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Information Technology Adoption and Assimilation : Towards a Research Framework for Service Sector SMEs

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ABSTRACT

Information technologies (*IT*) *have become one of the most important infrastructural elements for SMEs in service industries. Now, these firms show specific characteristics and behaviours with regard to adopting and assimilating IT. These specificities have not been taken into account however in formulating a research framework or programme on the adoption and assimilation of IT in service SMEs. The present study thus seeks to fill this void. After reviewing the literature on IT in the services sector, the antecedents of IT adoption and assimilation in the context of service SMEs are identified and integrated within a research framework. This framework is then applied to generate a set of twenty-two salient propositions for future research on IT adoption and assimilation in service sector SMEs.*

Keywords*: *IT Adoption*, *IT Assimilation*, *Service Sector*, *SME*, *Owner-Manager

1. Introduction

The manufacturing sector has long been considered to be the main engine of regional, national or continental economies, and thus has received the most attention from economists, management researchers, and governments. There has been an evolution of the role of various actors in the world economy however, such that a great part of the manufacturing employment is shifting toward emerging countries such as China, India and others, whereas the developed countries in North America and Europe that used to be most industrialized are seeing this employment being replaced by employment in the services sector [1]. Hence it is generally accepted that there now exists a "post manufacturing world" [2] in which service enterprises in general, and service SMEs (small- and medium-sized enterprises) in particular, are called upon to play an increasingly important role. In fact, service SMEs could become the economic engine for many countries that are undergoing industrial reorganizations and are redeploying toward knowledge-based industries. Yet we lack knowledge on the specific characteristics and operating ways of service SMEs, given that the service sector has been insufficiently studied to-date when compared to the manufacturing sector [3,4].

Now, while this transition to a service economy poses major challenges, notably to manufacturing enterprises that must adapt in order to survive, it creates numerous opportunities for service SMEs. In order to seize these opportunities, one crucial condition for these firms is the "need to establish capabilities to manage their portfolio of resources, including information technologies (IT), as services for business processes" [5]. The role of IT is especially critical as these technologies have quickly become one of the most important infrastructural elements of services firms [6-8]. Some authors go so far as to state that many service providers will need to implement "e-processes" in some form or other in order to survive [9].

In such a context, there is obviously a strong interest in ascertaining the level of IT adoption and IT use in service SMEs, and in identifying the antecedents of this adoption and this use. While there exists an abundant empirical literature on the adoption and assimilation of IT in both large and small manufacturing firms, such empirical studies on service firms in general and service SMEs in particular are also starting to increase in number [10-12]. The main result of these last studies is that service SMEs show specific characteristics and behaviors with regard to adopting and assimilating IT. These specificities have not been taken into account however in

formulating a research framework or program on the adoption and assimilation of IT in service SMEs. The present study thus seeks to fill this void.

We begin the paper by reviewing the literature on IT in the services sector. We follow by identifying the antecedents of IT adoption and assimilation in the context of service SMEs. We then integrate these antecedents within a research framework that enables us to formulate a set of twenty-two propositions for future research, and conclude with the study's theoretical and managerial contributions.

2. IT in the Services Sector

Do IT adoption levels in the services sector differ from those observed in the manufacturing sector? Beyond adoption levels, does the nature of the technologies adopted also differ? And do motivations to adopt IT and implementation approaches differ? These are the questions we attempt to answer in the following sections of the paper.

2.1. IT Adoption in the Services Sector

Statistics from OECD countries show that services sectors are typically the most intensive users of IT [13]. At the end of the 1990s already, enormous investments were made by the services sector to absorb new IT software, these absorption costs being conservatively estimated to be at least five times the cost of IT hardware [14]. In the United States, more than 30% of the total stock of equipment and software in services consists of IT hardware and software, whereas the average is just over 11% for all private industries, the much less IT-intensive sectors being the goods-producing sectors (agriculture, mining, manufacturing and construction) for which, in many cases, this rate fall under 5% [13].

The measure of IT intensity, that is, the share of IT investment in total investment also shows the services sector as leading in this regard: [15]'s study shows that for service firms, the average share of IT investment in total investment amounts to approximately 35 percent, whereas it is between 19 and 22 percent for manufacturing firms. One can also measure a firm's IT intensity by IT investment per employee. With this measure, it has been confirmed that service firms use IT more intensively than manufacturing firms [15]. Service sector organizations invest in IT twice as much per employee as manufacturing sector organizations [16]. As service firms in the United States invest annually over US$ 100 billion in IT, the sector's rate of aggregate ownership of the installed information and communication-based technology is estimated to be 85% [17].

This predominance has been attributed to the fact that many services are more information-intensive in nature, requiring more processing and distributing of information than manufacturing [15]. As denoted by [18], "information intensive work activities in terms of service practices require well developed IT systems so as to enable improved service performance". Another study shows that even in an economic downturn, IT expenses in the services sector continue to grow [19].

The statistics indicating massive adoption of IT by service enterprises must be further analyzed nevertheless, as notable differences may remain hidden. Firstly, adoption rates are variable depending upon the nature of the technology adopted. Secondly, there exist disparities among service sub-sectors. Thirdly, there exist disparities depending upon the size of service firms. And fourthly, one should not confound IT adoption rates with IT assimilation or usage levels in a given sector or sub-sector.

2.1.1. Adoption Rates Depending upon the Nature of IT

Adoption rates vary depending upon the nature of IT. For instance, in a study of ERP adoption by European mid-size companies, [20] indicated, already in 1998, an adoption rate of about 20% in the project industry and the wholesale industry, vs. nearly 40% in discrete and automotive, explaining these differences by the fact that "ERP has its roots in manufacturing". In effect, most ERP vendors initially developed products only for manufacturing companies and thus did not target the services market [10]. However, the expectations were high in the years 1998-2000 regarding ERP in the services sector, as [21]'s study found that 24% of the application budget in this sector was allocated to ERP.

This being said, if one analyzes the adoption of ERP or integrated enterprise systems further, one quickly identifies fundamental differences between the services and manufacturing sectors at the software module level. For example, one can easily understand that service firms do not implement production planning modules, as the notion of material requirements planning does not really apply in this context [10]. However, they use human resources and workforce management modules more than manufacturing firms [21]. With regard to ERP modules, research suggests that the services sector largely benefit from logistics modules such as project management and after-sales services even though their integration is not as complete as in the manufacturing sector [10].

While ERP and supply-chain management (SCM) system adoption rates are lower in the services sector, they are higher with regard to customer-relationship management (CRM) systems [22]. And studies also indicate that e-commerce technology has been adopted at a faster pace by services enterprises than by manufacturers [23]. For Web use in general, when compared to both

manufacturing and commercial firms, a higher percentage of service providers are "e-merchants", that is, they generally exhibit the highest scores in all types of Web uses [24]. Reference [9] identified two major applications of Internet-based processes (e-processes) which are being extensively used to enhance service firms' performance: e-transactions and e-CRM. E-transactions refers to the use of Web-based processes between service firms with their partners (suppliers and customers for instance) to handle many routine transactions such as order taking/sending, billing, payment and order tracking. This definition corresponds to the "e-purchasing" definition proposed by [24] for whom "e-transaction" refers merely to e-government and e-banking transactions. On the other hand, e-CRM refers to the use of Internet capabilities for keeping, improving and extending the firm's relationships with its customers: collecting the right information enables the firm to develop accurate customer profiles, launch targeted marketing campaigns, and provide better after-sales support. According to one survey, e-transactions absorbed 37% of the total investment in new IT at a typical company, while e-CRM absorbed 13% [9].

2.1.2. Disparities within the Services Sector

In matters of IT adoption in the services sector, there sometimes exist notable disparities among sub-sectors. For example, [1]'s study made in France indicates that IT usage is relatively weak for SMEs in the logistics sub-sector, whereas it is strong for those in the engineering and technical consulting sub-sectors. While certain sub-sectors such as professional services still invest in "back-office" solutions, others such as banks have almost no need to invest anymore, given the saturation level attained for IT adoption in such sectors [10]. The consensus is that "business and financial services generally lead in adopting IT, whereas areas such as health and retail generally lag" [25]. As noted previously however, this leadership of one sub-sector compared to another can vary if one considers a particular type of IT. For instance, [24]'s study of Web usage shows that the large retail chains undertake e-purchasing (*i.e*. electronic search for new suppliers, online orders, electronic monitoring of orders' status) more frequently than other firms; thus, a larger percentage of e-purchasers are found in commerce as compared to manufacturing and other services.

2.1.3. Disparities with Regard to Enterprise Size

IT investments levels also vary with the size of service enterprises. In analyzing three measures of such investment, namely "% of intensive IT users", "% of IT in total investment" and "IT investment per employee", [15] established that even if the majority of service firms use IT intensively regardless of their size, the very small firms (fewer than 10 employees) lead in regard to all three indicators. These authors also found that small enterprises have a significantly greater IT investment per employee and IT investment in total investment than medium-sized and large enterprises. In this regard, OECD data show that large firms more frequently use the Web to sell their products and services than small and medium-sized firms [25]. For their part, [24] show that the firm's size is a significant predictor of its specific use of the Web, as a greater proportion of large firms fall into the "e-merchant" and "e-purchaser" categories, whereas the largest percentages of "information-seekers" (*i.e*. firms that use the Web mainly for information search and gathering as part of their business intelligence activities") are found among medium-sized companies.

2.1.4. IT Adoption Does Not Mean IT Assimilation

The preceding observations with regard to enterprise size must be interpreted with prudence, given that IT adoption does not necessarily mean that these technologies are highly assimilated or used by the service firm that have adopted them. This is illustrated by investigations of the various levels of IT sophistication in the services sector. For instance, [1] denote four levels of Internet usage in service SMEs that operate internationally, as presented in **Figure 1**, by increasing order of sophistication: Internet for communication, Web site, prospecting for new markets, online service offer.

These uses are similar to what [26] call e-business capabilities, that is, by order of increasing prevalence in manufacturing firms: e-communication, e-intelligence, e-commerce and e-collaboration. These authors add that while it may seem logical to develop these capabilities in that order, it may be preferable to first develop those activities that are more aligned or in "fit" with the firm's strategic orientation.

Given that IT adoption rates include service firms that

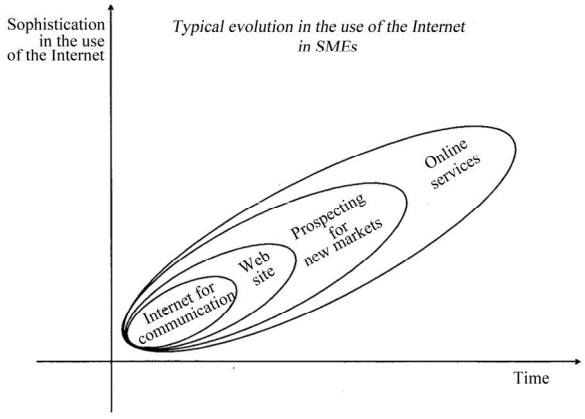

Figure 1. Levels of sophistication in the use of the Internet by service SMEs.

may be at very different IT sophistication levels and that a firm may increase its IT management and IT usage sophistication over time, these levels are more important than adoption in explaining the benefits or value obtained from IT by a company, be it large, medium-sized or small. This is confirmed by a multi-country study (Canada, Spain, Norway, Australia, Belgium, Sweden, Denmark and Finland) done by the OECD [27] whose main finding was that despite an increased use of IT, "the uptake and integration of more sophisticated electronic business applications remains relatively limited". In other words, there is a high level of business connectivity (use of the Internet) in all of these countries, but the level of e-commerce adoption (to purchase products online, receive orders online, sell products and services online) remains low. One should thus distinguish among service enterprises not by their adoption of IT in a generic manner but rather in regard to the sophistication of the IT adopted.

2.2. Motivations for IT Adoption

As to what motivates firms to adopt IT, studies have shown no particular differences between the service and manufacturing sectors [9,10], *i.e*. these motivations are basically technological, operational, strategic and performance-related [Ndubisi, 2007]. These are substantive or rational motivations, but one also denotes less rational motivations in service firms. For example, [9] found that some of these firms adopt e-commerce technologies due to a "bandwagon" effect or "gold-rush" mindset, regardless of their actual value or potential benefit, which is also the case for manufacturing firms [29]. With regard to integrated enterprise systems in the services sector, [10] assert that motivation for adoption and implementation problems later encountered are the same as those found in the ERP literature in general.

This being said, [30]'s analysis of the determinants of Internet usage shows that relative weight of each determinant varies by sector. For instance, expected near-term and long-term consequences of Internet adoption are found to have no predictive effect on usage in the manufacturing sector whereas in the service sector, near-term consequences have a positive effect while long-term consequences have a negative effect. Motivations may also vary with the nature of the IT adopted. Reference [9] shows for example that with regard to e-processes, reasons for adoption depend upon the type of e-processes. Thus, service firms wishing to access new markets implement e-transactions only, whereas those expecting performance benefits implement both e-CRM and e-transactions.

2.3. IT Implementation Approaches

Most information technologies adopted by service enterprises were first developed for manufacturing enterprises. For instance, given that the former were not initially targeted by ERP system vendors, many face a serious "misfit" problem, that is, a gap between the functionalities offered by the system and that required by adopting firm [10]. This could explain, at least in part, why adapting IT to the specific processes of service enterprises has generally taken longer [15]. Longer IT implementation delays can also be explained by greater difficulties in reengineering processes within the services sector. In fact, process modeling methods and tools must take into account that the essential components of service production and delivery processes are the firm's employees, that is, human beings rather than goods or machines [10].

Contractual approaches to IT implementation have not been widely used in IS research, notwithstanding their explanatory potential with regard to the phenomena of IT outsourcing and software package adoption. Building on the IT productivity paradox notion, [16] propose a model of divergent enterprise systems contracting approaches in the service and manufacturing sectors. The results of their study show that service enterprises generally display a preference toward the revisionist-adversarial approach, whereas manufacturers generally display a preference toward a preservationist-cooperative approach. The former approach, marked by a short-term orientation and technology-driven, translates into an IT contract that allows for revision, change and disengagement at the opportune moment. The preservationist-cooperative approach is long-term oriented and business decision-driven; it translates into a contract that aims to insure the extension of software licenses, portability to other technological platforms and evolving compatibility.

3. IT Adoption and Assimilation Factors

Implementing a new IT successfully depends for a large part on the organization's capacity to conduct the implementation project and integrate the changes brought about by the new system, that is, on the "organizational readiness" of service firms for IT adoption and assimilation [31,32]. It thus becomes important to identify the factors that determine this capacity. While many success factors have been identified, all can be put into one of the three categories of the technology-organization-environment (TOE) framework [33]; hence the process by which a firm adopts and implements technological innovations is influenced by the technological, organizational, and environmental contexts. Now, many such contextual factors of IT adoption and assimilation have been studied in various contexts (SME vs. large enterprise, services vs.

manufacturing sector, for a specific type of IT such as ERP). In the present study, we seek to identify those factors that are applicable to service SMEs and to highlight the specificity of these factors in such a context.

3.1. Technology-Related Factors

While the notion of IT covers a reality that is diversified and complex, the tendency to refer to it as if it was a monolithic reality whose characteristics are well defined can seriously limit, even falsify our comprehension of IT adoption by business enterprises. Now, what similarity is there between adopting email technology and adopting an ERP system? It thus becomes crucial to discriminate different types of IT in order to adequately measure IT adoption practice characteristics [34].

In distinguishing standardized IT (company-wide applications of service-supporting technology) from customized IT (applications managed locally by contact employees or service teams that allow them to better meet customer needs), [34] found the antecedents of IT adoption to be notably different among the two types of technology. These authors concluded on the need for managers "to discriminate between types of technology and fine-tune their IT adoption strategy to the specific type of IT concerned". The distinction made by these authors can be linked to the three-category typology proposed by [35], based on the typical function of IT, namely general-use IT (e-mail and Internet access), production-integrating IT and market-oriented IT. Taking the specificity of service enterprises into account, these categories could be redefined as general-use IT, process-integrating IT and customer-oriented IT.

3.2. Organization-Related Factors

In reviewing the academic literature, [9] identified a wide range of firm-level factors that have the potential to enable technology adoption: those factors relate to a firm's technology opportunism, technological orientation, organizational innovativeness, technology portfolio and absorptive capacity. Reference [36] considered three factors that contribute to organizational readiness for IT adoption: top management support, organization culture, and characteristics of IT professionals. Top management support is essential for defining the role of IT, for IT planning, and for making resources for IT projects available. With regard to the organization's culture, elements deemed to increase readiness to adopt IT include end users' prior exposure to IT, strong support for the expression and discussion of new and innovative ideas, support for risk taking and experimentation, existence of technology champions, and a proactive business strategy. As for the characteristics of IS professionals, their understanding of business needs and their capacity to proactively follow developments in IT field can increase organizational awareness and push for the adoption of new IT applications.

These organizational factors do not have the same connotation however in a SME as in a large enterprise. The former is generally an extension of the beliefs, attitudes, and behaviors of the entrepreneur or owner-manager. This means that SMEs are strongly influenced by the owner's personal idiosyncrasies [23]. As the small firms' strategy, structure, and culture are embodied by their owner-managers, many organizational determinants of IT adoption can be considered as entrepreneurial determinants [37]. We further analyze the three factors that appear critical for SMEs, namely the owner-manager's strategic orientation and competencies that determine IT adoption, and the employees' competencies that determine IT assimilation.

3.2.1. SME Owner-Manager's Strategic Orientation

Entrepreneurs or SME owner-managers may differ in their strategic orientation, causing them to view their environments in different ways. A strategic orientation is "an indicator of the process developed to analyze and integrate new information, to coordinate decisions, to examine the evolution of environmental factors and to assess new projects" [38]. Miles and Snow's (1978) typology seems to be most appropriate to conceptualize and operate strategic orientation in the context of SMEs and indeed has been one of the most widely used constructs for ascertaining a firm's strategy in this context [38].

Briefly, according to the Miles and Snow's typology [39], the firm's strategic orientations can be classified into four categories: prospector, defender, analyzer, and reactor. This typology is based on how the firm responds to three major problems facing it: the entrepreneurial problem (the organization's product-market domain), the engineering problem (the choice of technologies and processes for production and distribution), and the administrative problems (formalization, rationalization and innovation in an organization's structure and policy processes). As indicated previously, the SME's strategic orientation will most likely be that of its owner-manager. Roughly speaking, the prospector is deemed to be entrepreneurial, innovative and new opportunity-oriented, while the defender is more internal-oriented, aims to maintain the firm's position in a relatively stable market. Being a hybrid of prospector and defender, the analyzer is selective in pursuing new opportunities while he/she seeks to maintain the firm's position in core markets. The reactor has no well-defined strategy and his/her reaction to changes occurring in the firm's environment cannot be predicted a priori; this is why the reactors are generally

excluded from formal analysis [26,40,41].

3.2.2. SME Owner-Manager's Competencies

Studying the determinants of the successful adoption and use of IT in manufacturing SMEs, [42] showed that top-management perspectives and attitudes towards IT adoption and use, along with IT competencies (IT people and knowledge available), are the key factors. Developing a framework for benchmarking IT practice within small firms, [43] established a link between the preceding factors and three sets of associated skills and competencies, namely technical IT skills, managerial IT skills, and business and general management skills.

Studying the determinants of business-to-business (B2B) e-services adoption and assimilation in SMEs, Scupola [12] brought the competencies identified by [42] down to four main competencies at the top-management level: technical, vision, value and control competencies. The technical competency implies that without really being an expert in IT, the manager is comfortable with new technology and its operation [12]. In [12]'s study, while technical ability at the managerial level was not found to be important for primary adoption, technical skills at the employee level were found very important for IT assimilation. Reference [42] showed however that in a SME context, there may be a strong link between IT knowledge at the managerial level and IT technical skills at the employee level. Without such knowledge, a small business manager in effect cannot ascertain the limitations of employees and have them develop the skills necessary to assimilate IT.

Reference [12] found that for managers, IT vision, IT value and IT control competencies were determinant for the primary adoption of IT. The IT vision competency refers to the managerial ability to foresee the strategic impacts of IT on the business. The IT value competency refers to the ability to recognize the opportunities to contribute to the business value embedded in the IT applications adopted. And the IT control competency refers to the managerial ability to enforce rules and policies and to provide required resources to ensure that IT is adopted at the individual level.

3.2.3. SME Employees' Competencies

Once the decision to adopt IT has been made at managerial level, a set of competencies at the employees' level are deemed necessary for the actual implementation and effective use of IT. It is at the individual level that one will see if the IT adopted has been well assimilated, *i.e.* has become an integral part of the firm's culture and routines. Reference [12] identifies three sets of competencies needed at this level: technical skills, interpersonal skills, and conceptual skills. The two last categories fall in the "interpersonal and management competence" sub-category of [44]'s taxonomy of business competencies for IT professionals.

Technical skills refer both to tacit and explicit IT knowledge. Reference [45] proposed a comprehensive model of IT competencies with the same two dimensions. In their model, the components of explicit IT knowledge include technology, applications, systems development, management of IT, and access to IT knowledge. The components of tacit IT knowledge are grouped into two sub-categories, namely experience (personal use of IT, IT projects, management of IT) and cognition (process view, vision for the role of IT). Contrary to technical skills, business competencies focus on domains of knowledge that are not specifically IT-related. They are defined as "the set of business and interpersonal knowledge and skills possessed by IT professionals that enable them to understand the business domain, speak the language of business, and interact with their business partners" [44]. These authors identify seven areas of knowledge, grouped into two broad sub-categories, which constitute the business competence. The first sub-category, the organization-specific knowledge refers to the understanding of the specific organizational context and of the connections between IT and business, and covers four areas of knowledge: organizational overview, organizational units, organizational responsibility and IT-business integration. The second sub-category, the interpersonal and management knowledge, refers to the ability of IT professionals to interact with and to manage others. It covers three areas of knowledge: knowledge networking, interpersonal communication skills, and leadership skills.

While IT professionals need to develop their business competence, it has been underlined also that business professionals need to develop their IT competence to some extent. Both categories need to develop a "shared knowledge" in order to implement and use IT effectively in support of business activities. Referring to [46], one may characterize shared knowledge as the knowledge that IT professionals possess about business processes on one hand, and the knowledge that business professionals possess about the potential of IT on the other hand. One may also define it as the common understanding between IT people and business people regarding how IT can be used to improve the performance of business processes. Hence, technical skills refer to the IT-knowledge of both IT professionals and business professionals, and business competence refers to the organization-specific knowledge and the interpersonal and management knowledge of both IT professionals and business managers.

3.3. Environment-Related Factors

A number of theories such as neo-institutional theory deny that technology adoption is the result of rational

decisions or cognitive choices by the firm [9]. IT adoption is thus rather seen as being a result of external or environmental pressures, and this would be particularly true of SMEs that are more susceptible to such pressures than large enterprises. The environmental context factors found in the literature are regrouped under four main categories: technology S-curves, sub-sector characteristics, networking intensity and commercial dependence.

3.3.1. Technology S-Curves

The relationship between a service provider firm and its customers is by nature often closer than a similar one in a manufacturing context. Service operations generally involve customer contact, joint production, and often require customer-specific inputs [47]. This means that the technology adopted and used in the service delivery process will be in contact with the customer to the very least, and can go as far as being considered as part of the service. Indeed, in the specific case of IT, the service practices-service performance relationship is moderated by IT sophistication [18]. One would thus understand [34]'s statement that "the customization of service technology is inherently implied in the definition of service customization".

In the services sector, the client organization's involvement in the service delivery process is such that its readiness to adopt the technology proposed to it must be taken into account. Hence the importance of technology S-curves (emerging technology, developing technology, and mature technology) as an environmental context factor for [48] who showed that the acceptance of an innovation by customers follows a multi-segment model. The first customer segment is made up of a small number of firms that see a high utility or competitive value in the new service offered and are ready to support a high cost. Subsequent segments arriving later in the technology development and maturity phases are made up of a larger number of firms that see less value in the service proposed and will thus only adopt it at a lower cost, but the market potential for these segments is greater. Reference [48] underlines that a company may make an expensive mistake if it tries to immediately capture the large-volume segments, overlooking "both the learning process and the fact that emerging markets nearly always start in small, specialist, high value segments".

3.3.2. Service Sub-Sector Characteristics

The structure of the industry and the market in which a firm operates determines for the most part the pressures and constraints that will apply to its technology adoption decisions. Building on the notion of "industry clockspeed", [49] analyzed the links between the dynamics of a firm's business environment and the speed of its internal operations, demonstrating that an organizational change such as the adoption of IT is modulated by industry forces. This leads one to more closely analyze the nature of the services sub-sectors in order to understand the role played by their specific attributes in the adoption and assimilation of IT, using to this end the multi-criteria classifications proposed in the literature [50,51].

Following a literature review on service typologies, [52] noted the diversity of existing classifications, based upon the great variety of criteria used. In addition to the ownership criterion (for-profit, private not-for-profit, public), all classifications of service enterprises are fundamentally composed of two aspects, one being the product package predominantly affected by marketing-oriented service dimensions (tangibility, differentiation, object of service, type of customer, commitment), the other being the product delivery process predominantly affected by operations-oriented service dimensions (customer contact, capital intensity, customer involvement, production process, employee discretion). Reference [52] also denoted the need to integrate these two aspects to arrive at a unified representation that captures all the important dimensions and their interactions. This multidimensional classification has been applied to a certain point by researchers attempting to derive a classification of services from empirical data [50,51]. Based on seven service attributes (importance of employees, customization, customer's ability to switch firms, employee/customer contact, services directed at people or things, continuous benefits, differentiation between firms), [50]'s study classified services into three categories: 1) high-contact, customized, personal services, 2) moderate contact, semi-customized, non-personal services, 3) and moderate contact, standardized services. In similar fashion, [51] proposed 1) professional services, 2) service shop and 3) mass services, while other researchers have refined these classifications by empirically deriving sub-categories [53]. For the purposes of this study, [51]'s classification will be used because of it is the most commonly referred to in the literature.

3.3.3. Networking Intensity

The literature indicates that external pressures as well as assistance to adopt and assimilate IT originate in the networks to which SMEs belong. On one hand, business partners who have developed close logistical links with SMEs will push for a technological alignment of these firms with their own technology [54]. On the other hand, it is through cooperative networks that SMEs can overcome their resource limitations [55]. For these firms, R&D efforts are associated to networking activities that act as a substitute for the economies of scale unavailable to them [56]. Thus for service SMEs, the number and quality of connections to other organizations constitutes

social capital that affects to a certain extent its IT adoption and assimilation capabilities [57]. For example, some studies show that the SME's decision to adopt and use e-commerce is made easier in a networked environment [23].

3.3.4. Commercial Dependency

One finds a number of SMEs that are dependent upon a small number of important customers, if not a single prime contractor in the case of subcontracting firms. Thus, the commercial dependency of a SME is generally measured by the proportion of its total sales that is accounted by its three most important customers [58]. A commercially dependent SME is subject to strong pressures from these customers not only to reduce its costs and improve the quality of its products and services, but also to align its processes with their own. While most IT studies indicate these pressures as a push to adopt IT [59], the opposite can sometimes be true as a SME may wish to adopt a technological innovation that does not satisfy the foreseeable needs of its current powerful customers [60].

4. Research Framework and Propositions

Given the preceding considerations, the research framework proposed in this study is presented in **Figure 2**.

The research framework posits that IT adoption and IT assimilation are directly affected only by the elements of the organizational context. These two constructs are affected by the technological and environmental contexts only indirectly, through the mediating effect of the organizational context, and especially through the SME owner-manager's strategic orientation.

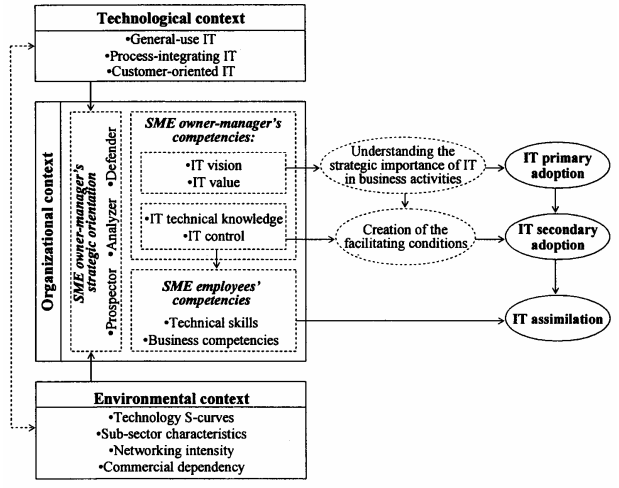

Figure 2. IT adoption and assimilation research framework for SMEs in the service sector.

4.1. Owner-manager's Strategic Orientation

Among all organizational factors, there is reason to underline the particular role played by the owner-manager's strategic orientation. Indeed, according to the upper echelon theory [61], organizational strategic outcomes and processes are a function of the managerial characteristics of top managers, and this is particularly true in the case of SMEs, as previously mentioned. Following this theory, strategic choices are more of the outcome of behavioral factors than calculations for economic optimization, and will reflect decision-makers' idiosyncrasies [62]. Strategy being the mediating force between the firm and its environment [26], it is through the small business owner-manager's strategic orientation that one can understand the latter's sense-making of the technological and environmental contexts, that is, how he or she detects threats and opportunities. This sense-making will affect the development of the owner-manager's competencies as well as his or her choices in regard to acquiring human resources and developing employees' competencies.

4.1.1. Strategic Orientation and Technological Context

Considering that SMEs of the prospector strategic type are constantly in search of new opportunities, one expects these firms to be the first and the most numerous in adopting new IT, and to experiment with a greater number of technologies [26]. Being preoccupied by reinforcing their position in existing markets, defenders will be less apt than prospectors to innovate technologically. In matters of IT, the former will stick with technologies that have been proven within their markets. For analyzer firms, as they sometimes behave as prospectors or as defenders depending upon the situation, an in-between position is assumed, thus the following proposition:

P1: Prospectors will adopt a wider range of information technologies than analyzers, and even more so than defenders.

Now one may also consider information technologies with regard to one of the three role categories to which they belong, namely general-use IT, process-integrated IT and customer-oriented IT. Prospectors would tend to adopt general-use IT more than defenders, as the latter would focus on proven technologies specifically adopted for their market, thus the following proposition:

P2: Prospectors will adopt general-use IT at a higher rate than analyzers, and even more so than defenders.

Operating in stable markets and emphasizing resource efficiency and cost-cutting process improvements to maintain their base business [41,63], defenders will be more attracted by process-integrating IT than prospectors. Constantly searching for new markets and new products, the latter cannot invest in processes that are called upon

to change incessantly. They will rather invest in developing business intelligence capabilities that will allow them to pre-empt their competitors by acquiring and processing strategic information on emerging markets/products. Prospectors will thus need to invest in e-intelligence for environmental scanning, and in e-communication to deal with internal complex coordination and communication mechanisms in their participative and decentralized decision-making processes [26]. As e-intelligence and e-communication technologies are considered to be general-use IT (cf. proposition 2), a third proposition follows:

P3: Defenders will adopt process-integrating IT at a higher rate than analyzers, and even more so than prospectors.

As the survival of defenders is based on their ability to protect their familiar products and markets, they have to develop excellent market sensing and linking capabilities [64]. While the same could be said of prospectors, the latter's perspective is different in that their survival is insured by developing new products rather than focusing on existing ones, and by detecting opportunities in the general business environment rather than in a specific market. Whereas in attempting to satisfy above all their existing customer base, defenders must know their customers better and develop tighter relationships with them, thus requiring customer-oriented IT. This leads to the following proposition:

P4: Defenders will adopt customer-oriented IT at a high rate than analyzers, and even more so than prospectors.

4.1.2. Strategic Orientation and Environmental Context

4.1.2.1. Strategic Orientation and Technology S-Curves

Most studies of IT adoption take the adopting firm's point of view rather than its customers' point of view. Since technology in support of service activities will be likely in contact with customers, service providers need to make sure that the technology adopted is acceptable and satisfactory to customers and service organizations [65]. As the adoption of a service technology by existing customers requires a shift in their behavioral patterns [66], introducing a new technology may induce customer "hostility" [65]. Given that "market innovation is essentially a social phenomenon rather than a response to known customer needs" [48], the firm should not overestimate its capacity to push the adoption of a new service technology by its customers. A service SME would thus have to decide at which stage of the technology S-curve (emerging, developing, or mature technologies) such technology will be proposed to its customers, reflecting its technology position by this decision.

Defining technology position as a pattern of investment in the technologies diffusing through an industry, [40] identify three such positions that a firm can adopt to integrate its technology and business strategies: first mover, early adopter, or late adopter. These authors establish a parallel on one hand between technology position and three broad classes of technology (base, key, or pacing technologies), classified by their competitive impact [67], and on the other hand between technology position and [39]'s strategic typology. Forming the technical core of the business and being necessary for it to remain competitive, base technologies are well known and available to competitors. Key technologies are those that provide a strategic advantage to the firms when they are adapted so as to provide new functionalities and better outputs that competitors will have difficulty in reproducing. Pacing technologies are those innovations that have the potential to significantly alter the basis for competition. Hence first movers, early adopters, and late adopters tend to adopt pacing, key, and base technologies respectively [40].

Reference [40] also contends that the first mover, early adopter, and last adopter technology positions reflect the prospector, analyzer, and defender strategies respectively. From the customers' point of view, there also exist first movers and late adopters. Diffusion of innovation theory refines the technology position concept by proposing five categories [48], namely innovators, early adopters, early majority, late majority, and laggards. Innovators and early adopters tend to adopt technologies that are in an emerging phase, firms in the early majority adopt developing technologies, whereas firms in the late majority and laggards would rather adopt mature technologies. Thus follow propositions regarding the moment of IT adoption by service SMEs:

P5: Prospectors will tend to adopt emerging IT when there are innovators and early adopters among its customers that are willing to use such technology.

P6: Analyzers will tend to adopt developing technologies when there is an early majority among its customers that are willing to use such technology.

P7: Defenders will tend to adopt mature technologies when there are a late majority and laggards among its customers that are willing to use such technology.

While first movers (prospectors), early adopters (analyzers), and late adopters (defenders) tend to adopt pacing, key, and base technologies respectively [40], the services sector requires that the customers' readiness with regard to IT be taken into account. For instance, this would mean that prospectors would have either to:

- be content with a small potential market constituted of innovators and early adopters [48];
- adopt multiple pacing technologies, each aimed at a

distinct market, to increase sales potential by reaching innovators and early adopters segments in each market;

- adopt pacing, key, and base technologies concurrently in order to serve all customer segments whatever their location on the innovation diffusion curve.

The first option would not only confine the prospector service firms to a small market without any growth potential, but would also cause them to lose existing customers unwilling to shift their behavioral patterns [66]. The second option would at first seem well suited to the prospector's nature as defined by [39], that is, innovative in introducing new technologies and seeking new markets (which means many technologies and many markets). However, pacing technologies do not emerge so often that a firm can rely solely on these. Service firms should thus be prudent with regard to pacing technologies [67], given the uncertainty that surround them and the high level of investment required at the expense of other technologies. There remains the third option for the prospector: in order to become or remain market leader, the firm "has no option but to move with the development of the market" [48], by following the customers' rate of technology adoption. This reasoning can also be applied to a certain extent to analyzers with regard to key and base technologies. Hence the following propositions with regard to the competitive impact of IT in service SMEs:

P8: Prospectors will adopt a range of information technologies that covers all three categories, that is, base, key, and pacing technologies.

P9: Analyzers will adopt a range of information technologies that covers mostly two categories, that is, base and key technology.

P10: Defenders will adopt a range of information technologies mostly within a single category, that is, base technologies.

4.1.2.2. Strategic Orientation and Sub-Sector Attributes

The characteristics of an industry determine to a large extent its more or less intense recourse to IT, explaining the previously noted differences between the secondary and tertiary sectors with regard to IT investments. The greater IT-intensity of the services sector has thus been attributed to the essential nature of business activities in this sector, requiring a high level of information processing and diffusion [15,18]. This requirement can differ somewhat among service sub-sectors however, depending upon the specific nature of the services offered.

Using the criteria that most often distinguish service sub-sectors, namely customer contact, customization, degree of employee discretion and number of services processed by a typical service unit per day, [18] infer the more or less important role of IT sophistication in the delivery of service performance. These authors suggest that for mass service organizations, this role will be more important due to the low levels of contact time, customization and employee discretion, and to the high number of services processed per day. The opposite would be true of professional service organizations characterized by high levels of contact time, customization and employee discretion, and to a small number of services processed per day. IT adoption will thus be greater in service sub-sectors where the expected impact of IT sophistication is greater. One could also presume that service shop organizations would stand between mass service and professional service organizations in this regard, as they occupy a middle position on all of the chosen criteria.

For [10], the variation in the demand for IT infrastructure capabilities amongst industries will be determined by the level of information intensity and marketplace volatility along with business unit strategies and strategy formation processes. Differences in IT adoption and assimilation within service sub-sectors could then be explained by strategies developed and implemented by SME owner-managers. Taking the latter's strategic orientation into account (*cf*. propositions 1 and 2), the following proposition can be made:

P11: Within the same service sub-sector (professional services, service shop, mass services), prospectors will have adopted the widest range of IT and will show the highest IT adoption rates, whereas defenders will have adopted the narrowest range of IT and will show the lowest IT adoption rates.

As both the service SME's strategic orientation and the service sub-sector's characteristics must be taken into account, comparing for instance a professional service prospector with mass service defender with regard to IT would not make much sense. Such a comparison would only make sense if it is made between SMEs whose strategic orientation differs within the same sub-sector, as in proposition 11, or between SMEs with the same strategic orientation but belonging to different sub-sectors, as in the following propositions:

P12a: Prospectors in the mass services sub-sector will show higher IT adoption rates than prospectors in the service shop sub-sector, and even more so than those in the professional services sub-sector.

P12b: Analyzers in the mass services sub-sector will show higher IT adoption rates than analyzers in the service shop sub-sector, and even more so than those in the professional services sub-sector.

P12c: Defenders in the mass services sub-sector will show higher IT adoption rates than defenders in the service shop sub-sector, and even more so than those in the professional services sub-sector.

4.1.2.3. Strategic Orientation and Network Intensity

A network can be broadly defined as "an integrated and coordinated set of ongoing economic and non-economic relations embedded within, among and outside business firms" [23]. Even though there are a number of different taxonomies of networks based on structure, process or power [68], the one proposed by [69] is of interest here in that it allows one to ascertain the intensity of relationships among network members and to relate networking choices to the strategic orientation of SME owner-managers. Based on two dimensions, namely the type of association (direct or indirect) and the form of interdependence (commensalistic or symbiotic), this taxonomy proposes four ideal types of collective alliances: confederate (direct and commensalistic), conjugate (direct and symbiotic), agglomerate (indirect and commensalistic) and organic (indirect and symbiotic).

As explained by [70], direct association refers to pair-wise relationships, indirect association refers to longer linkages, commensalistic interdependence refers to contracts based on economic ends, and symbiotic interdependence refers to contracts based on mutual need. Furthermore, according to [68], confederate relationships refer to competitors with contractual agreements that synergize functional activities such as shared shipping costs, agglomerate relationships refer to competitors with no contractual arrangements such as trade organizations, organic relationships refer to traditional networking across industries such as board memberships or other voluntary organizations (indirect and non-contractual), and conjugate relationships refer to alliances representing vertical linkages through the value-added chain such as buyer-supplier relationships. Characterized in the preceding manner, the nature of networks suggests stronger links when the association is direct rather than indirect and when interdependence is symbiotic rather than commensalistic. Given that the direct/indirect dimension seems more important, the four types of networks can be ordered by decreasing order of networking intensity, that is, conjugate, confederate, organic and agglomerate networks.

It has been demonstrated that SMEs adopt particular network alliance forms depending on their particular strategic orientation [70]. Prospectors, analyzers, and defenders are more likely to engage in confederate relationships, agglomerate/organic relationships, and conjugate relationships respectively, giving rise to the following proposition:

P13: Defenders, tending to engage in conjugate networks, will be subjected to greater pressure and will receive greater support for IT adoption from their networking partners than prospectors who tend to engage in confederate networks, and even more so than analyzers who tend to engage in agglomerate and organic networks.

4.1.2.4. Strategic Orientation and Commercial Dependency

While it is generally admitted that a business enterprise must be customer-oriented if it is to succeed, [60]'s study shows that firms who were leaders in their industry failed because they listened very carefully to their major customers who placed stringent limits on their innovation programs. Now, if a firm originates innovation projects depending upon a major customer's requirements, the success of such projects is determined by the customer's ability to correctly determine its requirements. While such customers may be found in the case of sustaining technological changes, that is, those changes in line with previous changes in the same industry, it is more difficult, if not impossible, to find such customers in the case of disruptive technological changes, that is, those innovations that modify the industry's technological trajectory [60].

By nature, prospectors operate in emerging markets, and thus have no existing customers to specify, with the required precision and exactness, the needs which an innovation is destined to fulfill. As their targeted markets are more diversified and as new business opportunities appear more frequently, there is less probability that prospectors become dependent upon one or more major customer when compared with defenders. In any case, given that a high level of commercial dependency is incompatible with an entrepreneurial behavior [71], prospectors in this situation would make great efforts to change it. As opposed to prospectors, defenders operate in more stable, less diversified markets. Careful to protect their market, the latter will tend to develop tight relationships with their customers, first by attentively "listening" to them. The following proposition thus emanates from the previous considerations:

P14: Defenders will be more commercially dependent and will be subject to more pressure for IT adoption from major customers than analyzers, and even more so than prospectors.

4.2. Role of Other Organizational Factors

Two other sets of organizational factors, namely the owner-manager's competencies and employees' competencies play a role in the IT adoption/assimilation process. Introducing a dynamic aspect into the study of IT adoption, certain researchers distinguish between primary adoption, secondary adoption, and assimilation [72]. It has been shown in fact that the factors that determine primary adoption differ from those that determine secondary adoption, and that these two groups of determi-

nants differ, a fortiori, from the determinants of IT assimilation [12]. IT primary adoption is the first stage of IT adoption, and it refers to the firm-level decision to adopt the innovation; the second stage, IT secondary adoption is the actual implementation or individual adoption by users; IT assimilation is defined as "the extent to which the use of a technology diffuses across organizational work processes and becomes routinized in the activities associated with those processes". In [12]'s study, primary adoption was found to be determined by the vision and value competencies at the top management level. While contingent to primary adoption obviously, secondary adoption was seen to be fostered by control competencies that create the conditions for employees to adopt the technology, therefore reducing the assimilation gap. IT assimilation was however mainly associated to three types of individual skills, that is, technical skills (tacit and explicit knowledge), interpersonal skills (communication and empathy) and conceptual skills (creativity and judgment).

4.2.1. Owner-Manager Competencies and IT Adoption

In the context of SMEs, owner-managers will play a key-role in the decision to adopt IT. Their attitudes towards IT adoption will be shaped by their own competencies, namely IT vision, IT value, IT technical knowledge and IT control. A small business manager who displays the IT vision competence will understand the strategic importance of information technology in business activities [12]. This understanding will ultimately lead to the adoption of IT that is aligned with the business strategy. This is critical as it is now known that IT-strategy alignment is a key determinant of the business value obtained by the SME from such technology [26]. But the IT vision competency, while necessary, is not sufficient. This general awareness of the technology's usefulness has to be translated into a specific appreciation of the value the firm could get from the IT. Evolving from the IT vision competency to the IT value competency is not easy for some entrepreneurs [73]. It has been found that the level of executives' perceived payoffs from IT is directly related to corporate goals for IT [74]. The owner-managers whose IT vision and IT value competencies are strong are likely to decide to adopt IT, hence the following two propositions:

P15: IT adoption rates will be higher in SMEs whose owner-managers have developed stronger IT vision and IT value competencies.

P16: SME owner-managers who have developed stronger IT vision and IT value competencies will lead their firm to adopt IT that is more aligned with their business strategy.

Once the decision to adopt IT has been made, top managers need to develop an IT control competency in order to encourage and direct the assimilation of the technology by users [12]. In SMEs, "the CEO has the authority to influence other members of the business, and he or she is likely to overcome any resistance to change". This is due to this individual's particular and central position, and to the nature of interpersonal relationships within the firm [42]. It is through the IT control competency that the owner-manager will create "facilitating conditions" necessary to implement IT, *i.e*. to facilitate the adoption and use of the technology by employees. These conditions include resource availability, technical support, user training, and removal of organizational barriers to the use of IT [75,76]. As already mentioned, the IT control competency could however be undermined, especially in the context of SMEs, if owner-managers do not possess sufficient technical knowledge in IT to allow them not only to correctly ascertain the technical competencies required of employees, but also to enforce appropriate rules and policies related to technical matters and to dedicate appropriate resources. Indeed, it has been advanced that the IT-related explicit and tacit knowledge of managers enables them to exhibit IT leadership and to leverage the knowledge of their employees [45]. The following propositions can thus be stated:

P17: SME owner-managers who demonstrate a stronger IT technical knowledge and IT control competency will create more facilitating conditions for IT implementation (IT secondary adoption).

P18: SME owner-managers who demonstrate a stronger IT technical knowledge and IT control competency will foster stronger competencies among their employees.

4.2.2. Employee Competencies and IT Assimilation

In their study on large enterprises, [77] found that the IT knowledge of senior business executives had no influence on IT assimilation. According to [12] this seems to be also true in SMEs as in the latter's study, the employees' competencies (rather than the executives' IT competencies) were found to be of utmost importance for achieving IT assimilation. As already discussed, these competencies can be roughly grouped into two broad categories: IT technical skills and business competencies.

Even if the IT technical skills of employees are seen as essential in the use and application of IT, they are not generally considered to be the source of sustained competitive advantage given that they usually are not heterogeneously distributed across firms and when they are, skilled employees are highly mobile [78]. Firms without these skills can indeed hire IT consultants and service providers, but what happens when they cannot afford the

cost of such external resources? Given that SMEs have greater difficulty in hiring qualified IT experts because of their scarce financial resources, IT skills are likely to be rare in such firms and thus become a source of competitive advantage among competing SMEs [42]. This was confirmed by [42] who found that an emphasis on developing IT resources and competencies internally was associated with successful IT adoption and use in SMEs.

It has been found that strong partnerships between the chief-information-officer (CIO) and other top-management executives contribute to IT assimilation in large enterprises [77]. As SMEs are likely not to show a distinct CIO position in their organizational structure, this role may be fulfilled by the owner-manager or by another manager or key employee. Small size in a business organization favours the development of organization-specific knowledge among key employees, and whoever fulfills the CIO's duties in such a firm will likely have developed a strong knowledge of other organizational business areas. The small firm may be disadvantaged in terms of IT skills and of interpersonal and management knowledge when compared to the large firm, but it may be advantaged in terms of organization-specific knowledge. The last two research propositions can then be stated as follows:

P19: SMEs whose employees demonstrate stronger technical skills and business competencies will achieve higher levels of IT assimilation.

P20: The smaller the size of SMEs, the stronger the organization-specific knowledge of their employees with regard to IT adoption and assimilation.

5. Conclusions

Information technologies are called upon to play a crucial role in enterprises that are now engaged in a knowledge-based economy. That is why there have been numerous studies on the determinants of IT adoption and assimilation, these determinants being most often regrouped under the three categories of the technology-organization-environment (TOE) framework [33], namely technology-related factors, organization-related factors and environment-related factors. In comparison to previous research, the first contribution of the present study lies in the light it brings to the antecedents of IT adoption and assimilation in the particular context of service SMEs, firms that have suffered an "attention deficit" on the part of researchers when compared to manufacturing SMEs. Given research results obtained in the latter's context cannot be necessarily extended to service SMEs, the former's inherent particularities must be taken into account, and the present study sought to highlight the effects of such particularities upon the adoption and assimilation of IT. For instance, a manufacturing SME can analyze an IT adoption opportunity without consulting its customers because they will not come into contact with the said technology but only with the product resulting from the process in which IT is used. A service SME cannot always do so as its customers are often part of the service process and are consequently exposed to the technology adopted (e.g. ATMs in the banking industry). The research framework proposed here thus takes the contextual peculiarities of service SMEs into account.

The second theoretical contribution of this study lies in its highlighting the predominance of organization-related factors over technology-related and environment-related factors. We have proposed that technology-related and environment-related factors, rather than directly affecting the adoption and assimilation of IT as most often hypothesized previously, have only an indirect effect, that is, through the effect they may have upon the organization-related factors. These last factors are thus presumed to be alone in directly affecting adoption and assimilation. And among organization-related determinants, emphasis was placed on the critical role of the SME's owner-manager in capturing, interpreting and reacting to signals emanating from the technological and environmental contexts.

In specifically targeting the services sector and SMEs, this study suggests that IT adoption and assimilation in these firms should be the product of an alignment between the strategic orientation and competencies that characterize their organizational context on one hand, and specific elements in their technological and environmental contexts on the other hand. While the present research is theoretical in nature, it offers managers a frame of reference to analyze their firm's situation before initiating an IT project by highlighting key adoption and assimilation factors in the specific context of service SMEs. The proposed research framework could also be used as conceptual foundation and methodological core to develop an instrument measuring the strategic alignment and organizational readiness of service SMEs for IT adoption and assimilation. Such an instrument should provide reliable and actionable insights to managers and IT practitioners in the services sector.

The twenty-two propositions resulting from this study are based on the literature and could thus serve as hypotheses in empirical research. In this regard, three avenues of research would seem to merit particular attention as they have yet to be explored: 1) the effect of the strategic orientation of the service SME's owner-manager upon the nature of IT adopted and the moment of adoption (in reference to the technology S-curve), 2) the moderating effect of this strategic orientation on the relationship between the service sub-sector, networking in-

tensity and commercial dependency on one hand, and IT adoption and assimilation on the other hand, and 3) the interdependency between the owner-manager's competencies, notably IT technical knowledge and the IT control competency, and the employees' IT and business competencies.

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