The Combined Effects of IT and HRM Capabilities on Competitive Performance: Empirical Evidence from Service and Manufacturing SMEs

Completed Research Paper

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Abstract

Building on the resource-based perspective, we analyze the combined effects of two highly-valued organizational resources, namely IT capabilities and HRM capabilities, on the competitive performance of SMEs. Three resource configurations are derived from data on 227 SMEs (121 manufacturing SMEs, 106 service SMEs) through a cluster analysis: “IT Capabilities-Dominant Configuration” (ITC), “E-Business Capabilities-Dominant Configuration” (EBC), and “HRM Capabilities-Dominant Configuration” (HRC). HRC is the best-performing one, followed by EBC, and ITC is the worst-performing. The results show that manufacturing and service firms are very unevenly distributed within HRC and ITC configurations, suggesting notable differences between the two sectors regarding their respective IT and non-IT capability-building. The fact that service SMEs are overwhelmingly represented (93%) in the worst-performing configuration and completely absent (0%) in the most effective configuration while displaying the strongest IT infrastructure capabilities confirms that the IT productivity paradox is aggravated in service SMEs and calls for further investigation.

Keywords


Introduction

While there have been numerous information systems (IS) studies of the information technology (IT) - performance relationship, the results of these studies have not converged (Kohli et al. 2003). Methodological and conceptual problems have been advanced to explain this lack of convergence. Methodological problems include mis-measurement of independent (IT-related) and dependent (performance-related) variables (Dievert et al. 1999), the difficulty in accounting for time lags in measuring the “payoff” of IT investments (Kohli et al. 2003), and the inadequacy of datasets and samples (Brynjolfsson et al. 2000). Conceptual problems refer either to divergent conceptualizations of key constructs (the IT artifact on one hand, and organizational performance on the other), or to inadequate modeling of the relationship between these constructs (Melville et al. 2004; Rao et al. 2011). In this regard, commonly used “variance” models, which attempt to establish a direct cause-effect relationship
between IT inputs and organizational performance, fail to take into account the complementary and potentially determinant role of other "non-IT" resources or factors. Indeed, in IS literature, the stream of research that adopts the resource-based view (RBV) (Mata et al. 1995; Piccoli et al. 2005; Wade et al. 2004) points to the fact that the differences between organizations with regard to IT business value stem from their respective capacity to develop and exploit appropriate IT resources and complementary non-IT resources, and above all, to exploit the two types of resources in synergistic fashion.

Among the complementary non-IT resources, it is the firm’s human resources (HR) that are deemed to be most critical. HR capabilities are reckoned to have not only a direct effect on organizational performance, but also a moderating effect on the performance effects of other organizational capabilities (Fabi et al. 2010). For some, the ultimate source of the firm’s competitive advantage for firms is the knowledge embedded in its employees (Crook et al. 2011). Moreover, the development and effective exploitation of IT resources by the firm hinge essentially on its HR capabilities. Hence there is a need to analyze the combined effects of IT capabilities and HR capabilities on organizational performance.

Such an analysis requires mobilizing both the IS and the HR management (HRM) literatures in an interdisciplinary approach that has been lacking until recently (Khatri et al. 2010). IT-related studies in both fields have been conducted in isolation, and as a result, the performance effects of IT-HR complementarities have yet to be fully identified and explained. In this study, we thus aim to further investigate the interaction effects of IT and non-IT resources in general (Chen 2012; Jeffers et al. 2008), and of IT and HRM capabilities in particular (Aral et al. 2012; Khatri et al. 2010). We do so by analyzing these effects in relation to the competitive performance of small and medium-sized enterprises (SMEs) in the service and manufacturing sectors. The main research question can be stated as follows: To what extent do the combined IT and HRM capabilities of a SME affect its competitive performance, that is, its ability to develop new products or services and to offer these to new markets worldwide?

With data collected from 227 SMEs (121 in manufacturing and 106 in services), we derived three resource configurations through a cluster analysis of the firms’ IT and HRM capabilities. With reference to the dominant category of resources for each configuration, the three resource configurations were labeled “IT Capabilities-Dominant Configuration” (ITC), “E-Business Capabilities-Dominant Configuration” (EBC), and “HR Capabilities-Dominant Configuration” (HRC). The results show these configurations to be associated to different levels of competitive performance (i.e., innovation performance and internationalization performance). The HRC exhibits the highest performance outcomes (high innovation and internationalization performances), followed by the EBC (high innovation and medium internationalization performances), and the ITC exhibits the lowest performance (low innovation and internationalization performances). The results also reveal service and manufacturing firms to be very unevenly distributed within the HRC and ITC configurations, suggesting notable differences between the two sectors with regard to their respective IT and non-IT capabilities.

Following this introduction, a brief review is done of the theoretical and empirical background of IT and non-IT resources and capabilities. A research model is then proposed, along with the research method employed to empirically validate this model. The results of this validation are next presented and discussed. The paper ends with the study’s implications and a conclusion.

Theoretical and Empirical Background

According to the resource-based view (RBV), achieving a sustainable competitive advantage depends upon the firm’s ability to develop valuable, idiosyncratic, and inimitable resources (Bhatt et al. 2005). With regard to IT resources in particular, some have argued that acquiring such resources cannot lead to sustainable competitive advantage for any particular firm, simply because they are accessible to all firms (Carr 2003). This argument has been debated and questioned however (Bhatt et al. 2005; Ray et al. 2007). First of all, with appropriate managerial IT skills (Mata et al. 1995), firms may ingeniously combine widely available IT resources to achieve a distinctive IT infrastructure and enterprise-wide information system that will be hard for competitors to imitate (Uwizeyemungu et al. 2012). Secondly, competitive advantage can result from an appropriate combination of IT resources with non-IT resources, that is, IT resources being used as leverage to enhance other organizational resources (Kalling 2003). Thirdly, even in the case where IT resources do not provide a competitive advantage, they can still
contribute to organizational performance in other ways since it is understood that “creating value” is not synonymous with “creating differential value” (Kohli et al. 2008, p. 26).

**IT Resources: IT Assets and IT Capabilities**

Following Wade and Hulland (2004) and Piccoli and Ives (2005), IT resources are defined here, in a broad sense, as a set of IT-related assets and capabilities with which a firm endows itself. IT assets are defined as “investments in different types of IT”, whereas IT capabilities are defined as “practices and competences that support the use of IT” (Aral et al. 2007, p. 764). The notion of IT resources (and non-IT resources for that matter) covers a diversified and complex reality, and one needs to discriminate between specific types of IT resources (and non-IT resources). Indeed, factors determining the adoption or development of these resources (de Jong et al. 2003) as well as their effects on firm performance (Byrd et al. 2010) may vary according to their respective characteristics. Taking into account this last observation, we distinguish different types of IT resources.

Based on previous studies (Lucchetti et al. 2004; Raymond et al. 2009), we adopt a three-category classification of IT assets: 1) product-design (service-development) IT, 2) process-embedded IT, and 3) logistics/planning applications. The first category regroups technologies, such as computer-aided design (CAD), used for the development of new or improved products/services, meant to enable product and service innovation, hence the “IT for product/service innovation” label. In the second category one finds technologies such as flexible manufacturing systems (FMS) or computer numerical control (CNC), that are embedded in production/service processes, meant to increase the flexibility of production/service processes, hence the “IT for flexibility” label. In the third category are grouped transactional and administrative applications whose role is to facilitate coordination (e.g. extranets, EDI) or to increase business and systems integration (e.g. ERP, MRP-II), hence the “IT for integration” label. In this study, we measure the level to which each of these different IT assets is mastered by SMEs, and we refer to these as IT infrastructure capabilities. In addition to these last capabilities, we also consider e-business capabilities. In doing so we focus on the synergy of the back-end IT infrastructure with the front-end e-business capabilities (Chi et al. 2010; Zhu 2004), in line with a basic tenet of the RBV.

Following previous small business and entrepreneurship studies (Raymond et al. 2008; Zhu et al. 2000), we define e-business as the usage of Internet-related technologies in different business activities, retaining three types of e-business capabilities, namely e-business intelligence, e-collaboration and e-commerce. E-business intelligence refers to a firm’s scanning of its technological, commercial and competitive environment in search of ways and means to improve its operations and decision-making, as well as to discover new product-market opportunities (Hill et al. 2004). E-collaboration refers to activities that imply sharing and exchanging of information and knowledge with business partners (Cassivi et al. 2004). E-commerce is about business transactions over the Internet, especially the selling of goods and the provision of services (Zhu 2004).

**Non-IT Resources: HR Capabilities**

Non-IT resources refer either to “complementary assets” (Davern et al. 2000, p. 122) that enable the firm to leverage the value of its IT resources, or more generally to “conversion contingencies” (Davern et al. 2000, p. 124) that affect the transformation of the firm’s IT investment into value. Applying the RBV, Piccoli and Ives (2005) have demonstrated how non-IT resources can contribute to the sustainability of an IT-based competitive advantage. The long list of complementary resources retrieved by these researchers from literature illustrates how numerous and varied non-IT resources can be. It is thus common for IT studies to emphasize a limited number of such resources. For example, Jeffers et al. (2008) considered two non-IT resources, namely openness of communication and business work practices.

As mentioned previously, we consider here that among non-IT resources, HR capabilities are the ones that are most critical in their capacity to enable – or be enabled by – IT capabilities (Aral et al. 2012). Now, in the strategic management literature, two mechanisms are seen to allow a particular firm to outsmart its competitors, namely resource-picking and capability-building (Makadok 2001). In this regard, the firm’s HR are key factors for both mechanisms as competent employees are needed to “pick”
the right IT resources and to build the appropriate IT capabilities. A firm endows itself with capable human resources through HRM practices meant to recruit outstanding candidates, and to develop, motivate and empower them. Therefore, HR practices (training, information, integration, participation, and remuneration) are used here as surrogate measures of HRM capabilities. Training refers to organized activities (general or tailored) to increase the knowledge and competencies of employees. Information refers to the diffusion of strategic, economic, and operational information to employees. Integration refers to practices such as job description, recruitment and performance appraisal meant to attract and retain highly-qualified employees. Participation refers to the level of involvement of employees in the decision-making process. Remuneration refers to the implementation of incentive compensation (such as profit sharing, stock ownership) for employees.

Research Model: A Resource Configuration Perspective

We know from the RBV that firms achieve a sustainable competitive advantage through a distinctive combination of different resources. Our research model (Figure 1) is based on this theoretical assumption.

Assuming the existence of a wide range of IT and non-IT resources, multiple combinations of resources are possible, and can be labeled “resource configurations” in reference to the configurational approach in organization studies (Meyer et al. 1993). These resource configurations would correspond to different levels of organizational competitive performance, with the possibility that some configurations, though different in their composition, would be comparable in their effects. The possibility of similar outcomes from different resource configurations, referred to as “equifinality” (Gresov et al. 1997; Payne 2006), is compatible with contingency theory, i.e. there would be no “best way” to combine different IT and non-IT resources, and the successful outcome of resource combinations would stem from more coherent or “aligned” combinations. This configurational approach is reflected in our research model (Figure 1): the resource configurations or more precisely the combinations of IT infrastructure capabilities, e-business capabilities (IT resources) and HR capabilities (non-IT resources) are assumed to determine the firm’s level of competitive performance. As for control variables, we consider the size, the age, and the industrial sector of the firm.
Research Method

Data Source

For the purpose of this study we used data already collected from manufacturing and industrial service SMEs by a university research institute. In cooperation with an important business association, this institute has created a database that contains information on a wide range of business practices and on various aspects of these SMEs’ organizational performance. SME owner-managers and key employees fill out a questionnaire and provide their firm’s financial statements for the last three years. On the basis of the information supplied, a comparative diagnosis (benchmarking) of their firm is provided to owner-managers, assessing the firm’s overall situation in terms of performance and vulnerability. These diagnoses link the SMEs’ results to their organizational resources and business practices, and formulate recommendations as to what actions should be undertaken in short and medium terms. It is worth mentioning that the authors of this study participated in the design of the questionnaire as well as in the diagnosis process.

Sample

We retrieved data on 227 SMEs (121 from the manufacturing sector, and 106 from service sector) from the aforementioned database, this number corresponding to the firms for which all data relative to our research variables were available. The average size of the sampled SMEs is 63 employees. Manufacturing SMEs tend to be larger than service SMEs, the former’s average size being 86 employees, versus 36 for the latter. The average age of the sampled enterprises is 27 years, that is, 25 years for the manufacturers and 29 years for the industrial service firms.

Measurement

IT infrastructure capabilities are measured through an assimilation index obtained by having each SME assessing to what extent IT systems and applications adopted in each IT category are mastered, on a scale of 1 (low) to 5 (high). E-business capabilities are assessed through three index measures obtained by asking the SME owner-managers to indicate from a list of business activities those for which the Internet and the Web are used in their organizations. These business activities include prospecting for new clients and scanning the business and technological environment (e-business intelligence), establishing collaborative partnerships for product/service design and collaboration with clients for product/service improvement (e-collaboration), and online ordering and selling of goods and services (e-commerce). By summing the number of activities corresponding to each category, we obtained a score corresponding to capability level for that category.

HRM capabilities are measured through the implementation level of HR-related practices in SMEs. These practices cover activities related to job task description, recruitment, training, performance assessment, information dissemination, employee participation, employee motivation, and remuneration. Following previous studies (e.g. Fabi et al. 2010), these practices were grouped into five dimensions or bundles: training, information, integration, participation, and remuneration. Except for the training capability which is measured through the firm’s training budget per employee, other HRM capabilities are measured through the number of implemented practices related to each capability. Aggregated measures for information, integration, and remuneration were standardized.

Two measures of competitive performance are used: innovation performance and internationalization performance. Innovation performance has always been associated to the firm’s ability to gain a competitive advantage (Radas et al. 2009; Reed et al. 2012). Moreover, the performance of a firm and of a SME in particular on international markets may be regarded as a manifestation of its competitive ability. Following previous studies (Becheikh et al. 2006; Garcia et al. 2002), innovation performance is measured by the average percentage of sales attributed to new or modified products/services over the last two years. Considering that export is the SMEs’ most prevalent entry mode on international markets (Armario et al. 2008), internationalization performance is measured through the intensity of export—that is, the ratio of sales exported over total sales.
Results and Discussion

In line with our research model, we derived from the data a configurational classification of SMEs based on the combination of IT and HRM capabilities. We did so by performing a cluster analysis, using six IT capabilities and five HRM capabilities as clustering variables. The aim of this analysis was to group the sampled SMEs into clusters such that firms in the same cluster are highly homogeneous and differ significantly from the firms in the other clusters with respect to their IT and HRM capabilities. The SPSS TwoStep clustering algorithm was chosen as it has been found to be the top-ranking algorithm (Gelbard et al. 2007). Besides, it can handle a large number of cases, and it automatically determines the optimal number of clusters. Here, a three-cluster solution was found to be optimal, corresponding to the three resource configurations presented in Table 1.

| Resource Configuration | I (n = 75) mean | II (n = 73) mean | III (n = 79) mean | ANOVA F | ANCOVA F
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<td>IT Infrastructure Capabilities</td>
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</tr>
<tr>
<td>1. IT for Innovation</td>
<td>High</td>
<td>Low</td>
<td>6.5</td>
<td>7.6 **</td>
<td>6.1 ***</td>
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<tr>
<td>2. IT for Flexibility</td>
<td>9.0</td>
<td>10.1</td>
<td>5.8</td>
<td>36.8 ***</td>
<td>25.9 ***</td>
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<tr>
<td>3. IT for Integration</td>
<td>19.2</td>
<td>5.5</td>
<td>108.0 ***</td>
<td>93.2 ***</td>
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<td>HRM Capabilities</td>
<td></td>
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<tr>
<td>4. Training</td>
<td>Low</td>
<td>Medium</td>
<td>5.0</td>
<td>4.0 **</td>
<td>4.0 **</td>
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<tr>
<td>5. Information</td>
<td>-0.17</td>
<td>-0.07</td>
<td>-0.03</td>
<td>3.9 *</td>
<td>3.6 **</td>
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<tr>
<td>6. Integration</td>
<td>0.38</td>
<td>0.02</td>
<td>0.02</td>
<td>0.36</td>
<td>0.28</td>
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<tr>
<td>7. Participation</td>
<td>0.84</td>
<td>2.85</td>
<td>86.8 ***</td>
<td>57.1 ***</td>
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<tr>
<td>8. Remuneration</td>
<td>-0.07</td>
<td>-0.11</td>
<td>2.9</td>
<td>2.9 **</td>
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<tr>
<td>E-Business Capabilities</td>
<td></td>
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<tr>
<td>9. E-Business Intelligence</td>
<td>Low</td>
<td>High</td>
<td>High</td>
<td>25.9 ***</td>
<td>10.1 ***</td>
</tr>
<tr>
<td>10. E-Collaboration</td>
<td>0.0</td>
<td>1.0</td>
<td>0.0</td>
<td>269.7 ***</td>
<td>95.7 ***</td>
</tr>
<tr>
<td>11. E-Commerce</td>
<td>0.3</td>
<td>0.7</td>
<td>33.8 ***</td>
<td>12.3 ***</td>
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*: p < 0.05  **: p < 0.01  ***: p < 0.001  (2-tailed tests)

Table 1. Resource Configurations Resulting from the Cluster Analysis

Overall, SMEs in the first group are characterized by the weakest resource configuration: even though they are the strongest in IT infrastructure capabilities, they are the weakest in the two remaining categories. SMEs in the second group display the strongest resource configuration: they come first in two categories (e-business capabilities and HRM capabilities), and they are in second position for the other category (IT capabilities). SMEs in the third group fall in “in-between”: they are dominant in one category (HRM capabilities), they come in second in terms of e-business capabilities, and come in last in terms of IT infrastructure. This order becomes clearer if one attributes a value of 1, 2, and 3 to the bottom, middle, and top positions, and calculates the results for each resource configuration: 5 for configuration I (3+1+1); 8 for configuration II (2+3+3); and 6 for configuration III (1+3+2). We labeled the resource configurations based on the dominant category of resources as each configuration has at least one. Hence, group I was labeled “IT Capabilities-Dominant Configuration” (ITC in short), group II “E-Business Capabilities-Dominant Configuration” (EBC), and group III “HRM Capabilities-Dominant Configuration” (HRC).

The breakdown of control and competitive performance variables by resource configuration is presented in Table 2. These results show significant differences between the three clusters with regard to variables “theoretically related to the clusters, but not used in defining clusters” (Ketchen et al. 1996, p. 447).
With regard to the size of firms, SMEs in groups I and II are statistically comparable (mean size of 48 and 59 employees respectively) and smaller than SMEs in group III (mean size of 81 employees). Regarding the age of firms, although group I is composed of SMEs that are older (mean age of 32) than the ones in the other two groups (mean age of 25 for both groups II and III), the difference is not statistically significant. The striking differences as far as control variables are concerned appear when one considers the industrial sector: service SMEs are overwhelmingly represented in group I (93%) and completely absent from group III (0%), while SMEs from both service and manufacturing sectors are almost equally represented in group II (49% versus 51%).

As for competitive performance, group III (HRC) is the best-performing, followed by group II (EBC), with group I (ITC) as the worst-performing. Groups II and III are equally successful with respect to innovation (34% of total sales coming from new or modified products/services), but group III outperforms group II with regard to internationalization performance (24% versus 12% of sales exported). These results confirm the theoretical basis of our research model. First, they confirm the existence of different resource configurations that correspond to different levels of organizational competitive performance. Second, they partly support the equifinality assumption, i.e. groups II and III achieve the same level of innovation performance although they are configured differently.

**Implications, Limitations, and Research Avenues**

The necessity to combine IT resources and non-IT resources for creating and maintaining a competitive advantage is a theoretically deep-seated idea in the IS research stream founded upon the RBV. However, few studies have attempted to empirically confirm the presence of interaction effects between IT and non-IT resources (Chen 2012; Jeffers et al. 2008). The present study has thus contributed to furthering our knowledge of the synergetic effects of three types of IT and non-IT resources upon SMEs’ competitive performance, namely e-business capabilities, IT infrastructure, and HRM capabilities. Another contribution lies in providing added validity to the configurational approach employed to tackle the research question. Another theoretical contribution resides in the empirical comparison of manufacturing and service SMEs, as it was clearly shown that both sectors tend to follow divergent patterns when it comes to resource-picking and capability-building. Furthermore, this study had provided evidence of the greater acuteness in industrial service SMEs of the well-known “IT productivity paradox” (Lin et al. 2010) when compared to manufacturing SMEs.
From a practical point of view, this study should render SME owner-managers more aware of the importance of looking at their IT and non-IT resources in a combined manner. In order to outperform competitors, what matters is not the development of individual IT and non-IT resources, but an astute combination of such resources. This means that it is of utmost importance for owner-managers and their key employees to develop resource-picking and capability-building competences that allow them to develop a highly competitive resource configuration. Another practical implication is that considering the interaction effects of different resources, any “improvement” or change in one resource, or any new resource acquisition must be accompanied by a re-alignment of other resources to prevent disruptive effects or dysfunctions that would negatively impact the SME’s competitive performance. The re-alignment would be guided by the need to find or to regain the firm’s optimal resource configuration.

The first limitation of this study relates to the organizational capability measures that are based on self-reported ratings from owner-managers and key employees that may not adequately reflect the breadth and depth of the SMEs’ capabilities in matters of HRM, e-business and IT infrastructure. Moreover, the non-IT resources included in the research model are limited to HRM capabilities. Although HRM capabilities are highly-valued, there are other non-IT resources such as R&D capabilities or marketing capabilities that can be analyzed in combination with IT resources to further understand innovation and internationalization-related performance. Future studies should thus extend the resource configuration analysis to include other key non-IT resources, and also include alternative measures of competitive performance. With regard to the industrial sector, the present research has highlighted the differences between manufacturing SMEs and industrial service SMEs, finding that the former’s resource configurations yield greater competitive performance than the latter’s. Future studies could also focus on the service sector SMEs to account for their specificities with regard to their business models and core technologies, and thus provide more contextualized theoretical and managerial contributions (Chiasson et al. 2005), commensurate with the service-dominant logic of these SMEs (Lusch et al. 2008; Vargo et al. 2009).

**Conclusion**

In spite of the theoretical acknowledgement of the importance of IT and non-IT resources’ complementarity, few studies have actually empirically investigated the combined effects of both types of resources on the firm’s competitive performance. The present study illustrates how different combinations of IT and non-IT resources affect the competitive performance of SMEs. More precisely, we analyzed the effects of IT infrastructure and e-business capabilities (IT resources) when combined with HRM capabilities (non-IT resources). Both IT and HR are highly-valued resources, and one would have expected that a combination of high-end IT capabilities and top-level HRM capabilities would lead to higher levels of competitive performance. The analysis of the three resource configurations that emerged from this study calls for a more nuanced view. What matters ultimately for the SME’s competitive performance is its capacity to configure a coherent combination of resources such that synergies between resources are maximized. Another important conclusion is that manufacturing SMEs and service SMEs are far apart in terms of resource configurations. This result confirms an aggravation of the IT productivity paradox in service SMEs and calls for further research on this issue. Indeed, IT productivity is one form of IT impact that has been widely debated in IS literature, and this debate has centered on the IT productivity paradox, referring to the fact that a greater investment in IT does not necessarily translate into greater performance. Although some claim that the IT productivity paradox has been resolved and the debate closed (Liang et al. 2010; Sirçar et al. 2009), others claim quite the opposite (Brasini et al. 2012). Given that our results support the latter as the heavy investment of service SMEs in IT infrastructure did not translate into greater competitive performance, this issue needs further investigation.

Facing competition that is more and more global and under pressure from their main business partners, many manufacturing SMEs are called upon to expand internationally and innovate, and to do so in collaboration with industrial service SMEs. In light of the strategic objectives of these SMEs, developing their IT capabilities with regard to e-business and IT infrastructure in a coherent manner, that is, in conjunction with their HRM capabilities, constitutes a key success factor for these firms. This should lead researchers to identify the interactions among the strategic IT attributes of manufacturing and industrial
service SMEs that determine the performance of these organizations, notably in terms of innovation, and internationalization, rather than identifying individual determinants of performance.

REFERENCES


