

The Strategic Role of IT as an Antecedent to the IT Sophistication and IT Performance of Manufacturing SMEs

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Abstract — The business value of information technology (IT) applications for small- and medium-sized enterprises (SMEs) is dependent upon how such applications “fit” with the strategic orientation of these firms. Based on the strategic alignment of IT, this study uses a systemic approach to test the contribution of three predictors of IT performance in an organization: the strategic role of IT as well as the sophistication of the management and the use of IT. A multivariate mediation perspective is used to conceptualize alignment. The results of an empirical investigation of 44 manufacturing SMEs establish an important mediating effect of IT management and IT usage sophistication between the strategic role of IT and IT performance.

Keywords - *IT sophistication; IT performance; SME; strategic alignment; strategic role; e-business applications*

I. INTRODUCTION

The current economic context is marked by a considerable expansion of electronic markets. The need for information technology (IT) comes with the ever increasing demand for information and communication. The impact on business is tremendous, especially on small- and medium-sized enterprises (SMEs) who need to invest in systems with the ability to store, process, and generate data stemming from their dealings with various business partners. For many small companies, investing in IT has become necessary to ensure their survival and competitiveness in the face of globalization [27], and especially to enable their innovation capabilities [17]. While IT-based systems have substantially improved the manufacturing process and productivity of SMEs, they have also allowed for more organizational flexibility by removing constraints of time and space, and by reinventing the internal and external mode of business organization [16].

With the opening of the global marketplace, SMEs have been subject to rapid change and great instability. Now, IT can play an important role in a company’s performance and its ability to respond effectively to the changing needs of the market, therefore special attention for the small business domain has been demanded of researchers [35]. And given the inherent

fragile nature of the SME, IT plays an increasingly strategic role in creating new managerial challenges for these firms [11]. New online competitors easily enter emerging or existing markets, customers are more informed and more demanding because they can compare features and prices of products through the Web, and the changing needs and wants of the market often render recent IT investments obsolete [39].

As a result of substantial IT investments by many manufacturing SMEs, it has become essential to foresee the threats and opportunities that are inherent in these technologies, to discover the mechanisms that manage and drive IT, and to analyze their impact in terms of cost-effectiveness and profitability for such enterprises [24]. The increased strategic nature of the role of IT in the organization may give rise to IT management and IT usage problems that may be not only technical but also strategic and organizational in nature [6]. It has therefore become important for SMEs to understand how their investments in IT, coupled with an increased understanding of their IT management and usage practices, can provide the most value to them [12].

This research thus aims to study the impact of the strategic role of IT upon the IT management sophistication, the IT usage sophistication and the IT performance of manufacturing SMEs by answering the following research question: *To what extent and in what manner do the strategic role of IT, the sophistication of IT management, and the sophistication of IT usage contribute to the realization of business value from IT by manufacturing SMEs?* We first present the theoretical background of the research, followed by the research model, and the method by which 44 French manufacturing SMEs were empirically studied in order to answer the research question. Next, the results are presented and discussed. We further identify the study’s implications and limitations, and conclude with future research.

II. THEORETICAL BACKGROUND

The study’s theoretical background is founded on the concept of *strategic alignment* which is at the core of

the strategic paradigm in information systems research. First defined in terms of its impact on organizational performance rather than on the attainment of business value from IT, this concept still constitutes a fundamental basis of our understanding of the strategic role of IT and IT performance in organizations. According to Henderson and Venkatraman [20], strategic alignment is founded on the assumption that the firm's realization of business value from information technologies results from a dynamic coherence among the firm's business strategy, organizational infrastructure, IT strategy, and IT infrastructure. SMEs should thus "align" their IT processes and IT capabilities with their business processes and organizational capabilities. As presented in Figure 1, Henderson and Venkatraman's model is based on a systems perspective of alignment, emphasizing the importance of aligning both internal and external business activities in order to achieve strategic objectives and improve organizational performance.

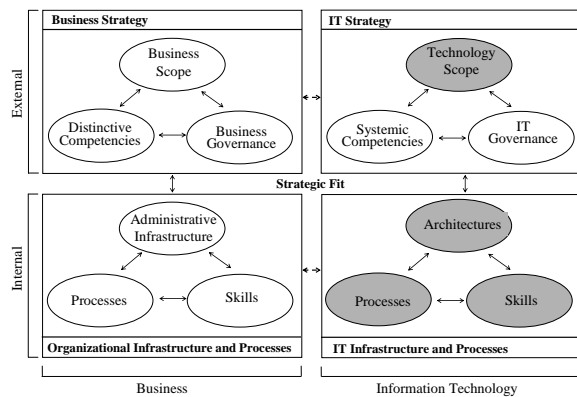


Figure 1. Adaptation of Henderson and Venkatraman's [20] IT alignment framework

As conceptualized above, the strategic alignment of IT has studied in various ways over the past two decades, often by exploring some of its aspects or dimensions in more detail. While it has been demonstrated that coherence between business strategy and IT strategy contributes to both IT performance and organizational performance [8, 13, 25], few studies have taken into account exogenous factors such as the organizational context (business strategy, organizational structure), the environmental context (industry, firm size), and the technological context (technology solutions, IT management), that is, the "TOE" framework emanating from Tornatsky and Fleischer's [42] work. Despite previous empirical studies that have allowed us to better understand the contexts in which strategic alignment contributes to the

attainment of business value from IT and to organizational performance, many aspects remain unexplored, including alignment at the technological level [2].

This study proposes a research model for ascertaining in what manner IT "works" in SMEs, that is, in terms of the strategic role of IT, and the sophistication of IT management and IT usage. The attainment of business value from IT, namely IT performance, is seen here as a result of direct or "proximal" strategic alignment of IT [8], while organizational performance would be considered rather as an indirect consequence or "distal" of this alignment. Returning to Figure 1, the shaded sections of Henderson and Venkatraman's model are the basis of the research model used for the current study.

A. Strategic Role of IT

According to Powell and Dent-Micallef [34], the firm's IT capabilities and organizational capabilities must complement one another in a way that creates intrinsic benefits from IT investments and the use of IT. Thus, more emphasis is placed upon optimizing the use and management of IT based on the internal characteristics of the firm as well as its strategic profile, size, in-house IT expertise, as well as its managerial, technological, and functional capabilities. In this regard, certain researchers have explored the idea of an evolution in IT usage within the firm, such Ward, Taylor and Bond [46] who observed that the strategic role of IT is developed over three major periods in order to support the business throughout its growth cycle: 1) a period of developing data processing standards and automating repetitive tasks, thereby improving operational efficiency, 2) a period of managing information systems, designed to improve managerial efficiency by producing relevant and timely information that will be used to better manage and control the firm, and 3) a period of developing strategic information systems that enable the firm to be more competitive in a global economy.

In the evolutionary model of the role of IT proposed by Philip and Booth [33], each organization has specific expectations with regard to IT that are dependent upon its capacity to align these technologies with its strategic objectives. According to this model, information technologies can play five potential roles in the enterprise:

- survival - the goal of IT is to achieve greater control over managerial processes and day-to-day administrative and production tasks in order to improve operational performance and reduce costs;
- resources - IT is used by the firm to procure itself of resources such as materials and services from

suppliers, and to provide and deliver products and services to its customers;

- competitive advantage - IT is used strategically to fully exploit the potential of resources in order to gain a competitive advantage, especially by enabling innovation;
- value analysis service - using IT to rethink business processes by reengineering them to improve the firm's competitiveness and flexibility, taking into account the rapid changes in the environment;
- cyberspace - it is through the Internet and the Web that virtual organizations build relationships with suppliers, consumers, and other organizations. This type of structure is meant to be very flexible, innovative, and to provide personalized service.

B. IT Sophistication

The evolution of the strategic role of IT is closely linked to IT sophistication because it reflects the way IT is managed and used by the company. Now, IT sophistication can be explained by the way IT "falls into line" with the firm's strategic objectives [36]. The concept of IT sophistication and its measurement were first defined and validated by Raymond, Paré and Bergeron [38], to be subsequently used by other researchers [10, 21, 31, 36]. IT sophistication refers to the nature, complexity, and interdependence of the management and use of IT within an organization. IT management sophistication includes managerial and functional sophistication on the one hand, while IT usage sophistication includes informational and technological sophistication on the other hand.

Managerial sophistication takes into account the mechanisms used to plan, monitor, and assess current and future applications [37]. Within the context of the SME, this is demonstrated by the degree of formalism of the company's IT processes and the level of alignment with the organization's goals, including the development of applications and the level of user participation in this development. This dimension may also contain aspects related to the presence of external consultants, the development of IT resources and competencies, and the level of support for – and appropriation of – IT within the firm. Functional sophistication refers to the location and functional autonomy of IT within the organization. In the SME context, this can refer to the presence of a designated manager for IT and by the organizational level at which the IT function is positioned [4].

Informational sophistication refers to the nature, both transactional and managerial, and functional coverage (accounting / finance / HRM, logistics / production / distribution, marketing / sales / customer service) of the applications portfolio [5]. IT may also include information quality and user-system interaction

quality. Another aspect of informational sophistication is the degree in which applications are integrated in the SME; this element can be characterized by the implementation of an enterprise system software package (ERP). Technological sophistication reflects the number or variety of technologies used by the SME in several areas such as CAD/CAM, internal networking and external networking, including Internet and Web technologies. It also refers to the measures put in place by the firm for purposes of IT security and confidentiality [38].

C. IT Performance

Assessing the performance of the IT function in an organization is not a simple task [28]. In a process evaluation of IT costs, Keen [23] proposed taking into account various elements such as the technical obsolescence of software, the declining cost of work units and operating software, development flows, and operating costs. Benefits gained from IT remain very complex to identify, specifically in relation to organizational performance [43]. In addition, quantifying benefits from organizational change, improved customer follow-up, or even an improvement of internal and external communication, are a challenge for a number of enterprises.

In regard to assessing the business value of IT, DeLone and McLean [14, 15] developed and validated a model of IT "success" or performance that comprises six dimensions: quality of the system, quality of information, usage, user satisfaction, individual impact of IT use, and organizational impact of IT use. User satisfaction remains however one of the most important measures of success and most recognized in IT, and it has been demonstrated that the quality of the system, the quality of the information output and the usefulness of applications point to, in large part, the satisfaction of users [40].

III. RESEARCH MODEL

As presented in Figure 2, the research model developed for this study is based upon a conceptualization of the strategic alignment of IT proposed by Henderson and Venkatraman [20], more specifically the alignment between the IT strategy and the IT infrastructure and processes that is deemed to have a positive impact upon the performance of IT in manufacturing SMEs. The IT strategy is defined as the strategic role attributed to IT by the SME's leader, whereas the IT infrastructure and processes are as the firm's sophistication in both managing and using IT. Testing this model should help us answer the research question.

As shown in the research model, the strategic role of IT is an independent construct directly related to the

dependent construct, i.e. IT performance. The impact of the strategic role of IT will also be felt by the sophistication of IT management and IT usage. This research model aims to explain IT performance in a novel way by focusing on the strategic role of IT while taking into account the sophistication level of IT deployed in manufacturing SMEs. It is for this reason that the IT sophistication concept [38] is mobilized here, that is, IT management sophistication on one hand, and IT usage sophistication on the other hand. The first hypothesis is in line with the main proposition found in previous conceptualizations of the strategic alignment of IT, and is made on the basis of the evolution of information technology's role in organizations [33, 45]. Its distinction and contribution however lie in the choice of IT performance (business value of IT) rather than organizational performance as the outcome of such alignment.

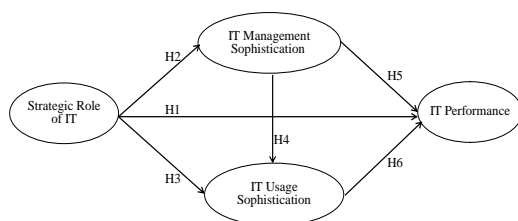


Figure 2. Research model

It had been previously noted that the strategic role played by IT in organizations could only be ascertained if one took into account their IT management and usage characteristics. Now the notion of IT sophistication effectively reflects how IT are managed and used within organizations [46]. Hence the second hypothesis assumes the more strategic the role played by information technology in the organization, the greater the presence of its IT function. Following Henderson and Venkatraman [20], it is presumed that in manufacturing SMEs, the strategic importance of IT will be reflected in the IT resources and capabilities developed by the IT function. The third hypothesis reflects the premise that users will be more satisfied with the applications implemented and with the quality of information output if the SME's leadership views IT as a strategic necessity or as a source of competitive advantage. Here, the notion of "top-management support" as a determinant of IT performance would take on added importance in small business [40].

The fourth hypothesis assumes a certain hierarchy in the evolution of IT, as previously indicated, i.e. this

technology must be effectively managed and deployed in the SME if it is to be appropriated and effectively used by employees. This is basically in line with DeLone and McLean's [15] updated IS success model in which system usage and user satisfaction are dependent upon the quality of the system, the information output, and the "service" provided by the IT function [32]. The fifth hypothesis proposes that the performance of IT improves when the sophistication of the management of IT increases [29]. As noted by Philip and Booth [33], "sustainable advantage depends on the ability to manage the IS resources effectively on an ongoing basis". The last hypothesis similarly proposes that IT performance improves with a more sophisticated usage of IT [38], this being in line again with DeLone and Mclean's [14, 15] IS success model.

In summary, the following hypotheses are tested:

- H1*: The more strategic the role played by IT, the higher the performance of IT.
- H2*: The more strategic the role played by IT, the greater the IT management sophistication.
- H3*: The more strategic the role played by IT, the greater the IT usage sophistication.
- H4*: The greater the IT management sophistication, the greater the IT usage sophistication.
- H5*: The greater the IT management sophistication, the higher the performance of IT.
- H6*: The greater the IT usage sophistication, the higher the performance of IT.

IV. METHOD

Secondary data was provided by a database created by a university research center for benchmarking purposes and containing information of 44 French manufacturing SMEs. For the study's purpose, a SME is defined as having between 10 and 299 employees, the median size of the sampled firms being 38 employees. The industrial sectors represented include metals (27%), food and beverage (16%), wood (9%), plastics (9%), textile (7%), minerals (5%), electronics (2%) and others (25%).

A. Data Collection

This database was created in collaboration with business owners that belong to chambers of commerce in Midi-Pyrénées region, by asking the management team and the IT manager to answer a questionnaire on the firm's strategic orientation, practices, and performance with regard to information technology and e-business, broken down by the main business functions of the SME, namely operations and production, sales and marketing, and accounting, finance and HRM. In exchange for this information, the firm was provided with an overall diagnostic of its situation relative to the

management and performance of its information technology.

B. Measures

In view of Henderson and Venkatraman's [20] framework on which this research is based, fit or alignment between the strategic role of IT and the sophistication of IT management and usage in the firm is ascertained here from a "fit as mediation" perspective [44]. First, the extent to which IT plays a strategic role in the SME was measured through a self-typing approach based on Venkatraman's [45] and Philip and Booth's [33] stage models, by asking the chief executive to answer the following question (statements were coded from 1 to 4 in order of increasing strategic importance):

Indicate among the following statements the one that best defines your understanding of the strategic role that is assigned to information technology-based applications (ITApps) in your firm (choose one statement)?

1. ITApps should allow us to improve our managerial control and our production monitoring.	<input type="checkbox"/>
2. ITApps should insure greater operational flexibility and better response to our customers' needs.	<input type="checkbox"/>
3. ITApps should facilitate and accelerate the development of new products, and allow us to increase our market share.	<input type="checkbox"/>
4. ITApps should allow us to integrate our business and production processes, and to improve exchanges with our business partners.	<input type="checkbox"/>

The measures of IT management sophistication, in terms of managerial and functional sophistication, and of IT usage sophistication, in terms of informational and technological sophistication, emanate from constructs developed, validated, and used in previous research [31, 38]. IT performance is measured by the level of attainment of the benefits associated with four types of IT-based applications (accounting-finance-HRM, logistics-production-distribution, marketing-sales-customer service, e-business-Internet-Web), thus following a process-based approach wherein the respondents evaluate the business value of IT for their firm [41, 43]. A list of expected benefits specific to each type of application (e.g. "increase flexibility", "improve customer service", "facilitate the recruitment of personnel") is presented to the manager (CEO or CFO, operations manager, sales and marketing manager, and IT manager) who must indicate on a 5-point scale the extent to which the applications implemented contribute to the attainment of these benefits.

V. RESULTS

Descriptive statistics of the research variables are presented in Table 1. Structural equation modeling was used to validate the research model. To this effect, the PLS technique was chosen for its robustness, more precisely its capacity to handle small samples and formative measurement models in comparison to covariance structure analysis techniques such as Lisrel, EQS and Amos [19].

TABLE 1. DESCRIPTIVE STATISTICS (N = 44)

Variable	mean	s.d.	range
Org. Size (no. of employees)	59	61	10-301
Strategic Role of IT ^a	2.5	1.3	1-4
Functional Sophistication			
designated manager for IT ^b	.727	-	0-1
org. level of the IT function ^c	.546	-	0-1
Managerial Sophistication			
IT development	3.0	0.8	1.0-5.0
IT evaluation	2.8	1.2	0.0-5.0
user participation	2.9	0.9	1.0-5.0
IT resources and competencies	3.4	0.9	1.2-5.0
IT support and appropriation	3.7	0.8	1.7-5.0
external consultants	2.4	1.8	0.0-5.0
Technological Sophistication			
# of uses of IT	4.8	1.8	2-10
# of uses of e-bus/Internet/Web	6.0	3.3	0-15
quality of IT security	4.4	0.9	2.0-6.0
Informational Sophistication			
# of accounting/fin./HRM apps	6.0	2.8	0-11
# of logistics/prod./distrib. apps	7.0	3.1	2-16
# of mark./sales/cust. serv. apps	3.8	2.0	0-7
# of ERP system modules	2.8	2.5	0-7
information output quality	3.6	0.8	1.4-4.6
user-system interaction qual.	3.5	0.9	1.5-5.0
IT Performance			
acc./fin./HRM app. benefits	3.3	1.2	0.0-5.0
log./prod./distrib. app. benefits	3.3	0.6	2.0-5.0
mark./sales/serv. app. benefits	3.0	1.1	0.0-5.0
e-bus./Net/Web app. benefits	2.6	0.7	0.0-4.1

^a1: IT for control (n = 14)

2: IT for flexibility (n = 9)

3: IT for product and market development (n = 4)

4: IT for internal and external integration (n = 17)

^b1: yes (n = 32)

0: no (n = 12)

^c1: supervised by the chief-executive (n = 24)

0: supervised by another manager (n = 20)

A. Measurement Model

Given their composite and multidimensional nature, the research constructs are modeled as being "formative" rather than "reflective" [9]. Such a construct is composed of many indicators that each captures a different aspect; hence changes in these indicators bring or "cause" change in their underlying

construct [26]. IT management sophistication is thus modeled as a second-order formative construct from two sub-constructs, namely managerial sophistication and functional sophistication. As presented in Table 2, each of these sub-constructs is in turn composed of six and two formative measures respectively, a functional sophistication and managerial sophistication score being obtained from the factor scores determined by a principal components analysis. Given that this analysis produced two components for managerial sophistication, a single score was obtained by averaging the two factor scores.

TABLE 2. PRINCIPAL COMPONENTS ANALYSIS OF IT MANAGEMENT SOPHISTICATION

indicator	factor	Funct. Soph.	Man. Soph. ^a	Man. Soph. ^b
Functional Sophistication				
designated manager for IT		.91	-	-
org. level of the IT function		.91	-	-
Managerial Sophistication				
IT development		-	.79	-
IT evaluation		-	.68	-
user participation		-	.75	-
external consultants		-	.58	-
IT resources&competencies		-	-	.93
IT support & appropriation		-	-	.95

^aIT management practices

^bIT management capabilities

The reliability of a formative construct, as opposed to a reflective one, is confirmed by the absence of multicollinearity between its measures or indicators [30]. Formative indicator validity is confirmed by a weight that is significant and not less than 0.1 [22], as confirmed in Figure 3. Discriminant validity of a formative construct is confirmed by it sharing less than 50% variance with any other construct, whereas nomological validity is confirmed when the construct's hypothesized links with other constructs are significantly greater than zero and in the expected direction [1].

In similar fashion, IT usage sophistication is modeled and measured from two sub-constructs, namely informational sophistication and technological sophistication. As presented in Table 3, each sub-construct is in turn composed of six and three indicators respectively. The reliability and validity of the IT usage sophistication construct was similarly confirmed. As to the IT performance construct, it is composed of four measures, that is, the average benefits obtained from each type of IT-based application. One may note again that there is no multicollinearity among these last formative measures, the highest correlation among them being equal to 0.19 ($p > 0.1$), with all four

regression weights being greater than 0.1 (see Figure 3), thus showing adequate reliability and validity.

TABLE 3. PRINCIPAL COMPONENTS ANALYSIS OF IT USAGE SOPHISTICATION

indicator	factor	Tech. Soph.	Inf. Soph. ^a	Inf. Soph. ^b
Technological Sophistication				
uses of IT		.90	-	-
uses of e-bus/Internet/Web		.81	-	-
quality of IT security		.50	-	-
Informational Sophistication				
accounting/fin./HRM apps		-	.78	-
logistics/prod./distrib. apps		-	.60	-
mark./sales/cust. serv. apps		-	.74	-
ERP system modules		-	.69	-
information output quality		-	-	.93
user-system interaction qual.		-	-	.95

^aextensiveness of IT usage

^bquality of IT usage

B. Test of the Research Model

The research hypotheses were tested by evaluation the direction, value, and level of significance of the path coefficients estimated by PLS, as presented in Figure 3.

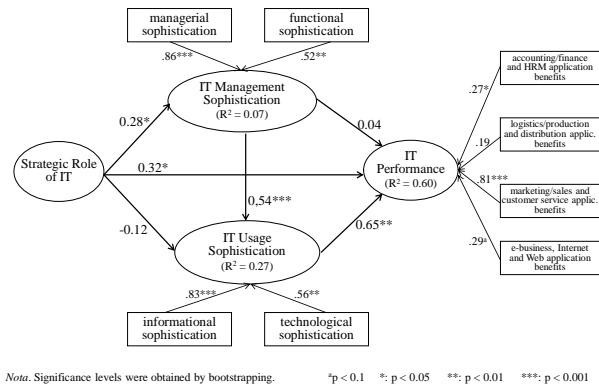


Figure 3. Results of testing the research model

A positive and significant path coefficient ($\beta_1 = 0.32$; $p < 0.05$) confirms the first research hypothesis, that is, the more strategic the role played by IT in the manufacturing SME, the greater its IT performance. Moreover, if one removes the effect of IT management and IT usage sophistication upon IT performance, the strategic role of IT still explains 25% of the variance in this same performance. The benefits obtained from marketing, customer service, and e-business applications thus flow directly from a vision of IT as a mean for the SME to develop its products and markets,

to integrate its production processes, and to improve exchanges with its business partners.

A positive and significant path coefficient ($\beta_2 = 0.28$; $p < 0.05$) confirms the second hypothesis, that is, the more strategic the role played by IT, the greater the IT management sophistication of the SME. When IT constitutes a strategic necessity or a competitive weapon, when IT is of critical importance for “core” business processes of small manufacturers, these organizations act in a coherent manner by adopting managerial practices that allow them to better manage the development and use of these technologies. These are practices such as planning, designing and evaluating IT-based applications, sustaining and favoring user participation and user appropriation of IT, preserving and developing IT resources and competencies, and seeking outside consultants to overcome internal lacks in this regard. These firms show similar coherence when they place the IT function at a high hierarchical level in the organization and render IT autonomous (with a designated manager), that is, not subordinated to the financial or accounting function as is still often the case in small business.

Due to a negative and non significant path coefficient ($\beta_3 = -0.12$), the third hypothesis could not be confirmed. It stated that the more strategic the role played by IT, the greater the IT usage sophistication of the SME. Thus it seems that the strategic role of IT would be only indirect here, that is, through its effect on IT management sophistication. For instance, seeking internal and external integration of business processes through IT would lead the firm to better plan its use of IT and to dispose of better IT resources and competencies; only then could a more advanced technological infrastructure and applications such as ERP and e-business be implemented.

The fourth research hypothesis is confirmed by a positive and significant path coefficient ($\gamma_4 = 0.54$; $p < 0.001$), relating the firm’s IT management sophistication to its IT usage sophistication. This result increases the relevance of a strategic perspective based on IT resources and competencies, namely a resource-based view to explain the level of adoption and assimilation of IT in manufacturing SMEs [3]. Now, firms that have sufficiently developed their IT function and managerial competence and that have access to external resources are those that have adopted and assimilated the greatest number of advanced manufacturing applications, and where system quality and security are best.

Due to a non significant path coefficient ($\beta_5 = 0.04$), the fifth hypothesis could not be confirmed. It stated that the greater the IT management sophistication, the greater the IT performance of the SME. In the absence of a direct effect, better management of IT has

nonetheless an indirect effect upon IT performance, that is, through its positive effect on the use of TI (which in turn has a direct effect on performance, as we shall see). This last result is obtained with an estimation of this indirect effect by the product of the two path coefficients ($\beta_4 * \beta_6 = 0.54 * 0.65 = 0.35$; $p < 0.05$).

A strong path coefficient ($\beta_6 = 0.65$; $p < 0.001$) confirms the sixth research hypothesis, that is, the greater the small manufacturer’s IT usage sophistication, the greater the performance of its information technology. Advanced applications such as an ERP system, a transactional Web site, videoconferencing, and mobile computing, to the extent that they are effectively assimilated by SMEs, are those that are the most strategic, that is, bring the greatest “value” to these firms in the form of increased competitiveness and competitive advantage. One may recall moreover that this increased assimilation of IT is the result of better management of these technologies. In turn, this better management is the result of a more strategic vision of the role played by IT in the organization.

In total, these three factors combined explain 60% of the variance in the performance of IT. One may note here that the applications that are most affected in terms of performance are the marketing and sales applications, followed by the accounting, finance and HRM applications, and the e-business, Internet and Web applications. This last result tends to underline the more operational rather than strategic nature of the logistics, production, and distribution applications as presently implemented in the sampled manufacturing SMEs.

VI. DISCUSSION AND IMPLICATIONS

The results obtained from 44 SMEs show that IT performance is influenced in two ways. First, IT performance is directly affected by the strategic role played by IT in the firm, and especially in the eyes of its leader. Second, IT performance is also influenced indirectly by the strategic role of IT through IT management sophistication, which in turn influences IT usage sophistication. It is then IT usage sophistication that directly contributes and contributes most to IT performance.

This dual contribution of the strategic role of IT to IT performance suggests that the functional sophistication of IT alone is not sufficient to increase IT performance; it is also necessary that IT be adequately used by employees. Thus, to ensure that information technology applications fully meet their strategic role, their development has to be adequately managed. The development and evaluation of these applications should take into account the needs of users, involving them when conducting business process analysis to

make the most effective use of resources and competencies, this being done within a structured IT function which reflects the strategic and operational reality of the organization while procuring external resources when necessary.

The strategic role of IT has no direct influence on IT usage sophistication; however it does have an indirect effect through IT management sophistication. This means that once information technologies are properly deployed, it is possible for users to enhance their strategic role. These results are in line with Westerman's [47] work on the evolution of IT, reiterating that IT should adequately support business operations, making certain that IT-based systems work as and when they are supposed to, that their access is secure, that the information output is accurate, complete and correct, and that all this is done in time and within budget. Users should then be able to learn and appropriate themselves of the various functional applications implemented by the firm, and to assess the quality of information output by these applications in order to make better decisions.

The descriptive results indicate that for all SMEs, the benefits of IT mainly come from accounting/finance/HRM, and logistics/production/distribution applications. Then come benefits accruing from marketing/sales/customer service applications, and to a lesser extent e-business, Internet and Web applications. This descending order of benefits is consistent with the increasing complexity of the strategic role of IT. Most manufacturing SMEs do not use IT for purposes of internal and external integration of business processes, which is the most strategic role. The IT applications easiest to implement are often the first deployed, and therefore are the first to provide benefits.

In this study, where the benefits are cumulated by the type of applications used, firms that have deployed several types of applications are the ones showing the highest performance from their IT. They are also those who envision the most comprehensive strategic role for information technologies, the more complex and more demanding. In this context, manufacturing SMEs that gain more business value from IT are those that devote a more strategic role to these technologies, manage them in a more sophisticated way, and use them more extensively and intensively.

VII. LIMITATIONS AND CONCLUSION

As in any empirical research, this study has some limitations that should be mentioned. Given the nature of the sample, its representativeness in relation to all SMEs limits the scope of the results. As sample firms have chosen to undertake an IT benchmarking exercise, they could differ from the general population in terms

of strategic orientation, IT sophistication, and IT performance [6]. The use of perceptual measures for assessing the strategic role and performance of IT may also have induced some respondent cognitive biases, although earlier studies have also resorted to such measures [41].

Notwithstanding its limitations, this study revealed that a strategic vision of the role of IT is critical to the managerial and technological skills developed by manufacturing SME, and to the realization of IT business value from these capabilities. Based on a strategic alignment perspective, future studies could extend the research model by examining whether the role assigned to IT depends on how well it "fits" with the SME's business strategy, structure, and environment. A more complete formative model for measuring IT performance, such as that proposed by Gable, Sedera and Chan [18], could also be used to include, in addition to the organizational impacts, individual impacts, quality of IT-based systems, and quality of information output by these systems.

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