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# CIO and CEO Heterogeneity, IT Support, and IT Competitiveness in Stable and Unstable Environments: An Empirical Study

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## ABSTRACT

While top management support is critical to the success of information technologies (IT), little is known about how differences and similarities between the CEO and the CIO influence such support. Accordingly, this research examines the heterogeneity between CEO and CIO as antecedents of organizational support and its impact on competitive position in regards to IT in stable and unstable environmental context. A survey instrument was developed and distributed to matched CIO and CEOs. The findings indicate that the CEO/CIO heterogeneity in terms of experience positively impacts the organizational support for IT. Also heterogeneity of the functional background has a negative impact on the long term support for IT in stable environment. With regards to the final outcome, the organizational support for IT positively influence the competitive position of the firm in regards to IT usage. The results provide guidance to both CIO and CEO regarding the type of support needed in different organizational context.

## Keywords

CEO/CIO Heterogeneity, Organizational support for IT, IT performance, competitive position, PLS

## INTRODUCTION

Significant efforts have been devoted to understanding the organizational impacts of Information Technology (IT). However, the empirical evidence is mixed and contradictory (Devaraj and Kohli, 2003). Previous studies have looked at usage (Devaraj and Kohli, 2003), capabilities (Bharadwaj, 2000), consumer surplus (Hitt and Brynjolfsson, 1996), and investment announcements (Dos Santo et al., 1993; Dehning et al., 2003). This study takes a different approach. Drawing upon work in strategy and management, this study applies the concepts of top management team heterogeneity to the IT context. More specifically, it looks at heterogeneity between a chief executive officer (CEO) and a chief information officer (CIO) and how it influences the organizational support for IT, which in turns is expected to influence the competitive position of the firm in regards to IT use.

Characteristics of individuals like gender, tenure, education, and race play critical roles in psychological research (Tsui and O'Reilly, 1989) and organizational demographics research (Boone et al., 2004; Preston et al. 2006). At the organizational level, by looking at the composition of the top management teams, insights from organizational outcomes can be gained. Indeed, organizations are a reflection of their top management teams and top executives matter since different types of managers are associated with different organizational outcomes (Hambrick and Mason, 1984). Consequences of characteristics of top management teams can be found by looking at the heterogeneity among individuals. When managers have different backgrounds, they tend to have a broader vision of their environment and the world, which influences the

organizational outcomes and performance levels (Hambrick and Mason, 1984; Miller, 1993). For this study, we are interested in looking at how CEO/CIO heterogeneity influences the long-term and current organizational support for IT, which in turn should influence the competitive position of the firm in terms of its IT usage. A firm's CEO and CIO identify environmental opportunities and problems, interpret relevant information, consider organizational capabilities and constraints, and formulate and implement strategic change (Mintzberg 1979). Thus, an examination of what influences how executives assess and direct the support for IT is an important area of investigation.

Consequently, the contributions of this paper are twofold. First, a theoretical foundation is provided and tested to better understand the antecedents of current and long-term organizational support for IT and the impact support has on the actual competitive position in regards to IT use. Second, the organizational context of the firm in term of stability is considered, which should help understand the differences of IT performance across firms.

The rest of the paper is organized as follow. The next section presents the research model guiding the study. The research questions and hypothesis are introduced next, followed by a description of the methodology. The data analysis and the results obtained with PLS are then discussed. The paper concludes with a discussion and implications of the findings.

## CONCEPTUAL MODEL AND RESEARCH HYPOTHESES

The conceptual model for this study suggests that (1) CEO/CIO heterogeneity impacts organizational support for IT and (2) organizational support for IT impacts competitive position in regards to IT use, and that these relationships are moderated by the organization's environmental context. The different constructs and relationships are described in more details next.

### CEO/CIO Heterogeneity

Characteristics of individuals like gender, tenure, education, and race play critical roles in psychological research (Tsui and O'Reilly, 1989) and organizational demographics research (Boone et al., 2004). At the organizational level, by looking at the composition of the top management teams, insights from organizational outcomes can be gained. Indeed, Hambrick and Mason (1984) argued that organizations are a reflection of their top management teams and that top executives matter since different types of managers are associated with different organizational outcomes. These characteristics of top management are looked individually and in terms of the relations that exist between different members of the top management teams on these different characteristics. Previous studies found a relationship between the characteristics and background of top management teams and corporate social performance (Thomas and Roy, 1995), corporate performance (Norburn and Birley, 1988; Richard et al., 2004), and corporate strategic change (Wiersema and Bantel, 1992). At the individual level, CEO demographic background was found to be linked to his/her strategy making behaviors (Miller et al., 1982) and to the alignment between organization and environment (Miller, 1991). CIO demographics such as age, tenure, and educational level, has also been associated with organizational use of IT (Li 2004). In addition, organizational demography is readily observable, unobtrusive, and convenient to measure, making it attractive for research (Thomas and Roy, 1995; Wiersema and Bantel, 1992).

Three areas of heterogeneity are looked at in this study; demographics, functional background, and experiential. Demographics refer to the age, level of education as well as gender. Functional background refers to the domain in which the respondent has worked while the experiential component includes the overall work experience as well as the tenure in the organization.

Consequences of demographic characteristics can be found by looking at the heterogeneity among individuals. For instance, top management team heterogeneity has been associated with strategic complexity, creativity, diversity, and innovation (Ferrier and Lyon, 2004; Wiersema and Bantel, 1992). Miller (1993) argued that heterogeneity among the top management team is an important factor preserving strategic complexity and later explained that adding a new member to the top management team from outside the organization will bring to the team new perspectives about internal and external factors that would otherwise be overlooked (Miller et al., 1996). When managers have different demographic backgrounds it allows them to have a broader vision of their environment and the world (Hambrick and Mason, 1984; Miller, 1993). In the context of IT, the similarity between the CIO and TMT has also been investigated and linked to the shared understanding between these parties (Preston et al. 2006).

For this study, we are interested in looking at how CEO/CIO heterogeneity influences the organizational support for IT. Based on previous work, we suggest that firm led by heterogeneous CEO and CIO will have greater needs for diverse and rich information, which would necessitate greater current and long-term organizational support for IT (Hambrick and Mason, 1984; Miller, 1993).

### **Information Technology: Organizational Support for IT and Competitive position**

Organizational support for IT (OSIT) is a key factor that shape IT use in a firm (Jarvenpaa and Ives 1991). In order to leverage the potential benefits from IT, organizations need to put adequate resources both in the short term and long term support. In addition, organization support can provide a signal to the rest of the firm about the importance of IT to the achievement of the overall firm goals. More importantly, strong support for IT can be expected to get managers personally active in proposing and developing IT-related initiatives, which should influence the competitive position of the firm (Jarvenpaa and Ives 1991). Indeed, prior research suggests that the CIO cannot achieve goals without the necessary resources and support from the firm (Earl and Feeney 1994). Thus, the impact of the level resources devoted to IT should be reflected in better competitive position in terms of IT usage – a measure of organizational innovativeness of IT (Li et al., 2006). In this study, the organizational support for IT is defined in term of current and long-term support for IT resources.

### **Organizational Context: turbulent and stable environment**

Organizational context is an important variable in organizational theory research because depending on the context, different managerial style and organizational structures may be more appropriate (Bourgeois et al., 1978). Different terms have been used to define organizational context such as organizational environment, organizational settings, and environment. Depending on the degree of instability or turbulence, two organizational contexts are identified (Miller et al., 1996). The first one is illustrated by a context that is changing, turbulent and unpredictable, which is classified as unstable, uncertain, or unpredictable. For example, clients' demands may be constantly changing and hard to anticipate. The degree of turbulence is high causing organizations to search for new alternatives that will reduce their uncertainty regarding the environment. At the opposite, stable contexts, or predictable ones, where products, markets and methods are uniform and unchanging, organizations tend to focus on their current activities, goals, or IT applications (Miller et al., 1996). Previous studies have found that financial success induces functional favoritism of CEO in uncertain environments where there is a good deal of scope and motivation for attributional opportunism and superstitious learning (Miller et al. 1997). In the same direction, firm-level performance improved steadily with CEO's tenure in relatively stable industry, while in dynamic industry, CEOs were at their best when they started their job, and firm performance declined steadily across their tenure (Henderson et al. 2006).

Thus, we argue that differences in the context will lead to differences in the factors that shape organizational support for IT. More specifically, in stable organizational context, heterogeneity among members of the top management team may be less prevalent since diverse managerial perspectives are not necessary to cope with the context (Miller and Chen, 1996). Less complex IT applications are also most likely to be prevalent, and thus less organizational support for IT is likely to be needed. Top management does not need much information about their competitors or clients for example. At the opposite, in unstable context, organizations must deal with new challenges and opportunities. Managers will need to be more innovative, search for new ways to compete, have different demographic background and assume a higher degree of risk (Bourgeois, 1980; Miller, 1993). Indeed, significant changes in the environment, which leads to unstable organizations, will force organizations to follow broader orientations and complex strategies (Miller, 1993; Bourgeois, 1980). Less complex activities are risky because they are apt to leave gap that ignore important challenges or opportunity (Miller and Chen, 1996). Organizations may also experiment with new strategies and IT applications to stay successful (Miller et al., 1996). More IT applications are likely to be necessary to manage the current organizational context and respond to top managers' information needs, and organizational support for IT may be more prevalent. Therefore, we would expect the effect of CEO/CIO heterogeneity and organizational support for IT to depend on the organizational context of the firm. Below are the hypotheses developed for this study, which posit different relationships between CIO/CEO heterogeneity and organizational support for IT across stable and unstable organizational context. However, we expect that the relationship between organizational support for IT and competitive position will remain the same across both contexts.

#### **In a stable environment:**

Hypothesis #1: CEO/CIO heterogeneity in (a) demographics, (b) functional background; and (c) experience is negatively related to current organizational support for IT.

Hypothesis #2: CEO/CIO heterogeneity in (a) demographics, (b) functional background; and (c) experience is negatively related to long term organizational support for IT.

#### **In an unstable environment:**

Hypothesis #3: CEO/CIO heterogeneity in (a) demographics, (b) functional background; and (c) experience is positively related to current organizational support for IT.

Hypothesis #4: CEO/CIO heterogeneity in (a) demographics, (b) functional background; and (c) experience is positively related to long term organizational support for IT.

**In both environments:**

Hypothesis #5: The relationship between (a) current organizational support for IT and (b) long term organizational support for IT is positively related to competitive position in regards to IT use.

**RESEARCH METHODOLOGY**

**Study Sample**

The sample consisted of small and medium-sized firms polled in the province of Quebec. Smaller firms provide good opportunity to study the effects of CEO/CIO heterogeneity as they generally have a dramatic impact (Miller, 1991). Two questionnaires were used to collect data and both were pre-tested and checked for validity and reliability. The first one was sent out to the CEO and the second one went to the CIO. The question regarding the stability of the environment was assessed by the CEO, while the questions regarding current and long-term organizational support for IT and competitive position were assessed by the CIO. Both the CIO and CEO answered questions regarding their demographic background. Having two respondents reduced problems of single-source bias but resulted in nonresponses (Miller and Toulouse, 1998). The final sample consisted of 111 matched pairs of CEO and CIO across a mix of industries.

Firms were from different sectors, but all were production oriented. Within the sample, 54 firms were considered being in an unstable environment and 55 in a stable one. The average size of the firms was 208 employees (SD = 105) with a minimum of 100 and maximum of 495 employees. Firms with less than 100 employees were not selected because they are more likely to have less formalized IT applications.

Among CEO's, 98 % were male, had an average of 9.1 years of experience as CEO, were on average 47 years old, and most of them (65%) had completed at least an undergraduate degree. More than the majority of CIO's were male (83%), had an average of 5.3 years of experience as CIO, were on average 37 years old, and most of them (58%) had completed at least an undergraduate degree.

**Data Collection**

First, respondent were contacted by phone to inform them on the study and ask for their consent to send the questionnaire. Two questionnaires were sent by mail or by fax to those who agreed to participate. Out of the 787 firms initially contacted, 307 agreed to participate and received both questionnaires. Response rate for the CEO was 36% and 51% for the CIO, for an overall sample of 111 complete sets (36%).

**Measures**

When existing measures existed, they were adapted to the context of this study and used, but if none were found, they were developed. The heterogeneity between the CEO and CIO was assessed in three domains: demographics, functional background, and experience. Heterogeneity in age, level of education, and gender were used as indicator of heterogeneity in demographics, heterogeneity of the years of overall experience as well as of the tenure in the organization were used as indicator of heterogeneity in experience while heterogeneity in the functional domain has only one indicator. The choice of these indicators of heterogeneity is based on previous studies (Ferrier and Lyon, 2004; Preston et al. 2006, Tsui and O'Reilly, 1989). Tenure and education variables were taken from Tsui and O'Reilly (1989) research on superior-subordinate demographic dissimilarity. Age, experience, and tenure in the organization was measured by squaring the difference between the values for the CEO and CIO. The squared term is used to derive an absolute difference score and to postulate an exponential function between the distance and the outcome (Tsui and O'Reilly, 1989). The 3 others variables were dichotomous, with 0 indicating that the CEO and CIO were of the same gender, functional background and education level. Functional background was divided into three categories based on Hambrick and Mason (1984). Output functions emphasize externally oriented activities (Thomas and Simerly, 1995) and are responsible for monitoring and adjusting products and markets. Throughput functions improve the efficiency of the transformation process and focus on the efficient transformation of inputs to outputs (Thomas and Simerly, 1995). Finally, peripheral functions are those that are not involved with the organization's core activities. Education level was divided into nine categories from high school to doctoral degrees and gender comprised male and female.

The impact of the different domains of heterogeneity was assessed on two measures: the current resources devoted to IT and the long term resources committed to IT. These two variables were assessed by the CIO, as the most likely person in the

organization to be able to provide an accurate evaluation of the IT resources. The current resources for IT was measured by asking the extent to which the financial resources devoted to hardware, software, development, maintenance and personnel was sufficient to achieve the objectives. The long term resources for IT asked about the CEO’s commitment to financial resources in the long term also for hardware, software, development and maintenance, and personnel. Lastly, IT competitive position was measured by asking CIOs how they rank their organization’s use of IT as compared to competitors.

Organizational context was measured by asking the CEO to assess to what extent each of the following factors was stable or not: competition, clients, suppliers, technology, industry economy, and rules and law. Results were averaged and each firm that had a value of 4 or more on a scale of 7 was assigned the number 1 for stable, otherwise, 0 for unstable.

**DATA ANALYSIS**

The antecedents and consequent of organizational support for IT are analyzed using partial least squares (PLS), a component-based approach suitable for smaller datasets, as implemented in Smart PLS 2.0 (beta) (Ringle, et al. 2005).

**Measurement Model**

Of the six constructs included in the model, the three constructs of heterogeneity (demographics, functional background, and experience) are modeled as formative; the other three (current IT resources, long term IT resources, and IT competitive position) are modeled as reflective. Heterogeneity in the functional background and IT competitive position each has one item. To assess the reflective measurement model, factor loadings, composite reliability, convergent and discriminant validity are assessed. The reflective constructs current IT resources and long term IT resources both exhibit good psychometric properties. Items loadings are ranging from .82 to .96, well above the threshold value of .70. Results are also supportive of good convergent and discriminant validity (Table 1). The weights for the formative constructs with more than one item are shown are Table 2.

	Composite Reliability	Current IT resources	Long term IT resources
Current IT resources	.94	<b>.88</b>	
Long term IT resources	.97	.76	<b>.94</b>

Diagonal elements are the square roots of average variance extracted

**Table 1. Intercorrelation among Reflective Constructs**

Construct	Indicator	Weight
Demographic Heterogeneity	Age	.635
	Education	.334
	Gender	.730*
Experience heterogeneity	Tenure	.377
	experience	.750**

Note: \* Significant at .10; \*\*Significant at .05

**Table 2. Weights of Formative Constructs**

**Structural Model**

To detect the moderating effect of organizational context, a group comparison is performed. The sample is split in two subsamples based on the stability of the environment; the first subsample is for organization in a stable environment; the

second for organization in an unstable environment. The path coefficients are estimated for each subsample using PLS. Moderating effect is represented by the differences between the path coefficients.

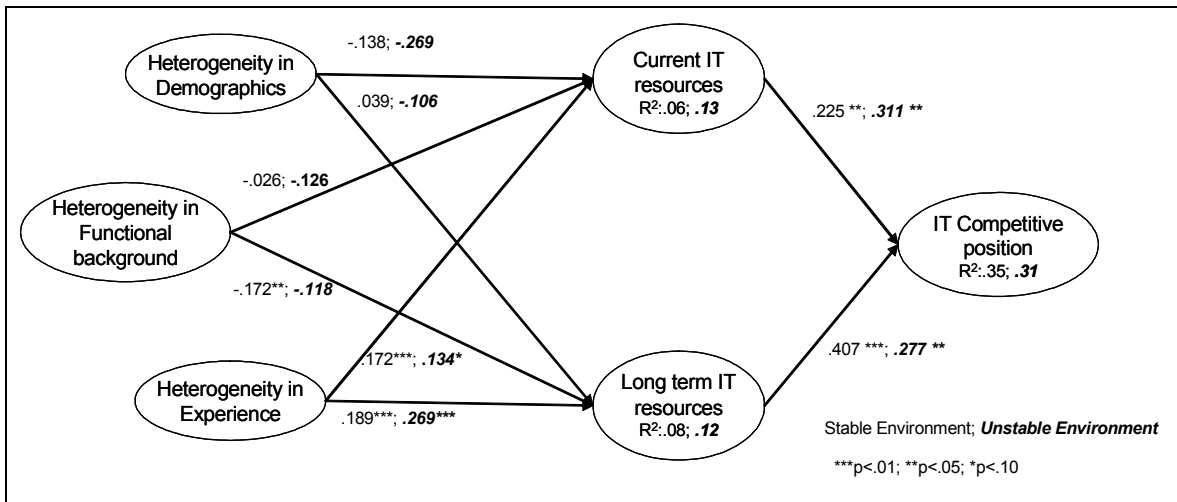


Figure 2. Results for Stable and Unstable Environment

**Findings**

Overall, the hypotheses for the links between heterogeneity and organizational support for IT suggested that relationships are negative in a stable environment (H1 and H2) and positive in an unstable environment (H3 and H4). Results are displayed in Figure 2. Three of six hypothesized relationships between heterogeneity and organizational support for IT in a stable environment were negative as expected, but only one was significant, supporting H2b that linked heterogeneity in the functional background and current IT resources. For the unstable environment, two of the six relationships between heterogeneity and organizational support for IT were significant and positive as expected, linking heterogeneity in experience with current (H3c) and long term (H4c) resources.

The role of the environment was not as strong as expected. The link between heterogeneity of the demographics was not significant to either form of support for IT in both environments. Heterogeneity in the experience was positively related to both form of support for IT, in both environments. The strength of the relationship changed however, from one sample to the other: the impact on current IT resources decreases from the stable environment to the unstable, while the impact on long term resources increases from the stable to the unstable environment. The stability of the environment had an impact on the influence of heterogeneity in functional background on the resources; indeed the influence of the heterogeneity on long term resources is negative in a stable environment, while it is not significant on the current resources or on both current and ong term in the unstable environment. This last result means that there will be more long term resources for IT when the CEO and CIO are alike or homogeneous.

Hypothesis 5 was supported, as the relationship between current and long term IT resources and the IT competitive position is significant and positive across both samples. Current and long term IT resources are positively related to the IT competitive position in both organizational contexts.

**DISCUSSIONS AND IMPLICATIONS**

The present study focused on evaluating the impact of CEO/CIO demographic heterogeneity on organizational support for IT in two organizational contexts. This study addresses three research questions: (1) what is the relationships between CEO/CIO heterogeneity and organizational support for IT? (2) how do current and long-term IT resources affect IT competitive position? and (3) what is the effect of environmental stability? Results demonstrated that the heterogeneity of top managers, in this case the CEO and the CIO, have different impact of organizational support of IT, based on the environment. In a stable environment, the more the CEO and CIO are heterogeneous in terms of experience, the more current and long term resources are devoted to IT, and the more heterogeneous the CEO and CIO are in terms of functional background, the more long term resources are devoted to IT. On the other hand, in an unstable environment, the heterogeneity between the CEO and CIO

functional background influences negatively the current organizational support for IT resources, and not the long term ones. Still in an unstable environment, heterogeneity of the experience has an influence on both current and long term resources, but the impact on the long term is more important and the impact on the current resources is less important than in a stable environment. Finally, the impact of current and long term IT resources on IT competitive position remains the same across contexts.

Although the small sample employed in this research suggests that its implications must be interpreted with care, this study makes important contributions. For instance, it enhances our understanding of the role CEO/CIO heterogeneity in explaining organizational support to IT. The findings that CEO/CIO heterogeneity is not the same in all organizational contexts implies that. More research is needed to test these results further. Data from larger firms with a large enough sample could draw additional conclusions. Future research could investigate further the moderating effect of the environment by using other tests for split sample methods or by modeling the interacting effect. Future research could also explore other antecedents of organizational support for IT and how it the results change across industries.

## CONCLUSION

The study provides empirical support for the antecedents and consequent of organizational support of IT and offers a novel perspective by integrating concepts borrowed from strategy and management to the context of IT. Results provide guidance to both CIO and CEO regarding the type of support needed depending on the organizational context. More specifically, CEO/CIO heterogeneity in the experience impacts the organizational support for IT. However, while in the stable environment heterogeneity of the functional background has a negative impact on the long term support for IT, in unstable environment, this impact changes to the current support for IT. Finally, organizational support for IT is a key factor that influences the competitive position of a firm in regards to IT usage.

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