT Defenders. *The black filled circle means SMEs have an IT Prospective strategy whereas the white crossed-out circle means SMEs have an IT Defender strategy.* The environmental uncertainty and IT performance also used crisp sets classification based on the median value of the scales. The results presented in Table 3 show three solutions for achieving high-IT performance. The first solution (#1) is characterized by three core conditions: an IT Defender strategy, an IT informational capability and the absence of (or unsophisticated) IT technological capability. This solution has a raw coverage of 0.33 and a unique coverage of 0.13. The second solution (#2) shows the absence of environmental uncertainty as a peripheral condition and the presence of an IT functional capability and an IT informational capability as core conditions. This solution has a raw coverage of 0.73 and a unique coverage of 0.40. The third solution (#3) is also characterized by the absence of environmental uncertainty as a peripheral condition and the presence of a Defensive IT strategy, an IT managerial capability and an IT informational capability as core conditions. This solution has a raw coverage of 0.33 and a unique coverage of 0.06.

We used the notation for solution tables introduced by Ragin (2008), as used for example by El Sawy et al. (2010) and Fiss (2011) (see Legend in Table 3). A test of necessary and sufficient conditions indicated that the IT informational sophistication is a necessary condition in all reported configurations for the outcome to exist (consistency = 1.0 and coverage = 0.88). Note that a consistency threshold of 0.80

Table 3: Configurations for achieving high IT performance.

	Solution		
	1	2	3
Environmental Uncertainty		⊗	⊗
IT Strategic Orientation	⊗		⊗
IT Managerial Capability			●
IT Functional Capability		●	
IT Informational Capability	●	●	●
IT Technological Capability	⊗		
Consistency	1.00	1.00	1.00
Raw coverage	0.33	0.73	0.33
Unique coverage	0.13	0.40	0.06
Overall Solution Consistency	**1**		
Overall Solution Coverage	**0.93**		

Legend:
● Presence of a core condition
• Presence of a peripheral condition
⊗ Absence of a core condition
⊗ Absence of peripheral condition
Blank = "do not care"

satisfied this condition (Ragin, 2008). The sufficient conditions were identified by the configurations (or solutions in QCA terms) obtained from the parsimonious solutions generated to test the research model, as presented in Table 3. Three IT configurations were associated to high-IT performance firms as parsimonious solutions.

6 DISCUSSION

The results revealed that the most frequent solution, observed in 73% of the cases, is the solution #2. It is not specific to any IT strategic orientation and thus applies to both type of IT strategic orientation, be it of a Defender or a Prospector one. Each of the two other solutions (#1 and #3) are observed in 33% of the cases and apply specifically to the IT Defender type. While the presence (and absence) of IT capabilities as core conditions and environmental uncertainty as a peripheral condition differ among solutions, the presence of IT informational capability is common to all configurations. This indicates that there exist various configurations for achieving high IT performance and that the concept of a gestalt

alignment applies.

A first consideration in explaining these results relates to the IT strategic types. One finds out at the outset that two out of the three solutions (#1 and #3) concern SMEs with an IT Defender strategic orientation (i.e., crisp set where presence = IT Prospector orientation, and absence = IT Defender orientation) while no specific conclusion could be drawn concerning IT Prospector strategic orientation (#2). It might mean that IT Defender SMEs can define more precisely what information they need and they can be successful optimizing their management of the information (through the IT managerial capability) and their use of the information (through the IT informational capability) of the information. This is slightly different to what is reported by Miles and Snow (2003) whose theory is that an organizational Defender strategy should target a low cost strategy and focus on the management of IT. Based on Miles and Snow's theory, IT Prospector SMEs evolve in continuously changing markets, economic conditions and organizational conditions, and should focus on the use of IT capabilities which includes IT informational and technological capabilities. This is not observed here.

While all the solutions include the presence of IT informational capability, these solutions do not relate to any specific IT strategic orientation. Indeed, solution #2 reports that IT informational capability is a core condition of IT performance without distinction for the IT strategic orientation. While the presence of IT informational capability is in line with the Miles and Snow's theory for IT prospectors, the IT functional capability should not be a characteristic of IT Prospectors. This diversity in the configurations of the two types of strategy has already been observed by Fiss (2011) in a QCA research on large organizations. He discussed his findings by reporting that, at some point, there is no absolute configuration for any strategic orientation and that variations may exist among and within strategic types. Another explanation is that the IT strategic orientation is not a core causal condition to achieve high-IT performance as long as the IT functional and informational capabilities are present. This conclusion applies to the solution #2 firms who represent a large majority of the firms surveyed.

A second observation is that all solutions display a necessary condition to be rated as a high-IT performance SME. This core condition is the IT informational capability. It is reported here as an important characteristic of SMEs following an IT Defender strategy. In set theoretic vocabulary, the IT informational capability is a necessary (but not sufficient) condition to be in the group of high-IT performance organizations. It is a necessary condition, in the sense that without IT informational capability, no SME can be IT performing. It is not sufficient since, as presented in the three solutions, the IT informational capability has to be associated with other characteristics. Note that these characteristics differ among solutions. Again, although the IT informational capability is a characteristic of Miles and Snow's Prospector strategy, it is not a characteristic of Miles and Snow's Defender strategy. These results diverge from extant theory.

In addition to the IT informational capability as a necessary condition, the presence of IT managerial and functional capabilities are core conditions in two different solutions (#2 and #3). This corroborates the importance of IT management capability as found in earlier research (Raymond et al., 1995). However, it could be noted that they are not simultaneously present in the two solutions giving rise to a possibility of only a partial alignment among IT capabilities to be associated with high-IT performance SMEs as long as the IT informational capability is present.

The IT technological capability is also reported as a characteristic of one solution (#1) but in this case (the IT Defender strategy), the solution indicates that it is its absence that makes of it a core causal condition. In this solution, an unsophisticated IT technological capability characterize organizations with an IT Defender orientation. In this case, the absence of IT technological capability is in line with what is reported in the literature (Miles and Snow, 2003).

The absence of environmental uncertainty is another characteristic, of a peripheral type in this case, of two (#2 and #3) out of three solutions for high-IT performance SMEs. It means that among high-IT performance firms, two observed solutions concern SMEs in low environmental uncertainty. No solution concerns a high environment uncertainty.

The gestalt form of alignment is appropriate for the tested model since it allows to define three different configurations of environmental uncertainty, IT strategic orientation and IT managerial, functional, informational and technological capabilities, associated to high-IT performance. As a necessary condition, the IT informational capability matches the definition of a moderator variable (Bergeron et al., 2004). In terms of alignment of specific causal conditions, an IT Defender strategy (as a core condition) (remind here that in table 3, the "absence" of an IT strategic orientation means the "presence" of firms with an IT

Defensive strategy as a core condition), a low level of environmental uncertainty (as a peripheral condition) and various IT capabilities support a gestalt form of alignment. The presence of a high level of environmental uncertainty and an IT Prospector strategic orientation did not show up as core conditions in any of the three solutions. Moreover, the simultaneous presence of all IT capabilities is not necessary to achieve a high level of IT performance. Indeed, each configuration relies on the alignment of various combinations of IT capabilities, with two capabilities suffice to allow an alignment of the components. One configuration carry no specific IT strategic orientation (be it Defender or Prospector), and no specific level of environmental uncertainty (be it high or low). Still, a partial level of alignment between the presence of IT informational capability, a necessary condition, and only one of the three other IT capabilities is needed to be in the high-IT performance SMEs. In all cases, it is the presence (and not the absence) of IT capabilities that allow the alignment while in one case (solution #1), it is the absence (of sophistication) of a capability (the IT technological capability) that allows the alignment. This confirms that it is a mix of conditions that form specific configurations, thus a gestalt type of alignment.

7 IMPLICATIONS

In being among the first to answer El Sawy et al.'s (2010) call for information systems researchers to better study digital ecodynamics by using configuration theory, this research has provided evidence of a "holistic confluence" among environmental uncertainty, IT strategic orientation and IT capabilities in the context of manufacturing SMEs. In so doing, we have gained initial insights as to which types of IT strategy and IT capabilities are critical to the IT performance of these firms in uncertain (and more certain) business environments. The three equifinal gestalts solutions identified through the QCA approach were shown to constitute a more likely source of IT performance for manufacturing SMEs than any single type of IT strategy and IT capability, given the complex relationships and various interactions involved (Fiss, 2011).

This research contributes to the understanding of the contribution of IT to firm performance. For practitioners, it explains that there is no "one best way" to perform in the management and use of IT. SMEs have the choice of which IT capabilities they want to emphasize and they do not need to attain a high level on all four IT capabilities to become high-IT performing firms. Instead, a gestalt perspective of alignment wherein some IT capabilities are highly developed while others are not is the solution. For researchers, the results underline the analytical possibilities offered by QCA to study small-sized samples. QCA allows the researcher to achieve a deeper understanding of the complexity faced by SMEs when they attempt to strategically align their management and use of IT. While specific results are obtained for IT Defender SMEs, additional thoughts should be made toward the appropriate capability configurations for IT Prospector firms since no specific configuration conclusion could be drawn that would differentiate high-IT performance firms from other firms. Finally, the gestalt alignment perspective combined with QCA unveils results that have not been observed before using traditional statistical analysis. As noted by Fiss (2007, p. 1180), by using QCA "researchers take a systemic and holistic view of organizations where patterns or profiles rather than individual independent variables are related to an outcome such as performance". Based on these results, we call for more QCA research in the management of information technology.

8 LIMITATIONS AND CONCLUSION

As in all empirical research, this study has some limitations. Given the size of the sample, its representativeness in relation to manufacturing SMEs is necessarily limited. A potential selection bias might orient the results toward SMEs that are more sophisticated in their management and use of IT. A longitudinal study could also be needed for an in-depth study of the IT alignment process. A more complete formative model for measuring IT performance could include information quality, system quality, service quality and individual benefits, in addition to organizational benefits. Its limitations notwithstanding, this study has provided further insight on the manner by which the environmental uncertainty, IT strategic orientation and IT sophistication of manufacturing SMEs contribute to their IT performance, i.e. to their realization of benefits from their investment in - and use of - information technology.

In summary, the QCA approach allowed us to unveil sets of core causal conditions characterizing various solutions associated to a high level of IT-

business value for manufacturing SMEs. Among the important observations are first, a sophisticated IT informational capability as a necessary (but not sufficient) causal condition for SMEs to realize the most benefits from their investment in IT independently from their IT strategic orientation and the environmental uncertainty. Second, the strategic alignment of all the IT capabilities (managerial, functional, informational and technological) is a condition that does not have to be fulfilled completely to attain a high level of IT performance, as we observed that only two of the four capabilities suffice. Finally, two high-IT performance configurations were identified for IT Defenders.

REFERENCES

Bergeron, F. and Raymond, L. (1995). The Contribution of IT to the Bottom Line: A Contingency Perspective of Strategic Dimensions. Proceedings of the 16th International Conference on Information Systems, Amsterdam, pp. 167- 181.

Bergeron, F., Raymond, L. and Rivard, S. (2004). Ideal patterns of strategic fit and business performance, Information & Management, 41 (8), pp. 1003-1020.

Bergeron, F., Raymond, L. and Rivard, S. (2001). "Fit in Strategic Information Technology Management Research: An Empirical Comparison of Perspectives", Omega, 29 (2), pp. 125-142.

Bharadwaj, A. S. (2000). A resource-based perspective on information technology capability and firm performance: An empirical investigation. MIS Quarterly, 24 (1), pp.169-196

Blili, S. and Raymond, L. (1993). Information technology: Threats and opportunities for SMEs. International Journal of Information Management, 13 (6), pp. 439-448.

Caldeira, M.M. and Ward, J.M. (2003). Using resource-based theory to interpret the successful adoption and use of information systems and technology in manufacturing small and medium-sized enterprises. European Journal of Information Systems, 12, pp. 127-141.

Cegielski, C. G., Jones-Farmer, L. A., Wu, Y. and Hazen, B. (2012). Adoption of cloud computing technologies in supply chains: An organizational information processing theory approach. International Journal of Logistics Management, 23 (2), pp. 184–211.

Charoensuk, S., Wongsurawat, W. and Khang, D. B. (2014). Business-IT Alignment: A Practical Research Approach. Journal of High Technology Management Research, 25 (2), pp. 132-147.

Christopher, M. and Lee, H. (2004). Mitigating supply chain risk through improved confidence. International Journal of Physical Distribution & Logistics Management, 34 (5), pp. 388–396.

Clark, C. E., Cavanaugh, N. C., Brown, C. V. and Sambamurthy, V. (1997). Building Change-Readiness Capabilities in the IS Organization: Insights from the Bell Atlantic Experience. MIS Quarterly, 21 (4), pp. 425-455.

Cragg, P.B., Mills, A. and Suraweera, T. (2010). Understanding IT management in SMEs. Electronic Journal of Information Systems Evaluation, 13 (1), pp. 27-34.

Croteau, A.-M. and Bergeron, F. (2001). An information technology trilogy: Business strategy, technological deployment and organizational performance, Journal of Strategic Information Systems, 20 (2), pp. 77-99.

DeLone, W.H. and McLean, E.R. (2003). The DeLone and McLean model of information systems success: a ten-year update. Journal of Management Information Systems, 19 (4), pp. 9-30.

Dibrell, C., Davis, P.S. and Craig, J. (2008). Fueling innovation through information technology in SMEs, Journal of Small Business Management, 46 (2), pp. 203-218.

Dutot, V., Bergeron, F., Raymond, L., (2014). Information management for the internationalization of SMEs: An exploratory study based on a strategic alignment perspective. International Journal of Information Management, 34 (5), pp.672-681.

El Sawy, O.A., Malhotra, A., Park, Y. and Pavlou, P.A. (2010). Seeking the Configurations of Digital Ecodynamics: It Takes Three to Tango. Information Systems Research, 21 (4), pp. 835-848.

Escribá-Esteve, A., Sánchez-Peinado, L. and Sánchez-Peinado, E. (2009). The Influence of Top Management Teams in the Strategic Orientation and Performance of Small and Medium-Sized Enterprises. British Journal of Management, 20 (4), pp. 581-597.

Fiss, P. C. (2011). Building better causal theories: a fuzzy set approach to typologies in organizational research. Academy of Management Journal, 54 (2), pp. 393-420.

Fiss, P.C. (2007), A set-theoretic approach to organizational configurations, Academy of Management Review, 32 (4), pp. 1180-1198.

Flynn, B. B. and Flynn, E. J. (1999). Information processing alternatives for coping with manufacturing environmental complexity. Decision Sciences, 30 (4), pp. 1021–1052.

Ganter, A and Hecker, A. (2014). Configurational paths to organizational innovation: qualitative comparative analyses of antecedents and contingencies, Journal of Business Research, 67, pp. 1285-1292.

Gattiker, T. F. (2007). Enterprise resource planning (ERP) systems and the manufacturing-marketing interface: An information-processing theory view. International Journal of Production Research, 45 (13), pp. 2895–2917.

Guillemette, M.G. and Paré, G. (2012). Toward a new theory of the contribution of the IT function in organizations. MIS Quarterly, 36 (2), pp. 529-551.

Gregory, R.W., Keil, M., Muntermann, J., and Mähring, M. (2015), Paradoxes and the Nature of Ambidexterity in

IT transformation Programs, Information Systems Research, 26 (1), pp. 57-80.
Henderson, J.C. and Venkatraman, N. (1999). Strategic alignment: Leveraging information technology for transforming organizations. IBM Systems Journal, 38 (2&3), pp. 472-484.
Kan, A.K.S., Adegbite, E., El Omari. S., and Abdellatif (2016). On the use of qualitative comparative analysis in management, Journal of Business Research, 69 (4), pp. 1458-1463
Kohli, R. and Grover, V. (2008). Business value of IT: An essay on expanding research directions to keep up with the times. Journal of the Association for Information Systems, 9 (1), pp. 23-39.
Kyobe, M. (2008). The influence of strategy-making types on IT alignment in SMEs. Journal of Systems and Information Technology, 10 (1), pp. 28-35.
Liu, G., Shah, R. and Babakus, E. (2012). When to mass customize: The impact of environmental uncertainty. Decision Sciences, 45 (5), pp. 851–887.
Marbert, V.A., Soni, A. and Venkataramanan M.A. (2003). The impact of size on enterprise resource planning (ERP) implementation in the US manufacturing sector. Omega, 31, pp. 235-246.
Miles, R.E. and Snow, C.C. (2003). Organizational Strategy, Structure, and Process, Stanford, California: Stanford University Press.
Miller, D. and C. Dröge (1986). Psychological and Traditional Determinants of Structure. Administrative Science Quarterly 31, pp. 539–560.
Miner, A.S. (1990). Structural evolution through idiosyncratic jobs: the potential for unplanned learning, Organization Science, 1 (2), pp. 195 -210.
Pflughoest K.A., Ramamurthy, K., Soofi, E.S., Yasai-Ardekani, M. and Zahedi, F. (2003). Multiple conceptualizations of small business Web use and benefit, Decision Sciences, 34 (3), pp. 467-512.
Philip, G. and Booth M.E. (2001). A new six 'S' framework on the relationship between the role of information systems (IS) and competencies in 'IS' management. Journal of Business Research, 51, pp. 233-247.
Ragin, C.C. (1987). The Comparative Method, University of California Press: Berkeley.
Ragin, C.C. (2000). Fuzzy Set Social Science, Chicago University Press: Chicago.
Ragin, C.C. (2008). User's Guide to Fuzzy-set / Qualitative Comparative Analysis, Department of Sociology, University of California.
Rai, A., Tang, X., Brown, P. and Keil, M. (2006). Assimilation patterns in the use of electronic procurement innovations: A cluster analysis. Information & Management, 43, pp. 336-349.
Raymond, L., Bergeron, F., Croteau, A.-M. and St-Pierre, J. (2015). Developing absorptive capacity through e-business: The case of international SMEs. Journal of Small Business Management, 53 (S1), pp. 75-94.
Raymond, L., Paré, G. and Bergeron, F. (1995). Matching information technology and organizational structure: Implications for performance. European Journal of Information Systems, 4 (1), pp. 3- 6.
Rekik, L. and Bergeron, F. (2017). Green practices motivators and performance in SMEs: A qualitative comparative analysis, Journal of Small Business Strategy, 27(1), pp. 1-17.
Riemenschneider, C.K. and Mykytyn, P.P. (2000). What small business executives have learned about managing information technology. Information & Management, 37, pp. 257-269.
Rihoux, B. and Ragin, C. (2009). Configurational comparative methods: Qualitative comparative analysis (QCA) and related techniques, Los Angeles: Sage.
Tornatsky, L.G. and Fleischer, M. (1990), The processes of technological innovation, Lexington, Massachusetts: Lexington Books.
Tushman, M. and Nadler, D. A. (1978). Information processing as an integrating con-cept in organization design. Academy of Management Review, 3 (3), pp. 613–624.
Venkatraman, N. (1994). IT-enabled business transformation: From automation to business scope redefinition, Sloan Management Review, 35 (2), pp. 73-87.
Ward, J., Taylor, P. and Bond, P. (1996). Evaluation and realisation of IS/IT benefits: An empirical study of current practice. European Journal of Information Systems, 4 (4), pp. 214-226.
Woodside, A.G. (2013) Moving beyond multiple regression to algorithms: Calling for adoption of a paradigm shift from symmetric to asymmetric thinking in data analysis and crafting theory, Journal of Business Research, 66, pp. 463-472.