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ABSTRACT

In this paper, we address the issue of IT organizational alignment in terms of internal consistency within IT-enabled organizational patterns: mechanistic versus organic. To test our model, we have used data collected due to a large multi-sector survey conducted within 1900 European firms. Our findings stipulate that complementarities between coordination-oriented IT and organic organizational designs are higher than complementarities between Control-oriented IT and mechanistic organizational designs and imply higher levels of performance for the firm.

Keywords

IT alignment, mechanistic, organic, organizational patterns, structural equation modeling

INTRODUCTION

IT alignment is a widely investigated research topic. From an empirical point of view, one can argue that is no more questionable that alignment leads to more strategic use of IT and therefore induces increased levels of performance. In fact, in the last two decades, firm performance implications of aligning IT strategy and business strategy has been demonstrated from multiple perspectives. So what is challenging concerning the alignment issue? Why does it still require the interest of practitioners and researchers?

As reminded by Chan & Reich (2007), "*alignment should be present at all the levels of the organization, including the organizational level, system level and the individual/cognitive level*" (p. 301). However, it is not equally studied at all these levels.

Many authors have pointed out that part of the alignment literature has failed to capture the very essence of the concept of alignment and has addressed only some of the phenomena through which it is enacted and perceived (Ciborra, 1997). We argue in this paper that the "strategic" alignment's component is a widely studied topic, while the "organizational" alignment view is still lacking deeper investigation.

We also emphasize that IT alignment is not only a strategic matter that requires the interest of high level executives and decision makers (whether Business or IT oriented) but also an organizational characteristic deeply diffused within the processes and structures that build up the organization. Our aim in this paper is to build a framework to examine the fit between IT types and organizational patterns, and how these relationships produce impacts on performance.

This paper is organized as follows. We first develop our theoretical background, we present our research model and how we have tested it within a sample of 1900 European companies. We then display our findings. To conclude, we discuss the implications and limits of the present research.

THEORETICAL BACKGROUND

Many researchers have investigated the link between information technology and organizational structure. For decades, there seems to be a general expectation that IT can induce positive impacts on firm performance. We argue in this research that IT effects within organizations are inherently related to the degree of enactment of IT investments in the diverse organizational processes and are dependent on the fit between the capabilities provided by IT and the organizational requirements, specifically in terms of information processing.

In order to more closely examine the link between IT and organizational patterns, we need a theory in which the effects of IT are more easily interpretable. For this purpose, the contingency and information processing view of organizations and the IT alignment literature are used in this research to provide complementary insights on the different patterns through which IT and organizational processes and structures potentially complement and fit each other.

Contingency and Information Processing Theory

Organizational research has explored the relationship between organizational design and performance. Since Burns & Stalker (1961) have sustained that different approaches to structuring organizations might induce differential levels of performance under certain conditions, numerous studies have focused on identifying and modeling the complementary elements which contextually lead to performance. The attempt to identify critical contingent variables has led to the investigation of issues such as the contingent role played by technology in the organizations (Mohr, 1977; Perrow, 1972; Woodward, 1965).

The central premise of Burns & Stalker (1961) model is that organizations need different systems of control, information sharing and authorization. A continuum of organizational patterns has been proposed: Mechanistic versus Organic. Mechanistic organizational forms, characterized by hierarchical control, are supposed to be more suited to stable environments, and to afford a high level of control over tasks and subordinates behavior. While, Organic organizational forms, characterized by dispersed control, are more suited to unstable conditions, under which task accomplishment and innovation should shift to the most knowledgeable and expert parties.

The theoretical underpinnings of this research area rely to a systemic and a contingent paradigm of thinking about organizations (Van de Ven & Drazin, 1985; Zott & Amitt, 2008). As explained by Tushman & Nadler (1978), three assumptions underlie this paradigm: (1) organizations are open systems which deal with environmental and organizational uncertainty. A critical task of the organizations is to gather and process information in order to solve all sorts of problems inherently related to the ways the units and sub-units of the organizations interact with each other and with the environment, (2) the organizational components considered as information processing sub-systems have to deal with diverse sources of uncertainty and therefore a basic function of the organization's structure is to create the most appropriate configuration of functions and processes, (3) A crucial issue to achieve performance is to settle the appropriate structure for the different subunits within the organization and the structural mechanisms which enable coordination and control processes.

The Information Processing Theory has proposed to handle these issues and especially the third assumption defined above. Huber (1990) has emphasized the idea that organizations are information processing and decision making systems in which IT are enacted within the organizational components to automate and informate (Weick, 1990). Galbraith (1973, 1974) has addressed the organizational design problem as a given set of information processing needs and capabilities. He has proposed a typology composed of 4 organizational structures which provide different levels of information processing needs: Slack resources, Self-contained tasks, vertical Information systems processes and lateral relations.

We propose in this paper to address this third assumption using a contingent based concept: IT alignment.

IT alignment literature

Chan & Reich (2007) have provided an extensive review of the IT alignment literature, in which they address questions such as what have we learned? And what are the new perspectives on alignment? This paper echoes their claim for more accurate theoretical developments and empirical testing.

What we will notice here is the predominance of "comprehensive" theories and models that attempt to put forward "all" the components and linkages (direct or cross-domain) to be fitted in order to attain IT induced value. Examples: The Strategic Alignment Model, SAM (Henderson & Venkatraman, 1993) and the Punctuated Equilibrium Model (Sabherwal et al. 2001) which have certainly been the most quoted models and those which have served as a basis for a great number of empirical studies (Luftman et al. 1993; Croteau & Bergeron, 2001; Avison et al., 2004; Kefi & Kalika, 2005).

Henderson and Venkatraman (1993) have depicted their alignment model into two complementary relationships; "Strategic Fit" which is the extent of match between business and IT strategy, and "Functional Integration" which is the relationship between organizational infrastructure and processes and IT infrastructure and processes. Reich and Benbasat (2000) have defined two types of strategic alignment: short term and long term. This analysis has introduced time as part of the issue but remains still faithful to the static spirit of the SAM.

The Sabherwal et al. (2001) alignment model is at the contrary intended to be more dynamic and aimed at examining the ways alignment evolves over time. Sabherwal et al. (2001) have reminded the conception presented by Thompson (1967), according to which alignment is a "*moving target at which organizations shoot*" and have emphasized the conception of alignment as an emergent process. The model however is composed similarly by complementary interactive dimensions: business strategy, business structure, IT strategy and IT structure.

Compared to the SAM, Sabherwal et al. (2001) model has also provided deeper insights on its components: Business structure has been examined in terms of decision making processes being organic or mechanistic (Burns & Stalker, 1961), which can be linked to centralized, decentralized and hybrid processes (Brown & Magill, 1994). IS structure has been examined using centralized, shared or decentralized IT management (Brown & Magill, 1994). IT strategy has been assessed using the five strategic thrusts (low cost, differentiation, growth, alliance and innovation). And finally business strategy could be assessed using the so popular typology of Defenders, Analyzers and Prospectors (Miles & Snow, 1978).

This model conceptualizes alignment as a set of dynamics where contextual factors related to the environment and to the organizational characteristics (size, culture, etc.) play a crucial role in shaping the alignment equilibrium that occurs at a certain point of time and most importantly the extent of changes produced by this equilibrium state (evolutionary, versus revolutionary changes for example).

We argue therefore that this conceptualization of alignment provided by the Sabherwal et al. (2001) is more appropriate to handle our research issue. It is important to notice however that neither of these models tell us which IS types fit which structures. Empirical studies focusing on this specific point are also dramatically lacking.

RESEARCH MODEL

We draw on the view of organizations as information processing systems facing uncertainty and propose to develop a conceptual model for IT organizational alignment. In our model, information processing refers to gathering and interpreting information in the context of organizational decision making. Uncertainty is defined as the difference between information processed and information required to complete a task.

In this section, we first define the components of our model, we then explain how they are related by formulating our research hypotheses.

The concept of fit

To understand the nature of alignment, we suggest the use of Venkatraman's (1989) and Van de Ven's and Drazin's (1985) conceptualization of fit as a lens through which we discuss the implications of organizational alignment on performance. Venkatraman (1989) defines fit from six different perspectives: matching, moderation, mediation, gestalts, co variation and profile deviation (Shin, 2003).

In this paper, we interpret fit as an internal consistency between organizational design (organic versus mechanistic) and IT structure (coordination –oriented versus control-oriented). The level of fit achieved is then assessed as an antecedent variable to performance. The matching perspective of fit will therefore be adopted in our model.

We also argue following Sabherwal et al. (2001) that fit is a dynamic concept. To translate this theoretical concept into empirical measures, it is therefore important to assess how it is reflected in terms of the (perceived) role played by IT to support business processes (static measure) and how it is enacted in terms of diverse adjustments that have to be realized within the existing organizational processes due to IT introduction and usage within the firm (dynamic measure). As explained by Kerarns & Grover (2003), alignment can be conceptualized as a dynamic capability which refers to the ability of the firm to reconfigure its internal and external capabilities to address a dynamic environment (Teece, Pisano, & Shuen, 1997).

IT Structure

In our model, the IT component is related to the firm's IT structure and therefore integrates the IT systems that support the organizational processes. The IT component should be measured on the level of IT types, informing which combinations of IT types provide appropriate information processing functionalities. Research based on contingency theory measures IT in terms of IT structure or IT support to the firm's strategy. Studies with a resource-based perspective mostly interpret IT in terms of IT investment (Oh & Pinsonnault, 2007). Finally, some researchers have analyzed IT at the level of IT applications (ERP, CRM, etc.)

In our model, we use an adapted version of Pinsonnault and Kraemer's (1997) classification, distinguishing between coordination-oriented IT and control-oriented IT

-Coordination-oriented IT systems facilitate the horizontal flow of information between employees, to enhance communication and decisions on a lateral level.

-Control-oriented IT systems facilitate the vertical information flow of information along a firm's hierarchy, provide support for decision-makers to supervise and monitor the activities of subordinates and their performance outcome.

It is important to notice here that coordination versus control orientation of IT is determined by the technical functionalities embedded in the IT and by the different usages which are enacted by individuals and groups within the firm. The same IT application can therefore serve as a control-oriented and/or coordination oriented, depending on the functionalities used and the usage context.

Organizational Structure

The firm's organizational structure can be described by different dimensions. The most commonly used are: centralization, formalization and differentiation: horizontal differentiation (work specialization), and vertical differentiation (hierarchy's levels). Formalization is the standardization by written rules as well as the level of measuring the degree of compliance with these rules, i.e. monitoring of behavior and outcomes, and can serve as another substitute for centralization (Burton & Obel, 2004).

Burn's and Stalker (1961) organic and mechanistic structures represent two opposite ideal types of organizational patterns, that are supposed to be suited to specific contingency factors (see table 1).

Stable/simple environment ***Size/structure/activities of the firm***	***Dynamic/complex environment*** ***Size/structure/activities of the firm***
High centralization/formalization/specialization Many hierarchical levels High vertical and low horizontal information flows	Low centralization/formalization/specialization Few hierarchical levels High vertical and horizontal information flows
Mechanistic structure	**Organic structure**
↕ FIT	↕ FIT
Control-oriented IT	**Coordination-oriented IT**
↘ Performance	↙

Table 1. IT-enabled organizational patterns and performance

Performance

Organizational performance is the ultimate dependent variable of our model. Drawing on Porter (1996) and Tallon et al. (2000), we have chosen to assess this variable with regard to 2 foci: (1) efficiency: productivity improvement; costs reduction; and (2) effectiveness: Innovation capabilities, reactivity capabilities toward business opportunities and responsiveness to customer requirements.

Research hypotheses

The structure of our model, depicted into two variants (see figures 1and 2), is defined according to the research hypotheses formulated as follows:

H1: Combining control-oriented IT and mechanistic organizational structures induces perceived IT-organizational alignment (mechanistic IT-organizational alignment).

H2: Combining coordination-oriented IT and organic organizational structures induces perceived IT-organizational alignment (organic IT-organizational alignment).

H3: Complementarities between coordination-oriented IT and organic organizational designs are higher than complementarities between control-oriented IT and mechanistic organizational designs.

H4: Organic IT-organizational alignment induces higher levels of performance than mechanistic IT-organizational alignment.

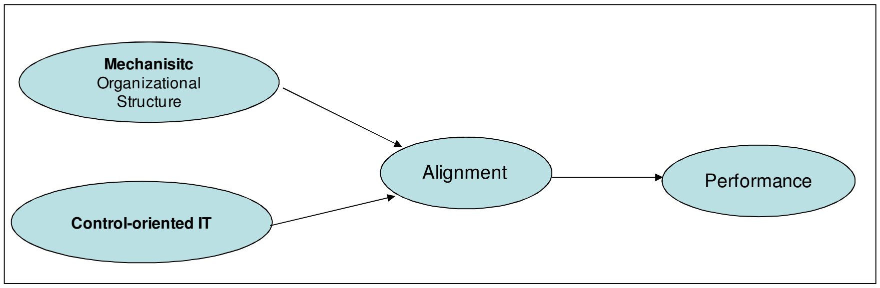

Figure 1. Mechanistic IT-organizational alignment model

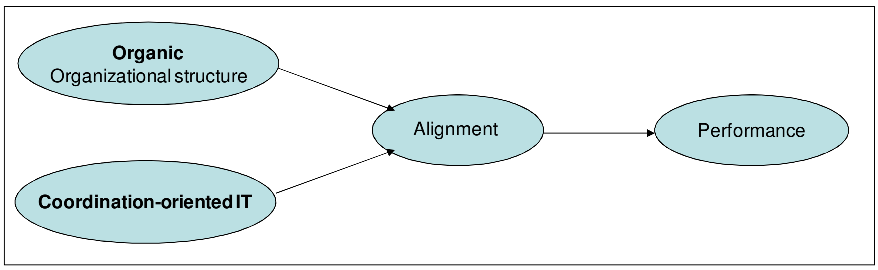

Figure 2. Organic IT-organizational alignment model

Measurement

Drawing upon our literature review, we defined our constructs and translated them into survey items (see table 2). While we recognize that prior items might exist for each of these constructs, we instead created a new measurement approach for this study, in an attempt to create a new understanding of these concepts in the specific context of IT-organizational alignment evaluation. All our items have been pretested within a group of scholars. A pilot test has then been achieved in order to avoid any bias. Given that the study has been iterated and the questionnaire administered once a year during the period 2001-2005, all the items that have generated a sensitive amount of missing data have been removed from our model.

Constructs		**Items**	**Scales**
Alignment	Static measures (adapted from Kearns & Lederer, 2003)	Q9 : Top management is committed to the strategic use of IT	Likert 1-5
		Q11 : In your firm, IT in use support the strategic deployment of the firm	
		Q12 : In your firm, IT constitute a competitive advantage	
	Dynamic measures	Q10A : In your firm, IT usage has been accompanied by strategic changes	
		Q10B : In your firm, IT usage has been accompanied by organizational changes	
Performance (Adopted from Tallon et al. 2000)	Efficiency Measures (Internal)	Q13B : The individual productivity has been improved (thanks to IT)	Likert 1-5
		Q13C : Costs control has been improved (thanks to IT)	
	Effectiveness Measures (external)	Q13D : Innovation capabilities have been improved (thanks to IT)	
		Q13E : The reactivity of the firm has been improved (thanks to IT)	
		Q13F : Customers expectations are more accurately fulfilled (thanks to IT)	

Coordination organizational processes	Lateral communication processes	Q28 : Reports and drafts related to project management are available to the team projects members	Likert 1-5
		Q29 : information required for auditing and performance evaluation is available to the concerned collaborators in the firm	
	Knowledge sharing	Q30 : Best Practices in your firm are reported and available	
		Q31 : Solutions and expertise are stored in a dedicated knowledge database accessed by all collaborators in the firm	
		Q32 : In your firm, it is possible to identify and contact the best person(s) to handle an issue	
Coordination-oriented IT		Q15 : In your firm, IT (e-mail, Intranet, groupware) are effectively used to facilitate work processes between different departments	
		Q16 : In your firm, IT (e-mail, Intranet, groupware) are effectively used to share information between collaborators	
Control organizational processes	Vertical communication processes	Q21A : When an issue involves two collaborators belonging to different departments, they first have to report to their respective hierarchical superior	Likert scale
	Monitoring processes	Q22 : Work processes are systematically analyzed and described to produce standards	
		Q23 : Work processes are available to evaluate individual outcomes compared to standards	
		Q24 : In your firm, formal work processes are systematically validated using workflow systems	
Control-oriented IT		Q4: Are e-mailings controlled and monitored in your firm?	1. Yes 2. No 3. Do not Know
		Q5 : Data processed by the subordinates is systematically stored and used to assess their performance	1. Yes 2. No 3. Do not Know
		Q6 : IT systems periodically report monitoring results to subordinates	1. Yes 2. No 3. Do not Know

Table 2. Constructs and items of the research model

DATA ANALYSES AND FINDINGS

To test our research model, we have used data collected in the period (2001-2005) due to a survey conducted within a sample of 500 companies per year. A total of 1900 questionnaires were available for analysis, corresponding to the companies that have participated for once to the survey during the investigation period. 30% of the respondents were chief executives, 57% IT managers and 13% other business executives. 42% of the companies have multiple sites in the European Community, 22% are implemented worldwide. The manufacturing sector is strongly represented (49%), Telecommunications and IT services providers represent 6% of the firms studied.

We have started our data analyses by an exploratory phase in which we have conducted a factor analysis. We have then applied structural equation modeling (SEM) analyses on the two variants of our research model: the mechanistic and the organic, using a covariance-based SEM analysis tool AMOS Graphics 5. We argue that this choice is appropriate with regard to our sample size and the confirmatory objective of our analysis (Chin and Newsted 1999; Gefen et al. 2000). Moreover, all our items are considered as reflective, which is a common case in empirical alignment studies.

The exploratory phase: Factor analysis

This phase has been very important to make sure that our items provide relevant measures to the theoretical constructs they are related to. We have conducted a factor analysis (with Varimax rotation and Kaiser normalization). The results (see table 3) obtained are satisfactory: a majority of the items load to the theoretical constructs they were supposed to measure and present a good internal validity. More specifically, dynamic alignment measures (Q10, Q10b) load adequately to their construct while some static measures do not load. This can be explained by the fact that the former items are usually used to measure strategic fit, while the purpose of this study is to measure organizational alignment. 5 items have finally been removed from the analysis.

Items	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Q28	0,683				
Q29	0,721				
Q30	0,653				
Q31	0,701				
Q32	0.695				
Q9		0,744			
Q10a		0,792			
Q10b		0,664			
Q15			0,795		
Q16			0,846		
Q21a				0,701	
Q22				0,580	
Q24				0,570	
Q5					0,837
Q6					0,817
Variance (%)	23,088	10,230	8,370	7,674	5,816
Total Variance (%)	55,178				
Cronbach's Alpha	0,789	0,717	0,781	0,604	0,624
Factors translated into constructs	Coordination organizational processes	Alignment	Coordination-oriented IT	Control organizational processes	Control-oriented IT

Table 3. Factor analysis Findings

In order to depict our theoretical model into its two variants: the Mechanistic IT-organizational alignment model and the Organic-IT organizational model, we have conducted a hierarchical regression analysis. The procedure is the following: for each of the efficiency and effectiveness measures (considered each as a dependent variable), we consider a regression model which we iteratively build by sequentially entering the independent variables (starting with the alignment measures, then the IT types and the organizational processes types), and sequentially eliminating the variables which are not significant.

The most solid regression models we have obtained are represented in two different models (see figure 4), in which it clearly appears that alignment is not exactly measured the same way in the two variants of our model. In the mechanistic model, Q10a is significant while in the organic model, Q10b is significant. In the meanwhile, Q9 is significant for the two models. It is what we have called the "dynamic" measure of alignment that differs in the two variants of our model. This important finding can be explained by the fact that a firm which encompasses coordination-oriented IT types which fit the needs of coordination processes would require the support of the top management support (static measure) and has to be accompanied by business and strategic orientations adjustments (dynamic measure). These adjustments are external and are imposed to all the members of the organization and remain therefore faithful to the control orientation of the mechanistic pattern.

While Control-oriented IT which fit organizational control processes would require equally top management support and have to be accompanied by organizational changes (dynamic measure). These adjustments seem to be more necessary in order to help the organizational members get more involved in the IT implementation and usage and are therefore faithful to the coordination orientation of the organic pattern.

Consequently to this hierarchical analysis, the operationnalization of the Performance variable is not the same for the two models:

(1) The organizational alignment between coordination processes and coordination oriented-IT produce significant impacts on effectiveness measures (and non significant impacts on efficiency measures).
(2) The organizational alignment between control processes and control oriented IT produce significant impacts on efficiency measures (and non significant impacts on strategic effectiveness measures).

We have then tested the two models obtained using Structural Equation Modeling.

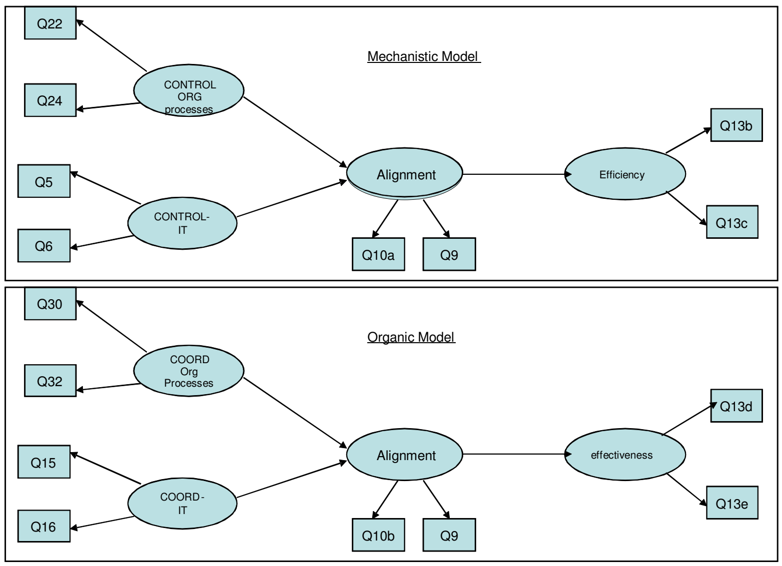

Figure 3. Structural Models

Structural Equation Modeling analyses

The two variants of our model (the mechanistic and the organic) are tested using AMOS Graphics 5. For each of them, we examine if the overall model presents good fit with the data, then we analyze path coefficients. (cross-loadings and discriminant validity were also computed but are not included in the paper because of space limitations). As noted by Chin and Newsted (1999), there is no one agreed goodness of fit measures for structural equation models. We propose to use absolute, incremental and parsimonious goodness-of-fit indices to estimate our mechanistic and organic models. The results obtained are presented in tables 4 and 5.

Goodness-of-fit measures	Observed values	Recommended
Absolute indices		
Chi-square *Ddl*	56,325 17	None
GFI	0,962	> 0,9
Holfer's critical N	1127	> 200
RMSEA	0,035	<0,08
Incremental indices		
NFI	ns	> .9
CFI	ns	> .9
Parsimonious indices		
Chi-square adjusted	3,313	As low as possible
AIC	110,325	As low as possible

	(88,000 for the saturated model)	(the closest to the saturated model)
ECVI	0,058 (0,046for the saturated model)	As low as possible (the closest to the saturated model)
PGFI	ns	As high as possible

Table 4. Mechanistic Model Goodness of fit

Goodness-of-fit measures	Observed values	Recommended
Absolute indices		
Chi-square *Ddl*	59,396 17	None
GFI	0,958	> 0,9
Holfer's critical N	284	> 200
RMSEA	0,07	<0,08
Incremental indices		
NFI	0,943	> .9
CFI	0,958	> .9
Parsimonious indices		
Chi-square adjusted	3,494	As low as possible
AIC	113,396 (88,000 for the saturated model)	As low as possible (the closest to the saturated model)
ECVI	0,225 (0,175for the saturated model)	As low as possible (the closest to the saturated model)
PGFI	0,582	As high as possible

Table 5. Organic Model Goodness-of-fit

The overall fit indices are good, especially for the organic model where all the indices are significant. The regression coefficients can now be examined.

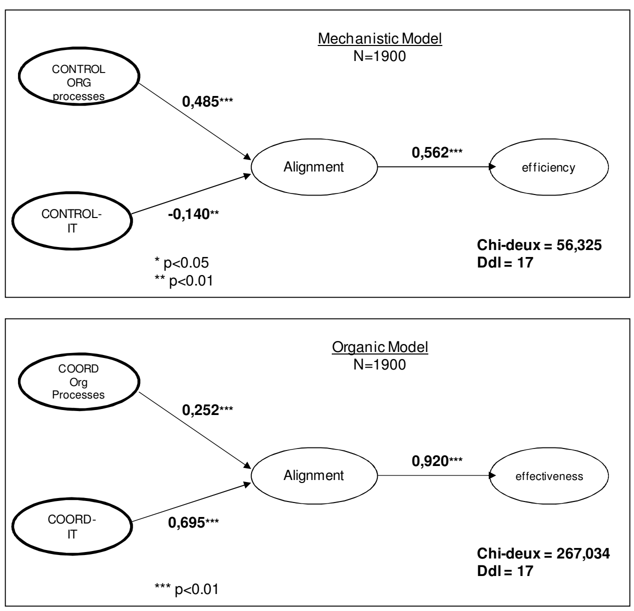

Figure 4. Structural Equation Findings

The path coefficients represented in figure 3 are standardized partial regression coefficients. When they are close to one with high level of significance ($p<0.01$), this means that a strong positive correlation is identified.

The results indicate that mechanistic IT-organizational alignment and organic IT-organizational alignment are important for achieving performance. The organic alignment has a strong effects on enhancing the innovation and reactivity capabilities of the firm. While the mechanistic alignment produces positive impacts on individual productivity and costs control. These findings are not surprising if we argue as it is the case in this research that organic patterns are more suited to a dynamic environment in which innovative and reactivity capabilities are the pre requisite to success. While mechanistic patterns allow the organization to avoid any slack in resources allocation and allows the achievement of efficiency. Our research hypotheses are therefore confirmed.

CONCLUSION

From a conceptual perspective, the empirical support for our model attests to the pertinence of approaching IT alignment in terms of internal consistency among IT-enabled organizational ideal-types: mechanistic versus organic. Our main research finding according to which complementarities between coordination-oriented IT and organic organizational designs are higher than complementarities between Control-oriented IT and mechanistic organizational designs, and imply higher levels of performance, are in line with those studies that believe that organic structures have higher information processing capabilities than mechanistic structures (Burton & Obel, 2004; Gresov, 1989) and which propose that IT in general leads to organic structures (Crowston et al. 1986).

Our study has some limitations concerning the measurement items chosen, their perceptual nature and the use of a single informant, which are prevalent limitations within MIS research, and remain a source of bias when interpreting study results (Kearns & Lederer, 2003). We have also conducted our study among European firms, within a sample which consists of 81% of small firms (i.e. firms of less than 500 employees). Thus, there may be some questions about the generalization of our findings.

We suggest addressing the "lagged-effect" of IT-organizational alignment, allowing the assessment of alignment at one point of time and its implications on performance at another (future) point of time.

Finally, we have made the choice in this paper not to integrate contingent factors to mediate the relationship between organic/mechanistic alignment and performance. This issue is currently addressed by the authors and will be presented in a future publication.

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