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Abstract

This paper defines cross-functionality as the awareness that organizational actors have of the coupled and integrated nature of processes across various business units, which allows employees to deliver products and services to customers. That the implementation of enterprise systems (ES) provides a more complete cross-functional view of the firm has been taken for granted by managers and researchers alike. The cross-functional potential of enterprise resource planning (ERP) is a widely-held assumption and is one approaching conventional wisdom: "Because ERPs tear down walls within organizations, they help everyone to understand their impact on an entire operation. Ultimately, companies find their staff adopting an increasingly broad enterprise perspective rather than a departmental one" (McKeen and Smith 2003, p. 143). This paper challenges this conventional wisdom that equates technical integration and socio-cognitive integration. The "impacts" of ERP systems depend on organizational context and implementation process. We show that flexibility, the primary goal of ERP adoption, as well as implementation strategy factors (organizational vision, speed, and core modules) exert a positive impact on cross-functionality in small and medium enterprises but not in large firms. These findings are obtained through a study of 100 French firms, then further illustrated and built upon by investigating two medium-size firms as opposed to two large firms. The findings suggest that large firms might have fewer problems than SMEs in bringing different business functions to be integrated into the project. Further, they also might have a larger inter-organizational scope of integration, but their ERP systems do not foster cross-functionality. There is also a need for social interaction to coordinate activities effectively. In SMEs, cross-functionality may be easier to reach with adequate implementation strategy.

Keywords: ERP, cross-functionality, flexibility, organizational vision, core modules, speed, firm size

Introduction

Enterprise resource planning (ERP) systems promise to replace discrete, home grown systems with an integrated, enterprise-wide infrastructure that will streamline organizational activities and eliminate duplication of effort and data (Shang and Seddon 2002). These shared information systems have been diffused rapidly and extensively, especially across large firms (Parr and Shanks

2003). Even small organizations are increasingly installing them (Van Everdingen et al. 2000). ERP systems are more integrated than conventional IS because the different modules are designed to be tightly coupled and their evolving architecture and expanding functionality promise cross-functional integration of all information flowing through a company (Markus and Tanis 2000). In an ideal implementation, ERP systems affect numerous parts of the organization simultaneously rather than a single department alone and can serve each different department's particular needs. ERP systems may facilitate a cross-functional view of how organizations work and trigger broader organizational changes (Robey et al. 2002). This effect of cross-functionality is taken for granted when ERP modules are implemented. Generally, there is some confusion between cross-functional integration and its perception by social actors. Up to now, authors have failed to distinguish between cross-functional integration in theory and the perception that organizational actors have of their activity as it relates to the overall business processes in which they contribute (i.e., cross-functional integration in practice). For reasons of clarity, we use cross-functionality as a concept describing the perception of organizational actors and we consider the impact of ERP implementation and organizational context on cross-functionality.

The cross-functional potential of ERP is a widely held assumptions, one approaching conventional wisdom: "Because ERPs tear down walls within organizations, they help everyone to understand their impact on an entire operation. Ultimately, companies find their staff adopting an increasingly broad enterprise perspective rather than a departmental one" (McKeen and Smith 2003, p. 143). It is important to address this question because the principle of cross-functional integration via a single database is new for many companies and cross-functionality is supposed to offer several benefits. For example, cross-functionality may help understand better the perspective taken by other functions (Boland and Tenkasi 1995), develop a more collective sense of belonging, and facilitate the reduction of cross-functional conflicts by ensuring political correctness (Huang and Newell 2003; Hutt et al. 1995).

Since it is recognized that small- to medium-sized enterprises (SMEs) are different from large companies, it is important in the context of ERP implementation (Markus and Tanis 2000) to examine and compare the factors that foster a perception of a more cross-functional overview both in SMEs and large companies (Mabert et al. 2003). Implementation strategies seem to have an effect on cross-functionality (El Amrani et al. 2003). The aim of this paper is to challenge this conventional wisdom by asking whether ERP systems are improving cross-functionality independently of the context of company size and implementation strategies. We first examine the theoretical bases of cross-functionality as well as the ERP literature on which we have formulated our hypotheses. Our methodology is then described. We present the tests results of our quantitative study and discuss our results. Finally, we conclude this paper by mentioning future research directions for this topic.

Cross-Functionality with ERP

In this paper, we define cross-functionality as the awareness that organizational actors have of the coupled and integrated nature of processes across different organizational units that permit the delivery of services and products to customers. The literature on cross-functionality puts the emphasis on the precedence of processes over functions and ushers in a new vision of an organization built around a partition-free horizontal structure and multifunctional working teams (Galbraith 1994). According to this view, cross-functional integration represents the extent to which different business processes and functions are interconnected, standardized, and tightly coupled (Orton and Weick 1990). A process is "a lateral or horizontal organizational form, that encapsulates the interdependence of tasks, roles, people, departments and functions required to provide a customer with a product or service" (Earl 1994, p. 13). Past research indicates that horizontal integration can offer performance advantages over vertical integration and is a critical determinant for facilitating cooperation across business functions (Davenport 2000). The decision to adopt an ERP system is part of a general question of technical integration of processes in the firm. However, the emergence of cross-functionality depends on how the system is implemented by the company. ERP implementation does not intrinsically guarantee the cross-functionality of the organization. It is not something that can be imposed; it has to be built throughout the project's life cycle (Besson and Rowe 2001).

Some factors help this cross-functional logic in companies. For the sake of parsimony, we looked at how some important implementation factors for improving cross-functionality could be articulated from a theoretical viewpoint. Many of the threads running through the existing literature on change can be adopted and applied to ERP projects (Boudreau and Robey, 1999). We have, therefore, retained two major contributions from prior research. First, Leonard-Barton's (1988) work on organizational innovation shows that innovation implementation characteristics are based on implementation strategies which, in turn, determine whether a specific innovation is accepted or rejected. This claim is probably simplistic, but it effectively highlights the essential characteristics of innovation, which are both constraints and choices for managing change. There are three subsets of such characteristics.

Transferability: whether a given innovation is transferable depends on the preparations made and the effectiveness with which it can be communicated to potential adopters.

Implementation complexity is linked not only to the *number* of target users but also, and particularly so from our point of view, to their organizational *differentiation*. The more business functions an innovation supports, the more difficult it is to ensure acceptance since the innovation must address a number of distinct organizational subcultures.

Innovation *divisibility* streamlines potential difficulties involved in enterprise-wide usage. Divisibility is linked to innovation modularity and to opportunities for personalizing it.

The modular and configurable nature of ERP systems makes them an inherently divisible technology and, therefore, capable of responding to complex implementation strategies. If the scope of the project deals with a large number of functions, the company will have the option to implement a divisible technology in an incremental fashion rather than as a monolithic block.
A second major contribution to our research, Gallivan et al. (1994) clearly addressed the debate on the speed of implementation of radical innovations. These authors stress that in many cases, two quite different questions are confused: the extent of the change envisaged and the speed of the implementation. Per Hammer and Champy (1993), it is common to distinguish radical from incremental change. These two types of implementation strategies both link scope with speed. Radical change would be far-reaching and rapid, while incremental change would be a sequence of small steps made at a pace to suit the participants involved and adjusted by mutual agreement. Gallivan et al. demonstrate clearly that widespread innovation can be implemented gradually and more widely than one might think and can even justify (depending on the context) cases that combine scope and speed of change in novel ways. Thus, we are led to question what ERP implementation strategies are best suited to different scenarios and different organizational goals, and whether different strategies should be used for SMEs and large firms. Furthermore, we consider whether more radical implementation strategies enhance cross-functionality.

Cross-Functionality through Communicability and Searching for Flexibility

Information sharing between departments and cross-functionality are not sought by all firms. This presupposes that the key decision makers have specified their goals and defined an organizational vision prior to implementing the ERP solution (Van Stijn and Wensley 2001). In practical terms, the top management team must define both the goals pursued in choosing an ERP (H1), and the desired organizational vision, which consists of clearly outlining the future organization and the direction that project participants should follow to achieve their aims (Lipton 1996) (H2).

Clear goals should be specific and indicate the general direction of the project (Kumar and van Hillegersberg 2000). Furthermore, the underlying purpose of the project must remain clear and consistent through all stages of the project lifecycle. For SMEs, a strategic objective is to build an IS that provides the foundation for rapid response to changing market conditions, which is now referred to as *agility* (Carton and Adam 2005). This objective also applies to large firms, as dominant actors change throughout the project (Besson and Rowe 2001), while strategic goals and political agendas may also evolve during implementation (Lee and Myers 2005). Indeed, one of the major goals of ERP adoption is organizational flexibility (Wood and Caldas 2001). It is, however, unclear whether this holds in all organizational contexts.

If cross-functionality is a consequence of lateral organizational capabilities that seek to achieve flexibility (Galbraith 1994, xviii), this suggests that

> **H1**: The goal of achieving a more flexible lateral organization for ERP adoption promotes a stronger cross-functional perspective of the firm.

In such complex projects, the top management team must be *engaged* from the start and not just *involved* (Brown and Vessey 2003). How is it possible for ERP implementation to be successful if the company doesn't know what goals it is trying to achieve? The "organizational drama" at the company Metalica (Avital and Vandenbosch 2000) following SAP implementation was attributed to insufficient engagement on the part of senior management, both during requirements definition and during the "visioning" stage of defining the future organization. Managers need to express their interpretation of the vision and their intentions through clear targets, so that the project's objectives can be communicated to users in due course (Avison et al. 1998). Clear goals are a prerequisite for project success and should help users to understand the benefits of cross-functional integration.

> **H2**: Defining a clear organizational vision by top management prior to ERP implementation promotes a stronger cross-functional perspective of the organization.

Cross-Functionality through Functional Coverage

Selected at an early stage by top management as part of arriving at an organizational vision, the notion of ERP implementation scope reflects how many modules have penetrated an organization's business processes (Davenport 2000). The organizational boundary of the ERP project provides a sense of the scope of changes required. When functional coverage is wide and takes into account almost all of the company's functions and departments, the ERP project assumes strategic importance and leads to profound change. On the other hand, when ERP is chosen to cover a limited number of support functions, then strategic considerations become secondary and the scope of future change is narrower (Bingi et al. 1999).

Through the various forms of interdependence that it introduces, ERP encourages a cross-functional approach and takes users out of functional silos in direct proportion to the extent of ERP coverage. But is it simply that the wider the integration scope chosen, the greater that the user's perception of cross-functionality becomes, or is such cross-functionality determined by the specific ERP modules to be implemented (Porter 1985)?

> **H3**: Greater coverage of core functions of the company promotes a stronger cross-functional perspective of the firm.

Cross-Functionality: A Result of Speed of Deployment?

There are two basic implementation strategies that may be adopted: the "big bang" or the progressive option (Boudreau and Robey 1999). Progressive implementation proceeds module-by-module and/or site-by-site. Conversely, when a company chooses a big bang implementation, it seeks to simultaneously implement all ERP modules both simultaneously and pervasively. The financial risks inherent in such a complex project and the interdependence of the ERP modules demand rapid implementation in order to maximize the benefits of process integration (Beretta 2002). However, rapid implementation avoids the complication of temporary interfaces and other problems associated with introducing organizational change gradually and progressively.

Moreover, it is easier to make users aware of ERP's benefits—such as cross-functionality—if the implementation approach is rapid (Adam and O'Doherty 2000) because users must adopt the cross-functional logic embedded in the ERP system in order to use it. If the big bang strategy fails however, there is a risk of the ERP becoming dysfunctional as users attempt to find ways to work "outside the system" (Markus et al. 2000).

Within the perspective of progressive implementation, the firm's processes are, by definition, unstable: the sequential introduction of selected modules destabilizes business processes in the short- and medium-term, thus triggering ongoing learning processes, due to continual change. Notably, these repercussions place a burden on ERP users to properly assimilate the functionalities of the first modules installed, to prepare for subsequent new functionalities (with an increase in future versions), and to understand the interactions that link them to other business applications throughout the company.

> **H4**: Faster implementation promotes a stronger cross-functional perspective of the firm.

Size as Contingent Variable

Specific concerns for SMEs during ERP adoption are related to their intrinsic characteristics such as small size, centralized management, lack of organizational specialization, intuitive strategic planning, and generally unsophisticated internal and external IS. Blili and Bergeron (1993) point out some deficiencies that SMEs face during IT adoption: lack of competency and know-how, insufficient qualified human resources, and lack of appropriate support technologies or organizational structures. Laukkanen et al. (2005) show that small firms have fewer resources and, in particular, have problems in gaining sufficient participation from different organizational functions during ERP selection. Larger companies report improvements in financial measures following ERP implementation, whereas smaller companies report better performance in core functions such as manufacturing and logistics (Mabert et al. 2003). This seems to indicate a different scope of integration, with more support functions in large firms. Conversely, in Finland, there seems to be no difference in scope at the intra-organizational level, but medium and large firms seem to prioritize the ERP's interorganizational integration capabilities (Laukkanen et al. 2005).

The factors discussed above should have an effect on cross-functionality; however, we lack knowledge of whether the effects are related to firm size. We believe that SMEs, in general, have more centralized management structures, compared to large firms,

Figure 1. Research Model
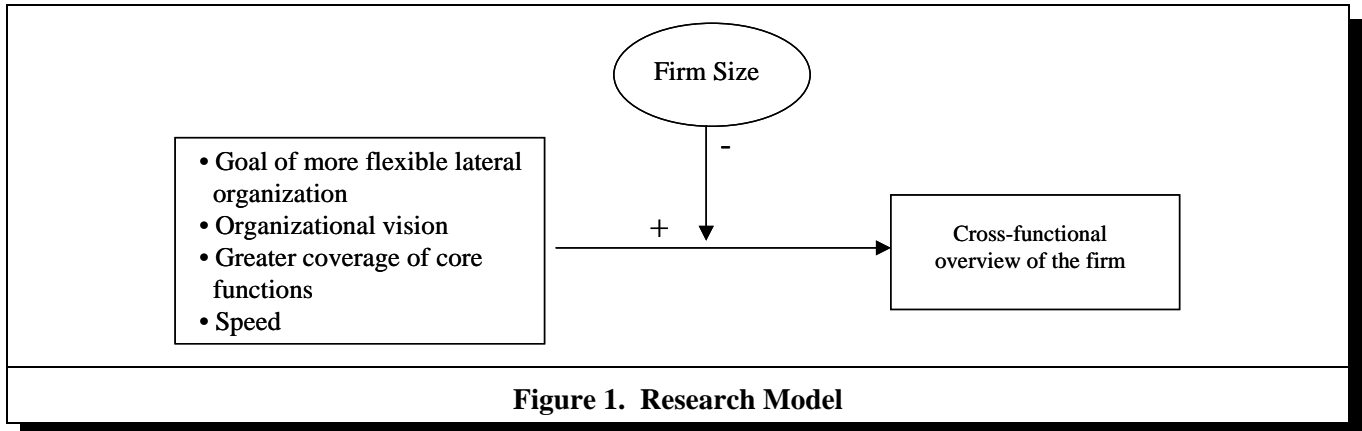
which may help them to quickly define their future organizational vision. In addition, SMEs have a narrower scope and flatter organizational structure that does not pose barriers to a rapid ERP implementation in core business functions. Managers in SMEs also know that one of their assets is their cross-functional view of their processes, due to their limited size. This greater insight into cross-functional processes can be enhanced by implementing an ERP system to help SMEs adapt to market changes more rapidly than large firms. Conversely, prior research on ERP implementation in large firms shows that introduction of ERPs in core functions may not be sufficient to improve cross-functional awareness of business processes, even when the goal is efficiency and elimination of divisional barriers (Newell et al. 2002).

> **H5**: Size is an important moderating factor of the previous hypotheses.

Our research model is presented in Figure 1.

Methodology: Mixed Survey and Case Studies

This research is based on a survey using quantitative methods and case studies as complementary (Kaplan and Duchon 1988). This *complementarity* in IS research was also suggested by Mingers (2001), who argued that much could be gained from collecting both quantitative and qualitative data in the same study. In our study, we first began with qualitative methods by conducting a series of interviews. The design of our questionnaire greatly benefitted from the case studies, which provided key insights for developing the questionnaire items. In turn, vignettes from our case studies serve to underscore key relationships in the survey data and offer more depth to the quantitative results. These qualitative examples remain primarily illustrative. We begin with a brief analysis of the design of the qualitative and quantitative research instruments employed within this study.

Qualitative methods: Data from 41 interviews in four firms that had implemented ERP systems were collected during two research phases: first 31 interviews were conducted during 2001, with 10 additional interviews conducted in 2003. Data were collected at different managerial levels and from various functional departments, in order to obtain different points of view: end-users (accounting, logistics, sales and human resources, operations), key users who participated in the ERP project teams, middle managers, and top management. We conducted all interviews after the ERP projects were completed. An interview guide was used to conduct all interviews. Data were collected using various techniques, which provided multiple perspectives and enhanced the validity of the findings (Eisenhardt 1989). These included semi-structured and unstructured interviews, as well as reviews of company and project documentation. Background data for the four research sites are summarized in Table 1. All interview data were analyzed and case summaries were developed. Later in the paper, we employ insights from these case studies to illustrate and explain the results of the statistical tests.

Quantitative methods: Subsequent to collecting and analyzing our case study data, we developed a survey, which we administered to members of CIGREF (Club Informatique des Grandes Entreprises Françaises)[1] in France for large companies, as well as a sample of SMEs with which the university has key contacts. The design of our questionnaire greatly benefitted from

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[1]This translates in English to "Society for Large French Organizations."

Table 1. Case Study Characteristics					
	Sector	**Size**	**ERP Vendor**	**Project Period**	**Number of Informants**
Air France	Air Transport	72,000	SAP	October 1999–April 2003	34
Renault	Automotive	140,000	SAP	February 1998–October 2000	6
Gruau	Customized vehicles	800	Baan	February 1996–January 1997	11
RBL	Plastics industry	140	MFG Pro	July 2000–January 2001	10

Table 2. Respondents' Profiles		
	Number of Respondents	
Respondents Profiles	**Large Firms**	**SMEs**
CIO	17	22
CFO	5	6
CEO	5	17
Project Manager	12	7
Others	6	3
Total	45	55

the case studies in various industries, which provided the basic context for developing the questionnaire. All survey items were developed as original items for our study, and were pretested by various respondents (including three project managers, two consultants, and three key users) to check its validity. It was posted and sent by e-mail, in January 2002, to a population of 223 SMEs and 116 large companies in France. In April 2002, we had received 177 responses (a 52 percent response rate). Respondents were ERP project managers, CIOs, CEOs, and functional managers, since these individuals were best informed about the ERP implementation processes and outcomes. Responses were coded and extensively checked for validity. All answers with questionable validity were discarded. A total of 77 responses were omitted from our analyses because the responding organizations had not adopted ERP systems. This left us with exactly 100 completed questionnaires—55 from SMEs (fewer than 500 employees) and 45 from major companies (see Table 2). The resulting data were analyzed using SPSS.

Developing a Measure of Cross-Functionality (The Dependent Variable)

One of the challenges of our study was developing a reliable cross-functionality metric, which is lacking in the existing ERP and organizational literature at present.[2] We first discussed the issue of cross-functional integration with 15 informants from the four case study firms. From this belief elicitation about cross-functionality, we later created five survey items related to the concept of cross-functionality. During our survey pretest, we paid close attention to our pilot subjects' responses to these items. The eight pretest respondents did not mention any problems understanding the survey questions; however, their responses are certainly influenced by their job roles: project managers and senior managers were influenced by their own views of cross-functionality, as were users. We believe these questions and questionnaire were taken seriously and were understood. No returned questionnaires mentioned any difficulties. We analyzed results from the cross-functionality items, each of which was based on five-point Likert scales, ranging from "completely agree" to "completely disagree." The items were as follows:

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[2]To locate prior research on cross-functionality, we conducted Internet searches (EBSCO, Science Direct, Google) that covered North American and European IS journals, as well as in management and operations management. We found few references, and most of these were to "cross-functional projects" or "cross-functional teams." Subsequent reading of the IS and management literature revealed that various researchers had used the term cross-functionality either with respect to technical integration only or without any definition. With that realization, we sought to clearly define and measure the construct of cross-functionality.

- "*In my opinion, ERP users have a broader view of their department*"
- "*In my opinion, ERP users have a broader view of their company*"
- "*In my opinion, ERP users are more aware of the integrated character of cross-functional processes*"
- "*In my opinion, ERP users are more aware of the effect their actions may have on the work of others*"
- "*In my opinion, ERP users believe that they have a single system of reference*"

We analyzed internal reliability using Cronbach's alpha. The values obtained from four possible combinations of the above items ranged from 0.40 to 0.92. We selected the best combination, consisting of the first three items, to create our cross-functionality metric (alpha = 0.92). The cross-functionality metric, therefore, sums the values (0 to 4) across the three items and may assume values from 0 (minimal cross-functionality) to 12 (maximum cross-functionality). The mean value for our 100 respondents on the cross-functionality construct was 6.99, with a standard deviation of 2.94. We note also a modal value of 9 and a median of 8. This result seems to support the conventional wisdom that ERP systems increase stakeholders' perceptions of cross-functionality, but perhaps not in all implementation contexts.

Results for Independent Variables

This section explains the four independent variables, which were created for our study.

Flexibility Goal

Which reasons pushed you to adopt an ERP system?

Respondents were asked to rank order their principal reasons for adopting ERP based on the following list of reasons: modernization of IS, reorganization of processes, improving the organization's flexibility, improving communication between departments, improved access to information for decision-making, achievement of growth objectives, preparation for year 2000, preparation for Euro changeover, mandate by a parent firm, and other reasons. Results are presented in Table 3.

For 47 percent of our sample, achieving organizational flexibility was one of the top three reasons for adopting an ERP system. This was the top goal in 53 percent of SMEs, but in only 40 percent of large firms.

The Organizational Vision

Was the implementation of your ERP system guided by the definition of a targeted organizational vision by the top management Team?

Survey result show that nearly two-thirds of companies (61 percent) had defined an organizational vision prior to implementing ERP; 39 percent did not define it. Identifying such a vision was the main preoccupation of top management, yet its form differed depending on the context: companies decided to centralize or decentralize their organizational structures as part of harmonizing their processes.

Table 3. Frequencies of the First Main Goals for ERP Adoption						
	Overall Sample (n = 100)		SMEs (n = 55)		Large Firms (n = 45)	
	Selected %	Not Selected %	Selected %	Not Selected %	Selected %	Not Selected %
Flexibility goal	47	53	53	47	40	60
Modernization of IS	43	57	26	74	64	36
Reorganization of processes	48	52	43	56	53	47

Table 4. Frequencies of the Core Modules Variable						
Core modules	0	1	2	3	4	Total
Frequency	16	20	30	16	18	100

Number of Core Modules Functions Implemented

All companies in our sample had implemented at least two modules and had at least 6 months' experience in using them across business units. Respondents were asked to identify which modules they had implemented from the following list: *accounting, finance, production, procurement, logistics, sales, human resources, project management, maintenance, others.* For each item, respondents could indicate whether it had already been implemented and if not, if it was planned or even envisioned for the future. Hence the variable labeled "number of core modules" sums the total number of modules implemented across the five core categories: production, logistics, procurement, sales, and maintenance. Table 4 presents the results for the core modules variable, which is less than to the total number of ERP modules that firms had adopted (Mean: overall sample (4.39), SMEs (4.76), large firms (3.93)). We believe the total number of *core* modules implemented is more meaningful than the *total* number of implemented modules for purposes of understanding cross-functionality. (Many firms require the ERP accounting module be implemented, even if it is not used by the accounting staff.) Moreover, we believe that having a cross-functional firm view requires core functions to be implemented.

Speed of Implementation

Which method was used to deploy your ERP?

The companies in our sample opted in equal measure for one of the two implementation strategies: big bang (47 percent), progressive (47 percent), others (6 percent).

Results

Correlation and Analysis of Variance (ANOVA)

For each of our hypotheses, we examined the link between each independent variable (flexibility goals, organizational vision, speed, and core modules) and the dependent variable to be explained (cross-functionality). The data were analyzed using ANOVA to test H1, H2, and H4, and Pearson's correlation coefficient to test H3 (see Table 5). We examined the correlations among all the independent variables for possible evidence of multicollinearity and found none.

Table 5. Results of Hypothesis Testing ANOVA for Categorical Predictor Variables and Pearson's Correlation for Continuous Predictor Variables			
Independent Variables / Dependent Variable	Cross-Functionality		
	Overall Sample (n = 100)	SMEs (n = 55)	Large Firms (n = 45)
Flexibility [F-value]	3.868	6.540*	.029
Organizational vision [F-value]	8.625**	10.457**	1.155
Speed [F-value]	7.245**	7.163**	.376
Core modules [Pearson correlation (*r*)]	.336***	.358***	.272

Legend: $*p < 0.05$; $**p < 0.01$; $***p < 0.001$

Table 6. Cross-Functionality and Correlation with Scope According to Speed, Organizational Vision, and Size				
Speed/Organizational Vision	**Big Bang/ Yes**	**Progressive/ Yes**	**Big Bang/ No**	**Progressive/ No**
SMEs				
Sample Size (n)	23	8	8	12
Mean for cross-functionality	8.74	7.74	7	5.08
Pearson Correlation (r) [Core module]	0.211	0.723**	0.677	0.162
Large firm				
Sample Size (n)	10	17	6	10
Mean for cross-functionality	7.20	6.65	6.17	5.60
Pearson Correlation (r) [Core module]	0.497	0.259	0.948**	-0.078

Legend: $*p < 0.05$; $**p < 0.01$

Our survey results indicate that all factors are significant for the whole sample, but their impact is strongly moderated by firm size. In order to check for spurious significance of some correlations, we calculated the means for each subpopulation (see Table 6). It clearly appears for SMEs that, when the top management team has defined an organizational vision prior to ERP implementation in a big-bang approach, cross functionality is greater (8.74) than when such a vision is overlooked (7.0) or when it has been defined but in a more progressive manner (7.74). In the latter two cases, cross-functionality is nevertheless greater than when implementation has been progressive but with no organizational vision (5.08). Also, cross-functionality is associated with increased project scope (i.e., number of core modules), which was statistically significant for SMEs and for the overall sample, but not for the large firms.

The various methods crossing speed and organizational vision have the same effects on the level of cross-functionality for the large firms, but the observed differences are far lower. Moreover, with all methods except in the last case (progressive/no vision), cross-functionality is higher for SMEs than for large firms.

Regressions Tests

We conducted multiple regression analysis in order to simultaneously evaluate the various predictors that contribute to enhanced cross-functionality. In order to take into account possible relationships among the independent variables, we employed stepwise regression (see Table 7). Stepwise regression results for the entire sample showed that three predictor variables (organizational vision, speed, and number of core functions) were related to cross-functionality (adjusted $R^2 = 0.283$, $p < .000$). We repeated the same analysis separately for the SMEs (n = 55) and for the large firms. In analyzing the large firms alone (n = 45), none of the predictor variable were statistically significant, while for the SMEs, two predictors were statistically significant (the number of core modules installed and top managements' definition of an organizational vision). Both predictor variables were positively related to cross-functionality, as we expected.

Table 7. Results of Multiple Regression Analysis			
	Overall sample	**SMEs**	**Large firms**
Stepwise Regression Variables Selected	Core modules Organizational vision Speed	Organizational vision Core modules	None
R^2 adjusted	.229	.283	
Significance	.001	.000	

Table 8. Results of Case Studies	
Case Studies	**Principal Characteristics**
Air France	Objective: reduce the number of applications and modernize IS. Scope: core functions (control operating)/support functions (accounting, purchasing, Human Resources) Team project by function and module Step by step implementation BPR and modification of management procedures (Purchasing & Control Operating)
Renault	Objective: get a single database in support functions Scope: core functions (no)/support functions (accounting, purchasing, Human Resources and control operating) Team project by function and module Step by step implementation BPR and modification of accounting procedures; many difficulties during post-implementation period
RBL	Objective: improve IS flexibility Scope: core functions (production & stock)/support functions (control operating, accounting, purchasing, sales) One team project for all functions (6 people) Step by step implementation
Gruau	Objective: improve IS flexibility Scope: core functions (logistic & production)/support functions (control operating, accounting, purchasing, sales) One team project for all functions (6 people) Big-bang implementation strategy

Case Study Results

The results of the case studies are presented in Table 8.

Discussion and Illustration of Cases

We now present the discussion of the results analyzed in parallel with four case studies and by emphasizing the moderating effect of firm size. This analysis not only describes which hypotheses were supported, but illustrates the supported hypotheses with case study vignettes.

> **H1**: The goal of achieving a more flexible lateral organization for ERP adoption promotes a stronger cross-functional perspective of the firm.

Table 5 shows that H1 can be rejected for the overall sample, but is supported for SMEs. Indeed, flexibility is the top goal for ERP adoption, although this result was moderated by firm size (see Table 7). The three principal reasons of SMEs for adopting ERP are improving company flexibility (53 percent), reorganization of processes (43 percent) and modernization of IS (26 percent). Conversely, for large companies, modernization of IS (64 percent) ranked first, whereas improving flexibility (40 percent) ranked last of the three main reasons.

In the case of the two SMEs in which we conducted interviews (RBL and Gruau), IS obsolescence was perceived as a barrier to flexibility (i.e., lead-time and variety management) vis-à-vis their clients and overcoming this barrier was a determining factor in the choice of ERP system. The ERP implementation objectives for both RBL and Gruau were having a more inclusive and coherent IS built around a single database accessible to all departments and improving flexibility. Thanks to this form of interdependence, both companies were able to reduce the number of steps required to find information, resulting in few phone calls and less paper being circulated. The two large companies that we studied (Air France and Renault) were already in a phase

of modernizing there is, the goal of which was simplifying their IT architectures, rather than enhancing the firms' level of flexibility.

> **H2**: The definition of a targeted organizational vision by the top management team before the implementation of ERP promotes a stronger cross-functional perspective of the firm.

Table 5 shows that H2 was supported for the overall sample and for SMEs, but not for large firms. The effect of the top management team's involvement in defining an organizational vision seems critical in SMEs. Our interpretation is that the smaller size and centralized management of SMEs helps to overcome the critical distance between functions and the political difficulties more commonly found in large firms. In the two small firms, a clear organizational vision was present from the conception of the ERP project. The objective stated by top management was to create an integrated database accessible to all departments. This integration objective, in turn, necessitated a large organizational scope. This included all cross-functional and core processes: production, contracts and sales, logistics, purchasing, accounting, and financial management. This choice enables a cross-functional overview of the firm.

For the two large firms, a clear organizational vision was initially absent. At Renault, we noticed a lack of engagement on the part of top management in the conception and design of the future organization throughout its SAP implementation. This situation contributed to the deviation from the project targets—not only in budgetary terms, but also in terms of project objectives and timelines. It also led to the absence of a cross-functional vision on the part of Renault's ERP users. Due to insufficient top management engagement, the various functional project leaders increasingly ignored key organizational issues when implementing SAP (e.g., definition and boundary drawing of the processes, the degree of cross-functionality, formalization of hierarchical power) that required their effort and involvement, such as deliberate reductions to financial, technical, and time-related constraints. This "functional" approach, limited to the problems of each business function, diluted the project and reduced it to the simple task of technical automation. Renault missed out on the integration potential of its SAP system and this contributed to the "fencing in" of the organization, taking root in an out-dated method of working, and extending old practices defined by a vision limited to local interests and concerns.

In the case of Air France, the vision and design of the future organization was also unclear at the start of the project. The organizational vision for SAP was limited to financial services only, before it was broadened by top management, advised by the editor skills center, to include the other services and supports (i.e., human resources and part of industrial maintenance). The lack of an overall vision of the future can be explained by the initial emphasis on financial processes alone. The subsequent broadening of the organizational scope was the result of the top management team eventually performing the required role of organizer and visionary.

> **H3**: Greater coverage of core functions of the company promotes a stronger cross-functional perspective of the firm.

Table 5 shows that H3 is supported for the overall sample and for SMEs, but not for large firms. Cross-functionality can not arise from ERP without a significant number of ERP modules implemented. However, it seems that a key difference between SMEs and large firms is that SMEs are really integrating their core functions with ERP in order to achieve more flexibility. Gruau and RBL chose wide functional coverage and implemented both core modules (production, logistics, and sales) and support modules (finance). This characteristic can be explained both by their goal of attaining flexibility and by the lower degree of structural complexity inherent in SMEs. The implementation of nearly all ERP modules allowed users to have a better view of interdependent information flows driven by ERP, creating a more cross-functional view of processes.[3]

For large companies, organizational complexity linked to specificity of core functions brought them to implement primarily the ERP support modules (accounting and finance). Large firms might have a larger scope of integration including interorganizational issues (Laukkanen et al. 2005), but in our survey they had mostly begun implementing ERP modules in support functions. Air France and Renault started their SAP project with implementing purchasing and financial modules. We observed that in both large companies, each manager overseeing a core business function had to focus on the specific nature of his/her task in order to justify

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[3]For example, sales module users explained that they now have a more cross-functional overview and, thus, have the necessary information to perform their work. They can now view product inventory levels without needing to call the production department to know whether they can fulfil customer orders. Such cross-functional operation was impossible prior to ERP, where viewing inventory levels required more than two people.

specific developments or the use of other applications (Brehm et al. 2001). In doing so, large companies encounter major difficulties in building a coherent IS due to lack of coverage for core functions.

H4: Faster implementation promotes a stronger cross-functional perspective of the firm.

Table 5 shows that H4 was supported for the overall sample and for SMEs, but not for large firms. The reason is clear when we compare the changes at Air France, Renault, and Gruau. In opting for a big bang implementation, Gruau managers noticed the evolution from a functional organization to a new matrix-based organization. Conversely we noticed a lack of cross-functional vision from the users in the two large firms, Air France and Renault, where the project was marked by a specific "phasing in" and compartmentalization of the ERP support modules. In each case, the firm's choice of SAP occurred following requests from accounting managers to replace old systems and tools. Following this, the purchasing managers expressed their desire to obtain new systems to back-up their processes, and subsequently, IT management got involved in order to ensure that SAP R/3 was adopted. The scope of integration became progressively broader in both large companies with the installation of CO and HR SAP modules at Air France and Renault, respectively. SAP implementation was conducted progressively, with different modules having separate and independent completion dates. Two significant lessons characterize the SAP projects from our large case study firms. First, the choice to modernize accounting and purchasing IS was the result of individual action and shows the lack of communication and coordination across business units. Despite the fact that large companies have fewer problems of project participation of the different functions, relative to SMEs (Laukkanen et al. 2005), there is still a compartmentalized type of layout. Second, a structure to back up the coherence of project management with a low integration factor. This structure relies on a SAP program manager with responsibility for overall coordination of the three subprojects and an SAP "competence center" whose role is to ensure technical coordination.

The details of coordination were achieved in each project: meetings were organized to answer cross-functional questions and steering committees met each month to approve various decisions. But in the absence of organizational systems to oversee the mobilization and coordination of different participants involved in the SAP project, the various subprojects evolved autonomously and the participants focused primarily on their own functional domains and largely ignored what was happening in the other subprojects. The cross-functional dimension of the SAP implementation was absent from the start; as a result, the potential integration benefits of SAP remained limited, at best.

Conclusions

This research explored the concept of cross-functionality, its measurement and antecedents. Organizational context and implementation strategies are important factors to understand ERP effects on cross-functionality. All four of our hypotheses were supported in SMEs but not in our sample of large firms. The results demonstrate that firm size is an important moderating factor that should be taken into account in ERP research. Therefore, these findings contradict conventional wisdom that streamlining horizontal process with ERP systems will facilitate users' perceptions of cross-functionality (McKeen and Smith 2003).

However, some limitations of our study can be grouped under two headings. First, our sample size (100 companies), while comparable to many survey studies that have been published internationally on ERP outcomes, is still low for SMEs; we could also distinguish between small and medium companies. Second, our results require more thorough explanation. We examined cross-functionality in our survey from the perspective of a single respondent. Future research should examine ERP outcomes from multiple stakeholder perspectives, although we achieved this in our case studies, to some degree.

Given these limitations, we have shown that there are fundamental differences in ERP implementation between large firms and SMEs, both in terms of ERP implementation strategy, the firms' primary objectives, and the likely outcomes, in terms of cross-functionality. As conventional wisdom suggests, an ERP is really a tool that fosters cross-functionality and eliminates functional silos, but apparently only in SMEs. Cross-functionality seems to occur when several ERP *core* modules are implemented, whereas, at least in large, French firms, the ERP implementation seems to start by implementing ERP *support* modules (Besson and Rowe 2001). Cross-functionality it is also influenced by other implementation conditions. If potentially appropriate to Western cultures (Liang and Xue 2004), a radical implementation approach (characterized by speed and broad functional scope) requires a clear, future vision for the organization. However, in large firms, even when senior management creates this vision and implements ERP core modules, this may not be sufficient to promote cross-functionality. We argue that this is not surprising in large firms (which are often much more complex), and where cross-functionality requires much more than just IS. In such large, complex firms, there is a special need for opportunities that facilitate social interactions, which provide the lateral capacity for information flow (Galbraith 1994, p. xviii) and the capability for coordinating activities effectively (Tsai 2002). Given these

limitations in large, complex organizations, the conditions necessary for developing cross-functionality still require further research. Finally, there is a consensus, both among professionals and in the literature, that cross-functionality can offer several benefits. This could also be challenged depending on organizational context.

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