ABSTRACT

Title of Dissertation:	A CONFIGURATIONAL APPROACH TO EXAMINING THE INFLUENCE OF INFORMATION TECHNOLOGY MANAGEMENT AND GOVERNANCE ON ORGANIZATION PERFORMANCE
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Information technology (IT) is becoming an increasingly crucial part of modern organizations. This dissertation includes two essays that examine how effective IT management and decision-making structure are associated with better organizational performance.

The first essay examines the complementarity between IT management and human resource (HR) management capabilities and discusses the mechanisms through which these two capabilities jointly lead to better organizational performance. The unique contribution of this study is the use of direct measures of IT management and HR management capabilities to estimate their joint impact on organizational performance. Furthermore, I disaggregate HR capability into two specific dimensions: (1) work systems such as employee performance management systems and hiring and promotion systems, and (2) employee learning and development. The main results confirm the complementarity between IT management and both HR management dimensions, and show that work systems more positively moderates the impact of IT management on organizational

performance based on financial and market measures. The study is supplemented with a configurational analysis that examines the complex relationships between the organizational capabilities and explain how the complementarity between IT management, work systems, and employee learning varies across sectors and relies also on the presence and absence of other capabilities such as leadership and strategic planning. The study compares the results of the conventional and configurational methods and highlights the unique insights derived from each approach.

The second essay discusses the optimal IT reporting structure in a firm, that is, whether the IT head should report to the chief executive officer or some other executive. This study proposes that there are several factors that determine the optimal IT reporting structure such as firm size, industry, IT investment intensity, and whether IT is viewed as strategic to the firm. The study argues that the relationship between these factors and the optimal IT reporting structure is too complex to be represented by linear models that rely on the correlation-based approach. Instead, there is a need to study configurations that lead to better performance based on different combinations of firm-level and industry-level conditions. The study uses a novel configurational approach and a corresponding method, the fuzzy-set qualitative comparative analysis, to determine the optimal IT reporting structure of different configurations. The study results shed light on the complex relationship between IT reporting structure and the conditions defining various firm configurations.

Together the two essays provide new insights on how successful IT management and governance structure lead to organizational success.

A CONFIGURATIONAL APPROACH TO EXAMINING THE INFLUENCE OF INFORMATION TECHNOLOGY MANAGEMENT AND GOVERNANCE ON ORGANIZATION PERFORMANCE

by

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Table of Contents

Chapter 1: Introduction and Overview

The expanding role of information technology (IT) in organizations has been attracting massive attention as technology has been increasingly seen as an agent of change and a source of competitive advantage. Therefore, it is critical for organizations to manage their IT resources more effectively and make the right technology-related decisions. My dissertation discusses two important issues related to the business impact of IT management and governance structure and provides insights on how an effective use of technology can lead to better organizational performance. The first study examines the relationship between IT management and human resource (HR) management capabilities and how their joint synergy leads to a competitive advantage. The second study analyzes one of the IT governance issues, which is IT reporting structure, and tries to explore how the optimal choice depends on several contextual factors. In each study I review the existing literature and take advantage of an emerging configurational approach and a corresponding method, the qualitative comparative analysis (QCA), to introduce a unique perspective to address the issues in the two studies. Unlike the conventional regression-based methods that aim to isolate and measure the additive linear effect of each variable, the QCA method inspect all the variables (or *conditions*) simultaneously and treat each observation (for example, a company) as a *configuration* formed by combinations of all causal conditions. The objective is to find which of these configurations are associated of an outcome of interest such as organizational performance. Although the conventional approach provides an appropriate methodology for measuring the relationships between single conditions and the outcome, it usually fails to account for the causal complexity embedded in the management issues of real organizations. The two studies demonstrate how the configurational methods can either be a complement or even an alternative approach to studying complex organizational issues.

The first study examines the complementarity between IT management and human resource management capabilities and discusses how these two capabilities jointly lead to better organizational performance. The study uses direct measures of IT management and HR management capabilities to estimate their joint impact on organizational performance. The study then breaks up the HR management capability into two dimensions: (1) work systems such as employee performance management systems and hiring and promotion systems, and (2) employee learning and development. Results of the main regression models confirm the complementarity between IT management and both HR management dimensions, and show that work systems dimension has a larger moderation effect on the impact of IT management on the financial and market performance of organizations. The study is supplemented with a configurational analysis that examines the complex relationships between the organizational capabilities and explain how the complementarity between IT management, work systems, and employee learning varies across sectors and relies also on the presence and absence of other capabilities such as leadership and strategic planning.

The second study discusses the optimal IT reporting structure in a firm, i.e., whether the IT head should report to the chief executive officer (CEO) or some other executive. Despite the widely held assumption among information systems academics and practitioners that firms are better off having their IT heads report to the CEO, this study argues that there is no simple answer to the IT reporting structure problem. The study proposes that there are several factors that determine the optimal IT reporting structure such as firm size, industry, IT investment intensity, and whether IT is viewed as strategic to the firm. The study argues that the relationship between these factors and the optimal IT reporting structure is too complex to be represented by linear models that rely on the correlational approach. Instead, there is a need to study configurations that lead to better performance based on different combinations of firm-level and industry-level conditions. The study uses a configurational approach to determine the optimal IT reporting structure for different configurations. The study results explores the complex relationship between IT reporting structure and the conditions defining various firm configurations.

Overall, the two studies provide theoretical and practical contributions on how effective IT management and governance structure lead to organizational success. The studies also provide new insights on how the neo-configurational approach can be utilized to advance research on the IT governance and the business value of IT. On one hand, the first study uses the QCA models to complement the findings obtained from the traditional regression models by examining how the two key independent variables act as two conditions within configurations consisting of a set of other conditions. On the other hand, the second study demonstrates a context in which the configurational method is the optimal approach to answering the research questions due to the inherent causal complexity that is difficult to be addressed by the conventional regression models.

Chapter 2: The Complementarity between Information Technology Management and Human Resource Management: A Multi-Method Approach

Abstract

This study examines the complementarity between IT management and human resource (HR) management capabilities and discusses the mechanisms through which these two capabilities jointly lead to better organizational performance. The unique contribution of this study is the use of direct measures of IT management and HR management capabilities to estimate their joint impact on organizational performance. I disaggregate HR capability into two specific HR management dimensions: (1) work systems such as employee performance management systems and hiring and promotion systems, and (2) employee learning and development. The results confirm the complementarity between IT management and both HR management dimensions, and show that work systems more positively moderates the impact of IT management on organizational performance based on financial and market measures. The study also takes advantage from a neo-configurational approach to study the complex relationships between the organizational capabilities and explain how the complementarity between IT management, work systems, and employee learning varies across sectors and relies also on the presence and absence of other capabilities.

2.1. Introduction

As information technology (IT) has become an integral part of many business activities in most industries, organizations need to pay more attention to the critical role of those technologies in improving performance and securing competitive advantage. Previous research has shown that IT investments per se are not enough to ensure competitive advantage (Mata, Fuerst, & Barney, 1995); it is IT management capability that allows organizations better capitalize their IT investments. While improving IT management capabilities can provide a solution for how to make advantage of IT to improve organizational performance, I want to examine how IT capabilities can interact with other organizational capabilities, specifically, human resources (HR) management capability to enhance performance. While each of these capabilities can independently improve firm performance, this study examines how they interact with each other to produce value. Therefore, the study tries to answer the following questions: (1) How does HR management capability moderate the relationship between IT management capability and organizational performance? In other words, does the presence of better HR practices such as effective work systems and employee learning enhance the business impact of IT management? (2) Which of the two main HR management components (i.e. work systems and employee learning) has a higher effect on the relationship between IT management and organizational performance? (3) Are the IT management and HR management capabilities (and their joint presence) necessary or sufficient conditions to achieve high performance? How the answers to this question change in the cases of presence and absence of other capabilities such as high leadership quality and strategic management?

A growing literature on IT complementarities has studied the synergies between IT investments and a number of other management practices such as decentralized decision-making authority among employees (Bresnahan, Brynjolfsson, & Hitt, 2002; Tambe, Hitt, & Brynjolfsson, 2012), employee incentives (Aral, Brynjolfsson, & Wu, 2012; Tafti, Mithas, & Krishnan, 2007), employee training (Bartel, Ichniowski, & Shaw, 2007; Tafti et al., 2007), and teamwork and information sharing (Bartel et al., 2007; Bresnahan et al., 2002). In addition, several studies have compared the business value of IT across countries, especially between the United States and Europe (Bloom, Sadun, & Van Reenen, 2012; Gust & Marquez, 2004; Haltiwanger, Jarmin, & Schank, 2003; Timmer & Van Ark, 2005). Those studies generally found that IT investments can explain the higher productivity of American firms. Among the interesting explanations for the American IT superiority are those suggested by Bloom et al. (2012). The study suggests that the management practices of American firms account for their higher output elasticity of IT. They show that American firms have higher scores on “people management” practices which enable them to use IT more effectively.

In this study, I build on these insights and present a new empirical evidence on the relationship between IT, HR, and organizational performance. While previous studies on the IT-HR complementarity are based on production economics and use IT spending measurements, my study treat IT management and HR management as intangible organizational capabilities. I argue that it is better when complementarities between IT and HR are studied at the level of organizational capabilities rather than at the level of expenditures. My study takes advantage of a dataset that has direct measurements of IT management, HR management, and organizational performance. I take those measurements from the Baldrige Criteria for Performance Excellence framework for the years 1997-2006. The Baldrige framework is highly recognized as a standard for quality management and is widely adopted in the United States and worldwide to track and improve organizational performance in many aspects such as leadership, strategy, customer management, performance analysis, process management, and human resource.

The main empirical analysis, which uses conventional regression-based methods such as ordinary least squares (OLS), fixed effect, and random effect models, reveals two general findings that support the notion of complementarity between IT management and HR management capabilities. First, the results show that organizations with higher HR management scores have higher impacts of IT management on organizational performance. Second, I compare between two HR components and find that effective work systems such as employee performance management systems and effective hiring and promotion systems have a larger impact on the value of IT management than employee learning and education.

While the conventional methods can successfully test the simple two-way interactions between the two main independent variables, they fail to explain the complex nature of organizational phenomena where a firm's conditions and resources are intertwined. I take advantage of a neo-configurational method, known as qualitative comparative analysis (QCA), to account for the complex interactions between the main organizational capabilities (leadership quality, strategic planning, IT management, work systems, and employee learning). This analysis shows the different configurations of these capabilities that are associated with high and low performance for five different sectors. These results reveal the complex relationships between the capabilities and explain how the complementarity between IT management, work systems, and employee learning relies also on the presence and absence of other capabilities. While conventional methods provide advanced techniques to support the main hypothesis, additional insights can be learnt from the configurational approach that account for the complex relationships between a firm's capabilities.

The paper advances as follow. In the next two sections I review the literature on the complementarity between IT and HR management and present the main hypothesis. Then I present the main empirical analysis and results, followed by the configurational analysis and findings. The paper concludes with discussions of main findings, the research's theoretical and practical contributions, and limitations.

2.2. Theoretical Framework

Researchers in the literature on business value of IT have used different approaches to explain the impact of IT and IT-enabled capabilities on organizations. One approach is to use production economics, which is specifically useful in providing empirical specifications to estimate the economic impact of IT (Mithas & Lucas, 2014). The other approach is to develop process-oriented theoretical models to link IT to the overall organizational performance through intermediate-level contributions (Barua, Kriebel, & Mukhopadhyay, 1995). According to this approach, the impact of IT on the higher order variables can be examined through internal firm processes, interorganizational relationships, and customer relationships (Mithas & Lucas, 2014). A related way to examine the business impact of IT investments or IT-enabled capabilities is to analyze their interaction with other management capabilities and how this *complementarity* impacts business performance. This study follows the latter category.

Powell and Dent-Micallef (1997) examine the role of information technologies in producing competitive advantage and discuss the conditions under which IT can create sustainable advantages. Based on the resource-based view, firms achieve sustainable advantages by accumulating resource portfolios that (a) produce economic value, (b) are relatively scarce, and (c) can sustain competitive attempts at imitation, acquisition, or substitution (Barney, 1986). Those resources can be protected from imitation through several mechanisms; among them is *resource embeddedness*. Under this mechanism, the value of a resource may be inextricably linked to the presence of another complementary or co-specialized resource. Complementarity represents an improvement of resource value, and occurs when a resource produces greater returns in the presence of another resource than it does alone (Powell & Dent-Micallef, 1997). Keen (1993) divides resources into human, business, and technology resources, and argues that the key to IT success lies in the capacity of organizations to fuse IT with latent, difficult-to-imitate, firm-specific advantages embodied in existing human and business resources.

Subsequently, many studies have investigated the synergy between human resources practices and IT investments and examined whether this complementarity creates embedded advantages that explain performance variance among firms. These HR practices include dimensions related to flexible work organization, teamwork, information sharing, decentralized decision making, employee autonomy, and training (Tafti et al., 2007).

Bresnahan et al. (2002) find that IT investment accompanied by work reorganization investments and a more highly skilled workforce contribute to firm-level productivity and strategic advantages. They suggest that “innovative work organization practices”, which include a combination of practices that encourage teamwork and decentralized decision-making authority among employees, when combined with IT investments will enable firms to cultivate their strategic advantages. Tambe et al. (2012) find that the combination of (a) external focus, i.e. the ability of a firm to detect and therefore respond to changes in its external operating environment, (b) decentralization and changes in decision rights, and (c) IT investments forms a three-way system of complements resulting in higher productivity levels. In addition, Bartel et al. (2007) examine the relationship between IT and new HR management practices, which include the use of employee teams, information sharing, and training in technical skills. They find that adoption of new IT-enhanced capital equipment coincides with increases in the skill requirements, notably technical and problem-solving skills, and with the adoption of new human resource practices to support these skills.

Some studies from this stream of research compare the impact of IT across countries. Those studies have indicated that the US firms is superior to their counterparts, specifically in Europe, in terms of other capabilities that are complementary to IT investments and are necessary to better exploit IT. For example, Bloom et al. (2012) analyze the “US productivity miracle” and attempt to find why European countries did not have a similar productivity acceleration as the United States in the sectors that use IT intensively in the period between 1995 and 2006. The study examines the differences in IT related productivity between US owned organizations, non-US owned organizations, and domestic organizations in a European environment. They find that the US multinationals obtain higher productivity than non-US multinationals and domestic firms from their IT capital. They suggest that the management practices of American firms account for their higher output elasticity of IT. Similarly, Basu, Fernald, Oulton, and Srinivasan (2003) suggest that benefiting from information and communication technology requires considerable complementary investments in learning and reorganization.

Most of the literature on IT and organizational co-investments has focused on general-purpose information technologies. A more precise view of IT and organizational complementarity is possible with exploration of complementarities between particular technologies and the specific systems of practices they are intended to support (Aral et al., 2012). For example, Aral et al. (2012) examine the complementarities among IT, HR analytics, and "pay for performance" to determine whether these practices can be effectively implemented piecemeal or rather must be introduced as a three-way "system of practices". They find that the adoption of human capital management software is greatest in firms that have also adopted performance pay and HR analytics practices.

Other studies have examined the complementarity between IT investments and HR practices specifically for IT personnel. Tafti et al. (2007) discuss how incentives and training of IT-producing functions of the firm can enable it to better leverage the value of its IT investments. If IT professionals are well-trained, motivated and empowered, that will enable them to make better strategic choices in allocating IT investments or implementing IT projects.

In general, most studies in the IT complementarities literature use production economics with IT capital as one of the inputs of the production function. While these studies address the moderating effect of HR management practices on the business value of IT, most of them do so through an economic lens based on IT capital investment measurements that do not capture IT management as an organizational capability, which is the main construct of my interest. This study, in contrast, uses a direct measures of IT management and HR management capabilities.

2.3. Hypothesis

2.3.1. The Complementarity between IT Management and HR Management

The resource-based view of the firm suggests that the search for IT-based sources of sustained competitive advantage must focus less on IT, per se, and more on the process of organizing and managing IT within a firm (Mata et al., 1995). It is the IT management, not merely IT investments, that is most likely to distinguish those firms that are able to gain sustained competitive advantages from their IT (Mata et al., 1995). I followed Roberts, Galluch, Dinger, and Grover (2012) definition of synergy as the increase in value resulting from the interaction of complementary organizational capabilities. According to the theory of complementarities, the value of an organizational capability can increase in the presence of other complementary organizational capabilities (Milgrom & Roberts, 1995). Specifically, complementarity occurs when the returns to a capability vary in the levels of returns to the other capabilities (Roberts et al., 2012).

The two focal organizational capabilities of this study are information technology (IT) management and human resource (HR) management. IT management is defined as the way an organization ensures the quality and availability of needed data for employees, partners, and customers. I hypothesize that differences in the quality of HR management within firms account for the variability in the impact of IT management. HR management is evaluated based on two main criteria: (a) work systems, that is, the extent at which organization's work and jobs enable all employees and the organization to achieve high performance through compensation, career progression, and related workforce practices and (b) employee learning, which indicates how employee education, training, and career development build employee knowledge, skills, and capabilities and hence support the achievement of the overall objectives and contribute to high performance.

Based on the evidence from the studies in the literature on the complementarity between IT and HR, firms can achieve better performance when their IT investments are coupled with better HR management. While these studies examined the complementarity between IT investments and HR management, I take one further step and argue for the complementarity between IT management as a capability and HR management and that this complementarity will have a direct impact on firm performance results. Even with a high-quality IT management and a highly skilled IT workforce that can effectively use information technology, firms can achieve better performance when those capabilities are fused with better HR practices through increased efficiency and customization because employees are incentivized, better educated, and empowered with more decision rights. Therefore, I posit that the impact of information technology management on firm performance is amplified in the presence of better HR management.

Hypothesis 1 (H1). The impact of IT management on a firm's performance is positively moderated by the firm's HR management.

2.3.2. The Complementarity between IT Management and Specific HR Components

An organization's HR management quality can be classified into two main categories: (a) work systems, and (b) employee learning. I study how the presence of each these two HR categories enhances the effect of IT management. *Work systems* refers to how compensation, career progression, and related workforce practices implemented in an organization enable the employees and the organization to achieve high performance. Work systems improve employee performance through better organization and management of work, employee performance management system, and hiring and career progression. *Employee learning* refers to how the organization's education, training, and career development build employee knowledge, skills, and capabilities in order to support the achievement of the overall objectives and contribute to high performance. My arguments on the complementary relationship between IT investments and those HR practices such as performance pay and employee training rely on the prior work in the literature. Bartel et al. (2007) study the relationship between IT and new HR management practices, which include the use of employee teams, and technical training. In addition, Aral et al. (2012) introduce three-way complementarities consisting of performance pay, human resource analytics and information technology. Finally, Tafti et al. (2007) consider how training and performance incentives for IT professionals enable firms use their IT investments more effectively. These previous studies focus on tangible IT investments when they examine the positive interactions between IT and the HR practices. However, according to theories of complementarities and resource embeddedness adopted in this study, complementarities between IT and other management practices should be inspected at the level of intangible organizational capabilities. In other words, the positive impact of better management of IT resources is higher in the presence of effective work systems and employee learning. For the first part, when employees are empowered and motivated by effective performance management systems they will make advantage of the powerful information systems enabled by better IT management. Second, the better management of IT solutions that serve the business is more capitalized when employees are trained and educated, especially about the available technologies and how they can be effectively used to achieve the business objectives. Therefore, I expect the impact of IT management to be positively moderated by each of the two HR components.

Hypothesis 2A (H2A). The impact of IT management on a firm's performance is positively moderated by the firm's HR work systems.

Hypothesis 2B (H2B). The impact of IT management on a firm's performance is positively moderated by the firm's employee learning and education.

2.4. Methods

2.4.1. Data

To test the hypotheses, I use data from the Baldrige Framework of business excellence. Since the commencement of the Malcolm Baldrige National Quality Award in 1987, the award has become a widely accepted model of performance excellence (Flynn & Saladin, 2006). The Baldrige Framework is designed to help organizations improve their processes, capabilities, and performance. Each participating organization has to complete a self-evaluation and answer questions in seven categories: (1) Leadership, (2) Strategy, (3) Customers, (4) Measurement, analysis, and knowledge management, (5) Workforce, (6) Operations and (7) Results. Each category consists of two or more items. Each received application is comprehensively reviewed by six to ten certified examiners, who give a numerical score for each item. The median value of scores given by all examiners is released as the independent review score. The National Institute of Standards and Technology (NIST) has released a public dataset that includes the participating US firms scoring data between 1991 and 2006. Because the Baldrige criteria have evolved over the years and to avoid changes in items definitions, I will restrict my data for the period from 1997 to 2006. The final sample consists of 525 observations with independent scores. The applicants are classified into six sectors: manufacturing, service, small business, education, health, and non-profit. Table 2.1 summaries the observations across years and sectors. Among the 325 unique organizations that represent my sample, I have 211 organizations that appear only once in the dataset, 63 organizations that appear twice, 31 organizations that appear three times, 10 organizations that appear four times, 6 organizations that appear five times, 3 organizations that appear six times, and 1 organization that appear seven times. Because of this unbalanced nature of my data, I pool all the 525 observations in the primary analysis to run an ordinary least square (OLS) regression then I use panel models as robustness checks.

2.4.2. Variable Definitions

The dependent variable, *organizational performance* (PERFORMANCE), measures the financial and market performance. It is a single measure that takes into account two main criteria (a) financial performance, based on aggregate measures of financial return and economic value such as return on investment, profitability, and liquidity, and (b) market performance, based on market share, growth, and new markets entered.

The two main independent variables are information technology (IT) management and human resource (HR) management. *IT management* (ITMGMT) is defined as the organization's ability to ensure the quality and availability of needed data for employees, suppliers/partners, and customers. IT management is measured by how an organization ensures (a) data availability and information integrity, reliability, accuracy, timeliness, security, and confidentiality and (b) hardware and software quality (i.e. reliable and user friendly, and current with business needs and directions). The other key variable, *HR management* (HRMGMT), measures the extent at which an organization's work systems and employee learning and motivation enable employees to develop and utilize their full potential in alignment with the organization's overall objectives and strategy. The HR management variable measures two main criteria: work systems and employee learning. *Work systems* (WORKSYS) indicates the extent at which compensation, career progression, and related workforce practices enable employees and the organization to achieve high performance. It is measured through the following criteria: (a) how organization and management of work promote cooperation, initiative, innovation, and organizational culture and achieve the agility to keep current with business needs, (b) employee performance management system, which includes compensation, recognition, and feedback to employees, and (c) hiring and career progression. *Employee learning* (LEARN) indicates how an organization's employee education, training, and career development support the achievement of the overall objectives and contribute to high performance. It is measured through the following criteria: (a) how an organization's employee education, training, and career development support the achievement of the overall objectives and contribute to high performance, and (b) motivation and career development, i.e., how an organization helps employees attain development and learning objectives motivates and help them develop and utilize their full potential. I will use the two HR criteria separately to test the second set of hypotheses (H2A and H2B).

In order to rule out issues related to the endogeneity of the key independent variables, the model controls for leadership quality (LEAD) and strategic planning quality (STRATEGY). *Leadership quality* is measured as the effectiveness with which senior leaders guide a business unit through values, directions, and performance expectations and their review of organizational performance. So, it measures senior leadership's personal involvement and visibility in maintaining an environment for performance excellence. *Strategic planning quality* evaluates how an organization develops strategic objectives and action plans, how the chosen strategic objectives and action plans are deployed and changed if circumstances require, and how progress is measured.

I also control for industry sector, which includes manufacturing (MANUF), service (SERVICE), small business (SMALL), education (EDUC), healthcare (HEALTH), and nonprofit. Finally, the models include a variable that indicate the year the measurements were taken (YEAR) to control for economy-wide effects and possible changes in the rating criteria. Table 2.2 shows summary statistics and Table 2.3 shows correlations for the key variables included in the model.

2.4.3. Primary Analysis: Regression Model

In the primary analysis, I use ordinary linear regression (OLS) with the following equation:

$$PERFORMANCE = \beta_0 + \beta_1 \cdot ITMGMT + \beta_2 \cdot HRMGMT + \beta_3 \cdot ITMGMT \cdot HRMGMT + \beta_4 \cdot LEAD + \beta_5 \cdot STRATEGY + \beta_6 \cdot MANUF + \beta_7 \cdot SERVICE + \beta_8 \cdot SMALL + \beta_9 \cdot EDUC + \beta_{10} \cdot HEALTH + \varepsilon_1 \qquad (1)$$

The main objective is to show that the impact of IT management on organizational performance is positively moderated by HR management. Therefore, I can evaluate the first hypothesis by examining the coefficient of the interaction term (ITMGMT*HRMGMT). For the second set of hypotheses (H2A and H2B), the HR variable will be replaced by the corresponding HR component variables, WORK and LEARN.

As robustness checks, I take advantage of the organizations that appear in the sample multiple times and run fixed-effects and random-effects models. Despite the fact that the panel is severely unbalanced which should considerably reduce the significance of the results, the results remain robust.

2.4.3.1. **Results: The Complementarity between IT Management and HR Management**

The first hypothesis (H1) predicts that the impact of IT management on organizational performance is positively moderated by better HR management. A summary of the results of the OLS, fixed effects (F.E), and random effects (R.E) regression models are shown in Table 2.4. The coefficient of the interaction term (IT Management * HR Management) is positive and significant at 0.01 level, supporting H1. The coefficients of the main control variables, leadership quality and strategic planning quality, are positive and significant as expected. Although the IT Management variable appears to have negative and insignificant coefficient, the overall effect of IT management can be calculated by taking into account both the main variable and the interaction variable. At the average value of HR management, IT Management has an overall coefficient of 0.2092. These results confirm the positive synergy between IT management and HR management, which leads to better organizational performance. That is, the impact of IT management on performance is higher for organizations with better HR management. Figure 1 illustrates the main findings by showing the relationship between IT management (x-axis) and firm performance (y-axis) for three levels of HR management score. The figure shows that IT management has higher effect (larger positive slope) on performance when the level of HR management is higher.

2.4.3.2. Results: The Complementarity between IT Management and HR Components

The previous analysis focuses on the complementarity between IT management and the overall HR management of an organization. Now, I turn my focus to two specific components of HR: (a) work systems and (b) employee learning and motivation, to study each component's particular complementarity with IT management. Now that I have established the effect of general HR management on the relationship between IT management and organizational performance; I am interested in investigating which HR component has more influence on the value of IT management. Both components, works systems and employee learning, are suggested in prior literature among the management practices that can enable organizations use technology more effectively. Because the two HR items are highly correlated, which introduces multicollinearity, I start by using the two items in separate models then I add them together in one model to compare between the two coefficients. Table 2.5 summarizes the results. Model 1 includes the variable work systems (WORK) only. The interaction term ITMGMT * WORK is positive and significant, supporting H2A. Model 2 includes the variable employee learning (LEARN) only. The interaction term ITMGMT * LEARN is also positive and significant, supporting H2B, and has a lower value than the corresponding coefficient in Model 1. When I include both HR items in the equation as in Model 3 (third column of Table 2.5), the two interaction terms loss their significance as expected, while ITMGMT * WORK still has a higher value than ITMGMT * LEARN. I performed a Wald test to see whether the two coefficients have statistically different values. The test indicates that the coefficient of ITMGMT * WORK is significantly larger than the coefficient of ITMGMT * LEARN. I conclude that the people management practices that form a more powerful synergy with IT management are those related to the compensations and career progression that enable employees to achieve better performance.

2.4.3.3. The Endogeneity of IT Management and HR Management

It can be argued that unobserved variables such as "good management" are correlated with the independent variables and also with the dependent variable. This would cause independent variables to be correlated with the error term, which in turn would lead to biased estimated coefficients. Here, I present three arguments to address this issue. First, all the models included two control variables, leadership quality and strategic planning quality, which are conceptually highly correlated with the unobserved management quality. Second, any unobserved management-related factors are commonly "quasi-fixed" as they don't change significantly during a relatively short period of time. Therefore, a panel model, which controls for time-invariant organizational specific factors, is another way to rule out the mentioned endogeneity issue. Finally, the estimates of the interaction variables are, in general, less subject to omitted variable bias than the main effects estimates. It is easy to argue that good management, for example, is correlated with the two independent variables, IT management and HR management, individually as well as the dependent variable, organizational performance. So, omitting this variable can overestimate the main effects of each of IT management and HR management. However, it is unlikely that excluding "good management" variable also leads to overestimation of the interaction variable because this would require a much more unusual unobservable factor that increases the effect of IT management on organizational performance only in the presence of better HR management but not in its absence (Tambe et al., 2012).

2.4.4. Quantitative Comparative Analysis

While the regression models in the previous analysis have successfully supported the main hypotheses on the positive interactions between IT management and HR management, these conventional methods still have some limitations. First, the basic way to capture complementarities using regression methods is to add interaction terms, which can measure only two-way or three-way complementarities at its best. As we increase the number of interacting variables, the conventional methods fail to accommodate these complex interactions as it becomes hard to obtain statistically significant results and to find meaningful economical interpretations of the results. Consequently, conventional methods cannot examine the complex entangled relationships between several organizational capabilities similar to those in this study. Second, regression methods are based on the notion of correlations that assume symmetrical relationships between variables. For example, if variables x and y are correlated then high values of x are associated with high values of y, and low values of x are associated with low values of y. This correlational notion fails to address the fact that presence of a specific condition or a combination of conditions is *sufficient* to achieve a specific outcome meanwhile the absence of this condition does not necessarily lead to the absence of that outcome. The outcome can be achieved by the presence of other means or conditions. This *causal complexity* cannot be examined using correlation-based methods, which assume symmetric relationships between causal conditions and outcomes. That is, if a set of variables or combinations of variables are associated with high performance, for example, then the absence of these variables is automatically considered to be associated with low performance and, hence, there is no need to look for other conditions that could lead to low performance.

To address these limitations inherent in correlation-based methods, I implement a configurational approach that is based on set theory and Boolean algebra. A prominent method under this approach is the *Qualitative Comparative Analysis (QCA)*, which is designed to explain how causal conditions combine to form configurations that are associated with an outcome of interest (Ragin, 2008). In this method, each variable is treated as a set and the value of each variable represents a membership value for each observation to each set, including the outcome set. If the set membership can only take the value of 0 or 1, then this method is called *crisp-set QCA*. A more advanced method is the *fuzzy set QCA (fsQCA)*, which allows for partial memberships in sets. A set membership can take any value from 0 (full non-membership) to 1 (full membership).

In the QCA methods, each observation (or case) belongs to one of the *types* defined by different *configurations* of the causal conditions. In our settings, an organization A, for example, can belong to the type of those organizations with high leadership quality, high strategic planning, and low IT management. The QCA methods, therefore, allow for unlimited interactions between all available conditions (i.e. variables). In addition, unlike correlation-based conventional methods, the QCA methods allow for *causal asymmetry* between the conditions and the outcome. Therefore, conditions or combination of conditions that are associated with the presence of an outcome can be categorically different from those associated with the absence of the outcome. Finally, our configurational approach does not only show the associations between a condition or a combination of conditions and an outcome but can show multiple configurations that can lead to the same outcome, a notion known as *equifinality*.

The QCA method generally involves three basic steps. The first is *set calibration*, which is transforming each variable into a value from 0 to 1 representing set membership. The second step is establishing a truth table, where rows represent every possible combination of conditions. The output of the truth table algorithm is all the rows that are considered sufficient for the outcome. In the last step, a *minimization* algorithm is used to simplify the solution (i.e. the set of sufficient combinations) by combining and deleting configurations using the rules of Boolean algebra. Three different minimization approaches are commonly used to generate three types of solutions: a complex "conservative" solution, a parsimonious solution, and an intermediate solution. For more details on the QCA procedure, refer to the second chapter of this dissertation.

In this study's settings, the models includes five conditions: leadership quality, strategic planning quality, IT management, work systems, and employee learning. The truth table, therefore, consists of 32 rows representing all possible combinations of the five conditions. The *frequency cutoff* is set to 3, meaning that any specific configuration will be considered as empirically observable if it includes at least three cases. In addition, *consistency cutoff* is set to 0.8, meaning that a configuration is considered to be sufficient for the outcome if 80% of the cases that belongs to this configuration pass the sufficiency test. Using the QCA package in R, I implement the truth table algorithm for five sectors separately: manufacturing, service, education, small business, and healthcare. The not-for-profit sector is not included due to the limited number of cases. For each truth table, three types of solutions are generated according to the QCA procedure suggested by Duşa (2018): a complex solution, an enhanced intermediate solution, and an enhanced parsimonious solution. Tables 2.6 to 2.10 show graphical representations of the QCA solution of the five sectors. The left panel of each table shows the configuration associated with high performance while the right panel shows the configuration associated with lower performance.

Core elements are those that appear in both the parsimonious and intermediate solutions, while peripheral elements are those that appear in the intermediate solution only.

The solutions provide fine-grained insights not only on the relationships between IT management and the two HR components, but also on the complex interactions between all the five organizational capabilities. The results reveals that the complementarity between IT management and other management capabilities varies by sector and based on the presence and absence of the other capabilities.

Results for the manufacturing sector (Table 2.6) show that there are four organizational configurations that are associated with high financial performance. The first configuration of high performance (H1) indicates that leadership quality and strategic planning quality are together sufficient for high performance regardless of IT and HR capabilities. The raw coverage value of this configuration reveals that more than 80% of manufacturing organizations with high performance belong to this configuration. In the absence of high leadership quality, firms in the manufacturing sector can still achieve high performance if IT management is high (H2) or both HR components are high (H3). The fourth configuration (H4) show that organizations with good leadership quality can also achieve high performance when high IT management is fused with high employee learning even in the low score of work systems. The right panel of Table 2.6 show the three configurations associated with “not high” performance. Configuration N3 show an intriguing scenario where even in the presence of high leadership and employee learning, organizations will not achieve high performance in the absence of work systems and, to a lower extent, strategic planning quality. A quick comparison between H4 and N3 reveals the critical role of IT management in manufacturing organizations that have high employee learning and low work systems.

In the service sector (Table 2.7), the only configuration of high performance demonstrates that firms with good leadership and strategic planning can achieve high financial performance if they couple high IT management with high employee learning. This configuration covers 73% of the cases of high performing firms in the service sector. The configurations of not high performance on the right panel reveal the critical role of strategic planning in the service sector, especially when the absence of strategic planning is joint with the absence of leadership quality or either of the HR components.

In contrast, small businesses (Table 2.8) can achieve high performance when good leadership and strategic planning are coupled with good work systems. The right panel, on the other hand, shows that the absence of both IT management and employee learning is associated with low performance even in the presence of high leadership and work systems.

Results for the education sector (Table 2.9) reveal some interesting findings. The left panel shows two sets of "recipes" of high performance. Organizations can achieve high performance when their high scores of leadership and strategic planning are coupled with high scores of work systems and either of employee learning and IT management. In addition, the right panel shows three configurations of "not high" performance in the education sector. First, low scores of both leadership quality and strategic planning quality are sufficient for low financial performance. In addition, regardless of leadership quality and in the absence of good strategic planning, low scores of IT management can lead to low performance if any of the two HR components is absent. These findings indicate the complex interactions and substitutions in relationship between IT management and HR capabilities in the education sector.

The results for the healthcare sector show similar patterns. The left panel of Table 2.10 shows that there are three organizational configurations that are sufficient for high performance in the healthcare sector. The three configurations indicate that organizations can achieve high performance by having high scores in any two of the IT management, work systems, and employee learning. Leadership and strategic planning appears in the three configurations with the exception of H1 where strategic planning is not present. In this case, the combination of IT management and work systems is sufficient regardless of strategic planning quality.

Overall, the results of the configurational analysis reveal how complexity varies across the five sectors. Organizations in the manufacturing sector can achieve high performance by following one of the four available configurations of the organizational capabilities. In the service sector, in contrast, there is only one configuration for achieving high performance, which is maintaining high scores of leadership quality, strategic management, IT management, and employee learning. In other words, while organizations in the manufacturing sector have four alternative recipes to achieve high performance, there is only one way to succeed in the service sector. This might indicate the complexity and the management challenges that characterize industries in the service sector. Similarly, the configurations of "not high" performance (shown in the right panels of Tables 2.6 to 2.10) reveal the different configurations associated with lower performance. One notable observation is the five different configurations of low performance in the healthcare sector, which might demonstrate the complexities facing organizations in this sector as indicated by the several "traps" that can lead to failure.

2.5. Discussion

2.5.1. Research Contribution

Many previous studies have analyzed HR management and other complementary investments that can enhance the benefits of IT investments. Those studies mainly focused on the effect of those complementary investments on the relationship between the tangible IT investments and firm productivity. In this study, I suggest that it is better when these complementarities are studied through the lens of the intangible organizational capabilities. The objective of this study is to analyze and investigate in further details the complementary relationship between IT management as an organizational capability and HR management. I measure HR management as the level at which an organization allow its employee achieve higher performance through work systems and employee learning and motivation. I found that HR management positively moderate the impact of IT management on firm performance. The study makes several key contributions. First, previous studies have established the complementarity between IT investments and HR management by using production economics that treat IT investments as an input to the production function. My study, in contrast, follows the resource-based view of a firm that focuses less on IT per se and more on IT capabilities. To my knowledge, this study is the first to investigate the synergy between IT and HR as organizational capabilities. The study finds that the returns to IT management capability varies for different levels of HR management. Second, the study uses a unique and direct measurement of HR management. I also untangle this measurement into two main items: works systems and employee learning. The study finds that effective work systems have higher impact on the value of IT management than employee learning and motivation. Third, an important feature of my data is that it includes organizations from six different sectors, which are manufacturing, service, healthcare, education, small business, and nonprofit. Therefore, my main findings are not tied to a specific sector and can be generalized to most types of organizations.

In addition to the insights from the main regression-based analysis, the study is also supplemented with analysis using configurational approach that reveals the complex interactions between several organizational capabilities. This analysis examines the importance of the synergy between IT management, work systems, and employee learning in the presence and absence of other organizational capabilities. It also studies whether and when IT management and the two HR components work as complements or substitutes. All these configurational models have been analyzed for five different sectors separately.

While the main regression models present robust evidence to support the main hypothesis on the complementarity between IT management and HR management practices, the QCA analysis provides additional insights that cannot be revealed using the conventional methods. First, while regression-based methods isolates and measures the linear additive effect of each individual organizational capability and the two-way interaction of capabilities, the QCA approach views organizations as configurations of these capabilities. In other words, one implicit assumption in the regression models is that the effect of each condition (i.e. capability) can be individually measured after controlling for all other variables. The configurational approach, in contrast, maintains that each capability may have completely different effects depending on the presence or absence of other capabilities. In our context, while the regression results show that the presence of good HR management positively influences the impact of IT management on firm performance, these results cannot examine whether high HR management, IT management, and their joint presence are necessary or sufficient conditions to achieve high performance and whether these answers hold in the presence and absence of high leadership quality and strategic management. For instance, our QCA results show that maintaining high scores of IT management and employee learning is part of the only configuration of high performance in the service sector, meanwhile it is sufficient to have high scores of leadership and strategic planning in the manufacturing sector. The second advantage of the configurational method is that it shows that high organizational performance can be achieved through different configurations or recipes. For example, in the healthcare sector, although leadership is found to be a necessary condition that also appears in all configurations of high performance, organizations can achieve high performance using either of three recipes based on some combinations of the other four organizational capabilities. In this way, we can examine whether and how these capabilities complement and substitute each other. Third, the configurational method challenges one of the assumptions of the correlation-based method that imply that the relationships between causal conditions and the outcome is symmetric. By maintaining *causal asymmetry*, the configurational method allows us to examine the configurations of both high performance and low performance, which are not assumed to be simply opposites of one another. For example, one of the configurations of high performance (H1) in the manufacturing sector shows that leadership and strategy are sufficient for high performance. However, the absence of these two capabilities does not necessarily lead to low performance. The configuration H3 indicates that organizations in the manufacturing sector can achieve high performance through high scores of work systems and employee training in the absence of high leadership quality and strategic planning.

2.5.2. Practical Implications

The research findings have important managerial implications. The results suggest that IT management has a positive impact on organizational performance, but this effect is boosted in the presence of better HR management. As information systems have become an integrated part of all business activities, the management of these systems is getting more critical to the organization success. While it important for an organization to ensure high performance of its IT department and provide employees with the right technology, it is also important to provide employees with the environment that allows them to use technologies more effectively. The study concludes that empowering employees with two categories of HR practices will ensure better value of IT use. The first category is to implement work systems that promote cooperation and innovation culture and implement an effective employee performance management system by setting the right compensation, recognition, and incentive practices. Previous research has found that IT employees perform better when provided with the right incentive (Tafti et al., 2007). My study indicates that employees in general are expected use IT more effectively in the presence of better incentive systems. The second set of HR practices that allow employees to better utilize IT is employee learning. It is important that employees are well educated about the information systems they use and their different features as well as other changes related to these technologies. However, employee training should not be restricted to the technical side of the systems implemented in the organization; training should also include domain-specific education and knowledge related to the relevant market and industry. In other words, employees should be educated about how the IT systems support their core business so that they utilize these systems to meet the firm's business needs and hence achieve better alignment between IT and business.

2.5.3. Limitations and Future Extensions

There are some limitations to this study, which also represent opportunities for future research. First, the nature of the Baldrige dataset presents some challenges. Most of the organizations appear only once throughout the years in the sample, therefore it is not possible to implement additional advanced models that require a more balanced data. Another limitation of the data is that it does not include additional information about organizations such as size and financial data, which can be used as control variables that enhance the results. The ability to identify the companies in the dataset would also have allowed us to improve insights derived from the QCA models by analyzing the types of companies belonging to different configurations leading to high and low performance. This would have allowed us to have a better dialog between data and theory. In addition, organizations in the sample voluntarily apply to the Baldrige National Award. This introduces sample selection issue that might affect the generalizability of results. The mentioned issues can be addressed if the study can be replicated with similar dataset but with more balanced panel and non-voluntary applicants. The results can also extended by comparing the business value of IT across countries. Bloom et al. (2012) have already found that "people management" explains the superiority of US firms in terms of production elasticity of IT. Future studies can use the Baldrige framework to compare the IT-HR complementarity across multiple countries. Finally, the complementarity between IT and HR management capabilities can open the door for research that studies other types of capabilities that can form synergies with IT management.

Chapter 3: The Information Technology Reporting Structure and Firm Performance: A Configurational Approach

Abstract

With the increasing recognition of the strategic role of information technology (IT) in modern organizations, prior studies have called for a direct reporting relationship between the IT head and the chief executive officer. Unlike prior studies that focus on the effect of IT reporting on firm performance, we propose a configurational lens to assess how several factors, such as firm size, industry, IT investment intensity, and the strategic role of IT in a firm, combine to determine IT reporting structure that yields high performance. Viewing firms as configurations based on different combinations of contextual causal conditions, I examine the optimal IT reporting structure for different configurations by using a configurational approach and a corresponding method, the fuzzy-set qualitative comparative analysis. I obtain a dataset from a survey of 154 firms in India, where senior IT representative answered questions about IT investments and IT decision making structure. The sample is matched with a public data on the financial performance measurements used as the outcome. The study results shed light on the complex relationship between IT reporting structure and the conditions defining various firm configurations.

3.1. Introduction

Given the critical role and importance of information technology (IT) in contemporary organizations, there is an increased emphasis on creating the right governance mechanisms to achieve alignment between strategies and execution (De Haes & Van Grembergen, 2009; Lee & Mithas, 2014; Leonhardt, Hanelt, Huang, & Mithas, 2018; Mithas & Rust, 2016). In this context, researchers have often emphasized the importance of IT governance for firm performance (Mithas & McFarlan, 2017; Weill & Ross, 2004). Although other aspects of IT governance such as those relating to allocation of decision rights, broader corporate governance, the role and structure of the IT department, determining the levels of IT investments and justifying IT investments, and options for IT delivery such as outsourcing, in-house, and hybrid arrangements for firm performance (Han & Mithas, 2013; Joshi, 2019; Lim, Han, & Mithas, 2013; Liu, Kude, & Mithas, 2015; Xue, Mithas, & Ray, 2014) have received significant attention, relatively fewer studies have focused on who the IT heads should report to considering contextual factors in a firm’s competitive environment. IT heads, whether they are named IT managers, vice presidents of technology, or chief information officers (CIOs), are ever more viewed as key contributors to formulating strategic goals in addition to their traditional role of managing the firm's information resources. The IT head of today is not only expected to manage IT infrastructure and coordinate the use of technology throughout the firm but also to lead IT strategic initiatives, offer vision for the role of technology in the firm, promote IT as an agent of business change, and accordingly create business value (Banker, Hu, Pavlou, & Luftman, 2011; Krotov, 2015).

As information technologies has gained fundamental roles and also become subject to large capital investments, the IT decision making structure grows into a critical concern to contemporary firms. One of the important issues on how to make IT related decisions is the IT reporting structure, that is, whom the IT head should report to. This issue has attracted significant debate among IT practitioners about whether the IT head, or the CIO, should report to the chief executive officer (CEO), the chief financial officer (CFO), the chief operations officer (COO), or other executive or manager. The proponents of the CIO-CEO reporting structure argue that moving the IT organization up to the C-suite allows for more direct visibility of business initiatives, challenges and operations (Shiver, 2017), which leads to better alignment between business and IT (Luftman & Kempaiah, 2007). In addition, reporting to the CEO gives the CIO more influence on the overall business strategy (Kuebler, 2011) and therefore better chance for leading IT-driven transformation. They also draw attention to some issues that may arise when the CIO reports to another executive, especially the CFO. For instance, some argue that the CIO-CFO reporting structure puts too much focus on the financial impact of IT operations and not enough focus on IT's impact on business operations and growth (Ingevaldson, 2005; Shiver, 2017; White, 2015). As a result, IT could be pushed to a purely operational rule, thereby hurting the creation of new digital capabilities (Heller, 2017), or the ability for IT to be a strategic enabler within the organization (Chillingworth, 2014). On the other side of the debate, the opponents of the CIO-CEO reporting structure cite several issues such as CIO's underestimation of costs, communication problems, and conflicts of interest (Brans, 2014). Therefore, they recommend that the IT head should report to other executives such as the CFO or the COO. There is also recognition that there may not be an easy answer to this problem as the optimal reporting structure may vary based on factors such as the IT's role in the business, individual characteristics of the CEO and the CIO, firm size, industry, and company strategy (Brans, 2014; Raskino, 2011; Tillmann, 2009).

Among the academic studies in the information systems (IS) literature, several discuss the advantages of the CIO-CEO reporting structure (Preston & Karahanna, 2009; Raghunathan & Raghunathan, 1989, 1993; Saldanha & Krishnan, 2011; Watson, 1990; Zafar, Ko, & Osei-Bryson, 2016). Banker et al. (2011) follow a contingency perspective and argue that the optimal IT reporting structure depends on the strategic positioning of a firm, i.e. whether a firm is pursuing differentiation or cost leadership. Specifically, firms that align their IT reporting structure with their strategic positioning (i.e., a differentiation strategy with a CIO–CEO reporting structure or a cost leadership strategy with a CIO–CFO reporting structure) have superior future performance.

My work in this study extends the work of Banker et al. (2011), and uses a configurational view to argue that the search for a universally optimal IT reporting structure may be futile in that there may be multiple configurations of IT reporting structure that can yield high performance. Instead of assessing the importance of each contingency factor in isolation, there is a need to study these factors jointly to understand how different configurations of these factors affect performance. In particular, we examine whether the IT head should report to the CEO, CFO, or the COO based on firm size, industry, IT investment intensity, and whether the firm views IT as strategic or operational. We argue that the effect of each of these factors cannot be examined independently from other factors. For example, there is no straightforward answer on the optimal reporting structure for small versus large organizations or for those firms with high IT intensity versus those with low IT intensity. Instead, we treat each organization as a configuration of these characteristics along with its IT reporting structure to find which of those configurations lead to high financial performance, as measured by return on assets (ROA). The conventional variance-based methods such as linear regression are designed to measure the individual effect of each variable independently; these linear terms are added to produce the overall effect. The typical way to study the joint effect of two variables is to add interaction effects to the model to analyze how the effect of each variable varies depending on the presence (or different levels) of other variables. This moderation analysis gets more complicated and hard to interpret when having more than two variables. Therefore, we use fuzzy- set qualitative comparative analysis (fs-QCA), a neo-configurational approach that is based on set theory and Boolean algebra, to account for complex and unexplored interactions among firm-level and industry- level conditions that affect the optimal IT reporting structure. With fs-QCA, we are able to split all the cases (i.e., firms) into configurations of variables to assess whether each configuration is a sufficient condition for high or not-high firm performance. For example, we can test whether a configuration of large, low IT intensive manufacturing firm with IT-CEO reporting structure meets the conditions for sufficiency for high financial performance. Our analyses use survey data of 154 firms in India matched with data on the financial performance from another publicly available source.

3.2. Theoretical Framework

The extant IS literature has discussed many issues related to the highest IT executive in a firm, such as CIO roles (Chun & Mooney, 2009; Ding, Li, & George, 2014; Hütter & Riedl, 2017), CIO effectiveness and influence (Enns, Huff, & Higgins, 2000; Smaltz, Sambamurthy, & Agarwal, 2006), the inclusion of the CIO in the top management team (Hu, Yayla, & Lei, 2014; Luo, 2016; Ranganathan & Jha, 2008; Zafar et al., 2016), whether a CIO position exists in a firm (Chatterjee, Richardson, & Zmud, 2001; Lim et al., 2013), CIO's decision-making authority (Preston, Chen, & Leidner, 2008), CIO characteristics (Armstrong & Sambamurthy, 1999; Corsi & Trucco, 2016; Csaszar & Clemons, 2006; Li & Tan, 2013; Lim et al., 2013), CIO communication with other executives (Enns et al., 2000; Feeny, Edwards, & Simpson, 1992; Johnson & Lederer, 2006; Karahanna & Preston, 2013), and finally the IT reporting structure.

The vast majority of studies on the IT reporting structure suggest advantages of the direct reporting relationship between the IT head and the CEO. For example, Raghunathan and Raghunathan (1989) show that CIOs who report to CEOs have expanded organizational roles and more effective IT planning. They also argue that the closer the IT manager is to top management, the more feasible it would be to maintain awareness on critical issues and trends affecting information management. Watson (1990) shows that IT managers who report directly to the top executive have a greater understanding of organizational goals, which in turn may impact their assessment of key issues. In addition, Preston and Karahanna (2009) conclude that the CIO who reports to the CEO and is a member of the top management team (TMT) will have a better understanding of the strategic needs of the business and the “mindset” of top management, leading to congruent IT vision and IT-business alignment. Similarly, Zafar et al. (2016) argues that a closer reporting relationship between the CIO and the CEO develops a trusting relationship and improves the CIO’s deep understanding of business and enhances his or her capabilities. As a result, the CIO becomes effective as an integrator between business and IT, influencing organizational support for the IT related decisions. Finally, Saldanha and Krishnan (2011) find that IT-enabled business innovation is more likely when the CIO reports to the CEO.

In contrast to these studies, Banker et al. (2011) argue that the optimal reporting structure depends on a firm's generic strategic positioning. Differentiators are better off having their CIO reports to the CEO while cost leaders are better off having their CIO reports to the CFO. We extend Banker and his colleagues' argument further by using a configurational view, and suggest the need for considering many other factors that can also influence the optimal reporting structure.

3.3. Conditions Influencing IT Reporting Structure

I first show that whether the IT head should report to the CEO, the CFO, the COO, or other executive depends on several factors. Then, I argue that each of these factors cannot be analyzed independently and in isolation from other factors. Instead, we need to study them jointly so that each firm is considered as a configuration of different firm-level and industry-level characteristics and then we can study how these configurations influence firm performance.

I propose that optimal IT reporting structure depends on several conditions, namely, firm size, industry, IT investment intensity, and whether the firm views IT as strategic or operational. First, firm size can affect the optimal reporting structure in many ways. Larger firms tend to have more complex structural hierarchies and extra reporting levels; therefore larger firms might be less likely to have the IT head directly reporting to the CEO. In addition, larger firms with large IT departments are more likely to have dedicated attention to IT planning and budgeting while smaller firms' IT function can be combined with other supporting functions.

Second, a firm's industry can also play an important factor in determining the optimal IT reporting structure. IT can play different roles in different industries and these roles may impact how the IT investments are planned and managed within a firm regardless of the individual firm's strategic positioning. For example, some studies in the IS literature classify industries into three categories based on the role IT plays in firms in the industry: Automate, Informate, and Transform. In Automate industries, the IT main role is to replace human labor by automating business processes. Informate industries use IT to provide information to empower management and employees. Finally, IT in Transform industries fundamentally alter traditional ways of doing business by redefining business processes and relationships (Chatterjee et al., 2001). Previous studies have analyzed the presence of a CIO position in those different industry categories. Lim et al. (2013) find that the impact of CIO's position on IT investments is much greater in "Transform" industries compared to "Automate" and "Informate" industries. In addition, Chatterjee et al. (2001) find that announcements of newly created CIO positions provoke positive market reactions for firms competing in industries undergoing IT driven transformation. Therefore, the highest level IT executive has different roles and levels of power and influence in those different types of industries.

Third, even those firms operating in the same industry can vary substantially in terms of their levels of IT investments. Firms with higher IT investment intensity may require more top management visibility for IT and a special attention to key decisions about IT utilization. This can be achieved through a dedicated seat for the CIO in the top management team and through a direct reporting to the CEO. Lim et al. (2013) find that a CIO position has stronger impacts in IT intensive firms than in non-IT intensive firms. However, it is possible to argue that IT intensive firms may require that those IT investments be placed under close scrutiny by finance-savvy executive such as the CFO to guide and control these investments.

Fourth, firms are also different in their IT orientation, that is, the way they view their IT investments. For some firms, IT plays a crucial role in their core business and is a part of their business strategy. Those firms view their IT investments as strategic investments. Other firms, in contrast, use IT mainly to improve operational efficiency and consider IT as a support function. Here IT is treated as a cost center that plays no central role in their business strategy. Firms whose IT head reports to C-level executives tend to have a strategic IT orientation, whereas firms whose IT head reports to other managers often have an operational IT orientation (Banker et al., 2011). Therefore, the optimal IT reporting structure is expected to be different for firms with different IT orientations. We propose that IT orientation is a firm-level attribute regardless of the industry and market where the firm competes. For example, even in the banking industry where information technologies are assumed to play a transformative role, firms may vary in how they view the main purpose of their IT investments. This general notion is also supported by the low correlation between IT orientation and industry categories in our dataset. Furthermore, a firm's IT orientation does not imply its IT investment intensity. For example, even those firms that use IT mainly for cost reduction might invest more in IT initiatives that promote lean operations, tight cost management, automated processes, cost-effective asset utilization, and efficient manufacturing (Banker et al., 2011). Therefore, firms with operational IT orientation may still have large IT investments if they can achieve such cost reductions. This idea is also supported by the low correlation between IT orientation and IT intensity variables in our dataset. Therefore, we use a distinct condition for IT orientation in addition to industry classifications and IT intensity in our configurational analysis of the optimal IT reporting structure.

So far, we made an argument about various factors that can impact the suitable IT reporting structure. Our key overarching argument is that each of these factors cannot be analyzed independently from the others. In other words, there is no magic formula for small firms as compared to large firms, or for firms in a specific industry or with a specific IT orientation. Instead, each of these factors can work differently depending on the presence of other conditions or based on different levels of other factors. For example, the optimal IT reporting structure for firms with high IT investment intensity could be different, depending on firm size, industry, and IT orientation. That is, we relax a widely held assumption that there are only two-way or at most three-way interactions among different factors. We go beyond these relatively simpler interactions, and study all possible interactions by treating combinations of factors along with reporting structures as "configurations" that define different types of firms to examine which configurations are associated with high firm performance.

3.4. A Configurational Approach to the IT Reporting Structure Problem

To solve this problem with conventional methods such as linear regression, we need to add interaction terms for all possible combinations of the independent variables (the four factors along with the IT reporting structure). This approach is infeasible for at least two reasons. First, by adding all possible interaction terms, including two-way, three-way, four-way, and five-way terms, the model will end up with too many terms to be able to produce statistically significance results. Second, it would be massively difficult to interpret the model results with such large number of interaction terms. Therefore, I approach this problem by using a neo-configurational approach known as the qualitative comparative analysis (QCA), which is different from the conventional additive net-effect approach used in regression models. Instead, QCA methods are designed to understand how causal conditions simultaneously and systemically combine to form configurations that are associated with an outcome of interest (Ragin, 2008). The QCA method has been recently adopted in the IS literature (Dawson, Denford, & Desouza, 2016; El Sawy, Malhotra, Park, & Pavlou, 2010; Park, El Sawy, & Fiss, 2017; Park & Mithas, 2019; Rivard & Lapointe, 2012).

The method is based on set theory and Boolean algebra where each variable is treated as a set. The value of each variable is represented by a membership value for each observation to each set, including the outcome set. The most basic variant of QCA is called the crisp set QCA (csQCA), where membership is a binary variable that takes either the value of 1 (member) or 0 (non-member). The algorithm starts by establishing a "truth table" with every possible combination of conditions (independent variables). The table has as many as 2^k rows, where k is the number of conditions. Each case (or observation) is assigned to one of these combinations based on its set membership values. The goal of the algorithm is to determine whether a condition or a combination of conditions (i.e. a configuration) is consistently a *sufficient* condition of the outcome set. In the set theory terms, a condition A is a sufficient condition of the outcome B if all members of set A are also members of set B, that is, A is a subset of B. A more advanced method is the fuzzy set QCA (fsQCA), which is an extension of the csQCA that allows for partial memberships in sets. A set membership can take any value from 0 (full non-membership) to 1 (full membership). For instance, firm size, measured as the number of employees, is transformed into a set membership value in a process called *calibration*. The final solution of the truth table algorithm is all the combinations of conditions that pass a sufficiency test. A common way to test the sufficiency of a condition (or a combination of conditions) is to calculate its *consistency*, the ratio of all cases belonging to this condition that also belong to the outcome set. If the consistency of a specific condition is above a specified threshold, say 0.80, then this condition is considered as a subset of the outcome and therefore a sufficient condition.

3.5. Data

The model is tested using data from two sources. The first dataset is based on a survey of firms that was taken in 2008 in India. The survey generally asks each firm's representative about IT spending details and IT governance structure and decision making. I also use a public data for the financial performance of those companies. Table 3.1 summarizes all variables used in the models. After removing observations with missing data, the final sample consists of 154 firms. Industries are categorized based on the role IT plays in each industry into three types: Informate, Automate, and Transform. Table 3.2 shows all the industries in the sample and their corresponding categories according to Chatterjee et al. (2001).

3.6. Fuzzy Set Analysis

3.6.1. Models Set-up and Results

The fsQCA model includes the following conditions that are relevant to the IT reporting structure based on our theoretical framework: (1) Firm size, measured by number of employees, (2) Industry, whether a firm belongs to a transform, Informate, or automate industry, (3) IT intensity, measured by annual IT spending divided by number of employees, (4) IT orientation, i.e., whether the firm views IT as strategic (versus operational), and (5) Three conditions representing IT reporting structure, that is, whether the IT head reports to the CEO, CFO, or COO. A recent survey indicate that 88.5% of CIOs reported to CEOs, CFOs or COOs (Kappelman et al., 2018). Therefore, there are nine conditions used to build the possible configurations. The outcome is the firm's financial performance, measured by return on assets (ROA).

We first calibrated all continuous variables using three anchors (full exclusion, crossover, and full inclusion) to transform all variables into set membership values between 0 and 1. The models are set up and run using the QCA package in R. Table 3.3 shows part of the *truth table*, which consists of 512 rows (2^9) representing all possible configurations of the 9 conditions. The truth table indicates which configurations are associated with high performance. The truth table function has two key parameters: inclusion cut-off and frequency cut-off. The inclusion cut-off indicates the minimum row consistency such that a configuration can be considered as a consistently sufficient condition. The inclusion cut-off is set as 0.8. The frequency cut-off, set as three, indicates minimum number of cases from each row (configuration) such that a configuration is considered as empirically observed. All configurations below this threshold are considered as *remainders* (remarked by question marks) that do not enter the conservative solution but may be used in counterfactual analysis to produce the parsimonious solutions as I explain below.

The next step is the *minimization* process, which simplifies the solution extracted from the truth table by combining configurations and removing redundant configurations using the rules of Boolean algebra in addition to counterfactual analysis. I start with the *most complex "conservative" solution*, which relies on empirically observed configurations and does not use any remainders in the minimization process. The solution (shown is Table 3.4) includes two different configurations that are associated with high ROA. In contrast, the simplest type of solution, referred to as the *pure parsimonious solution*, utilizes all available remainders in the minimization process. The solution (provided in Table 3.5) contains four different configurations as the simplification process splits the two complex configurations into simpler ones. A more conservative solution is the one that removes any contradictory simplifying assumptions from the minimization process (Duşa, 2018). Contradictory simplifying assumptions are those remainders that end up being utilized for both the outcome and its negation. This solution is called the *enhanced parsimonious solution*. Table 3.6 shows this solution for high ROA as the outcome. While the standard QCA analysis typically includes an *intermediate solution*, which evaluates remainders based on directional expectations of the relationships between the conditions and outcome, my analysis does not include such solution because I do not make any assumptions about direction of the relationship between each of the conditions and firm performance.

One of the main characteristics of the set-theoretic configurational methods is that, unlike correlational-based methods, they do not assume symmetric relationships between causal conditions and outcomes. That is, the existence of a causal relationship between specific configurations and an outcome does not imply that the absence of these configurations are associated with low levels of the outcomes. Therefore, I repeat the previous steps (truth table analysis and minimization) for a model where the outcome is the set negation of ROA. The parsimonious solution consists of eight configurations that lead to “not high” financial performance. Tables 3.7 and 3.8 provide graphical representations of the configurations leading to high ROA and configurations leading to not high ROA.

Solid circles indicate the presence of a condition while circles with cross indicate absence of a condition. Big circles represent core conditions, while small circles represent peripheral conditions. I follow Fiss (2011) definition of *core elements* as those causal conditions for which the evidence indicates a strong causal relationship with the outcome, whereas *peripheral elements* are those for which the evidence for a causal relationship with the outcome is weaker. Therefore, a condition is considered a core element if it appears in both pure and enhanced parsimonious solution. Otherwise, if the condition appears only in the enhanced parsimonious solution, then it is considered as a peripheral element. The common procedure used by previous QCA studies does not include the most complex solution in such graphical representation as such a solution is typically needlessly complex and provides rather little insight into causal configurations (Fiss, 2011). In Tables 3.6 and 3.7, the configurations that share similar conditions are grouped together. For example, configurations 2A and 2B have the same conditions except that 2A has ~Transform “the negation of the Transform set” and 2B has Automate. The only difference between these two configurations is that the former includes firms in Automate and Informate industries while the later only includes firms in Automate industries.

3.6.2. Results Analysis

The fsQCA results demonstrate that multiple configurations are sufficient for high financial performance, a phenomenon known in the configurational analysis as *equifinality*. This indicates that several "organizational recipes" can lead to the same outcome, which is high financial performance. In addition, the results confirm asymmetric relationships between configurations and outcome as proven by the diverse solutions of the high ROA and "not high" ROA models. Most importantly, the different configurations confirm the argument that there is no straightforward optimal IT reporting structure. Instead, whether an IT head of a firm should report to the CEO, CFO, or COO appears as one of the dimensions of different organization configurations that are associated with high financial performance. In other words, the optimal reporting structure depends on multiple firm-level and environmental factors.

Table 3.7 shows the three groups of configurations that are sufficient for achieving high financial performance. The first set of configurations (H1-A and H1-B) suggests that IT intensive firms in Automate industries, whose IT investments are viewed as strategic will have high financial performance if the IT head reports directly to the CEO. The second configuration, in contrast, shows that regardless of the industry, smaller firms with low IT investment intensity and whose IT heads do not report to their CEOs or COOs can also have high performance. The last configuration of high financial performance shows that smaller firms that use IT mainly to achieve operational efficiencies (as opposed to those using IT for strategic purposes) are better off not having their IT head reporting to none of the CEO, CFO, and the COO. This may indicate that high performing firms of this type have their IT manager reporting to another manager below the TMT level.

Table 3.8 presents the five groups of configurations that are associated with lower ROA. A quick comparison between these configurations and those associated with high performance demonstrates that the two sets of configurations are different, which confirms the *causal asymmetry* in the relationship between the conditions and the outcome. The first configuration for "not high" performance (N1) represents firms with low IT intensity whose IT heads report to the CFOs. This rare parsimonious configuration points out that firms with lower IT budgets may be better of not having their IT head reports to their CFOs. Configurations N5-A and N5-B for low performance, on the other hand, suggest that large, IT-intensive firms operating in "transform" industries might be in bad positions if their IT heads report to their CEOs or COOs. Configurations N3 and N4 apply to large firms that view their IT investments as strategic but do not have their IT heads report to their CEOs. The two configurations suggest that this combination can be worrying specifically for firms with low IT intensity (configuration N3) and those in "Automate" industries (configuration N4). The second set of configurations (N2-A and N2-B) suggests that large firms operating in Automate or Informate industries and having an IT-to-CFO reporting structure are low performing.

3.7. Discussion

Despite the fact that each group of configurations in the two solutions (high financial performance and not-high financial performance) is relevant to distinctive kinds of organizations, we can observe some common themes across the two solutions. In this section, I summarize my observations from the QCA model results, inspect how IT reporting structure interacts with each of the other firm-level and industry level conditions (IT orientation, IT intensity, industry category, and firm size), and introduce propositions that build a middle-range theory on the optimal reporting structure under different organizational configurations.

3.7.1. IT Reporting Structure and IT Orientation

I classify firms based on their IT orientation into two categories: (a) those that view their IT spending as strategic investments that can lead to competitive advantages, and (b) those that mainly use their IT investments to achieve operational efficiencies. The IT orientation condition (IT Strategic) appears with IT reporting structure conditions in two of the three configurations of high performance as well as two of the five configurations of lower performance, which highlights the important interactions between IT orientation and IT reporting structure. Although these configurations specify different types of conditions in term of industry, firm size, and IT intensity, a common observation from all these configuration is that firms with strategic IT orientation are better off with a direct CIO-CEO reporting structure. This observation is highly expected as such type of firms tends to pursue IT initiatives with strategic impact on the firm's competitive landscape. The purpose of such IT initiatives is to attain differentiation advantage through innovation and customer intimacy. This is better achieved by having the IT head (or the CIO) in a closer relationship to the CEO who has a broader view of the firm and its needs for customer intimacy and innovative products (Banker et al., 2011). This idea also confirms the practitioners' view that a direct reporting relationship gives the CIO more influence on the overall business strategy, which gives a better chance for leading IT-driven business changes (Kuebler, 2011). Hence, I propose the following:

> **Proposition 1 (P1).** Firms with a strategic IT orientation are better off having their IT heads report directly to the CEO. This relationship between IT orientation and IT reporting structure is specifically important in the following situations: (a) IT intensive firms in

Automate industries, (b) large firms in Automate industries, (c) non-IT intensive firms in any industry.

3.7.2. IT Reporting Structure and IT Intensity

The IT intensity condition appears in conjunction with IT reporting structure conditions in one configuration of high performance and three configurations of "not high" performance. Despite being highly diverse in terms of other conditions, these four configurations agree on a couple of observations. First, we saw that if a firm has a strategic IT orientation, then the optimal reporting structure is a direct CIO-CEO reporting even for firms with high IT intensity (configurations H1-A and H1-B). Otherwise, IT intensive firms are better off having their IT heads report to the CFO or another senior executive other than the CEO. The models find evidence supporting this relationship for large firms in Transform industries (refer to configurations N5-A and N5-B). If the firm is not IT intensive, then CIO-CFO reporting is associated with lower financial performance regardless of all other conditions (configurations N1 and N3). The overall conclusion is that IT intensive firms that use IT to achieve operational efficiencies are better off having their IT heads report to the CFO. This finding endorses the view that one of the advantages of having the IT head (or CIO) reporting to the CFO is to control IT spending and remedy a reported weakness of IT leaders, which is their underestimation of costs. This issue is naturally more critical in firms with large IT budgets (i.e. IT intensive firms). However, as some IS researchers and practitioners suggest that a drawback of the CIO-CFO reporting structure is that it limits the strategic and transformational role of IT, we notice when IT is viewed by the firm as strategic then the optimal reporting structure is the direct reporting to the CEO. Therefore, the advantages of the CIO-CFO reporting structure in guiding IT investments only present for firms that use its IT investments for operational efficiencies and therefore there is no potential strategic role of IT that is feared to be limited. This view is also supported by two of the configurations associated with not-high performance (N3 and N4). The two configurations indicate that when firms with strategic orientation of IT do not have their IT heads reporting to the CEO, this can lead to low financial performance in two specific situations. The first, according to N3, is when a firm is not IT intensive, as IT budgets are not large enough to be required to be supervised by the CFO. The second situation, according to N4, is when a firm is large and in an Automate industry such as manufacturing. Therefore, I propose the following:

Proposition 2 (P2). Firms with high IT intensity are worse off having the IT heads report to the CEOs, specifically for large firms in Transform industries.

Proposition 3 (P3). Firms with low IT intensity are worse off having the IT heads report to the CFOs, regardless of all other conditions.

3.7.3. IT Reporting Structure, Industry, and Firm Size

In this study, industries are classified into three categories based on the role IT plays in firms in each industry: Automate, Informate, and Transform (Chatterjee et al., 2001). Most of the configurations that appear in the two solutions belong to the Automate industry, while there is only one configuration with the Transform industry (configuration N5). The reason for this low diversity is that most firms in the sample belong to Automate industries (56%), while only 33% and 11% belong to Transform and Informate industries, respectively. A similar issue appears with the firm size condition where two of the three configurations of high performance include the negated “Large” condition while four of the five configurations of “not high” performance appear with the presence of “Large”. Nonetheless, we find that firm size and industry categories are factors that influence the relationship between IT reporting structure and IT orientation (refer to P1) and the relationship between IT reporting structure and IT spending intensity (refer to P2).

In addition, regardless of IT orientation and IT intensity, the second configuration of "not high" performance (N2) provides evidence to an interesting and unexpected finding. This configuration shows that large firms in the Automate industry with the IT-CFO reporting structure are bad performers. For firms in Automate industries such as manufacturing, the main role of IT is to replace human labor by automating business processes. Therefore, Automate represents no IT-driven transformation efforts (Chatterjee et al., 2001), so we would expect that the IT-CFO is the most suitable reporting structure for such firms. However, the results show that if firms in the Automate industries are large, then their IT heads should not report to the CFO. Large firms in the Automate industries also appear as one of the special cases in Proposition 1 where firms with strategic IT orientation should have their IT heads report to the CEO. The next proposition recommends the IT reporting structure for large firms in the Automate industries regardless of their IT orientation.

Proposition 4 (P4). Large firms in Automate industries are worse off having their IT heads report to the CFO.

Finally, the second and third configurations of high performance provide some insight for small firms. H3 show that small firms where IT is used to achieve operational efficiencies are better off having their IT heads reporting to none of the CEO, CFO, or the COO. While this configuration does not specify the optimal reporting structure, it is likely that the IT head should report to a manager outside the TMT level. Similarly, H2 show that small, non-IT-intensive firms are better off having their IT heads reporting to none of the CEO or the COO. We know from configuration N1 that firms with low IT intensity of any size are worse off with the IT-CFO reporting structure. Therefore, it appears that small firms with no IT focus, either through low IT investment intensity or operational IT orientation, should have their IT heads reporting to a non-executive manager.

Proposition 5 (P5). Small firms with operational IT orientation or low IT investment intensity are better off *not* having their IT heads report to c-level executives.

3.7.4. Limitations

This study represents the first attempt to investigate the IT reporting structure problem using a neo-configurational approach by examining multiple conditions simultaneously. While QCA has obvious advantages that overcome the shortcomings of traditional correlation-based methods to analyze this issue, the QCA method has a few limitations. First, the QCA uses set theory to examine whether specific conditions or combinations of conditions are sufficient for an outcome by testing for subset relationships. Although this method is convenient to find association between different configurations and an outcome as in our case, it does not provide advance tools to test for causality by ruling out endogeneity and reverse causality issues. For example, one of the proposition states that firms with low IT spending perform poorly if their IT heads report to the CFOs. One possible alternative explanation is that financially under-performing firms invest less in IT (i.e. have low it intensity) when their IT head reports to the CFO. This proposition can be validated using advanced econometric techniques with longitudinal data.

In addition, while this study provides important recommendations on the optimal reporting structure using different firm-level and industry-level conditions, other missing factors can also impact the reporting structure and interact with the available conditions. For example, whether an IT head reports directly to the CEO or other executive may also depend on the IT head individual characteristics such as whether they are from technical or business background. It would be expected that business-savvy IT heads are better equipped to translate the IT objectives to business leaders and therefore a direct reporting relationship is preferred. On the other hand, IT heads from technology backgrounds could face communication difficulties if they report directly to the CEOs. An interesting extension to this study is to examine the impact of IT head academic and career backgrounds on the optimal IT reporting structure and how these new conditions interact with other conditions used in this study.

Finally, the data does not show whether the IT heads of the firms in the sample have the position of IT manager, CIO, CTO, etc. neither does it show whether the IT head is part of TMT or not. As previous studies have shown, the IT head position may impact the nature of the relationship and communication between IT head and CEOs and therefore the optimal reporting relationship between them.

3.8. Concluding Remarks

This study tries to solve a practical question that appeared frequently in both academic and professional articles by using a recently adopted method. The IT reporting structure is a complex problem where the optimal solution depends on several factors such as firm size, industry category, IT investment intensity, and IT orientation. I propose that these factors cannot be studied in isolation. Instead, combinations of these factors along with the IT reporting structure itself are studied as different configurations that can lead to different levels of performance. Therefore, I implement the fsQCA method to determine to whom the IT head of a firm should report. This configurational method is well suited for examining how the multiple conditions simultaneously combine into configurations that are associated with the outcome of interest.

Results shed light on different configurations that are associated with higher and lower financial performance as measured by return on assets. The results demonstrate that different combinations of the discussed causal conditions have different optimal IT reporting structure. In addition, the results also show which cases the IT reporting structure is critical to the solution and which cases it is a minor factor that does not strongly impact firm performance. These findings challenge the common one-dimensional recommendations on the optimal IT reporting structure and highlight the complexity of this problem. In addition, the research contributes to the IS literature by implementing an emerging configurational methodology that is designed to address complexities that naturally exist in real organizations.

Chapter 4: Conclusion

This dissertation includes two studies that examine IT management issues that are becoming more critical as organizations are increasingly dependent and, sometimes, are disrupted by emerging digital technologies. The first study analyzes how the impact of IT management on a firm's market and financial performance is influenced by the presence of people management practices that ensure that employees are empowered and motivated to make the most of these digital technologies. Specifically, the study finds that the relationship between IT management and organizational performance is positively moderated by two HR management components: employee work systems and employee learning. Supplementary analysis using the configurational approach provides several other insights. First, this approach provides a holistic view of organizations showing how the five capabilities (leadership quality, strategic planning, IT management, work systems, employee learning) are all interconnected to form a complete system of complex interactions. Specifically, the results of the QCA models show whether IT management, the two HR capabilities, and their joint presence are necessary or sufficient conditions to achieve high performance with respect to the presence and absence of leadership and strategic planning. Second, the configurational approach reveals the several configurations or recipes associated with high performance in five sectors. Third, the QCA models demonstrate the causal asymmetry concept that challenges the assumption that the relationships between conditions and outcome is symmetric. The QCA analysis, therefore, describes the different configurations leading to both high and low performance for each sector.

The second study examines one of the critical IT decision-making issues in an organization, which is to whom the IT head should report. The study challenges a widely held assumption that the optimal IT reporting structure can be simply stated universally to all organizations or general types of organizations. The study argues that the optimal IT reporting structure depends on many factors such as firm size, industry, IT investment intensity, and IT orientation. The study further maintains that these factors cannot be examined independently. Instead, firms are viewed as configurations based on the complex interactions of these factors. The study implements a QCA approach to reveal the IT reporting structures that perform better for different complex configurations.

Together, the two studies show that this emerging configurational approach can advance the research even on established streams of literature in many ways. First, the configurational approach can be used to validate already proven theories by further studying their limitations and boundary conditions. For example, after verifying the basic complementarities between IT management and HR management components, I used the configurational approach to examine when and under which conditions the individual and joint presences of these capabilities are associated with high performance. In addition, the QCA approach allows us to challenge the causal symmetry condition inherent in the conventional correlation-based methods to provide rich insights that differentiates between the analyses for high and low performance. Finally, the second study shows how configurational methods are the most suitable approach to addressing issues characterized by causal complexities. Therefore, future research can take advantage of this method to revisit theories with such intrinsic complexities that make them difficult to be addressed by the conventional methods.

Tables

Table 2.1. Summary of observations over years and sectors

Year	Manu-facturing	Service	Small	Education	Health	Non-profit	Total
1997	9	7	10	0	0	0	26
1998	15	5	16	0	0	0	36
1999	4	11	11	16	9	0	51
2000	14	5	11	11	8	0	49
2001	7	4	8	10	8	0	37
2002	8	3	11	10	17	0	49
2003	10	8	12	19	19	0	68
2004	8	5	8	17	22	0	60
2005	0	6	8	16	33	0	63
2006	3	4	8	16	45	10	86
Total	**78**	**58**	**103**	**115**	**161**	**10**	**525**
Percentage	**15%**	**11%**	**20%**	**22%**	**31%**	**2%**	**100%**

Table 2.2. Summary statistics

Variables	N	Mean	Std. Dev.	Min	Max
PERFORMANCE	525	41.95	15.97	0.00	80.00
ITMGMT	525	47.93	13.44	0.00	80.00
HRMGMT	525	48.18	11.23	10.00	74.29
WORKSYS	525	48.39	11.84	10.00	74.29
TRAIN	525	47.96	12.15	10.00	80.00
LEAD	525	51.36	13.43	10.00	80.00
STRATEGY	525	43.53	13.45	5.00	75.29
MANUF	525	0.15	0.36	0	1
SERVICE	525	0.11	0.31	0	1
SMALL	525	0.20	0.40	0	1
EDUC	525	0.22	0.41	0	1
HEALTH	525	0.31	0.46	0	1
YEAR	525	2002	2.804	1997	2006

Table 2.3. Correlation table

	Variables	1	2	3	4	5	6	7
1	PERFORMANCE	1						
2	ITMGMT	0.64***	1					
3	HRMGMT	0.60***	0.72***	1				
4	WORKSYS	0.55***	0.66***	0.93***	1			
5	LEARN	0.57***	0.68***	0.94***	0.75***	1		
6	LEAD	0.70***	0.74***	0.77***	0.73***	0.71***	1	
7	STRATEGY	0.71***	0.75***	0.75***	0.69***	0.70***	0.84***	1

*Note: N = 509, '***' p<0.001, '**' p<0.01, '*' p<0.05*

Table 2.4. OLS, fixed effects, and random effects results of the main models

Independent Variables	***Dependent variable:*** **PERFORMANCE**		
	(1) OLS	**(2) F.E.**	**(3) R.E.**
ITMGMT	-0.002 (0.130)	-0.210 (0.265)	-0.0005 (0.130)
HRMGMT	-0.194 (0.135)	-0.303 (0.285)	-0.170 (0.135)
ITMGMT * HRMGMT	0.004^{**} (0.003)	0.008^{**} (0.005)	0.004^{**} (0.003)
LEAD	0.305^{***} (0.072)	0.128 (0.118)	0.294^{***} (0.071)
STRATEGY	0.425^{***} (0.069)	0.325^{***} (0.112)	0.393^{***} (0.069)
MANUF	9.729^{***} (3.663)		11.804^{***} (3.598)
SERVICE	9.127^{**} (3.695)		10.579^{***} (3.663)
SMALL	7.770^{**} (3.599)		8.903^{**} (3.572)
EDUC	4.150 (3.520)		4.944 (3.540)
HEALTH	9.282^{***} (3.441)		9.742^{***} (3.480)
YEAR	-0.359^{*} (0.196)		
Adjusted R^2	0.572	0.132	0.521
F Statistic	64.556^{***}	21.498^{***}	58.323^{***}

*Note: Standard errors in parentheses; *** p<0.01, ** p<0.05, *p<0.1 (One-tailed test for interaction variables, two-tailed test for other variables)*

Table 2.5. OLS results of the models with the two HR management categories

Independent Variables	***Coeff.***	***Dependent variable:* PERFORMANCE**		
		(1) Work Systems	**(2) Learning**	**(3) Both**
ITMGMT	β_1	-0.004 (0.127)	0.036 (0.123)	-0.005 (0.130)
WORKSYS	β_2	-0.233* (0.128)		-0.297 (0.221)
ITMGMT*WORKSYS	β_3	0.005** (0.002)		0.005 (0.004)
LEARN	β_4		-0.130 (0.124)	0.095 (0.211)
ITMGMT*LEARN	β_5		0.003* (0.002)	-0.001 (0.004)
LEAD	β_6	0.315*** (0.071)	0.298*** (0.070)	0.306*** (0.072)
STRATEGY	β_7	0.429*** (0.069)	0.423*** (0.069)	0.423*** (0.069)
MANUF	β_8	9.716*** (3.661)	9.699*** (3.665)	9.656*** (3.668)
SERVICE	β_9	9.098** (3.695)	9.088** (3.699)	8.985** (3.703)
SMALL	β_{10}	7.799** (3.595)	7.796** (3.602)	7.866** (3.603)
EDUC	β_{11}	4.063 (3.519)	4.184 (3.517)	4.105 (3.524)
HEALTH	β_{12}	9.216*** (3.445)	9.236*** (3.440)	9.138*** (3.452)
YEAR	β_{13}	-0.350* (0.195)	-0.365* (0.195)	-0.368* (0.196)
Observations		525	525	525
Adjusted R^2		0.572	0.571	0.571
F Statistic		64.684***	64.417***	54.630***

*The models in Columns (1), (2), and (3) include WORKSYS only, LEARN only, and both variables, respectively. The objective of the model in Column (3) is to test which HR component has higher moderation impact on the influence of IT management on performance. That is, the goal is to test whether the coefficients β_3 and β_5 are statistically different. The results of a Wald test indicate that the coefficient of ITMGMT * WORK is significantly larger than the coefficient of ITMGMT * LEARN.*

Table 2.6. QCA results for the manufacturing sector (n = 78)

Conditions	Configurations of High Performance				Configurations of Not High Performance		
	H1	**H2**	**H3**	**H4**	**N1**	**N2**	**N3**
LEAD	•	⊗	⊗	●	⊗		●
STRATEGY	●					⊗	⊗ (small)
ITMGMT		●		•		⊗	
WORKSYS			●	⊗			⊗
LEARN		⊗	●	●	⊗		●
Consistency	0.839	0.773	0.784	0.830	0.895	0.881	0.815
Raw coverage	0.806	0.185	0.202	0.302	0.442	0.605	0.301
Unique coverage	0.488	0.015	0.015	0.004	0.025	0.109	0.000

● = presence of a condition; ⊗ = negation of a condition; big circle = core element; small circle = peripheral element

Table 2.7. QCA results for the service sector (n = 58)

Conditions	**Configurations of High Performance**	**Configurations of Not High Performance**		
	H1	**N1**	**N2**	**N3**
LEAD	●	⊗		
STRATEGY	●	⊗	⊗	⊗
ITMGMT	●			
WORKSYS			⊗	
LEARN	●			⊗
Consistency	0.884	0.901	0.881	0.903
Raw coverage	0.732	0.604	0.580	0.621
Unique coverage	0.732	0.051	0.010	0.049

● = presence of a condition; ⊗ = negation of a condition; big circle = core element; small circle = peripheral element

Table 2.8. QCA results for the small business sector (n = 103)

Conditions	Configurations of High Performance	Configurations of Not High Performance	
	H1	N1	N2
LEAD	●		●
STRATEGY	●	⊗	
ITMGMT			⊗
WORKSYS	●		●
LEARN			⊗
Consistency	0.813	0.880	0.906
Raw coverage	0.770	0.875	0.268
Unique coverage	0.770	0.642	0.036

● = presence of a condition; ⊗ = negation of a condition; big circle = core element; small circle = peripheral element

Table 2.9. QCA results for the education sector (n = 115)

Conditions	**Configurations of High Performance**			**Configurations of Not High Performance**		
	H1	**H2-A**	**H2-B**	**N1**	**N2**	**N3**
LEAD	●	●	●	⊗		
STRATEGY	●	●	•	⊗	⊗	⊗
ITMGMT		●	●		⊗	⊗
WORKSYS	●	•	●		⊗	
LEARN	●					⊗
Consistency	0.852	0.848	0.821	0.852	0.854	0.868
Raw coverage	0.578	0.643	0.628	0.701	0.673	0.699
Unique coverage	0.016	0.043	0.028	0.067	0.016	0.015

● = presence of a condition; ⊗ = negation of a condition; big circle = core element; small circle = peripheral element

Table 2.10. QCA results for the healthcare sector (n = 161)

Conditions	**Configurations of High Performance**			**Configurations of Not High Performance**				
	H1	**H2**	**H3**	**N1**	**N2**	**N3**	**N4**	**N5**
LEAD	●	●	●	⊗			●	●
STRATEGY		●	●	⊗	⊗	⊗		●
ITMGMT	●	●			●		●	⊗
WORKSYS	●		●			⊗	⊗	●
LEARN		●	●				●	●
Consistency	0.771	0.812	0.833	0.887	0.805	0.842	0.867	0.894
Raw coverage	0.781	0.716	0.715	0.539	0.523	0.606	0.376	0.262
Unique coverage	0.082	0.018	0.017	0.027	0.067	0.038	0.039	0.011

● = presence of a condition; ⊗ = negation of a condition; big circle = core element; small circle = peripheral element

Table 3.1. Variable definitions

Variable Name	Definition
ITtoCEO	An indicator variable that equals 1 if IT head reports to CEO.
ITtoCFO	An indicator variable that equals 1 if IT head reports to CFO.
ITtoCOO	An indicator variable that equals 1 if IT head reports to COO.
Transform	An indicator variable that equals 1 if the firm belongs to a "Transform" industry.
Informate	An indicator variable that equals 1 if the firm belongs to an "Informate" industry.
Automate	An indicator variable that equals 1 if the firm belongs to an "Automate" industry.
Firm Size	Total number of employees in the firm.
IT Strategic	A dummy variable that indicates whether the firm views IT investments as strategic or operational.
IT Intensity	IT spending divided by firm size (number of employees).
ROA	Annual net profits (of the next year) divided by total assets value. The ROA value is adjusted using industry average.

Table 3.2. Industry classification

Industry	Industry Type
Finance	Transform
IT	Transform
Manufacturing	Automate
Healthcare	Transform
Telecommunications	Transform
Communication/media	Transform
Oil and gas	Automate
Transportation	Automate
Utility	Automate
Construction	Informate
Retail	Informate
Pharmaceuticals	Automate
Trading/wholesale	Informate

Table 3.3. Truth table of the ROA model

Row	TRANSFORM	ITTOCEO	ITTOCFO	ITTOCOO	ITSTRATEGIC	LARGE	ITINTENSIVE	OUT	n	incl	PRI
97	0	1	0	0	0	0	0	0	4	0.618	0.538
129	0	0	0	0	0	0	0	1	3	0.807	0.723
131	0	0	0	0	0	1	0	0	4	0.785	0.735
134	0	0	0	0	1	0	1	0	3	0.766	0.71
137	0	0	0	1	0	0	0	0	3	0.382	0.372
146	0	0	1	0	0	0	1	0	4	0.619	0.585
150	0	0	1	0	1	0	1	0	3	0.707	0.68
151	0	0	1	0	1	1	0	0	3	0.333	0.176
161	0	1	0	0	0	0	0	0	7	0.498	0.395
162	0	1	0	0	0	0	1	0	7	0.629	0.581
163	0	1	0	0	0	1	0	0	6	0.54	0.343
165	0	1	0	0	1	0	0	0	5	0.712	0.606
166	0	1	0	0	1	0	1	1	11	0.802	0.731
167	0	1	0	0	1	1	0	0	10	0.564	0.435
168	0	1	0	0	1	1	1	1	6	0.822	0.758
264	1	0	0	0	1	1	1	0	7	0.249	0.158
272	1	0	0	1	1	1	1	0	7	0.631	0.591
280	1	0	1	0	1	1	1	0	3	0.376	0.265
289	1	1	0	0	0	0	0	0	3	0.54	0.52
290	1	1	0	0	0	0	1	0	4	0.247	0.213
293	1	1	0	0	1	0	0	0	3	0.75	0.551
294	1	1	0	0	1	0	1	0	7	0.499	0.365
295	1	1	0	0	1	1	0	0	3	0.688	0.409
296	1	1	0	0	1	1	1	0	3	0.449	0.115

** OUT: output value, n: number of cases in configuration, incl: sufficiency inclusion score, PRI: proportional reduction in inconsistency*

** Two conditions are not shown for space limitation: INFORMATE and AUTOMATE.*

** The table only shows rows that satisfy the frequency threshold (n=3).*

Table 3.4. The complex solution for high financial performance

No.	Solution Configurations	inclS	PRI	covS	covU
1	~TRANSFORM*AUTOMATE*~INFORMATE* ITTOCEO*~ITTOCFO*~ITTOCOO* ITSTRATEGIC*ITINTENSIVE	0.72	0.663	0.163	0.163
2	~TRANSFORM*AUTOMATE*~INFORMATE* ~ITTOCEO*~ITTOCFO*~ITTOCOO* ~ITSTRATEGIC*~LARGE*~ITINTENSIVE	0.807	0.723	0.027	0.027
	---------- Solution (M1) ----------	0.731	0.67	0.19	

M1: ~TRANSFORM*AUTOMATE*~INFORMATE*ITTOCEO*~ITTOCFO*~ITTOCOO* ITSTRATEGIC*ITINTENSIVE + ~TRANSFORM*AUTOMATE*~INFORMATE*~ITTOCEO* ~ITTOCFO*~ITTOCOO*~ITSTRATEGIC*~LARGE*~ITINTENSIVE => ROA

** Notes: "~" indicates negated sets; inclS: sufficiency inclusion score, PRI: proportional reduction in inconsistency, covS: raw coverage, covU: unique coverage*

Table 3.5. Pure parsimonious solution for high financial performance

No.	Solution Configurations	inclS	PRI	covS	covU
1	~TRANSFORM*ITTOCEO*ITSTRATEGIC* ITINTENSIVE	0.743	0.68	0.184	0.021
2	AUTOMATE*ITTOCEO*ITSTRATEGIC* ITINTENSIVE	0.72	0.663	0.163	0.000
3	~ITTOCEO*~ITTOCOO*~LARGE* ~ITINTENSIVE	0.406	0.256	0.061	0.034
4	~ITTOCEO*~ITTOCFO*~ITTOCOO* ~ITSTRATEGIC*~LARGE	0.811	0.73	0.027	0.001
	---------- Solution (M1) ----------	0.616	0.521	0.245	
	---------- Solution (M2) ----------	0.751	0.686	0.211	
	---------- Solution (M3) ----------	0.595	0.505	0.224	
	---------- Solution (M4) ----------	0.731	0.671	0.19	

M1: ~TRANSFORM*ITTOCEO*ITSTRATEGIC*ITINTENSIVE + ~ITTOCEO*~ITTOCOO*~LARGE*~ITINTENSIVE => ROA

M2: ~TRANSFORM*ITTOCEO*ITSTRATEGIC*ITINTENSIVE + ~ITTOCEO*~ITTOCFO*~ITTOCOO*~ITSTRATEGIC*~LARGE => ROA

M3: AUTOMATE*ITTOCEO*ITSTRATEGIC*ITINTENSIVE + ~ITTOCEO*~ITTOCOO*~LARGE*~ITINTENSIVE => ROA

M4: AUTOMATE*ITTOCEO*ITSTRATEGIC*ITINTENSIVE + ~ITTOCEO*~ITTOCFO*~ITTOCOO*~ITSTRATEGIC*~LARGE => ROA

** Notes: "~" indicates negated sets; inclS: sufficiency inclusion score, PRI: proportional reduction in inconsistency, covS: raw coverage, covU: unique coverage*

Table 3.6. Enhanced parsimonious solution for high financial performance

No.	Solution Configurations	inclS	PRI	covS	covU
1	~ITTOCEO*~ITTOCFO*~ITTOCOO*~ITSTRATEGIC*~LARGE	0.811	0.73	0.027	0.027
2	~TRANSFORM*AUTOMATE*ITTOCEO*~ITTOCFO*ITSTRATEGIC*ITINTENSIVE	0.72	0.663	0.163	0.163
	---------- Solution (M1) ----------	0.731	0.671	0.19	

M1: ~ITTOCEO*~ITTOCFO*~ITTOCOO*~ITSTRATEGIC*~LARGE +
~TRANSFORM*AUTOMATE*ITTOCEO*~ITTOCFO*ITSTRATEGIC*ITINTENSIVE => ROA

** Notes: "~" indicates negated sets; inclS: sufficiency inclusion score, PRI: proportional reduction in inconsistency, covS: raw coverage, covU: unique coverage*

Table 3.7. Configurations for high financial performance

Conditions	**Configurations of High Performance**			
	H1-A	**H1-B**	**H2**	**H3**
Transform	⊗	⊗ (small)		
Automate	● (small)	●		
Informate				
ITtoCEO	●	●	⊗	⊗
ITtoCFO	⊗ (small)	⊗ (small)		⊗
ITtoCOO			⊗	⊗
IT Strategic	●	●		⊗
Large			⊗	⊗
IT Intensive	●	●	⊗	
Consistency	0.743	0.720	0.406	0.811
Raw coverage	0.184	0.163	0.061	0.027
Unique coverage	0.021	0.000	0.034	0.001

● = presence of a condition; ⊗ = negation of a condition;
big circle = core element; small circle = peripheral element

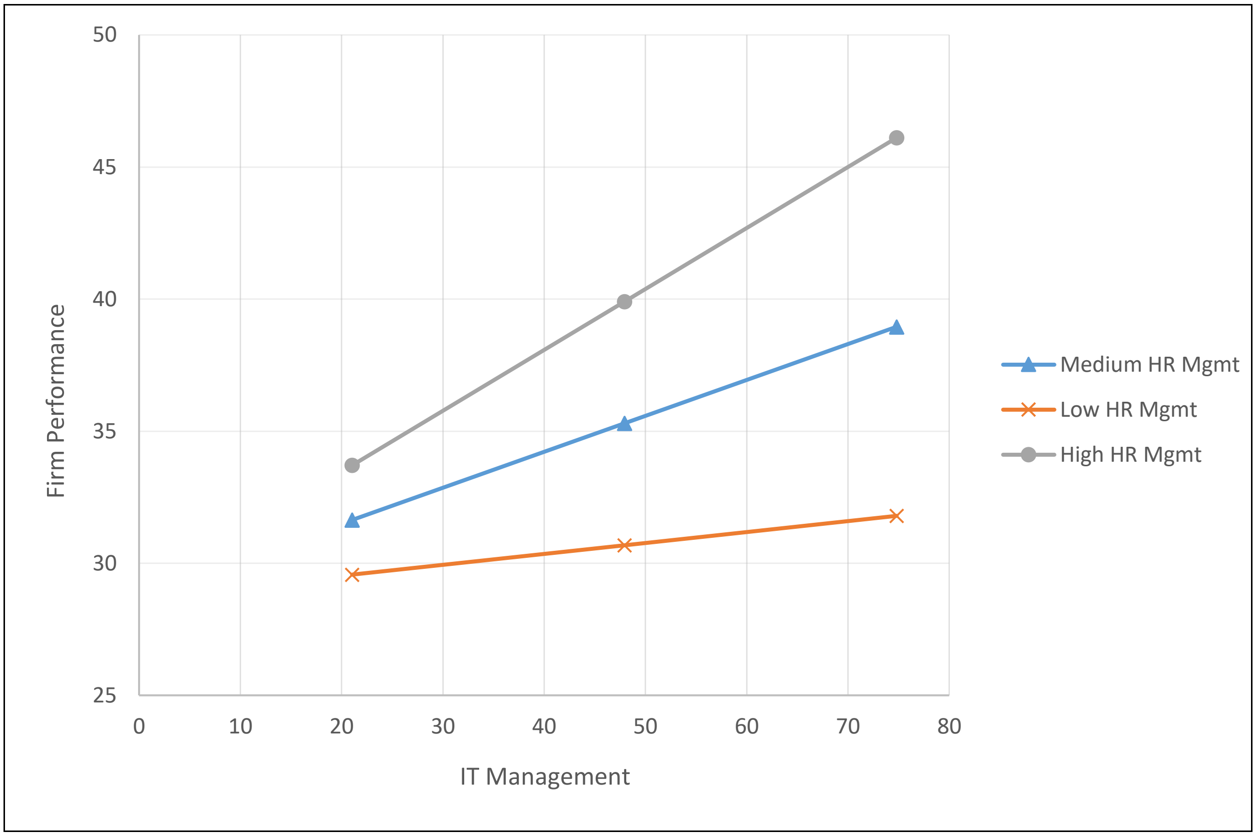
Table 3.8. Configurations for "not high" financial performance

Conditions	Configurations of Not High Performance							
	N1	N2-A	N2-B	N3	N4-A	N4-B	N5-A	N5-B
Transform		⊗			⊗		●	● (small)
Automate			●			●	⊗ (small)	⊗
Informate								
ITtoCEO		⊗ (small)	⊗ (small)	⊗	⊗	⊗		
ITtoCFO	●	●	●				⊗	⊗
ITtoCOO							⊗	⊗
IT Strategic				●	●	●		
Large		●	●	● (small)	●	●	●	●
IT Intensive	⊗			⊗			●	●
Consistency	0.785	0.678	0.601	0.740	0.697	0.651	0.866	0.836
Raw coverage	0.110	0.091	0.059	0.127	0.080	0.057	0.118	0.138
Unique coverage	0.030	0.009	0.000	0.042	0.000	0.000	0.000	0.020

● = presence of a condition; ⊗ = negation of a condition; big circle = core element; small circle = peripheral element

Figures

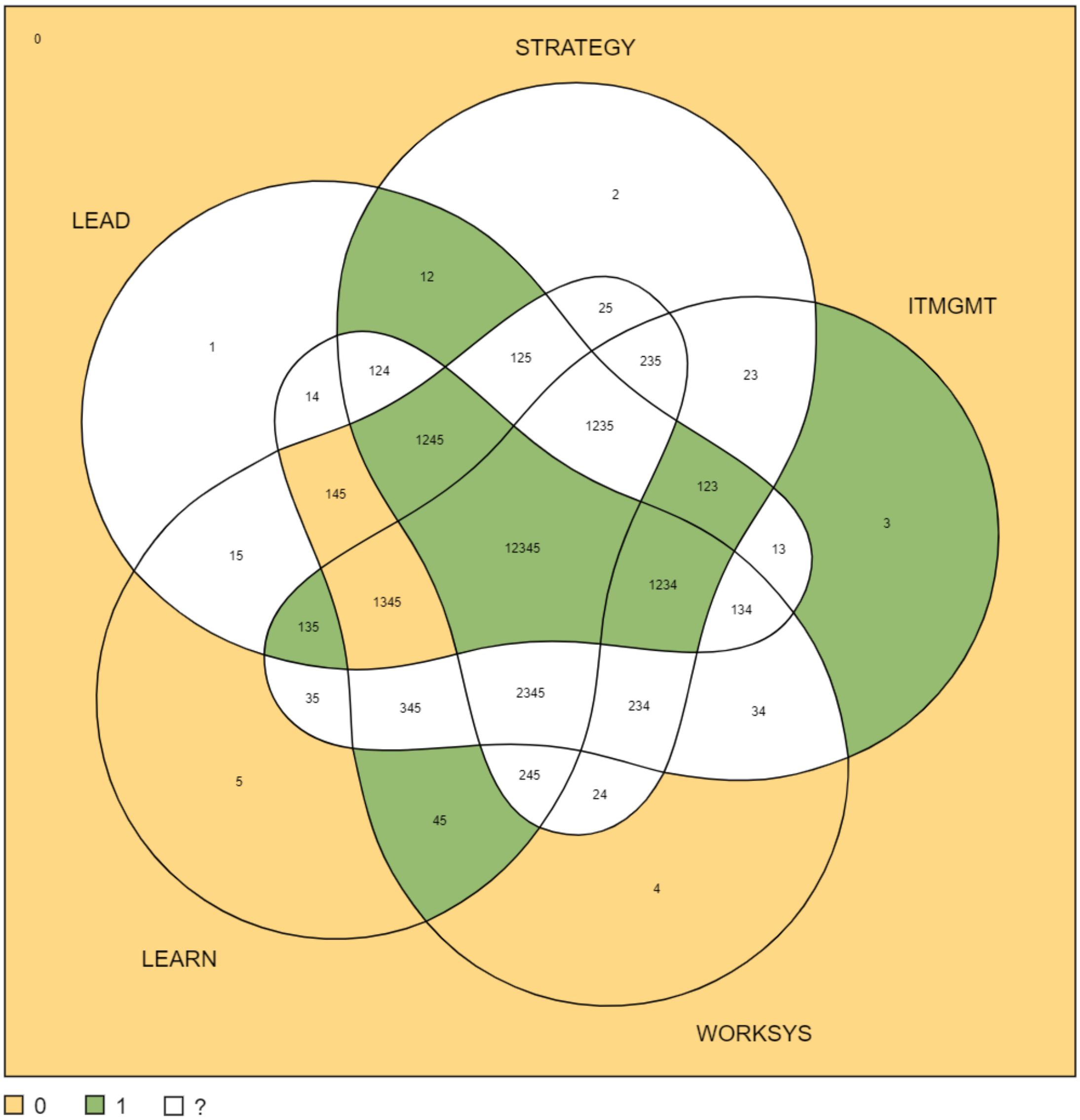
Figure 1.1. The relationship between IT management and firm performance for three levels of HR management



Appendices

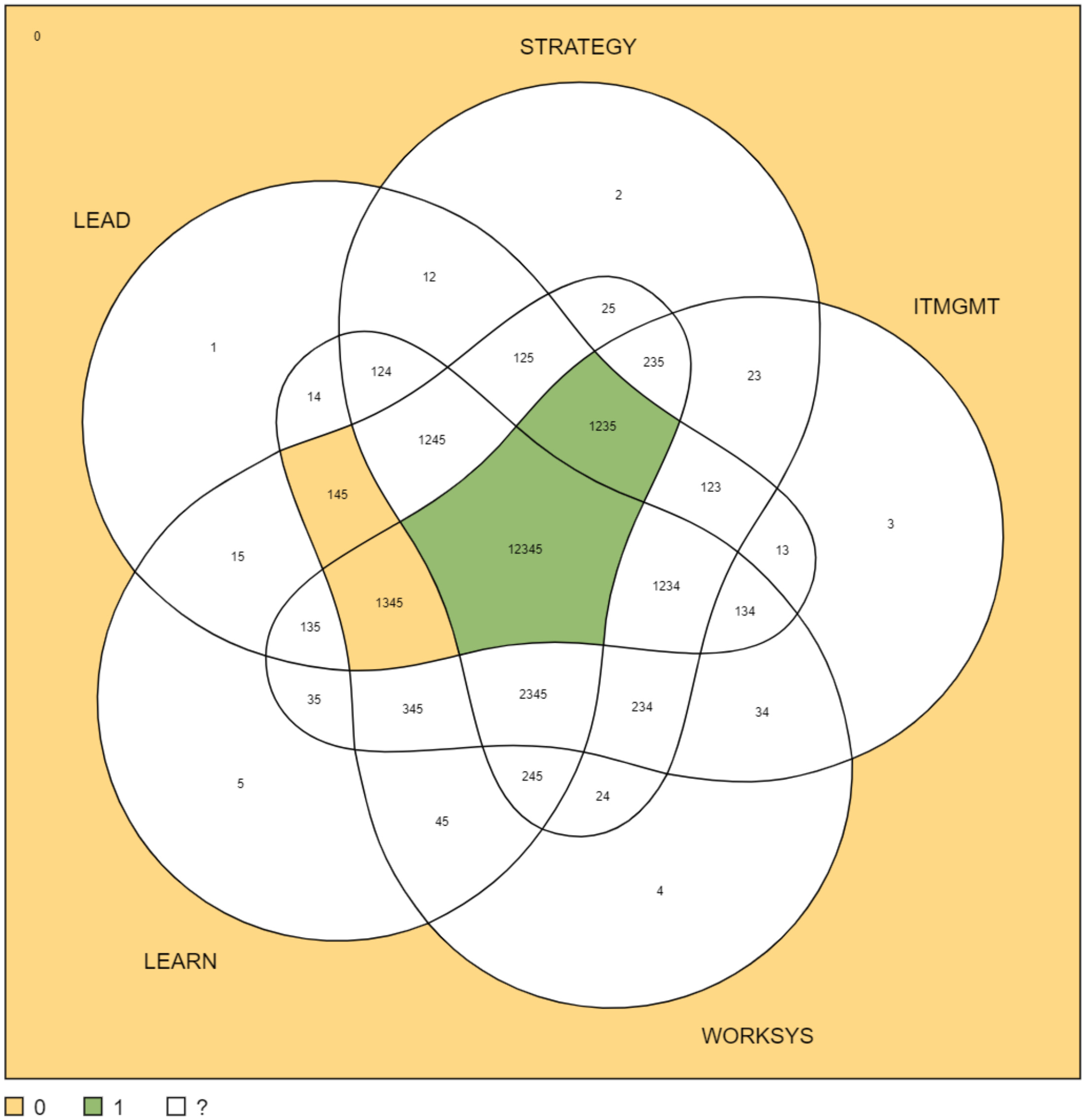
Appendix 1. Venn Diagrams for the Study in Chapter 2

Figure A1-1. Venn diagram representing the truth table of the manufacturing sector



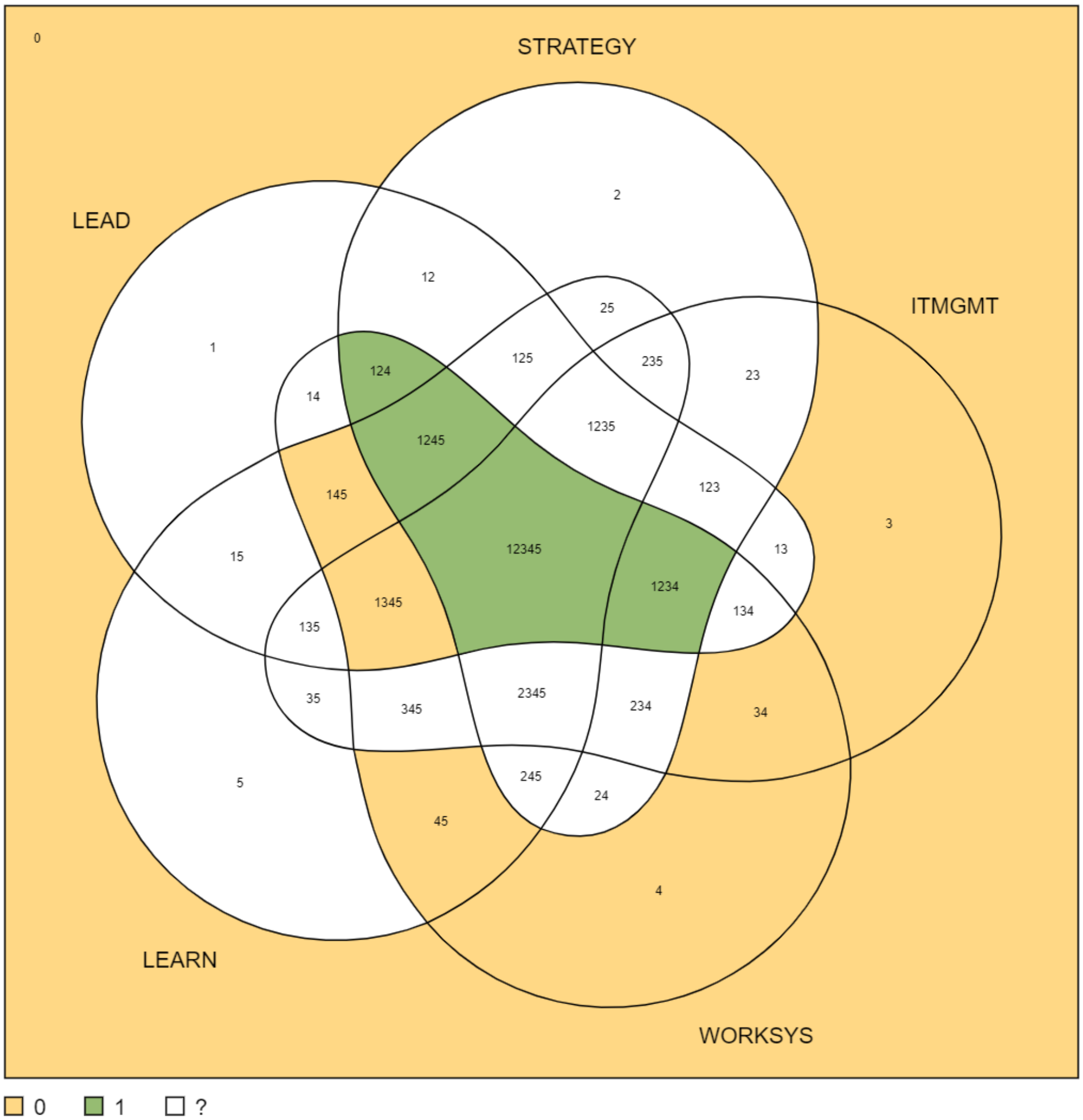
The Venn diagram shows the sets representing the five causal conditions. Each numbered area represent a single combination of these conditions (i.e., a single row in the truth table). The conditions are numbered as the following: 1: LEAD, 2: STRATEGY, 3: ITMGMT, 4: WORKSYS, 5: LEARN. Each number in the cells represents the conditions that are present for the corresponding combination. For example, the area with the code “12” corresponds to the truth table row for which LEAD and STRATEGY are present and all other three conditions are absent. An area colored in green indicates that the corresponding truth table row has a value of 1 for the outcome (i.e., the row has a consistency above the 0.80 threshold) while an area colored in amber (orange) indicates a value of 0 for the outcome. White areas represent the truth table rows without enough cases and therefore are considered as remainders (empirically unobservable).

Figure A1-2. Venn diagram representing the truth table of the service sector



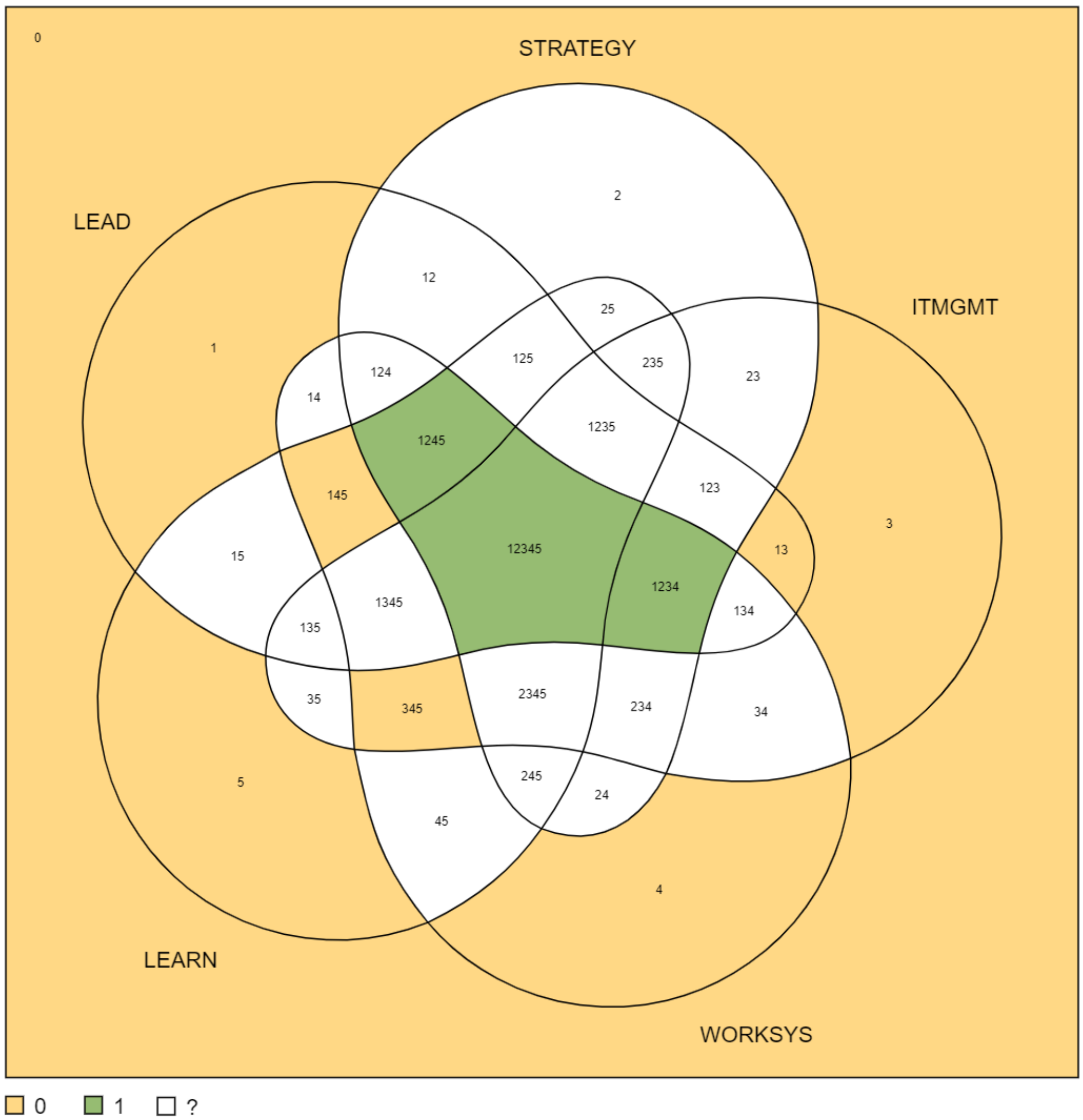
The Venn diagram shows the sets representing the five causal conditions. Each numbered area represent a single combination of these conditions (i.e., a single row in the truth table). The conditions are numbered as the following: 1: LEAD, 2: STRATEGY, 3: ITMGMT, 4: WORKSYS, 5: LEARN. Each number in the cells represents the conditions that are present for the corresponding combination. For example, the area with the code “12” corresponds to the truth table row for which LEAD and STRATEGY are present and all other three conditions are absent. An area colored in green indicates that the corresponding truth table row has a value of 1 for the outcome (i.e., the row has a consistency above the 0.80 threshold) while an area colored in amber (orange) indicates a value of 0 for the outcome. White areas represent the truth table rows without enough cases and therefore are considered as remainders (empirically unobservable).

Figure A1-3. Venn diagram representing the truth table of the small business sector



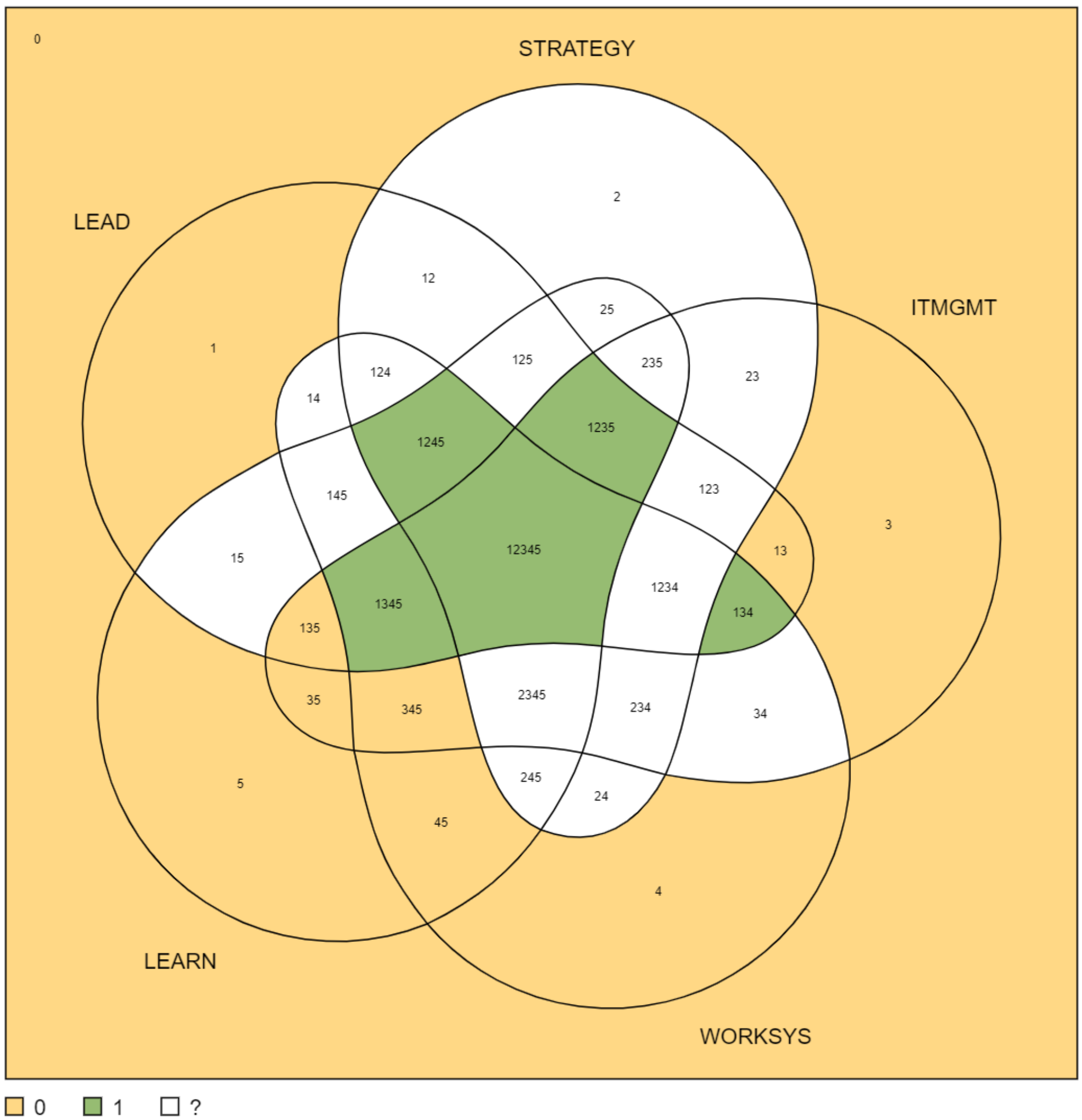
The Venn diagram shows the sets representing the five causal conditions. Each numbered area represent a single combination of these conditions (i.e., a single row in the truth table). The conditions are numbered as the following: 1: LEAD, 2: STRATEGY, 3: ITMGMT, 4: WORKSYS, 5: LEARN. Each number in the cells represents the conditions that are present for the corresponding combination. For example, the area with the code “12” corresponds to the truth table row for which LEAD and STRATEGY are present and all other three conditions are absent. An area colored in green indicates that the corresponding truth table row has a value of 1 for the outcome (i.e., the row has a consistency above the 0.80 threshold) while an area colored in amber (orange) indicates a value of 0 for the outcome. White areas represent the truth table rows without enough cases and therefore are considered as remainders (empirically unobservable).

Figure A1-4. Venn diagram representing the truth table of the education sector



The Venn diagram shows the sets representing the five causal conditions. Each numbered area represent a single combination of these conditions (i.e., a single row in the truth table). The conditions are numbered as the following: 1: LEAD, 2: STRATEGY, 3: ITMGMT, 4: WORKSYS, 5: LEARN. Each number in the cells represents the conditions that are present for the corresponding combination. For example, the area with the code “12” corresponds to the truth table row for which LEAD and STRATEGY are present and all other three conditions are absent. An area colored in green indicates that the corresponding truth table row has a value of 1 for the outcome (i.e., the row has a consistency above the 0.80 threshold) while an area colored in amber (orange) indicates a value of 0 for the outcome. White areas represent the truth table rows without enough cases and therefore are considered as remainders (empirically unobservable).

Figure A1-5. Venn diagram representing the truth table of the healthcare sector



The Venn diagram shows the sets representing the five causal conditions. Each numbered area represent a single combination of these conditions (i.e., a single row in the truth table). The conditions are numbered as the following: 1: LEAD, 2: STRATEGY, 3: ITMGMT, 4: WORKSYS, 5: LEARN. Each number in the cells represents the conditions that are present for the corresponding combination. For example, the area with the code "12" corresponds to the truth table row for which LEAD and STRATEGY are present and all other three conditions are absent. An area colored in green indicates that the corresponding truth table row has a value of 1 for the outcome (i.e., the row has a consistency above the 0.80 threshold) while an area colored in amber (orange) indicates a value of 0 for the outcome. White areas represent the truth table rows without enough cases and therefore are considered as remainders (empirically unobservable).

Appendix 2. Detailed QCA Solutions for the Study in Chapter 2

Table A2-1. Complex solution for high financial performance in the manufacturing sector

No.	Solution Configurations	inclS	PRI	covS	covU
1	LEAD*STRATEGY*~WORKSYS*~LEARN	0.827	0.649	0.249	0.007
2	LEAD*STRATEGY*WORKSYS*LEARN	0.882	0.827	0.691	0.017
3	~LEAD*~STRATEGY*~ITMGMT*WORKSYS*LEARN	0.811	0.198	0.159	0.015
4	LEAD*~STRATEGY*ITMGMT*~WORKSYS*LEARN	0.819	0.518	0.247	0.007
5	~LEAD*~STRATEGY*ITMGMT*~WORKSYS*~LEARN	0.806	0.430	0.165	0.012
6	LEAD*STRATEGY*ITMGMT*WORKSYS	0.880	0.826	0.708	0.018
7	LEAD*STRATEGY*ITMGMT*~LEARN	0.823	0.665	0.286	0.000
	---------- Solution (M1) ----------	0.813	0.733	0.809	
	---------- Solution (M2) ----------	0.810	0.726	0.791	

M1: LEAD*STRATEGY*~WORKSYS*~LEARN + LEAD*STRATEGY*WORKSYS*LEARN +
~LEAD*~STRATEGY*~ITMGMT*WORKSYS*LEARN +
LEAD*~STRATEGY*ITMGMT*~WORKSYS*LEARN +
~LEAD*~STRATEGY*ITMGMT*~WORKSYS*~LEARN +
(LEAD*STRATEGY*ITMGMT*WORKSYS) => PERFORMANCE

M2: LEAD*STRATEGY*~WORKSYS*~LEARN + LEAD*STRATEGY*WORKSYS*LEARN +
~LEAD*~STRATEGY*~ITMGMT*WORKSYS*LEARN +
LEAD*~STRATEGY*ITMGMT*~WORKSYS*LEARN +
~LEAD*~STRATEGY*ITMGMT*~WORKSYS*~LEARN +
(LEAD*STRATEGY*ITMGMT*~LEARN) => PERFORMANCE

** Notes: "~" indicates negated sets; inclS: sufficiency inclusion score, PRI: proportional reduction in inconsistency, covS: raw coverage, covU: unique coverage*

Table A2-2. Enhanced intermediate solution for high financial performance in the manufacturing sector

No.	Solution Configurations	inclS	PRI	covS	covU
1	LEAD*STRATEGY	0.839	0.781	0.806	0.488
2	~LEAD*ITMGMT*~LEARN	0.773	0.408	0.185	0.015
3	~LEAD*WORKSYS*LEARN	0.784	0.342	0.202	0.015
4	LEAD*ITMGMT*~WORKSYS*LEARN	0.830	0.624	0.302	0.004
	---------- Solution (M1) ----------	0.789	0.711	0.870	

M1: LEAD*STRATEGY +
~LEAD*ITMGMT*~LEARN +
~LEAD*WORKSYS*LEARN +
LEAD*ITMGMT*~WORKSYS*LEARN => PERFORMANCE

** Notes: "~" indicates negated sets; inclS: sufficiency inclusion score, PRI: proportional reduction in inconsistency, covS: raw coverage, covU: unique coverage*

Table A2-3. Enhanced parsimonious solution for high financial performance in the manufacturing sector

No.	Solution Configurations	inclS	PRI	covS	covU
1	STRATEGY	0.841	0.784	0.821	0.490
2	~LEAD*ITMGMT*~LEARN	0.773	0.408	0.185	0.015
3	~LEAD*WORKSYS*LEARN	0.784	0.342	0.202	0.008
4	LEAD*~WORKSYS*LEARN	0.800	0.580	0.312	0.007
	---------- Solution (M1) ----------	0.787	0.707	0.880	

M1: STRATEGY +
~LEAD*ITMGMT*~LEARN +
~LEAD*WORKSYS*LEARN +
LEAD*~WORKSYS*LEARN => PERFORMANCE

** Notes: "~" indicates negated sets; inclS: sufficiency inclusion score, PRI: proportional reduction in inconsistency, covS: raw coverage, covU: unique coverage*

Table A2-4. Solution for high financial performance in the service sector (all the three solutions are identical)

No.	Solution Configurations	inclS	PRI	covS	covU
1	LEAD*STRATEGY*ITMGMT*LEARN	0.884	0.823	0.732	0.732
	---------- Solution (M1) ----------	0.884	0.823	0.732	

M1: LEAD*STRATEGY*ITMGMT*LEARN => PERFORMANCE

** Notes: "~" indicates negated sets; inclS: sufficiency inclusion score, PRI: proportional reduction in inconsistency, covS: raw coverage, covU: unique coverage*

Table A2-5. Solution for high financial performance in the small business sector (all the three solutions are identical)

No.	Solution Configurations	inclS	PRI	covS	covU
1	LEAD*STRATEGY*WORKSYS	0.813	0.693	0.770	0.770
	---------- Solution (M1) ----------	0.813	0.693	0.770	

M1: LEAD*STRATEGY*WORKSYS => PERFORMANCE

** Notes: "~" indicates negated sets; inclS: sufficiency inclusion score, PRI: proportional reduction in inconsistency, covS: raw coverage, covU: unique coverage*

Table A2-6. Complex (and enhanced intermediate) solution for high financial performance in the education sector

No.	Solution Configurations	inclS	PRI	covS	covU
1	LEAD*STRATEGY*ITMGMT*WORKSYS	0.861	0.779	0.599	0.038
2	LEAD*STRATEGY*WORKSYS*LEARN	0.852	0.766	0.578	0.016
	---------- Solution (M1) ----------	0.843	0.755	0.616	

M1: LEAD*STRATEGY*ITMGMT*WORKSYS +
LEAD*STRATEGY*WORKSYS*LEARN => PERFORMANCE

** Notes: "~" indicates negated sets; inclS: sufficiency inclusion score, PRI: proportional reduction in inconsistency, covS: raw coverage, covU: unique coverage*

Table A2-7. Enhanced parsimonious solution for high financial performance in the education sector

No.	Solution Configurations	inclS	PRI	covS	covU
1	LEAD*STRATEGY*WORKSYS*LEARN	0.852	0.766	0.578	0.016
2	LEAD*STRATEGY*ITMGMT	0.848	0.767	0.643	0.043
3	LEAD*ITMGMT*WORKSYS	0.821	0.725	0.628	0.028

M1: LEAD*STRATEGY*WORKSYS*LEARN +
(LEAD*STRATEGY*ITMGMT) => PERFORMANCE
M2: LEAD*STRATEGY*WORKSYS*LEARN +
(LEAD*ITMGMT*WORKSYS) => PERFORMANCE

** Notes: "~" indicates negated sets; inclS: sufficiency inclusion score, PRI: proportional reduction in inconsistency, covS: raw coverage, covU: unique coverage*

Table A2-8. Complex solution for high financial performance in the healthcare sector

No.	Solution Configurations	inclS	PRI	covS	covU
1	LEAD*~STRATEGY*ITMGMT*WORKSYS	0.790	0.454	0.430	0.047
2	LEAD*STRATEGY*ITMGMT*LEARN	0.812	0.660	0.716	0.018
3	LEAD*STRATEGY*WORKSYS*LEARN	0.833	0.690	0.715	0.017
	---------- Solution (M1) ----------	0.763	0.592	0.780	

M1: LEAD*~STRATEGY*ITMGMT*WORKSYS +
LEAD*STRATEGY*ITMGMT*LEARN +
LEAD*STRATEGY*WORKSYS*LEARN => PERFORMANCE

** Notes: "~" indicates negated sets; inclS: sufficiency inclusion score, PRI: proportional reduction in inconsistency, covS: raw coverage, covU: unique coverage*

Table A2-9. Enhanced intermediate (and enhanced parsimonious) solution for high financial performance in the healthcare sector

No.	Solution Configurations	inclS	PRI	covS	covU
1	LEAD*ITMGMT*WORKSYS	0.771	0.611	0.781	0.082
2	LEAD*STRATEGY*ITMGMT*LEARN	0.812	0.660	0.716	0.018
3	LEAD*STRATEGY*WORKSYS*LEARN	0.833	0.690	0.715	0.017
	---------- Solution (M1) ----------	0.740	0.574	0.815	

M1: LEAD*ITMGMT*WORKSYS +
LEAD*STRATEGY*ITMGMT*LEARN +
LEAD*STRATEGY*WORKSYS*LEARN => PERFORMANCE

** Notes: "~" indicates negated sets; inclS: sufficiency inclusion score, PRI: proportional reduction in inconsistency, covS: raw coverage, covU: unique coverage*

Appendix 3. Regression Models for the Study in Chapter 3

This appendix shows the results of ordinary least square (OLS) regression models that shows the basic two-way interactions between IT reporting structure and the remaining conditions. The model in column (1) includes the main terms without the interaction terms. The model in columns (2), (3), (4), and (5) include the interactions between the IT reporting structure dummy variables and the following variables, respectively: ITstretgic, FirmSize (the natural log of the number of employees), ITintensity, and Transform.

Table A3-1. OLS regression results

Independent Variables	***Dependent variable:* Log (ROA)**				
	(1)	**(2)**	**(3)**	**(4)**	**(5)**
ITtoCEO	0.011 (0.027)	0.013 (0.043)	0.040 (0.141)	0.035 (0.032)	0.003 (0.035)
ITtoCFO	0.011 (0.033)	0.022 (0.050)	0.221 (0.189)	0.023 (0.040)	0.001 (0.041)
ITtoCOO	0.007 (0.035)	-0.080 (0.059)	-0.372* (0.193)	0.093** (0.045)	-0.022 (0.056)
ITstrategic	0.032* (0.019)	0.026 (0.049)	0.031 (0.019)	0.023 (0.019)	0.032 (0.020)
FirmSize	0.005 (0.007)	0.003 (0.007)	0.003 (0.013)	0.003 (0.007)	0.005 (0.008)
ITintensity	0.0003 (0.004)	0.0004 (0.004)	0.0004 (0.004)	0.106 (0.078)	0.0002 (0.004)
Transform	-0.013 (0.033)	-0.017 (0.033)	-0.009 (0.033)	-0.009 (0.033)	-0.034 (0.058)
Automate	-0.009 (0.030)	-0.007 (0.030)	-0.007 (0.030)	-0.011 (0.029)	-0.009 (0.031)
ITtoCEO * ITstrategic		-0.006 (0.054)			
ITtoCFO * ITstrategic		-0.021 (0.066)			
ITtoCOO * ITstrategic		0.134** (0.073)			
ITtoCEO * FirmSize			-0.004 (0.018)		
ITtoCFO * FirmSize			-0.027		

			(0.023)		
ITtoCOO * FirmSize			0.046*** (0.023)		
ITtoCEO * ITintensity				-0.105* (0.078)	
ITtoCFO * ITintensity				-0.077 (0.087)	
ITtoCOO * ITintensity				-0.213*** (0.087)	
ITtoCEO * Transform					0.020 (0.057)
ITtoCFO * Transform					0.026 (0.071)
ITtoCOO * Transform					0.051 (0.074)
Observations	154	154	154	154	154
R^2	0.026	0.065	0.077	0.091	0.030
F Statistic	0.490	0.898	1.080	1.297	0.395

*Note: Standard errors in parentheses; *** p<0.01, ** p<0.05, *p<0.1 (One-tailed test for interaction variables, two-tailed test for other variables)*

Appendix 4. QCA Analysis of Industry Categories in the Study of Chapter 3

This appendix shows the Venn Diagrams and QCA results for the three industry categories: transform, automate, and informate. For simplicity and for better illustration using Venn diagram, only the IT-to-CEO reporting structure has been included in these models. Therefore, any indirect reporting structure (such as IT-to-CFO and IT-to-COO) are are combined into one category. The results show that while there is only one configuration of high performance and one configuration of not high performance for each of Transform and Automate industry categories, the results for the Informate categories show four configurations of high performance and three configurations of not high performance.

Table A4-1. Configurations for the Transform industries

Conditions	**Configurations of High Performance**	**Configurations of Not High Performance**
	H1	**N1**
ITtoCEO	⊗	●
IT Strategic	⊗	
Large		●
IT Intensive		●
Consistency	0.412	0.890
Raw coverage	0.102	0.146
Unique coverage	0.102	0.146

● = presence of a condition; ⊗ = negation of a condition;
big circle = core element; small circle = peripheral element

Table A4-2. Configurations for the Automate industries

Conditions	**Configurations of High Performance**	**Configurations of Not High Performance**
	H1	**N1**
ITtoCEO	●	⊗
IT Strategic	●	●
Large		
IT Intensive	●	⊗
Consistency	0.720	0.738
Raw coverage	0.264	0.116
Unique coverage	0.264	0.264

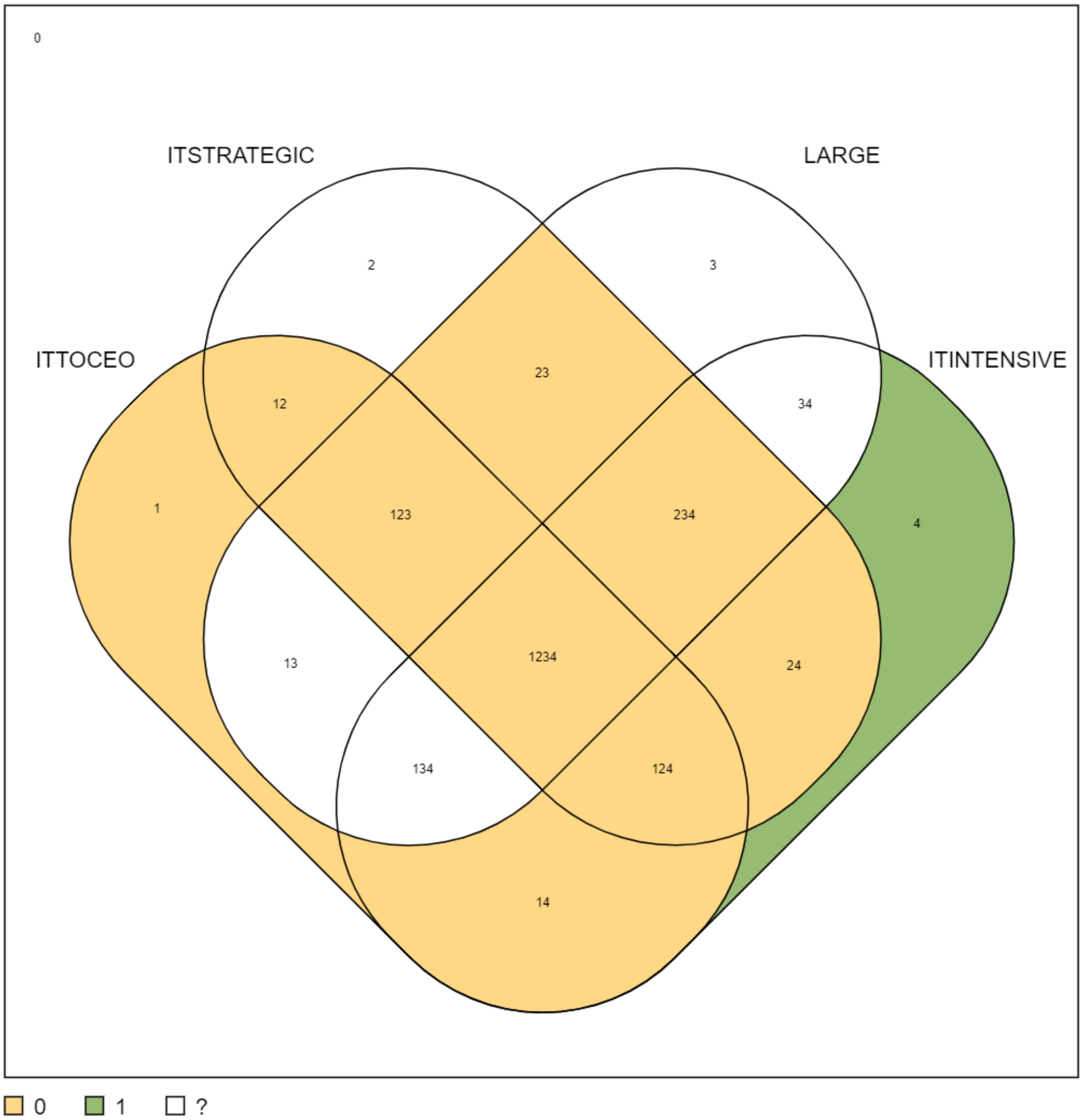
● = presence of a condition; ⊗ = negation of a condition;
big circle = core element; small circle = peripheral element

Table A4-3. Configurations for the Informate industries

Conditions	**Configurations of High Performance**				**Configurations of Not High Performance**		
	H1	**H2**	**H3**	**H4**	**N1**	**N2**	**N3**
ITtoCEO	●	●	⊗		⊗	⊗	
IT Strategic	●	●		●			⊗
Large	⊗		⊗	⊗	⊗	●	●
IT Intensive		●	●	●	⊗	●	⊗ (small)
Consistency	0.942	1.000	0.755	0.987	0.861	0.908	0.870
Raw coverage	0.219	0.188	0.110	0.235	0.121	0.201	0.177
Unique coverage	0.093	0.063	0.000	0.000	0.108	0.188	0.176

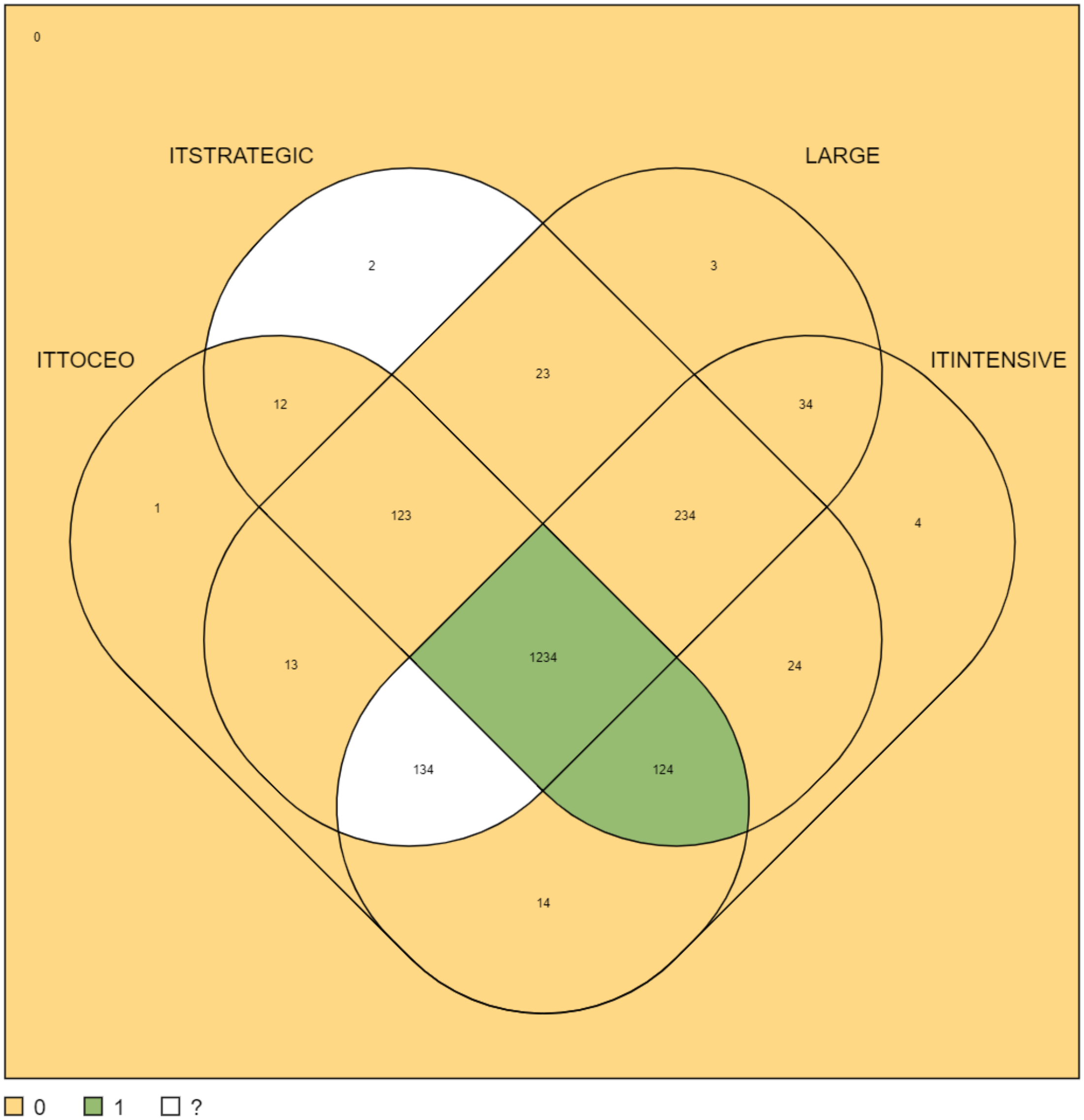
● = presence of a condition; ⊗ = negation of a condition;
big circle = core element; small circle = peripheral element

Figure A4-1. Venn diagram representing the truth table of the Transform industries



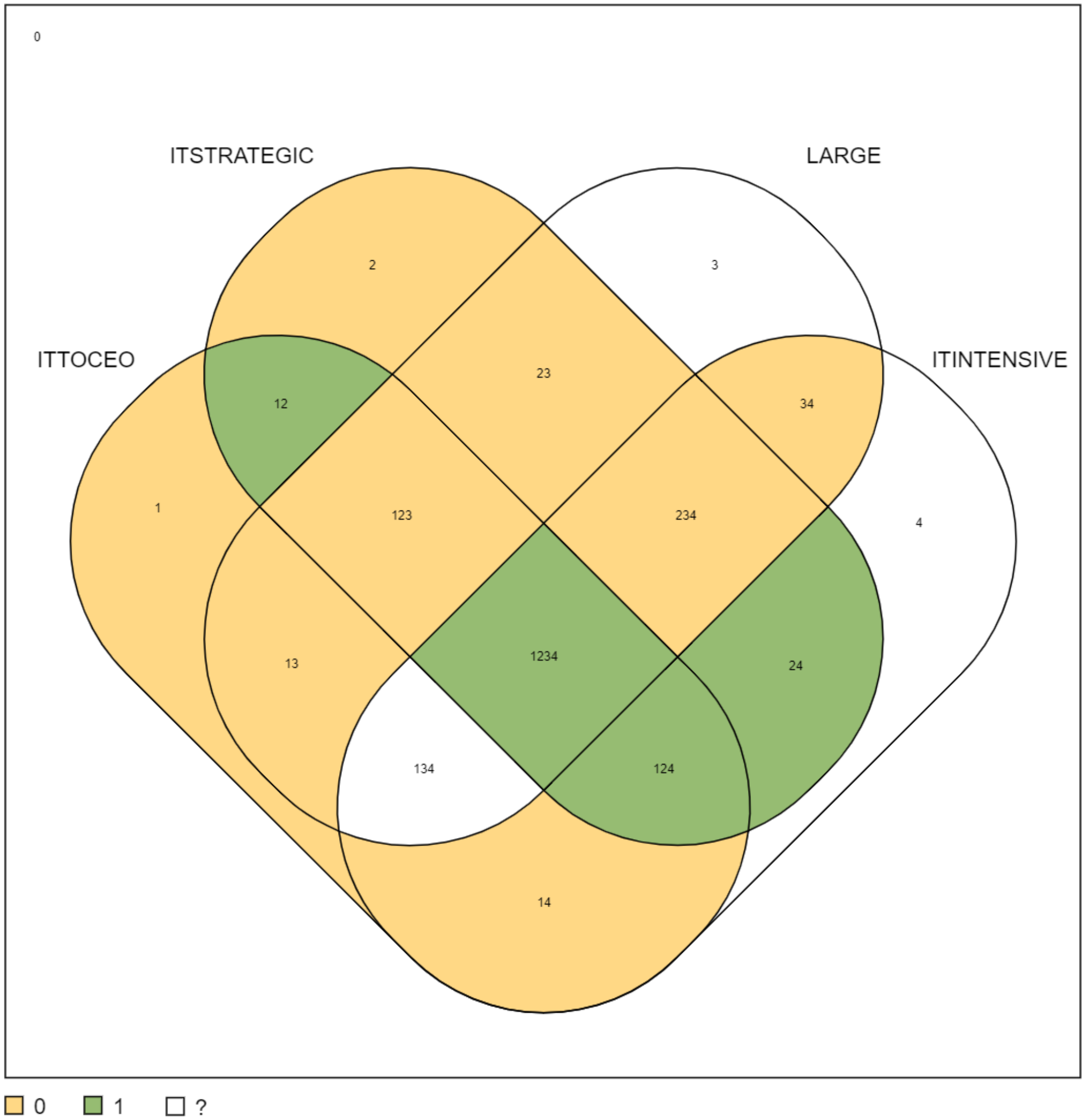
The Venn diagram shows the sets representing the four causal conditions. Each numbered area represent a single combination of these conditions (i.e., a single row in the truth table). The conditions are numbered as the following: 1: ITTOCEO, 2: ITSTRATEGIC, 3: LARGE, 4: ITINTENSIVE. Each number in the cells represents the conditions that are present for the corresponding combination. For example, the area with the code "12" corresponds to the truth table row for which ITTOCEO and ITSTRATEGIC are present and all other three conditions are absent. An area colored in green indicates that the corresponding truth table row has a value of 1 for the outcome (i.e., the row has a consistency above the 0.80 threshold) while an area colored in amber (orange) indicates a value of 0 for the outcome. White areas represent the truth table rows without enough cases and therefore are considered as remainders (empirically unobservable).

Figure A4-2. Venn diagram representing the truth table of the Automate industries



The Venn diagram shows the sets representing the four causal conditions. Each numbered area represent a single combination of these conditions (i.e., a single row in the truth table). The conditions are numbered as the following: 1: ITTOCEO, 2: ITSTRATEGIC, 3: LARGE, 4: ITINTENSIVE. Each number in the cells represents the conditions that are present for the corresponding combination. For example, the area with the code “12” corresponds to the truth table row for which ITTOCEO and ITSTRATEGIC are present and all other three conditions are absent. An area colored in green indicates that the corresponding truth table row has a value of 1 for the outcome (i.e., the row has a consistency above the 0.80 threshold) while an area colored in amber (orange) indicates a value of 0 for the outcome. White areas represent the truth table rows without enough cases and therefore are considered as remainders (empirically unobservable).

Figure A2-3. Venn diagram representing the truth table of the Informate industries



The Venn diagram shows the sets representing the four causal conditions. Each numbered area represent a single combination of these conditions (i.e., a single row in the truth table). The conditions are numbered as the following: 1: ITTOCEO, 2: ITSTRATEGIC, 3: LARGE, 4: ITINTENSIVE. Each number in the cells represents the conditions that are present for the corresponding combination. For example, the area with the code “12” corresponds to the truth table row for which ITTOCEO and ITSTRATEGIC are present and all other three conditions are absent. An area colored in green indicates that the corresponding truth table row has a value of 1 for the outcome (i.e., the row has a consistency above the 0.80 threshold) while an area colored in amber (orange) indicates a value of 0 for the outcome. White areas represent the truth table rows without enough cases and therefore are considered as remainders (empirically unobservable).

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