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Information technology capability within small-medium enterprises

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INFORMATION TECHNOLOGY CAPABILITY WITHIN SMALL-MEDIUM ENTERPRISES

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Abstract

The study presented in this thesis investigates the influence of IT capability on the relationship between IT expenditures and long term business performance. To do so, the Resource Based View (RBV) has been used as the theoretical framework, and, within such a framework, the concept of sustainable competitive advantage has been used as a point of reference. IT capability, a term often mentioned in the scientific literature dealing with the applications of RBV in the IS field, has been the subject of this study. Within the IS discipline, IT capability is perceived to have considerable influence on the effect of IT expenditure on the long term results of an organization. However, few studies have identified the extent of this influence and indeed the very definition of IT capability has been so ambiguous that no measurement instrument has been developed and universally accepted.

In this thesis we recognized this lack and carried out a multi-method study, to first identify a comprehensive definition of IT capability and then to develop and validate a measure of IT capability and evaluate its role on business performance.

The empirical study was performed within the context of small-medium enterprises (SMEs), which implies a lower level of organizational complexity but in order to reflect the reality of modern business all such organisations were involved in inter-organisational networks within industrial aggregations in Italy. Eleven SMEs were involved in a multiple case study, and 77 SMEs (belonging to the textile and the mechanical industrial districts in Italy) were surveyed and these results analysed and aggregated to form some conclusions with respect to the meaning and influence of IT capability.

The study was conducted over a number of stages to allow an initial definition of IT capability to be evaluated within a case study context and then expanded prior to the main survey. As such the literature review and analysis of previous studies was carried out in two different time periods as the scope of the study was refined.

This empirical investigation led to the development of a comprehensive definition of IT capability comprising three main areas: Managerial Skills, Technical Skills and Relationship Assets, and further showed a positive influence of such capabilities on business performance. Finally it appears that a major requirement for realising the strategic potential of IT investments is to focus on the development of a business orientation in the development of competencies of the IT staff .

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Table of Contents

1 Chapter One: Framing the Research Questions

1.1 Introduction

This PhD study seeks to investigate the effect of Information Technology (IT) capability on the relationships between IT expenditure and Business productivity within the context of Small and Medium Enterprises (SMEs as defined by the European Union) and specifically within those SMEs engaged in Inter-Organisational Information Systems (IOIS) through aggregations of enterprises. This chapter will discuss the scope of the research and why this particular environment has been selected and the theoretical frameworks which will be applied using a Resource Based View (RBV) and Process Approach. The research problem and research questions will be clearly identified and an overview provided to the research approach. Finally, the structure of this thesis and presentation of results will be summarized.

1.2 Scope of Research

1.2.1 Background and significance of this study

The relationship between IT expenditure and firm performance has generally been found to be positive but tenuous (Barua and Kriebel 2004; Tanriverdi 2005). The consensus explanation for this finding is that IT is used in concert with other resources to enable business processes and strategy. As a consequence, the value of IT is found in its "competent" use. For example, one could imagine two firms similar in all respects that purchase a database management system with the intent of collecting and analyzing customer data. One firm is able to design a robust database, collect accurate data, and analyze it effectively. The other creates a poorly designed database, is unable to maintain the integrity of the data and, as a consequence, is unable to extract meaningful insight. It stands to reason that the first firm should be able to outperform the second. Such an example - although oversimplified - highlights the nature of the relationship between IT and company performance, complex, intricate and multi-dimensional: technological versus organizational issues, strategic vs operative issues, short-term versus long-term issues, intra-organizational vs interorganizational issues.

Not surprisingly, therefore, defining, and especially measuring, "IT competency", or "IT capability", has proven very difficult. The literature to date has remained mainly theoretical (Mata 1995; Ross, Beath et al. 1996; Willcocks, Feeny et al. 1997; Willcocks and Lester 1997; Feeny and Willcocks 1998; Sambamurthy, Bharadwaj et al. 2003; Wade and Hulland 2004).

Moreover, studying the effects of IT on companies' performance has not led to agreed results. Some research asserts a positive impact of IT use on business performance (Barua et al. 1995; Stratopoulos and Dehning 2000), or reports examples of benefits, in terms of added value and competitive advantage, achieved through IT use (Dutta and Evrard 1999; Guimaraes, Martensson et al. 1999; Andersen 2001). Others consider it scarcely significant (Strassman 1990; Yosri 1992) or even assume a negative impact (Brynjolfsson and Hitt 1995; Holland and Lockett 1997; Setzekorn 1998). In an extensive review of the literature of the past decades of IS research, Dewett and Jones (2001) investigated how IT impacts organizational characteristics and results by studying the moderating and beneficial effects of information efficiencies and synergies (e.g. higher efficiency, organizational innovation, increased coordination and collaboration). Several scholars have studied which factors influence or determine this contribution (Weill 1992; Mukhopadhyay, Kekre et al. 1995; Broadbent, Weill et al. 1996) without reaching a clear and agreed understanding. A literature review focused on more recent years shows continuing research efforts in this direction by introducing conceptual frameworks (Ruey-Jer 2008) or emphasizing the mediating role of complex variables such as absorptive capacity (Francalanci 2008) or IT planning capabilities (Kearns 2006).

The work that has moved beyond theorizing has not developed measures of IT capability, but rather has relied on lists of companies most admired for their technology from trade magazines as a proxy (Bharadwaj 2000; Santhanam and Hartono 2003), or has focused on the moderating effect of other variables, such as organizational learning (Schroeder 2002). Indeed, Santhanam and Hartono conclude that "*to continue the assessment of the impact of IT capability, it is critical to develop standardized scales to measure a firm's level of IT capability*" (Santhanam and Hartono, 2003 pp. 151).

Only during the past few years have IS scholars shown an interest in achieving a similar result. Within this very broad field, one of the streams of research has built upon the Resource Based View model, that since the 90's has gained increasing popularity among Management Science researchers, starting from Barney's theoretical work, first linking the concept of sustainable competitive advantage (SCA) and investments in what he called "information processing systems" (Barney 1991).

The reviews provided by Wade and Hulland (2004) and Piccoli and Ives (2005) represent a systematic attempt to define the domain of IT capabilities, and, more generally, of the IS domain of the RBV. These reviews, essentially based on previous theoretical studies, re-emphasize the

need for a conceptualization and measurement of IT capabilities and emerge, coherently and contemporarily with general calls for appropriate methods to deal with capabilities as a central construct of the resource based theory (Dutta 2004; Subramanian 2005). However, neither Piccoli and Ives (2005) nor Wade and Hulland (2004) even try to formalize the scales suggested by Santhanam and Hartono's (2003) paper.

The complexity of the concept of IT capability is a likely reason for recent IS studies focusing on the role of IT capability in specific contexts, characterized by a specific organizational structure, e.g. within supply chain networks (Setia 2008), by a specific business focus, e.g. among export-based Chinese SMEs (Zhang 2008), or by the type of IT system implemented, e.g. with enterprise-level systems implementations (Davis 2009). Only very recently have some publications addressed the topic of the relationship between IT capability and firm performance at the enterprise-wide level (Coltman 2007, Stoel 2009, Doherty 2009)

This study proposes to move beyond the limitations of prior work and is positioned within this latest stream of research, by developing and testing a measure of the IT capability construct. While there is a broad coverage of such a general topic in the IS literature, the scope of this study is specific as follows:

- the domain of interest is limited to organizations falling under the definition of **SMEs** (as defined by European Union). The study assumes that results achieved by studying large enterprises are very unlikely to be applicable to SMEs. This hypothesis, supported by many studies in the field of Organization and Strategic Management, has been more recently confirmed by a number of research studies related to IS. However, researchers dealing with IS/IT within SMEs appear to have very often limited their unit of analysis to the boundaries of a single company. As a result, the deriving studies seem to inherit such a limitation, and very often appear unable to provide a complete picture of the phenomenon or, even more rarely, to suggest guidelines for IS management among SMEs.
- according to this rationale, a more comprehensive approach should extend the object of the research to the **inter-organizational** level, including clients, suppliers and more generally the network of partners an SME is in contact with for business purposes (or, with respect to the classic Ansoff's (1988) model, this broader approach redefines the boundaries dividing the internal from the external environment). Different forms of inter-organizational structures, such as supply chain, business associations, industrial districts, appear in fact:

- both relevant in explaining the way an organization interacts with its environment (for example: to achieve competitive advantage), as shown by the attention devoted to such forms in the Strategic Management and Organizational field; and
- highly impacted by innovations in IT. In the past few years hardware and software developments (e.g. mobile devices and web services) have led to strategic business applications supporting information exchange across the boundaries of firms. Together with those, new promising technologies, such as Radio Frequency Identification (RFId) systems, make it easier to improve information flows at the inter-organizational level, which represents the subject of the Inter-Organizational Information System (IOIS) discipline.

This study aims at achieving a better understanding of the factors and mechanisms that bring SMEs identified as members of an industrial district to fully exploit the potential of IT, which – in turn- could eventually lead to the development of guidelines for inter-organizational IT adoption and use.

IT capability and SMEs

To this aim, a basic hypothesis of this PhD study is that research on IT capability can find a fertile field in the context of SMEs. In fact, the many differences between SMEs and large companies both at the organizational level, but more specifically, regarding the differences in the way such types of companies manage their IS are expected to reduce the complexity of the construct under study, and - ultimately - to enable the identification of the main variables influencing IT capabilities.

The widespread adoption of IT has impacted both large and small companies since the early '70s. However, as often happens with research in the IS field - and generally in Management Science - the emphasis of both theoretical and empirical research has been traditionally focused on companies of large size. Until the early '90s, only a few attempts to study IS management within companies of smaller size had been carried out, and such studies were typically based on the "downgraded" transposition of theories and models developed for large companies, without taking into account the actual specialties that make SMEs not simply "lower-size large companies".

Starting with the work of Cragg (Cragg and Zinatelli 1995), and Iacovou (Iacovou, Benbasat et al. 1994) an increasing number of studies have highlighted the specific characteristics of IS use

within SMEs showing that it is not possible to merely extend the general results from studies of larger organizations to such specific contexts.

In fact, SMEs typically show a lack of strategic view in their IT investments. Those that care about developing IS typically invest in IT incrementally and for reasons of contingency. Once benefits arise in some areas, SMEs appear more inclined to invest further in IS: as a consequence, their IS ends up extensively supporting mainly those areas where higher results have already been experienced or were expected. Such behavior leads SMEs to exclude from IS development those activities not producing short-term and quantifiable benefits, independently from the causes of such ineffectiveness (Levy and Powell 2000).

While large enterprises usually own the managerial competence and financial resources to stimulate and/or counter innovation, SMEs often face a number of weaknesses (Raymond 1985; Raymond 1992; Burns and Dewhurst 1996). Their typical focus on production activities, together with their limited investment budget, very often lead SME entrepreneurs to exclude IS issues whenever planning organizational development. As a result, SMEs usually devote scarce resources to the IS department and, whenever they do, IS staff competence is typically restricted to technical issues (Soh, Yap et al. 1994; Palvia, Means et al. 1994; Zinatelli, Cragg et al. 1996). The consequent lack of internal expertise limits IT specification and selection policies (Schleich, Carney et al. 1990; Monsted 1993), and inevitably leads SMEs to develop an IS which is inadequate to the organizational needs (Cragg and Zinatelli 1995; Lai 1995; Lang, Calatone et al. 1997; Zhu 2003; Brown 2004).

Although this synthesis represents the most commonly accepted view about the approach to IS management of not- large firms, a deeper analysis suggests that this picture does not properly represent IS in SMEs anymore.

As another study (Buonanno, Gramignoli et al. 2002) brought to evidence, the high diffusion of computer based tools among SMEs suggests that figures about degree of IT adoption have improved radically, increasing the strategic potential of IT in the future of these enterprises.

What is more important, the broadly adopted classification based on size, that divides large firms from SMEs, seems to further confuse understanding of IS management for not-large companies. In fact, differences between small and medium size companies appear remarkable: both are increasingly aware of IT importance, but medium ones have more resources to spend on IT adoption and appear more mature in putting in place managerial practices when dealing with

IT. On the contrary, small companies are characterized by a limited technical knowledge, as to the technology as well as to the IS management.

Nevertheless, an effective connection between IT investments and the strategic control of the enterprises is still lacking: IT adoption is often considered just an operational cost, without any clear understanding of its strategic implications. A profound connection between the company strategic orientation and the IT investment policy might improve the effectiveness of such investments, even though in many cases the problem seems related to the lack of awareness of the company strategic direction. Other forces driving this evolution could be the succession phase that many enterprises are going through and the growing managerial presence (especially in medium size companies).

Inter-Organizational Information Systems

A second relevant hypothesis of this PhD study concerns not the size of the organizations examined by the study, but the broadness of the domain under investigation. It is argued that many firms, and specifically many SMEs, have such intertwined relationships with other organizations that it is likely that they do not achieve their results just exploiting the capabilities they directly control (to which one could refer as "strictly internal" capabilities), but such results can be better explained in the light of a wider analysis, involving clients, suppliers, Public Administration and providers of services of various types.

The growing complexity and instability of the worldwide market during the past few decades forced enterprises in every industry to undertake significant organizational and strategic changes (Tetteh 1999). Companies had to find new ways to create value and innovate in an environment characterized by the evolving applications of IT, the development of extended supply chains and global e-markets, and an increasing customers' knowledge-intensity and sensitivity for time-to-market. Nevertheless organizational and technological changes often require resources exceeding those available to SMEs (Fariselli 1999; Tetteh and Burn 2001; Buonanno, Gramignoli et al. 2002).

It is well documented in literature that, for example, the investments required to meet most of the reorganization cost coming from the adoption of IT, and the risks involved in these projects, largely exceed the budget and the capabilities of an average SME (Fink 1998; Poon 1999; Fariselli 1999; Tetteh and Burn 2001; Buonanno, Gramignoli et al. 2002). Therefore these circumstances suggest the feasibility of a broader approach to the implementation of ICTs in SMEs by examining the potential of inter- organizational IT-supported relationships. The risk

and the cost sharing coupled with the possibility to better utilize a combined competitive advantage should be able to overcome the typical constraint faced by single SMEs.

However, unless dealing with SMEs participating in supply chains of larger firms or tied in some sort of hub, it is difficult to gather a sufficient number of enterprises able to leverage an IO technological solution as a sustainable competitive advantage (Fariselli 1999; Buonanno, Gramignoli et al. 2002). In this context the many different forms of aggregation of enterprises - clusters, industrial districts, business associations, business park, etc. - described in the normative literature (Marshall 1922; Becattini 1990; Markusen 1996; Roelandt and Hertog 1998; Costa-Campi and Viladecans-Marsal 1999; Gordon and McCann 2000; Enright and Roberts 2001; Bennett and Robson 2001; McDonald and Vertova 2001) could play a pivotal role in the development of successful IT solutions that aim to create value by improving collaboration, work specialization, information sharing and responsiveness between SMEs (Afuah 2000; Kunsoo 2004; Steinfield 2005; Zaheer, 2005).

Business process approach

When describing their organizational structure, SMEs very often refer to the functional view, mostly because of its simplicity. Nevertheless, there are a number of intrinsic limitations characterizing this way of representing a company structure:

- the difficulties in keeping the strategic issues separate from the operational ones;
- the uncertainty due to the absolute dependence on the entrepreneur's choices;
- the entrepreneur's resistance to change when facing the so called "growth crisis";
- the lack of membership and involvement by the members of the organization, who often feel the company as something which does not belong to them.

A number of researchers claim that a process-based approach is more appropriate to support any managerial activity, since it should help address a number of common organizational problems, such as fragmentation and the lack of cross-functional integration (Galbraith and Kazanjian 1986; Harrington 1991; Garvin 1998), while enabling individual workers to identify and anticipate new business opportunities (Davenport 1993; Brooke 2000). In particular, a process-based approach seems to more properly fit SMEs, where employees carry out inter-functional tasks and do not have a precise formalization of roles (Dutta and Evrard 1999).

Within the IS field, the "process-oriented" view has been widely adopted to investigate the role and the effects of IT within companies. Works such as that by Hammer (1993) and Davenport

(1993) have built the basis of an entire stream of the IS literature (Barua, Kriebel et al. 1995; Mooney, Gurbaxani et al. 1995; Soh and Markus 1995; Avison and Fitzgerald 1999). Although not always providing coherent outcomes, such works are based on the common intuition that IT is one of the most important enablers for the reengineering of the business processes, which, in turn, represents a source of company and process higher performance (Davenport 1993; Kallio, Saarinen et al. 1999).

A process-based approach appears to be especially suited to the study of SME's, where employees carry out inter-functional tasks and do not have a precise formalization of roles (Dutta and Evrard 1999; Goodhue, Klein et al. 2000). Nevertheless, despite the wide theoretical justification for a process based view of the company, this approach turns out to have been adopted by very few SMEs.

1.3 Theoretical Framework: the Resource Based View

During the last two decades, a vast part of the IS literature has used as its theoretical framework the *Resource-Based Theory* (RBT) or *Resource-Based View* (RBV).

This theory is rooted in the strategic management literature and precisely focuses on the concept of sustained competitive advantage to explain organizations' performance and guide the conception and implementation of strategy (Grant 1996).

Within Strategic Management, one of the key objectives is represented by the understanding of the determinants of the competitive advantage for organizations (Penrose 1959). The concept of competitive advantage originates from theories on value creation and distribution in economic exchanges. A firm has a competitive advantage when the value it has, by an economic exchange in which the firm partakes, is greater than the value it had, without its participation in the exchange (Piccoli and Ives 2005; Brandenburger 1996).

The classical reference framework in strategic management proposes that organizations achieve a sustained competitive advantage through the implementation of strategies aimed at the exploitation of internal strengths to match the external opportunities, and, at the same time, neutralizing the external threats and limiting the internal weaknesses (Ansoff 1965). Although elegant and simple, this framework has since shown a very limited applicability, due to the assumptions on which it is based:

- homogeneity of the strategies: it is assumed that organizations, in the same industry or strategic group, have identical strategies and strategic resources (Scherer 1980; Porter 1981; Rumelt 1984);
- mobility of resources: in the case that strategic resources are heterogeneously distributed within the same industry or strategic group, they can be rapidly transferred from one firm to another and therefore be equally redistributed in the industry or strategic group (Hirshleifer 1980; Barney 1986).

Notably, both assumptions refer to the concept of *resources*, defined as "assets and capabilities which are available and useful in detecting and responding to market opportunities and threats" (Sanchez and Mahoney 1996).

The constraints to the applicability of the competitive advantage framework imposed by these assumptions pushed the academic community to develop alternative theories, trying to cope with resource heterogeneity and immobility as potential sources of competitive advantage (Penrose 1959; Rumelt 1984; Wernerfelt 1984; 1989).

The theory of the resource-based view of the firm is proposed by Barney (Barney 1991). According to RBT, organizations within an industry or a strategic group can have heterogeneous distribution of strategic resources and this heterogeneity can persist along time since resources may not be perfectly mobile across organizations.

These revolutionary assumptions shed light on the concept of the temporality of competitive advantage and the related sustainability (along time) of competitive advantage and drove the efforts of researchers towards the identification of potential sources of sustained competitive advantage.

The sustainability takes place when the competitive advantage persists even if competing organizations duplicate the same effort, resisting therefore "erosion by competitor behavior" (Porter 1985). This persistence is maintained when the firm possesses key resources that act as impediments to replication of its strategy by its competitors (Wernerfelt 1984).

In order to be a potential source of sustained competitive advantage, a resource must be (Barney 1991):

- Valuable. A resource is valuable when it enables the conception and implementation of successful strategies, as this resource exploits external opportunities or restrains internal weaknesses.

- Rare. A resource is rare when it is not possessed by current or potential competitors, otherwise this resource can be applied in the same way in the implementation of the same strategy, finally eroding the competitive advantage of the first mover.
- Imperfectly imitable. A resource is imperfectly imitable when organizations, which do not possess it, cannot obtain it, as the resource limited imitation depends on the organization's history, the causal ambiguity and social complexity of its competitive advantage.
- Not equivalently substitutable. A resource is not equivalently substitutable by other resources when it cannot be replaced by another resource for the implementation of the same strategy.

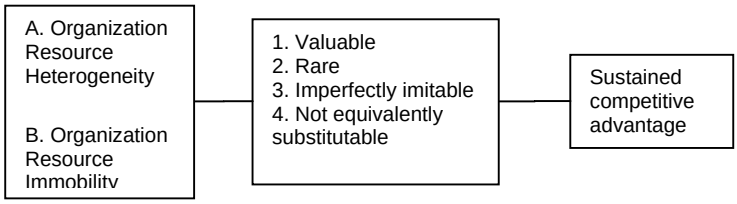

Figure 1.1: The Theory of the resource-based view of the firm (Barney 1991)

The extent to which a resource has these properties determines the degree to which it can be a potential source of sustained competitive advantage, as it affects the time, the difficulty and the cost for other firms to erode the competitive advantage.

Other attributes have been proposed as making resources a potential source of sustained competitive advantage (Grant 1991; Amit 1993; Collis and Montgomery 1995) but, beyond the different terms employed, there is a large consensus on those mentioned above.

In any case, the RBV theory does not assert that the potential source of sustained competitive advantage automatically determines a sustained competitive advantage. The potential of sustained competitive advantage is made real by managerial initiatives that exploit, on the one hand, the limited capabilities to homogenize and mobilize resources within competing organizations, and on the other hand, the heterogeneity and immobility of the organizational resources (Barney 1991).

Furthermore, even when such initiatives succeed, sustainability would require preservation of competitive advantage to the organization by renewing the impediments to replication of the strategy over time: this result can be achieved through organizational learning and asset stock accumulation (Piccoli and Ives 2005).

Organizational learning is defined as "the capacity or processes within an organization to maintain or improve performance based on experience" (Nevis, DiBella et al. 1995): repeating the experiences, analyzing mistakes and experimentation allows organizations to learn, improve performance and preserve competitive advantage.

Asset stock accumulation, i.e. "the process by which a firm accrues or builds up a resource over time" (Piccoli and Ives 2005) strengthens the barriers to replication, but requires consistent regular investments.

Following this rationale, the analysis of the resources' attributes leads to a distinction between resources (Priem 2001; Wade and Hulland 2004; Piccoli and Ives 2005) that *enable the attainment* of the competitive advantage, defined as "ex ante limits to competition", that include value, and rarity, and those *sustaining* that advantage, defined as "ex post limits to competition" that include imitability, and substitutability.

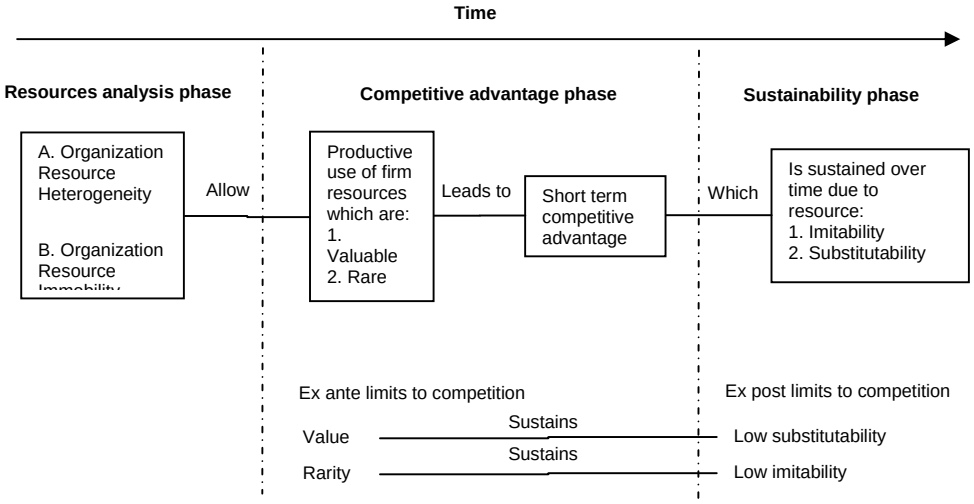

Figure 1.2: The resource-based view of the firm over time (adapted from (Wade and Hulland 2004))

Since Barney's foundational paper (Barney 1991), the resource-based view of the firm has been debated and applied in various management disciplines (Barney 1991; Fahy 1999; Foss 1997; Priem 2001). With respect to the IS discipline, it is argued that RBV was originally not suited to studying IS (Wade and Hulland 2004), but rather to frame the impact of the resources directly influencing sustainable competitive advantage. In fact, information systems resources contribute indirectly to sustained competitive advantage, through other assets and capabilities (Wade

2004), even if considerable research focuses on the direct role of IS in sustained competitive advantage (Piccoli and Ives 2005).

From the mid 90's RBV has been applied to study information systems, especially with the aim to provide an explanation to the productivity paradox (King and McAulay 1997; Santhanam and Hartono 2003). According to this theory, IT resources - per se - cannot lead a firm to competitive advantage, because they lack two of the main resources' attributes highlighted above: IT is not rare, since anyone can buy it on the free market, and IT is easily imitable by competitors (Bharadwaj 2000; Santhanam and Hartono 2003; Tippins 2003). The productivity paradox is therefore explained by noting that although IT investments are homogeneously distributed among firms, the resources and the capabilities related to IT are heterogeneously distributed and lead to different models in the adoption and use of IT (Bharadwaj 2000), and finally lead to different performances.

Research shows that it is not the mere presence of IT in a firm that generates a strategic advantage, but, rather, the way IT and the whole information system is used and managed (Bharadwaj 2000; Duhan 2001; Peppard 2004). In order to enable IT influencing business performance, hence to gain and maintain competitive advantage, firms need to achieve a high degree of co-specialization and complementarities between IT and the other resources.

The ability developed by a firm in assembling, integrating and employing IT in combination and in co- specialization with its resources is often referred to as "IT capability", and considered one of the critical factors for business performance (Bharadwaj 2000; Santhanam and Hartono 2003; Tippins 2003; Wade and Hulland 2004). It is evident that a clear definition of this key factor is, however, far from being unanimously recognized and so forms one of the major foci for this study (Chapter 4).

1.4 The Research Problem

1.4.1 Initiating a discussion of the RBV

The choice of the topic of this thesis originates from Wade and Hulland's MISQ paper (Wade and Hulland 2004), a review paper that states as its purpose "to initiate a discussion of the RBV within the conversation of information systems research". After a broad analysis of the IS literature taking into account different approaches in the use of the RBV and different interpretations of its key concepts (e.g. resource, capability, sustainability), they conclude that "the application of the RBV to IS contexts has the potential to identify key drivers of superior business performance. At the same time, use of the RBV introduces new considerations that

must be dealt with by researchers...three such considerations *are*: choice of an appropriate level of resource specificity, choice of an outcome construct, and modifying the RBV framework over time by introducing dynamic elements into it." (Wade and Hulland 2004)

The relevance of this paper within the broader area of Strategic Information Systems has been more recently confirmed by Piccoli's review paper in MISQ (Piccoli and Ives 2005) that substantially accepts the taxonomy proposed by Wade and Hulland and takes a step forward towards the definition of a framework for the application of RBV in the IS field. In particular, Piccoli's framework for studying the sustainability of IT- dependent strategic initiatives is coherent with the first type of consideration Wade suggested as mentioned above. In fact, IT capability, the central subject of this proposal, is one of the seven types of response lag drivers identified by Piccoli in a taxonomy of the barriers to erosion of competitive advantage. However, Piccoli's framework is mainly a theoretical model, and as such does not provide a validation of the constructs on which it is based.

Regarding IT capabilities, in particular, there have recently been a number of attempts to proceed beyond purely theoretical works. Authors have begun to test the role of specific response-lag drivers. Bharadwaj (Bharadwaj 2000) and Santhanam et al. (Santhanam and Hartono 2003) found that firms with high IT capability outperformed a control sample over a sustained period of time. Barton and Peters (Barton and Peters 1992) linked sustained competitive advantage to IT management skills and the availability of a modular IT infrastructure, and Pemberton et al. (Pemberton, Stonehouse et al. 2001) demonstrated the value of information repositories. Others found that IT management skills contribute to sustainable competitive advantage while technical IT skills and IT infrastructure do not (Dehning 2003). However, none of these studies - Piccoli notes - succeeded in developing "reliable measures that can be used to build a cumulative tradition" (Dehning 2003; Santhanam and Hartono 2003), and in general, it is recognized that operationalization of some of the key concepts is a major challenge for IS researchers (Piccoli and Ives 2005, page 21).

Indeed, a review of the literature highlights that a bigger even more critical challenge refers to the definition itself of such key concepts, before taking into account their operationalization. The next section develops a synthesis of the evolution of two terms: 'resource' and 'IT capability' in order to draw the boundaries of this research focus.

1.4.2 Objectives

This study proposes a) to develop a measure of the IT capability construct and b) to test such a measure in the context of SMEs.

The research will be based on a systemic approach for the representation of an organization. The context of SMEs will be addressed at three different levels of detail:

- at the **intra-organizational** level, the study will focus on business processes of SMEs;
- at the **organizational** level, single small and/or medium size companies as aggregations of business processes will be the object of study;
- at the **inter-organizational** level, the domain of the research will be extended to aggregations of SMEs.

This last level is very relevant, especially in SMEs but studying this level as deeply as the other two would increase the complexity of the research beyond the size and time limits of a PhD thesis. Therefore, inter-organizational activities will act as a pre-requisite characteristic of the environment to which the organizations under investigation belong, i.e. all sample SMEs will participate in a larger network of organizations as aggregations of SMEs.

Figure 1.3. provides the conceptual map for the research. The boxes with a bold border are the constructs of the research model: IT (that stands for *IT expenditures*) is the independent variable of the study, Business Performance is the dependent variable and IT capability is the variable moderating the relationship between the other two.

The PhD thesis has been built upon two pilasters:

- the review of the *theoretical context*: the IT capability construct developed in this thesis is the result of an extensive literature review in the field of Strategic Management, and - more specifically - has been drown upon the concept of sustainable competitive advantage and its subsequent theorization through the Resource Based View of the firm (Barney 1991).
- the exploration of the *empirical domain*: the research model has been empirically validated within the context of small-medium enterprises. The differences between large enterprises and SMEs are reflected also in how they take decisions about IT expenditures, and more generally in how they manage their Information System. Moreover, SMEs operate increasingly often as entities inter-related within industrial aggregations: the research about the empirical domain has taken into account the inter-organizational information systems that enact the management of these supra-organizational entities.

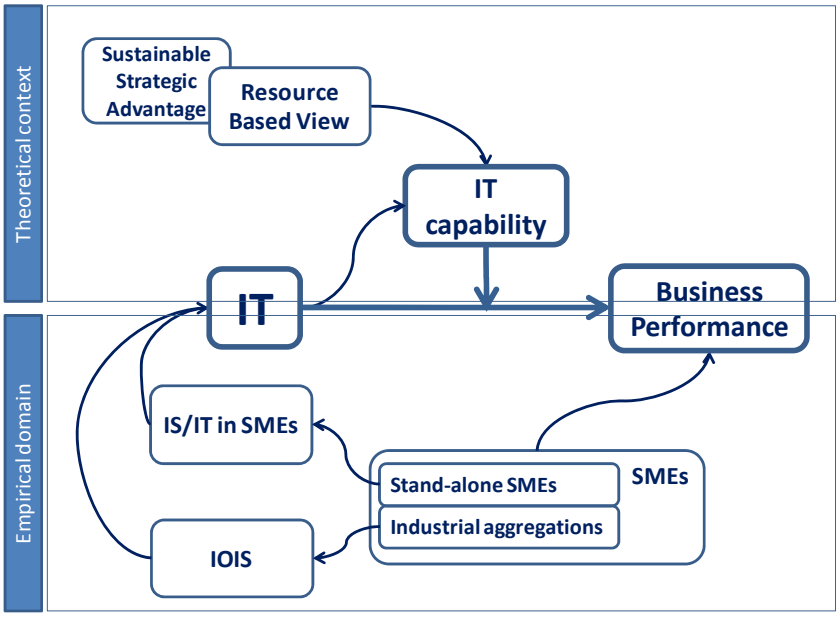

Figure 1.3: The conceptual map of the research: theoretical context and empirical domain of the study (the boxes in bold refer to the constructs of the research model)

1.4.3 Research questions

This leads us to develop a research model of the study where IT capability as a general construct is expected to be a variable moderating the relationship between IT expenditure and business performance (Figure 1.4).

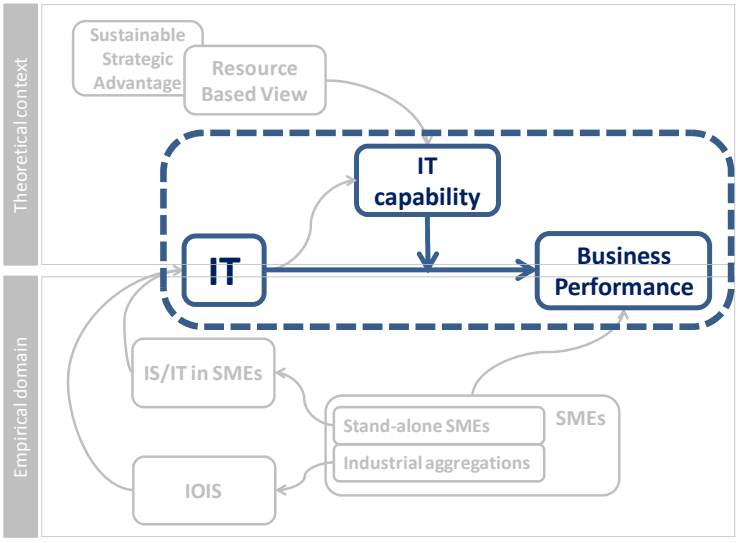

Figure 1.4: The general research model of the study

This work aims to study the relationships in this model, but also we expect to validate the underlying theoretical constructs. The literature in Management Science and IS of the last fifteen

years is rich in theoretical and empirical studies on IT capability. However, there is still the need to develop and test measures for explaining the dependent and the independent variable in the research model represented above. The identification of a measure of business performance, highlighting the role of IT capability as an enabler, will be a critical issue of this study (although this result will be carried out mainly through a literature analysis).

Finally, it would be desirable that a deeper and validated understanding of the role of IT capability gained through the theoretical and empirical study would enable the development of a more prescriptive outcome.

Therefore, the research problem will be addressed over a number of stages, as formulated below.

RQ1: what is the influence of IT capability on the relationship between IT expenditures and Business performance in SMEs?

> **RQ1.1**: which is the most comprehensive definition of IT capabilities that can be developed coherently with the RBV and validated within the context of SMEs?
>
> **RQ1.2**: what are the relevant variables that allow measuring IT capability in SMEs and how can they be applied?
>
> **RQ1.3**: what are the variables allowing measurement of business performance in SMEs according to the aim of highlighting the role of IT capability as enabler?

RQ2: what is the IS management model that SMEs should follow to grow and fully exploit IT capability to achieve effective business performance?

1.5 The structure of the research

In order to find answers to these research questions a multi-method empirical study was proposed. In particular, the most critical issue of the research - i.e. the development of a measure of IT capability - was split into three phases.

The first phase focused on developing a definition and first draft measure of IT capability. The initial first literature review identified 23 articles dealing mainly, though not only, with IT capability and IT competence relevant to the research problem of this study. A semi-structured questionnaire was developed and used to carry out a case study on a small set of SMEs belonging to the textile industry and located in Lombardy, one of the 21 Italian regions, whose main city is Milan, located in the northern part of the country. These interviews - among other results - enabled the identification of new subject areas and drove the development of the empirical study.

The second phase consisted in a further, extended review of the literature: a set of 31 articles were found compliant with the concept of IT capability as defined in the present study and were thoroughly analyzed in order to identify how the construct of IT capability had been operationalized or at least defined in each of them. This process allowed the enumeration of a list of 630 items defining the construct IT capability. The list was reviewed and processed to eliminate semantic overlaps among the items: the final structured measure of IT capability consisted of 68 different items. Finally, the measure was submitted to two CTOs with a specific expertise on IT in SMEs, in order to get a qualitative review and refine the formulation of the items.

Once integrated in a structured questionnaire, the measure was administered to a set of 77 SMEs belonging to the textile and mechanical industry, located in Lombardy. This survey was carried out through direct interviews to at least one of two organizational roles: the CIO and the entrepreneur/top executive (in some cases these were one and the same).

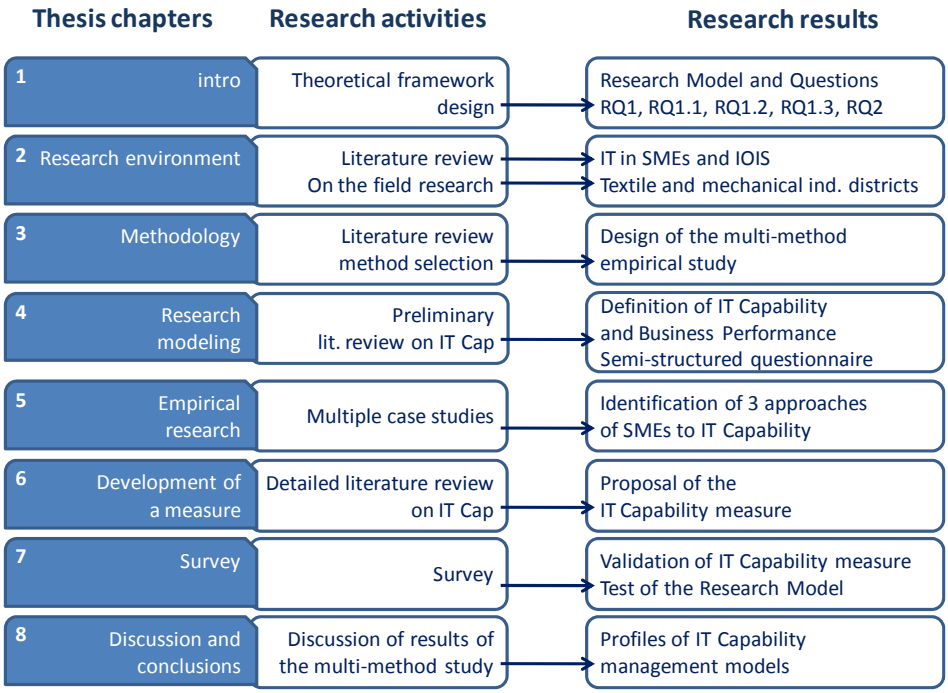

Figure 1.5: The structure of the thesis

This research process is presented in the following chapters, where the activities of reviewing the literature and developing and administrating a research instrument are described separately, according to a typical structure of a research work. The next chapter focuses on the domain of the study, small to medium enterprises, providing a comprehensive picture of the issues related

to IT investments and IT enabled initiatives within SMEs. A specific section of the chapter aims at characterizing the specific domain where the empirical study took place, i.e. the textile and mechanical industrial districts located in the Lombardy Region (in Northern Italy) . The third chapter describes the methodological approach used in this study, a multi-method approach, which combines qualitative and quantitative research methods to provide a richer contextual basis for interpreting and validating results. Chapter 4 presents a detailed literature review of the available definitions of IT capability and IT competence and a review of business performance measurements leading to the development of the preliminary research model and semi-structured questionnaire. The results of this preliminary qualitative study to draw a first picture of the variables composing the IT capability construct and further, to identify typical company profiles as to the approach they use to manage their IT capabilities is discussed in Chapter 5. Chapter 6 shows the detailed literature review focused on the concepts of "IT capability" and "IT competence", and describes the process that led to define a 67 item scale to measure IT capability. The quantitative, empirical study that applied this scale within a sample of 77 SMEs is the object of Chapter 7: here a survey is introduced and the results of the data collection are analyzed. Finally, the eighth chapter discusses the outcomes of the study and presents SMEs-specific guidelines to grow and fully exploit IT capability to achieve effective business performance.

1.6 Conclusions

The research described in this proposal is built upon three main concepts.

The central topic of the thesis is IT capability, a concept rooted in the Resource Based View (RBV), a reference theory in the Strategic Management field. Even in the paper where this theory was originally proposed, the author recognized in the information processing systems an exemplar domain of application of his theoretical framework (Barney 1991). Since then, a number of studies in the IS field have applied, customized and improved the RBV model in order to explain the relationships between IS and competitive advantage.

A second key aspect of the research is represented by the domain where the empirical research takes place. Small and medium-size enterprises represent an ideal field to collect data about a concept as controversial as IT capability. Under the reasonable assumption that company size is positively related with organizational complexity, SMEs provide a context where the choices on IT expenditure are determined by fewer decision makers and IT impacts on fewer business

processes compared to large companies,. Thus, we expect that the influence of IT capability on business performance should be more transparent.

SMEs will be studied not only as stand-alone subjects, but also as components of inter-organizational entities, where information management takes place beyond the company borderline. Therefore, a third foundational aspect of this work is Inter Organizational Systems (IOS) and Inter Organizational Information Systems (IOIS). The idea to extend the study of an organizational entity beyond the boundaries of a stand-alone organization is naturally locatable in the Organizational Science. However, the works within the IS field that have focused on aggregations of organizations have often borrowed key concepts and models from Strategic Management research. The two reference models concerning IOS at the basis of this thesis, Kumar and van Dissel's IOIS taxonomy (Kumar and van Dissel 1996) and Hong's IOIS functions matrix (Hong 2001) are representative of this inter-disciplinary approach.

It is relevant to note that the RBV has proven effective within multiple domains of application, as reported in a 2001 issue of The Strategic Management Journal, entirely dedicated to the achievements of the RBV in a decade. In other words, RBV has proved its maturity and explanatory power as a *theory* in every respect. The same cannot be argued regarding the IOIS theoretical frameworks, that should be more properly addressed as *models*, as - mainly due to their relative youth - they strive to improve their capacity to explain the complex phenomenon of the interactions among different organizations.

As a consequence, this chapter has focused on the first topic, while the subject of IOIS will be discussed in the form of a literature review within the context of SMEs in the following Chapter 2.

2 Chapter Two: Research environment and target sample: IS/IT, SMEs, industrial districts, IOIS

The aim of this chapter is to describe the environment where the study takes place. If we refer to the conceptual map introduced in Chapter one, the following sections will provide a broad picture of the domain of the empirical research (Figure 2.1).

First, the context of SMEs, and specifically of the use of IT in SMEs will be described through the results of a recent research on this topic on a sample of Italian firms. However, studying an SME as a stand-alone entity shows a limited picture of the opportunities available to entrepreneurs and the issues they face. Very few contemporary SMEs can take strategic decisions leaving aside the inter-organizational system they interact with. The central sections of this chapter will provide a background to broaden (to the inter-organizational level) the domain under investigation, using a twofold perspective. First, the domain of SME aggregations will be examined from an organizational standpoint through a structured literature review leading to identifying the key factors characterizing such aggregations. Then, the industrial aggregations will be presented from an information management and information technology standpoint: the inter-organizational information systems will be described through the lenses of the most relevant theories and in terms of the impact that IT can exert on inter- organizational relationships. The last section of the chapter is meant to complete the presentation of the research context by focusing on the economic characteristics of the specific target sample of the empirical study: aggregations of Italian SMEs in the textile and mechanical industries.

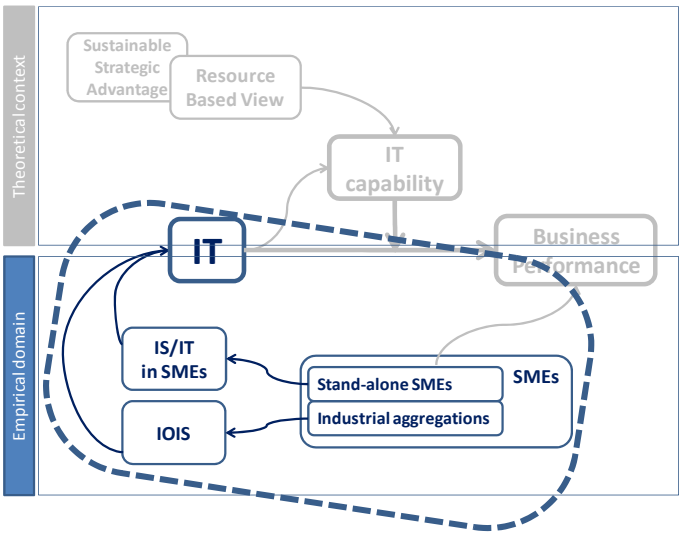

Figure 2.1: The focus of Chapter 2 within the conceptual map of the study

2.1 IS/IT and SMEs

In the ’80s, IT evolution mainly affected large companies, able to invest a large amount of their resources in IS development. Large information centers and specialized staff were required to effectively manage the IT introduction and development in these companies.

The initial advantages which promoted IT introduction in many companies were mainly related to productivity improvements. However, in the following years the impact on company strategies was theoretically proposed and empirically tested (Porter 1985; Wiseman 1985; King, Gurbaxani et al. 1994; Willcocks, Feeny et al. 1997; Kemerer 1998; Schroeder Bates and Junttila 2002; Coltman Devinney and Midgley 2007).

As the broadness of IT impact begun to expand beyond the boundaries of large enterprises, the academic world became increasingly interested in the phenomenon of IT adoption and use by SMEs starting in the 90s:

- a survey over 228 Canadian SMEs presented a positive relationship between IT adoption and organizational development (Raymond 1992);
- a study on a sample of 201 British small enterprises with under 10 employees reported that approximately 50% had at least one personal computer (Bums 1992);
- a research carried out in Japan (Institute 1995) pointed out that more than two thirds of the surveyed SMEs already owned one or more computers, and were working to reach higher levels of computerization, with a further 16% still in the planning phase of giving the business a superior information orientation.
- research dated back in the ‘90s in Italy, showed that IT support to business activities was on average lower when compared to other European countries (ASSINFORM 1997); nevertheless the diffusion of IS related assets appeared widespread even within small and very small Italian enterprises (Bartolozzi 1995).

2.1.1 SMEs and the strategic implications of IS/IT

From the late 90’s researchers in the IS strategy field have focused their attention on the specific characteristics of SMEs. The paper from Levy et al. dated 1999 (Levy & Powell 1999) together with the complementary work published one year later in The Journal of Strategic Information Systems (Levy & Powell, 2000) provide a good point of reference. Under the assumption that traditional IS strategy (ISS) frameworks have been developed within the context of large enterprises, the authors discuss the validity of such frameworks in the meaningfully different

context of SMEs. Through a multiple case study methodology in four SMEs (Levy & Powell 1999) and in a larger set of 42 SMEs (Levy & Powell 2000) the authors conclude that there are strategic IS frameworks that are applicable not only in the context of large organizations. This is the case of Porter's framework (1985), whose application in SMEs highlight opportunities to use IS for strategic advantage especially for improving customer relationship (according to Value Chain framework) and potentially protecting the competitive arena from new entrants (according to the Five Strengths framework). Other frameworks, such as the stages model (Nolan 1974) appear less suitable to support the growth and management of IS. Levy et al. recognize as a relevant differentiating aspect the frequent absence of an IS department in SMEs (Levy Powell 1999), and suggest a new ISS framework, adapted from Walsham's (1993) themes. This ISS approach for SMEs is shaped by three perspectives that focus on information and organizational issues and not merely on IT: business context, business process and strategic content.

In a later paper Duhan et al. (2001), starting from the evidence that "the RBV in the context of SMEs is largely unexplored", go beyond this more general approach and apply Barney's RBV (1991) to the context of SMEs. A case study of the identification and development of an IS strategy in a knowledge-based SME provides the "vehicle" to discuss the role of IS as a resource in an SME. The authors adopt a competence-based view of the strategy to align IS/IT with business objectives and to search for competitive advantage through its use: in other words, they are able to identify "opportunities of competence leveraging and building and the ways in which IS/IT can facilitate and enable these" (Duhan et al. 2001). However, the main contribution of this study appears limited to an identification of areas of further research to operationalize this competence-based approach. With respect to the aims of this PhD thesis, Duhan et al's study represents a point of reference to demonstrate the contribution at the academic and practitioners' level.

Along the same stream of research Caldeira et al. (2003) take a step beyond, towards providing empirical support to previous arguments on the application of the RBV to IS/IT. The authors propose that the search for strategic use of IS/IT within SMEs is best pursued by the consideration of the contribution of IS/IT to organisational capability. Under this assumption, they investigate the factors determining the relative success in the adoption and use of IS/IT within a multiple case study on 12 manufacturing SMEs. The main outcome of this study is the identification of two contrasting types of SME:

- those who are more successful in adopting IS/IT, that rely on their own IS/IT knowledge (and not on external solutions) to stay ahead of competitors. IS/IT here is viewed as an ever-changing variable, and the in-house IS/IT competence is developed just to "ensure that the core software permanently fits the business requirements" (Caldeira et al. 2003),
- the less successful firms, where problems in IS/IT adoption and use are due to their unrealistic expectations, that the market can provide them with the software solutions they need, and as a consequence they have little understanding of the need to have in-house IS/IT competences.

Other papers have dealt more recently with the issue of IS strategy within SMEs, although their focus is rather limited to specific domains: Brown and Lockett (2004) studied IT adoption for strategic applications in SMEs from the point of view of the application providers, in order to clarify the role of trusted third parties and suggest guidelines for effective business models; MacKay et al. (2004) study e-commerce adoption in six small voluntary organizations, and recognize in Strategic/Organizational Readiness (the ability to attract human or financial resources to develop a website, joint with the readiness to "react nimbly to donations and grants to develop a website"), a key factor for determining the success of IT adoption.

A more recent and focused work in the IS literature is from Duhan (2007), a mainly theoretical paper that discusses the conventional tools for strategic IS planning and develops (through two in-depth longitudinal case studies) and applies (in a single case study) a new toolkit, built upon the concept of organisational capability. The author claims that the toolkit can be used to analyse current capabilities and design future capabilities of a firm in terms of its component competences, the contribution of IS/IT, and the capability's impact on the firm's competitive advantage. From the design of organizational capabilities the toolkit enables also the identification of the IS/IT initiatives to support future capability requirements.

It is worth noting that all the papers mentioned present either theoretical or exploratory studies. As such, their potential for generalization is inherently affected by critical limitations.

2.1.2 The state of the art of IS/IT in SMEs. The case of Italy

In order to understand the specific context of the empirical research, the following paragraphs describe the role of IT within Italian SMEs. The unit of analysis of this PhD study is at the *firm* level, thus the next section will provide insights on how IT is used and managed within an Italian SME, observed as a stand-alone entity.

On the other hand, companies rarely act as single entities in the competitive arena. This is especially relevant in the highly inter-connected economic environment of Italy, well known for its inter-organizational business systems, usually addressed as *industrial districts* or, as *industrial aggregation.* While this study will examine the individual SME rather than the overall aggregation, it is useful to summarize: a) from an organizational standpoint, the characteristics of industrial aggregations, and b) from an IS perspective, the technological alternatives to manage inter-organizational information flows. This would allow identification of the way firms operate and compete within and across the borders of an industrial aggregation, and to understand the role of IT in supporting or enabling such competition.

Italian SMEs as stand-alone entities

The most recent available research on the use and management of IT in SMEs in Italy was performed five years ago (Ravarini 2004). This paper provides an analytical insight on the state of the art of IT use in Italy. The study was carried out on a sample of 370 SMEs located in Northern Italy during 2003. Responses were collected through personal interviews with a top manager (possibly the entrepreneur himself) as to the main business objectives while more technical issues were addressed to the chief information officer (CIO), if present.

Companies adopting an ERP system are only a minority (25%) and almost exclusively of medium- large size. These firms claim to have a high or very high integration of their business processes. In a later ERP study, Buonanno et al. (2005) focused on the relationship between business complexity, organizational change and ERP adoption and showed that business complexity, as a composite factor, is a weak predictor of ERP implementation, whereas just company size is a very good one. In other words, companies seem to be disregarding ERP systems as an answer to their business complexity. Unexpectedly, SMEs disregard financial constraints as the main cause for ERP system *non-adoption*, suggesting structural and organizational reasons as major ones, whereas, ERP systems *adoption* is more affected by exogenous reasons or "opportunity of the moment" than by business-related factors (contrary to large companies that are more interested in managing process integration and data redundancy/inconsistency through ERP implementation).

Ravarini (2004) pointed out an apparent contradiction between the availability of systems supporting internal automation of tasks and IT enabling the interaction with the external environment. Within SMEs infrastructural activities (including general management, planning, finance, accounting, legal services, etc) are heavily supported by IT. Likewise, high support is devoted to logistics, procurement and operations. Notably, meaningful differences can be

observed comparing SMEs with medium-large enterprises, where IT covers a wider range of activities than SMEs.

A different pattern was found for activities supporting external relationship (procurement, marketing and logistics) or in areas traditionally lacking IT support, such as human resources management. These activities lack IT support also within the few large organizations surveyed. Specifically, the study highlighted a lack of growth in the number of firms using an extranet or even just with a web site (66%), a result similar to that observed on average in EU (67%) (Ottens 2003). The use of an extranet is not meaningfully superior to the percentage of companies adopting more traditional EDI technologies (12% of the sample and 8% of the SMEs). SMEs confirmed a risk-adverse behavior, that leads them to favor reliable and less expensive solutions, instead of more expensive but technologically advanced ones (Gebauer and Buxmann 2000). The study also showed that medium-large enterprises have a higher confidence with IT and a more sophisticated approach to adoption than smaller ones. Both small and medium companies are aware of IT importance, but the medium ones have more resources to spend on IT adoption and management. Moreover, small companies are characterized by limited technical knowledge: this seems to be the major barrier to maximize the profitability of IT adoption. This results in a more innovative role (and - specifically - to support inter-organizational relationships) of IT within medium-size firms.

The strategic objectives to be achieved through the use of IT are added-value Internet-based services, dedicated to suppliers and customers (forums, order management systems, CRM systems), aimed at improving the integration along the supply chain. The improvement of *customer service* (in terms of reliability and respect of delivery times) is considered the most important strategic objective, followed by the improvement of communications towards suppliers, while only a minority of SMEs use IT to support their integration with other partners (such as shipping agencies or third parties).

It is worth noting that integration with customers and suppliers does not necessarily imply a change to the supply chain structure through *disintermediation*: integration occurs by *strengthening the relationships* with partners rather than eliminating one or more steps of the supply chain. Nevertheless data showed that integration with partners is not really widespread: only 31% of respondents effectively integrate at least six out of ten inter-organizational processes considered in the research. Notably, in these companies the CIO plays a strategic role: in 80% of the cases he/she directly relates to the entrepreneur or, in some cases, CIO and entrepreneur are the same person.

To summarize, an effective connection between IT investments and the strategic control of the enterprises is still lacking: IT adoption is often considered just an operational cost, without any clear understanding of its strategic implications. A profound connection between the company strategic orientation and the IT investment policy might improve the effectiveness of such investments, even though in many cases the problem seems related to the awareness of the company strategic course. Other forces driving this evolution could be the succession phase that many enterprises are going through and the growing managerial presence.

Italian SMEs as industrial aggregations: Clusters, Districts and Associations

The academic literature concerning industrial aggregations is extremely rich and highly differentiated. After Marshall introduced the concept of external economies and industrial districts in the 1920's (Marshall 1922) the strategic relevance of aggregation, especially for SMEs, has become a major research field within organizational studies, particularly during the last decade (Coe 2001; Enright and Roberts 2001; Donald and Vertova 2001). The growing complexity and instability of global markets has led a plethora of authors to analyze different forms of industrial aggregations, including how such aggregations can help enterprises to increase their competitiveness (Hoover 1948; Macneil 1980; Varaldo and Ferrucci 1997; Nassimbeni 1998; Paniccia 1998; Micelli and Di Maria 2000; Bernal, Burr et al. 2002).

The widest recognized forms of industrial aggregations in literature are represented by clusters and industrial districts, frequently seen as synonymous or akin, dividing authors between supporters of industrial districts as a specific case of clusters and those theorizing clusters and districts as two different phenomena. Moreover, there are other significant forms of industrial aggregations, such as business or industrial associations, industrial parks, and networks. Within such a heterogeneous environment, it is necessary to identify a common understanding of the different forms and definitions of industrial aggregations. The OECD specific Focus Group defined clusters as "network of production of strongly interdependent firms, knowledge producing agents, bridging institutions and customers, linked to each other in a value adding production chain" (Roelandt and Hertog 1998).

The main characteristics of a cluster are the linkages and interdependence between different subjects that generate value increasing the competitiveness and innovativeness. Following this definition, many authors (Roelandt and Hertog 1998; Gordon and McCann 2000; McDonald and Vertova 2001) have described the industrial district as a "cluster of firms in a particular industry that have constructed local networks with firms in supporting industries, and also with the local community". This definition, however, seems to underestimate the effects that the characteristics

of geographical localization and relationships with the local community entail. Therefore, a more comprehensive approach should be considered following authors like Becattini (1990) and Markusen (1996) who focus on the specific characteristics of industrial districts.

More precisely, instead of dealing with the dichotomy between clusters and districts, the complexity of the subject could be better approached by employing a "bottom-up" approach, i.e., identifying aggregations according to a set of relevant characteristics that are shared by the companies belonging to an aggregation. The size of the company, its geographical location, its industrial sector and wideness of market area are meaningful characteristics (McDonald and Vertova 2001). In a preliminary theoretical study specifically focusing on Italian industrial districts Ravarini (2003) suggested two other major dimensions:

- the critical actors, i.e. organizations playing key roles within the network of the district (business associations, banks and public administration; internal suppliers of direct goods; manufacturing companies; intermediaries; external suppliers of indirect goods; business clients);
- the type of competitive advantage a company can achieve; from this perspective it is possible to distinguish the Marshallian competitive advantages (common to all kinds of industrial districts) from the specific competitive advantages (that can be achieved only by specific industrial districts due to historical, cultural, territorial reasons) (Marshall 1922; Varaldo and Ferrucci 1997).

Focusing on the players that can enable and drive technological and organizational innovation it is possible to identify six **critical roles** characterizing an industrial district:

- associations, banks and public administration: subjects not-directly involved in the supply chain, but frequently very influent within the district. Their general aim is to increase the value and the competitiveness of the local system as a whole; coherently with this aim, they are thus considered eligible to play a critical role in all the identified district typologies but in the Ruled one, in which the leader's interest substitutes the general interest of the district;
- internal (i.e. belonging to the industrial district) suppliers of direct goods: subjects capable of pooling many district enterprises with their initiatives in those district environments where the supplies have a strategic role, therefore not in the Ruled Districts, where buyers rule.

- manufacturing companies: these subjects could play a critical role in the Ruled and Technologically Superior Districts, in which the chief district production is concentrated in the hands of few enterprises;
- intermediaries: subjects capable not only of pooling many district enterprises, but also of being promoters and managers of a B2B e-commerce solution in each district typology, just thanks to their role;
- external suppliers of indirect goods: usually incapable of playing a critical role, with the exception of those districts where the high cost of labor leads to outsource the product manufacture outside the district boundaries;
- business clients: subjects capable of influencing the district enterprises to join their electronic solutions for procurement, thanks to their importance.

The **competitive advantages** of industrial districts can be categorized as physical economies of localization, social economies of localization and external economies of agglomeration (Marshall 1922). These advantages are mainly related to factors that share a considerable decreasing of importance as a consequence of IT evolution. For example cost reduction due to the small geographical distance between districts members and the value of the embedded social 'know how' in sustaining the local labor (Varaldo and Ferrucci 1997; Micelli and Di Maria 2000; Alberti 2002). The nature of these advantages is very traditional, but it is not obvious how IT can be used to enable sustainable advantages (specific advantages that occur only in specific environments). There are three forms of specific competitive advantages:

- the *district brand*, which embeds heterogeneous advantages sharing the characteristic of being available to all the district enterprises;
- *district leaders*, which are recognized as pioneers in overcoming the actual difficulties districts are facing. Especially, district leaders seem to play a primary role " […] facilitating the introduction of new technologies and the sharing of codified knowledge, sustaining the demand for workforce in sub-contracting companies, […] modifying the organizational morphology of the industrial district, acting as boundaries spanners" (Alberti 2002);
- the *district superior technology*, referred to both products and production cycles, which are the possible results of the typical district labor specialization.

The cross-analysis of critical roles and type of competitive advantage should enable estimating how and to what extent IT can influence the creation and development of industrial

aggregations. To this aim, research about inter-organizational information systems can provide a solid background.

2.1.3 Inter-Organizational Information Systems (IOIS)

IOIS can be defined as an "[…] information and management system that transcends organizational boundaries via electronic linkages with trading partners […]". The IOIS purposes are to share data, business applications, and information, and to provide the business partners with the capabilities of electronic transactions about buying and selling goods and services (Eom 2005, pp 4-5).

In recent times, many companies have recognized in their IOIS a key factor for their growth (Eom 2005; Hong 2001). In fact, an IOIS can be a source of innovation and competitive advantage, thanks to faster and less expensive information exchange, better quality of information managed (related to the number of firms that take part in the network) and conversion costs reduction that can encourage collaboration between firms (Hong 2001). In other words, through an effective IOIS it is possible to transform a set of companies into a competitive industrial aggregation.

Background on IO relationships

Relationships have been the subject of studies within many research fields. The heterogeneity in contexts and times are reflected by the diversity of such works, which adopted different descriptive models and underlying theoretical perspectives (Haugland 1999).

In the IS field, Kern and Willcocks (2000) report that the research on IO relationships is still inconclusive. In their attempt to rationalize the existing research work, they first analyze IS literature and then go further considering organizational and marketing literature. This review highlights four main conceptual models on which those papers are based: life cycle dynamics, exchange theory, resource dependence theory, transaction cost theory and organizational learning. Three of the main traditional approaches from organizational and strategic literature are herein analyzed: the resource dependence model (Pfeffer and Salancik 1978), the relational exchange theory (Macneil 1978) and transaction cost theory (Williamson 1985). More recent and promising models have been trying to extend organizational theories such as the resource based view model (Penrose 1959; Barney 1986; Barney 1991; Bharadwaj 2000) and the dynamic capabilities theory (Teece, Pisano et al. 1997) by taking into consideration the contribution of IT to company performance.

The resource dependent model

The resource dependent model (RDM) aims to describe the multiplicity of relationships that occur between an organization and suppliers and customers as well as banks, shareholding institutions, government, distributors, consultants, associations, etc, namely organizations expected to interact with their environment in order to acquire resources. According to RDM organizations would enter into IO relationships to gain access or control over a resource or a perceived resource need. However, the focus is still the single firm and not the network of relationships in which it operates (Easton 1992).

The relational exchange theory

The relational exchange theory (RET) is based on four main principles of society (Kern and Willcocks 2000): labor specialization, exchange, choice and awareness of the future. Labor specialization is the pre-condition to the exchange as soon as individual and firms no longer produced everything for their own survival. The exchange is considered the activity emerging between individuals motivated by the returns they can bring from others (Macneil 1978). The level of choice agents have in terms of exchange represents the extent of their freedom. Finally, awareness of their future is the reason why contracts exist as those expectations determine the needs for a contract.

In the RET firms can be seen as complex bundle of contracts as they acts by the means of exchanges in order to fulfill their needs and future expectations. Taking into account the uncertainty of the future and the limited awareness of agents, the relational exchange theory "emphasizes the importance of building personal trust relationships and developing social norms" (Haugland, 1999 pp.273) as each economic action is considered to be related to the context of social relations where trust is a core aspect.

Transaction costs theory

Transaction costs theory (TCT), as proposed by (Williamson 1985) mainly focuses on governance structures. By postulating the existence of limited rationality and opportunistic behavior of agents, the TCT provides a framework that tries to explain why managers pursuing business objectives should choose to rely on their organization, on the market or in a mixed-relationship (Plunket, Voisin et al. 2001). The underlying statement is that in a free market a company would find it cheaper to buy a product from a specialized producer rather than to make it on its own. However, market failures limit the management understanding of costs, leading to less than optimal internalization of the production. However, firms still engage in repeated,

contract-based transactions when theory suggests hierarchical arrangements. In fact, developments of TCT include inter-firm cooperation as a third intermediate choice between the market and the hierarchy (Williamson 1985; Smith Ring and Van de Ven 1992; Smith Ring and Van de Ven 1994): a firm would activate an IO relationship whenever the production and transaction costs related to this choice are lower than hierarchies and markets if considering other variables: trust and risk.

Nevertheless, the application of TCT to inter-organizational issues presents some major drawbacks (Smith Ring and Van de Ven 1992):

- motivations other than efficiency such as equitable outcomes, learning and legitimacy are understated;
- the assumption that markets are invariably characterized by opportunistic behavior contradicts observed trusting behavior in designing governance mechanisms (such as cooperation);
- by essentially being above all a "vertical integration theory" (Plunket, Voisin et al. 2001) it emphasizes the notion of markets and hierarchies leaving a void in the understanding of alternative forms (such as joint ventures, joint research projects, extractive resources explorations).

Above all, these models provide an insight into the complexity of the research in the field of IO relationships. Despite the lack of a general and accepted framework, the proposed review allows a better understanding of the reasons driving a company to choose a cooperative behavior. A more extensive analysis on this field in IS literature can be found in the work by Kern and Willcocks (2000) or from an organizational standpoint in Barringer and Harrison (2000).

IT and IO relationships

A fundamental role in the analysis of implications of IT adoption on IO relationships should be acknowledged in the work of Venkatraman (Venkatraman 1994). In defining the business-transformation levels, he identified four different functions where IT would have enabled the redesign of the network of relationships of a business: transaction processing, inventory movement, process linkage and knowledge leverage. The expected redefinition of companies' boundaries through the adoption of IT should have then produced potential benefits on three main fronts: efficiency, differentiation and learning.

In an extensive review of the literature, Dewett and Jones (Dewett and Jones 2001) investigated the impacts of IT on organizational characteristics and results, by studying the moderating and

beneficial effects of information efficiencies and synergies (like higher efficiency, organizational innovation, increased coordination and collaboration). The study highlighted the effects on IO relations and the resulting benefits in terms of:

- cost savings;
- lower transaction costs, governance costs and exposure to opportunism;
- smaller firm size;
- more efficient suppliers and customers linkage, and customer lock-in;
- divergent value chains linkage;
- support to the building of innovative capabilities;
- collaborative learning process enhancement;

Despite this richness of studies suggesting wide IT impacts on IO relationships, a large part of the software industry, as well as considerable research in the IS field, has been focusing on a more specific matter: the automation of economic and financial transactions.

Well before the advent of the Internet, Electronic Fund Transfer (EFT) and EDI (Electronic Data Interchange) Systems had reached a high degree of spread. More recently, the opportunities of Internet technologies have been driving software companies to differentiate their offerings through eCommerce, eProcurement, eSupplyChain Management solutions. Such a differentiation makes it difficult to understand the range of applications of each type of systems.

On this matter, Pavlou and El Sawy summarized several theories on inter-firm relations and proposed the reach of relations as the most appropriate dimension to examine business relationships (Pavlou and El Sawy 2002). The reach of relations measures the number of potential partners to which a firm has access, i.e. potential trading partners in a B2B exchange. The dimension of reach measures the number of potential partners to which a firm has access, i.e. potential trading partners in a B2B exchange. The cross-analysis of the dimension of reach of both buyers and suppliers gives as a result a two dimensional classification scheme (Figure 2.2), in which four typologies of inter-firm relations are identified (Pavlou and El Sawy 2002):

- many to many, where many customers and many suppliers are able to interact (ex., TextileItaly);

- few to few, where a restrict group of buyers and suppliers shares tight and strong strategic and collaborative relations, so that few to few in conclusion means: a restricted and selected group of subjects interacting with each other (ex., Buzzsaw.com);
- many to few, where many suppliers are involved with the procurement process of one enterprise (this case can be referred to as many to one) or of few enterprises (ex., Covisint);
- few to many, where many customers buy through a sales channel of one enterprise (this case can be referred to as one to many) or of few enterprises (ex., Dell).

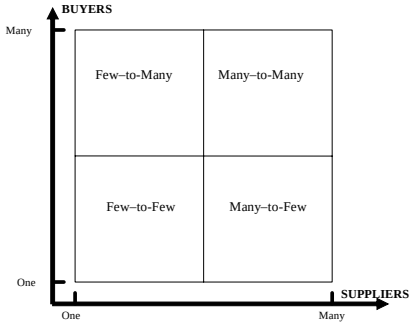

Figure 2.2: The two dimensional classification scheme of inter-firm relations (Pavlou and El Sawy 2002).

Within each of the four cells of the scheme it is possible to map a wide set of IT solutions for IO relationships (Figure 2.3):

- e-marketplace (many to many): defined as a virtual place where multiple buyers and suppliers are able to transact, buying or selling goods or services, asking for cost estimates, offering, and stipulating commercial relationships (Giamminola 2001). E-marketplaces make it possible to match demand with offer, so that buyers can reduce procurement costs and suppliers can improve the visibility of their companies and products (Phillips 2000; Neef 2001; Raisch 2001). On the other hand, the number of firms involved in this type of exchange precludes strong interfirm relations (Raisch 2001);
- e-procurement (many to few): solution that allows "traditional powerful buyers to capture benefits by leveraging their existing physical into online B2B exchanges" (Raisch 2001). There are two forms of e-procurement, the web- based that allow many suppliers to participate and the close one that can be enjoyed just by few selected suppliers
- e-sell (few to many): a virtual sales channel through which few big suppliers put their products and catalogues at many buyers' disposal, a mechanism that closely follows the primary model for business-to-consumer eCommerce. There are two forms of e-sell, the

web-based that allow many buyers to participate and the close one that can be enjoyed just by few selected buyers;

- supply chain management systems (few to few): solutions which support close and strategic relationships between a small number of firms, and benefit from web- based technologies to exceed the substantial costs that limited the spread of EDI solutions for this type of relationship.

Although providing a systematic representation of a segment of the software market, this scheme can only partially contribute to the aim of the present study. With respect to such aims, Pavlou's work lacks in completeness, since relationships not dealing with an economic transaction are simply excluded, and in practical relevance, since each of the IT solutions supports only one type of relationship at a time. It is unrealistic (in terms of costs involved and time needed) that a business association can implement and integrate a set of different solutions supporting each single inter-firm relation. The proposed framework should consider a wider range of dimensions thus including more agents and IT solutions.

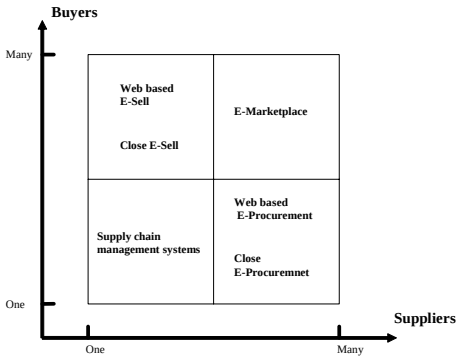

Figure 2.3: Two dimensional classification scheme of IT solutions of inter-firm relations (adapted from Pavlou and El Sawy, 2002).

More recently, Saraf et al. (2007) applied the concept of IS capabilities to the context of interfirm relationships to study their contribution to business performance. Through a survey of 63 firms from the hi-tech and the financial industry, the authors were able to uncover the interrelationships between two key IS characteristics: *IS flexibility*, as an essential factor contributing to integration with channel partners and customers; and *IS integration*, emerged as the antecedent of co-specialized relational assets and thus can play a strategic value in the extended enterprise and contribute to performance.

More specifically, IS integration with channel partners and customers contributes to both knowledge sharing and process coupling, whereas IS flexibility is a foundational capability that

indirectly contributes to value creation in interfirm relationships by enabling greater IS integration with partner firms. Two types of relational assets are significantly associated with business performance - knowledge sharing with channel partners and process coupling with customers.

In more pragmatic terms, the study supports - at the inter-enterprise level - the idea that business value can be enhanced by balancing conflicting needs by strategically developing IS capabilities. Thus, high IS integration achieved by customizing IS applications to an individual customer can result in higher efficiency through tight coordination; conversely, IS flexibility plays a critical role when the goal is to coordinate processes and share knowledge with a number of different partners.

2.1.4 IOIS in summary

By cross matching the characteristics of IT supporting inter-organizational relationships with the properties of industrial aggregations it is clear that the IOIS is the essential "glue" of an industrial district, that can drive its companies to achieve - aggregately – a competitive advantage. Implicitly, any industrial aggregation has an IOIS that interconnects the member organizations. Nevertheless, what can make the difference, in strategic terms, is the effective design and management of such IOIS.

To this end, we need to identify and study in depth the components of IT capability also taking into account the effects of IT expenditures at the interorganizational level. This should enable linking the potential of exploitation of IT investments of stand-alone SMEs with the strategic objectives of the industrial aggregations to which SMEs belong. In other words, understanding IOIS allows taking into account the amplification effect – at the interorganizational level – of the IT investments carried out by a single company.

2.2 The target sample of the empirical study: Italian industrial districts

Industrial districts are the distinctive trait of the Italian economic scenario. Instead of few, big companies, there are many small and medium companies, concentrated in a precise place, where social, cultural and economic history has in time stratified knowledge and skills.

2.2.1 The textile industry and the textile manufacturing industrial districts in Italy

The textile sector in Italy holds a very important role for the Italian manufacturing system. The Italian leadership in the sector at a European level is still unquestioned: Italy is today the main

manufacturer of the sector in Europe, followed by Germany, France and UK. Nevertheless, the Italian textile industry is not a whole, wide and compact reality, but rather a set of small manufacturers, highly specialized and concentrated in different areas, traditionally devoted to the manufacture of a specific product. Such areas are called districts.

The most important districts in textile manufacturing are located mainly in northern Italy. The most famous, such as Como and Prato, boast knowledge and skills developed across centuries. The Prato district as the main centre for textile manufacturing goes back to the 12th century. Since then, even though with ups and downs, Prato has remained the main actor for the wool industry, employing – in the 1980s – 50% of the people in the field in Italy. Other districts, such as Teramo or Gallipoli, were born in the '50s and '60s, pushed by the economic boom of the decade.

The strengths of districts in Italy certainly lie in the deep specialization of techniques and knowledge developed along the centuries and yet, the modern economy acts in a more and more globalized way. Commerce acquires dimensions that go far beyond the boundaries of the single states, while production and dynamics are characterized by an ever growing speed.

The evolution of the textile market

Up to 1990, the world textile industry was characterized by a relative balance: few actors and a competition that assured everybody a place in the global market. The most competitive countries, such as China, Hong Kong, Korea and Taiwan, were still restricted by quotas, and this made it possible for the less competitive countries to exist.

Since 1990, a new phenomenon has developed in the sector, that is, the entrance into the market of new exporting countries, also thanks to preferential agreements by the industrialized countries, which allowed some developing countries to have a special, tax-free and share-free access to their markets. Poland, Romania and Bangladesh obtained a preferential access to the European market; Mexico, in 1994, obtained a similar access to the US market thanks to NAFTA; the African Growth and Opportunity Act (AGOA, 2000) allowed the access, tax- and share-free, to a group of African states, and so on.

The result was an enormous increase in global exportations, which almost doubled from 1990 to 2002, going from a value of 108 billion dollars to 201 billion dollars (International Trade Centre 2005, pg. 1). This increase was initially amortized in the market; around the middle of the '90s, though, the demand, which had always been characterized by a stable growth, stopped growing at the previous years' speed.

In 2005, the abolition of the system based on shares, due to the enforcement in the textile industry of the new rules of GATT (General Agreement on Trade and Tariffs), occurred in a very discomforting scenario: demand which had been decreasing for almost a decade, market in a state of crisis. The new deregulated market has balances that are, once more, different. Many of the industries that had been protected by the "preferential lanes" of the '90s (share- and customs tariff-free access) are quickly driven to a crisis (International Trade Centre 2005). China, always blocked in its potential up to now, becomes the main player in textile manufacturing thanks to cheap labour, together with a deep-rooted, efficient industry, a policy which widely promotes development and a discipline in shipping times – an extremely important factor in the very fast-moving textile market.

The Italian textile industry in the last decade

Italy has not been spared by the crisis. Since the beginning of the '90s, employment in the textile sector has been characterized by a constant fall. In the period 1996-2001 the sector's employees decreased from 1 million to 931 thousand, with a loss of almost 7%; the occupational weight on the whole of the economy goes thus from 4,4% to 3,9%; the decrease in the clothing sector reaches down to -11% (Taronna 2004).

In Italy, where the industries of the textile and manufacturing sector have a relevant importance for the whole production system and its economy, these numbers are not to be underestimated. It should be remembered that in the past 10 years the sector as a whole has absorbed about 20% of the employment in manufacturing, and has produced 11% of the value added of the industry in our country; export represents 37% of production and 18% of the whole export of Italian manufacturing.

In 2006, for the first time after three years, the Italian textile industry showed growing values: export has had an increase of 3,7%. The growth derives first of all from the increase of exportations in the European market and, secondly, thanks to the higher exportations towards Asian countries; on the contrary, the export market towards the US is falling, particularly because of the exchange euro-dollar that, as everybody knows, in the last period has been quite unfavourable to exportations to the US market (US Commercial Service, Italy: apparel sector).

Such growth, even if homogeneous in the different branches of the textile sector, is yet limited basically to the big industries, which have seen acceleration in their sales. For SMEs the path is still long and difficult. The number of companies in Italy is constantly decreasing, and from 2003 to 2006 it had a fall of almost 10 thousand units. This shows that an ever growing number of companies, presumably small and medium enterprises, cannot face the fierce competition of

the new market and leave the field. In parallel, import is widely increasing, mostly from China; at present, Chinese export covers 1/5 of the whole Italian market (EURATEX 2007, pg. 54).

In a sector which rewards more and more dynamism and speed to market, big companies can afford higher investments in Research and Development, regarding both design or materials and information technology. In big companies, such as Zara, the automation of production processes is supported by an information system which can integrate all the various functions of the company, so as to allow a near perfect information management, with great advantages in terms of efficiency and effectiveness. Production times are reduced to a minimum and, together with this, costs and imperfections along the process are cut.

It can be easily deduced that SMEs cannot afford the investments of a big company, in terms of both research and development and technological innovation (Taronna, 2004). And yet, the manager's mentality and the company's approach are important factors in the development of production techniques which take IT, too, into account. In an environment such as the manufacturing textile sector, nowadays also SMEs need to be equipped with information systems that can at least keep up with competitors. It is necessary for the management to be aware that IT solutions are today a decisive competitive factor (Taronna, 2004).

2.2.2 IT and the business processes of the textile manufacturing firms

In the textile industry, prompt reactivity is fundamental to face the new market trends, in continuous and very quick evolution. Competitive advantage also lies in the capability to promptly respond to an extremely dynamic market, together with the search for quality and optimization of the products (Taronna 2004); moreover, organization and the management of human resources and company's activities in general should not be forgotten.

Such reactivity to the market is possible only if tasks like data collection, selection of useful information, coordination of the activities are managed flawlessly. Nowadays, a decisive competitive factor consists thus in technological innovation, that can occur along the business processes of a textile company (Taronna 2004).

The textile industry includes various types of processes, that are highly differentiated as far as output and competence are concerned. In general, we shall distinguish between design, the creative part of the process, and manufacturing, i.e. the actual realization of the product. Design is generated by the work of a team led by the product office, or style office, where the processes of invention and graphical representation of the final product takes place.

The production cycle begins with the transformation of the fabric, a series of operations which vary based on both the raw material used and the desired output. This process can be divided into four parts.

The first step is the production of textile fibres, that starts with a raw material that can have an animal origin, such as wool, a vegetal origin, such as flax, or a mineral origin, such as rock fibres. Textile fibres can also be produced through chemical processes, starting from natural polymers – rubber – or synthetic polymers – polyester. From the fibres in flakes, through spinning, the yarns with different composition are produced. The second step is the spinning, that can be carried out in different ways, that are carding and combing, and produces different outputs, depending on the raw material used and the type of manufacture chosen. These two initial phases rely mostly carried out on outsourcing, in particular for the supply of raw materials, but also for manufacturing itself.

The third step is the weaving, that is carried out from the yarns obtained, usually in Italy. In fact, Italy covers an important share of the world market, and according to the machines, the loom and the manufacturing techniques used, the output product will be different. The final step is the ennobling, that consists of the preparation, dyeing and finishing of the fabric. Once the fabric is done, the procedures for the transformation of the article begin.

The production cycle of clothing can be schematized as follows. After the input, which is the creative process, the following step is the creation of the models, when the shape and cut of the article are defined. The development of sizes uses algorithms and identifies the data that refer to a basic size, starting from which all other larger or smaller sizes are based. The cut is prepared through a placing graph, that is, the outlines of the paper pattern are put on the cloth, which will be cut so that as little fabric as possible is wasted. In the drafting phase, several layers of cloth are put together, and they form the mattress. After the draft, the fabric is cut, and then tailored (stitching, thermo-adhesion, welding, quilting, embroidery), ironed (which gives the fabric its actual shape) and fixed.

Despite such a complexity, IT typically supports the initial phases of the process: CAD and CAM play a significant role for the improvement of production and the maximization of efficiency.

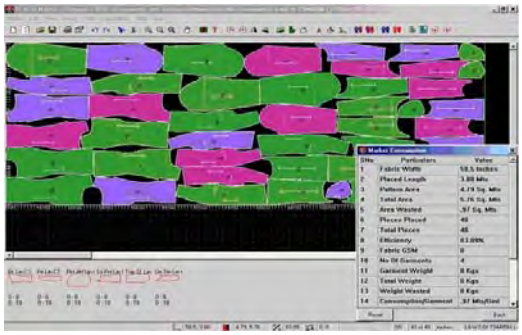

Figure 2.5: Screenshot of an automated placing graph to optimize the cut of the fabric

CAD systems are used to optimize the processes of design, the creation of models and the development of the sizes..They feature options of special visualization, enabling the identification of the optimal layout for the required cut of fabric. CAM systems automate the draft and cut of the fabric, substituting the traditional way, which made use of paper patterns. The process of size development, which required a considerable use of time and effort when hand-made and, nevertheless, gave unsatisfying results, is completely automated. The waste fabric is reduced to the least, and this is an important advantage, considering that the cost of the fabric represents about 60% of the total cost of a product. Other advantages of the system, related to the maximization of the efficiency in the development of the product, are the elimination of possibilities of error, which can't be avoided with the manual system, and the creation of models that can be reused for new models just modifying the style a little.

As to the infrastructural activities, medium-size firms make use of ERP systems essentially for efficiency purposes. The table below synthesizes the corresponding benefits (Table 2.2).

	Manual System	**ERP Solutions**	**Benefits**
General Management	Manual research and categorization are long and chaotic	Information search is simple and instantaneous	Time saving, immediate search
Cost of Products	Research and collection of all the relevant information to calculate the cost of the products	The system instantaneously calculates the cost components	Time and energy saving
Resource Management	Systems for the management of pending complicated and subjective orders	Automatic classification of the management of order priorities based on adjustable factors	Time saving, use of resources
Planning of Production programme	It requires frequent manual updates to the programme; high risk of input errors	User-friendly system; real-time progress, showing any delay and reducing the risk of input errors to almost null	Time and energy saving, error management
Human Resource Management	Work time and pay of everybody are manually calculated; risk of errors	Instantaneous monitoring of work hours carried out, with instantaneous calculation of pay; no risk of errors	Time and energy saving, error management
Production Activities	Manual planning, cut-make- trim process manually carried out, manual monitoring of the progress	Manufacturing processes automatically carried out	Time saving, use of resources

Table 2.2: Benefits of ERP systems for textile manufacturing industries (International Trade Centre, 2005)

In order to adequately compare the observations in different companies with respect to the multiple aspects of IT capability, it is suggestable to choose a set of companies sharing common organizational characteristics, in order to minimize the effect on the investigation of factors that do not belong to the research model. For this reason, the case study presented in the next chapter will be carried out among SMEs belonging to a textile industrial district, precisely the "distretto serico comasco": the district, located in the Province of Como, dedicated to the working of the silk.

The "distretto serico comasco" lies in an wide area covering 50 municipalities North of Milan, where manufacturing is the main industrial activity. The textile industry, in particular, is the most important one, employing about 40% of the manufacturing workers, and within the textile industry, most of the companies work on silk. Many companies belonging to this district are of small size and operate in just one of the process of transformation of silk into fabric and tailoring targeting two final markets: the clothes and the furnishing. Within the district, all the phases of the supply chain are covered by the companies, that give life to a rather autonomous inter-organizational entity dealing with the entire transformation process.

2.2.3 The mechanical industry and the mechanical industrial districts in Italy

According to the latest Italian census on industry and services (ISTAT 2001), mechanical districts (38) are located in the northern regions: Lombardia (leader region), Piemonte, Veneto, Emilia-Romagna, Friuli-Venezia Giulia and Trentino Alto Adige.

Among the most important, we cite here the district of the province of Varese (whose development goes back to the beginning of the 18th century and is characterized by the production of machine tools) and the two districts in the region of Veneto, in the North-East of Italy.

The mechanical industry plays a fundamental role in the Italian production system, contributing to the creation of wealth and to high performance, particularly in foreign markets.

This important position is due, together with the high sales of the sector (which represent about 30% of the same sector of the manufacturing industry – data from Federmeccanica), to the fundamental role of connecting its various segments to the other sectors of the Italian manufacturing industry. Such a connecting role is enacted in two ways: by providing the machinery used for production in any manufacturing firm, and through the high technological contribution deriving by a manufacturing process in general more competitive and innovative.

The Italian enterprises of the sector have stood out for their ability to produce quality and innovation, so that they can be competitive at an international level.

It is worth noting that this sector produces almost all the investment goods in machinery and equipment, through which it works as a promoter for technological innovation, not only towards the other branches of the industry but also, more in general, towards all sectors of the economy. The industrial development and the maintenance of the competitiveness levels of the whole manufacturing industry depend, in fact, on the ability of the mechanical sector to connect its growth to research and innovation.

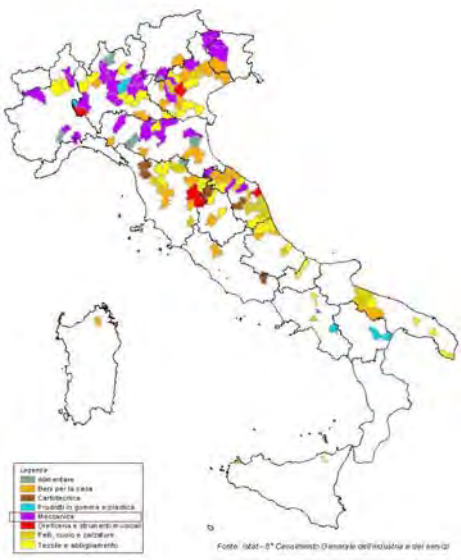

Figure 2.6: Distribution of Italian industrial districts (mechanical districts marked in violet)

The evolution of the mechanical industry in Italy

The iron industry, in its different manufacturing areas, was a major player in Italian economic development. Already in the early post-war period it led Italian economy out of the war depression and to the path of the economic boom. This segment (excluding micro-enterprises, which are around 110.000 with 424.000 employees on the whole) consists of about 60.000 enterprises employing 1.600.000 people. SMEs represent the basis of this industry: manufacturing enterprises, on average, employ 27 employees: companies with less than 200 employees represent 98,5% of the total and employ 43% of all the workforce in the mechanical industry.

During the '90s, this sector was the most important one in the manufacturing industry, despite the up-and-down results of its performance. In a decade characterized by a general contraction

of the work units, worth 1,2%, the mechanical sector recorded an important reduction in employment (-7,6% even higher than that of the other manufacturing industries: -7,2%).

The slackening of the world economy from the beginning of 2001 affected also the mechanical companies. However, in the last decade, in spite of the general economic downturn, the iron industry has continued being crucial for the Italian economy, contributing significantly to the export share of its production, particularly towards the European market and the Asian countries.

Recently, the different trends of employment and of value added caused a reduction in the sector's average productivity. The unit cost of work, a decisive variable for the competitiveness of enterprises, recorded an increase of 5,6%, higher than the achievements of the iron companies in rival countries. This caused a growing difficulty for Italian companies in the competition in international markets, with the consequent loss of market shares. It seems that the critical situation got better for the first time since 2001 in 2006, when a significant recovery was recorded with a positive growth rate of 2,3%. In the period 2000-2007, the growth for the enterprises of the iron sector was much higher than that of the manufacturing sector: 33,5% versus 22,1%.

IT innovation in Italian mechanical SMEs

As highlighted above, the iron sector covers a strategic position in the Italian economy, producing great wealth and performance. The high level of specialization, an important element both for the production of value added and in the trade balance, is the distinctive element of this sector. In a sector like the mechanical, it is fundamental for the companies to be reactive towards the new market trends, which are rapidly and constantly evolving.

According to the contents of the II report on the state of the industry promoted by the Observatory for the monitoring of industrial activities of the Minister of productive activities in March 2006, the different segments of the Italian iron industry are characterized by highly diversified levels of technological innovation. In the segments where the technological level is higher, the control on the know-how and on strategic investments in research leaves little freedom to Italian companies which, considered in the perspective of a global market, possess neither the size, nor the critical mass of financial resources to stand comparison.

In the past, mechanical enterprises considered innovation in terms of the acquisition of hardware equipment (computerized machinery, PCs, personal computer networks) and of application

software (management application programs), which are today seen as “commodities”, widespread ICT goods that do not give a direct competitive advantage.

More recently, thanks to the Internet and the globalization, technological innovation has become more pervasive, involving all dimensions in the company: from design to production, from decision making to the management of customers and suppliers.

One of the main boosts to technological innovation in this sector is given by the integration between mechanical and electronic systems. This can be seen in the design of totally automated, new-generation machinery, robots, sophisticated sensors, computerized systems for machine control, optic fibre or radio frequency communication technologies, embedded systems for the processing of materials.

These solutions are aimed to obtain machinery with high performance in terms of speed, precision and reduction of product processing cycles, waste of time and saving of monetary liquidity. All this leads to a consequent increase in the productivity and competitiveness of the company itself.

2.3 Conclusions

This chapter described in details the characteristics of the context where the empirical research takes place.

SMEs are the object of analysis of this study. The first section showed that information technology represents a core infrastructure even for small enterprises, although the complexity of this infrastructure and the corresponding investments are positively related with company size. This evidence supports the assumption of this work: to use SMEs as the ideal (because of organisational simplicity) test field to define IT capability, and makes it reasonable to proceed with the research. However, while internal processes are adequately supported (or claimed as such), inter-organizational processes are scarcely supported by IT, despite the fact that SMEs recognize the strategic importance of IT for the strategic integration with business partners.

This outcome led to a description of the inter-organizational context where SMEs operate, i.e. industrial aggregations. From a strategic perspective it was possible to highlight two essential dimensions to characterize an IA: critical roles and types of competitive advantage. From an information management standpoint, the theories explaining inter-firm relationships and the software systems supporting them were reviewed. Research about information systems of industrial aggregations appears still too far from maturity to provide a solid theoretical

framework on which to base a study. For this reason the present work will not shift the unit of analysis from the single company to the industrial aggregation. Nevertheless, the reported growing relevance of IOIS for companies of any size strongly suggests taking into account the related implications in terms of IT capabilities.

The choice of conducting the empirical research on Italian districts is coherent with the characteristics of the domain summarized above. The literature reviewed in this chapter shows how Italy has had a long tradition of industrial districts and IOIS for SMEs. In fact, the Italian districts represent a reference model for the research about industrial aggregations, not only in general, within the Management Science discipline, but specifically within the IS field, as testified by crucial papers about IOIS such as Kumar's et al. (1998).

On the other hand, if in the past decades the aggregations of SMEs were a phenomenon mainly occurring in Italy and few other European Regions, since 2000 international organizations such as WTO (Vinanchiarachi 2010) and OECD have recognized the global importance of such inter-organizational structures, although under different names (SMEs clusters, networks, districts). A clear evidence of the evolution of this phenomenon is the OECD Bologna Process on SME and Entrepreneurship Policies, launched in 2000, that promoted among policymakers and academics the significance of SMEs for the global economy, with an explicit focus on the role of partnerships and clusters for their success (OECD 2000). The most recent step in this process, the Tokyo Conference in 2007, was entirely dedicated to SMEs aggregations along the so-called global value chains (a model that includes also industrial districts). The output of the conference was synthesized in the OECD Tokyo Statement on Strengthening the Role of SMEs in Global Value Chains (OECD 2007), where one out of five support programmes is directed at promoting SMEs clusters and networks at a regional cross-regional and cross border level.

Thus, taking into account the reference role of the Italian economic structure based on industrial districts and the worldwide relevance of SMEs aggregation, the two Italian districts where the empirical research will take place provide an ideal source of data, which can be applied to the international scene.

Finally, the context of the empirical research was presented from an economic perspective, focusing on the two industrial districts (textile and mechanical) where the case studies and the survey of this research take place. Despite the differences in the products, these two districts show several similarities, in terms of the recent evolution of the industry, the structure of the processes, the degree of use of IT to automate the processes. These characteristics of the economic environment will provide elements to appropriately interpret the outcomes of the

empirical analysis. In the next chapter the methodology followed to perform this empirical part of the research will be introduced.

3 Chapter Three: Methodological approach

The aim of this chapter is to describe the design of the research. The first section of the chapter presents an overview of the available methodological options in the IS research field. Starting from the numerous works on IS methodology, a framework for IS epistemology is discussed and partially improved in order to better position the methodology of choice in the current study.

The second section of the chapter motivates and describes in details the research methodology, i.e. a multi-method approach where the qualitative phase makes use of multiple case studies and the quantitative phase is based on a survey. Finally, the research process is presented, structured into five phases, from the preliminary literature review to the development of a managerial tool for IT Capability.

3.1 Introduction

The choice of research methodology is one of the core issues for any scientific study. In fact, this issue is particularly crucial in a social-science field such as Information Systems that is struggling to gain reputation as an autonomous discipline, standing aside from the traditional references disciplines from which it originated and with which IS still maintains evident relationships and overlaps (Baskerville 2002; Benbasat and Zmud 2003; Wade 2006).

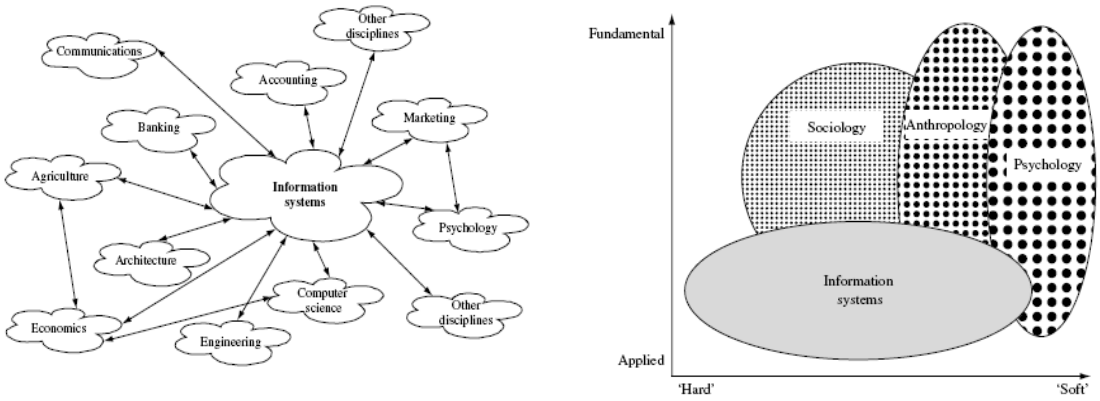

Figure 3.1: IS as a reference discipline in discourse with other reference disciplines (a), and differentiating from other social science disciplines (b) (adapted from (Baskerville 2002) and (Avison 2006)).

To this account, and with respect to the importance of the subject of this thesis, it might be relevant to note that when suggesting ways to heighten the distinctiveness of the IS discipline,

the subject of “IT capabilities” is proposed as a fundamental focus of IS researchers, as it represents one of the 5 components of the IS nomological net (Benbasat and Zmud 2003).

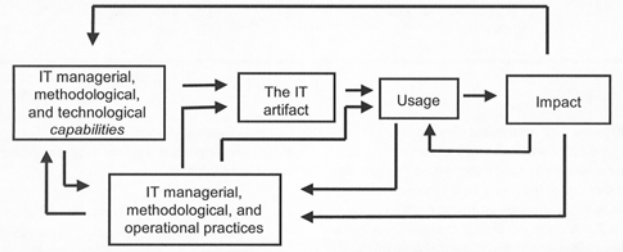

Figure 3.2: the IT artifact and its immediate nomological net (Benbasat and Zmud 2003).

An up-to-date analysis of the IS literature reveals a determined effort of the IS community along the last two decades to qualify and improve the scientific relevance of the IS discipline. Several taxonomies have appeared in the literature (Van Horn 1973; Vogel and Wetherbe 1984; Avison 1991; Galliers 1985; Galliers 1992). After the year 2000, in particular, one may note that the dialogue on epistemology in IS has become especially lively, as confirmed also by the establishment (in 2002) of the AIS Special Interest Group on Philosophy and Epistemology in IS.

3.1.1 A framework for IS epistemology

The nature itself of the subject “Information Systems” makes it inherently infeasible to reach a consensus on which research methodology is applicable within which problem context. Rather, it is possible to recognize a framework that gathers a limited number of works that might not find unanimous agreement within the IS community, but whose relevance is not in doubt. One of these works is Myers’ paper on qualitative research (Myers, Kappelman et al. 1997) and its “live” version published on the ISworld website (Myers 2006). In this article, Myers uses the classification already adopted by Orlikowski and Baroudi (Orlikowski and Baroudi 1991) and Chua (Chua 1986), where the distinction among research methods is discussed starting from the distinction between three categories of philosophical perspectives underlying research (or research paradigms): positivist, interpretivist and critical.

As clearly represented by Niehaves (Becker 2006), each research paradigm is based on a set of (epistemological) assumptions that define the scope of the paradigm and drive the definition of its main task, and allow identifying the research methods that comply with that research paradigm.

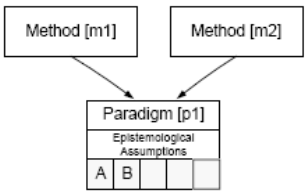

Figure 3.3: A framework for IS epistemology (Becker 2006).

Research paradigms

Positivist research

At the heart of positivism is Popper's (1959) principle of falsifiability: a scientific theory is a theory whose predictions can be empirically falsified, i.e., shown to be wrong. Accordingly, a scientific theory is, at most, extensively corroborated, which makes it accepted until proven otherwise. In reality, measurement is never perfect and is always based on theory. Hence, positivism differentiates between falsification as a principle, where one negating observation is all that is needed to cast out a theory, and its application in the real world through methodology, where it is recognized that observations may themselves be erroneous and hence where more than one observation is usually needed to falsify a theory (Straub 2004).

Positivists generally assume that reality is objectively given and can be described by measurable properties which are independent of the observer (researcher) and his or her instruments. Positivist studies generally attempt to test theory, in an attempt to increase the predictive understanding of phenomena (Straub 2004). A positivist research in IS requires identifying quantifiable measures of variables, testing the hypotheses, and drawing inferences a phenomenon from a representative sample to a stated population (Straub 2004).

Popper's perspective was strongly criticized - among others - by Kuhn (Kuhn 1962), who emphasized the revolutionary, opposed to the evolutionary, character of science, and by Lakatos (Lakatos 1970), who argued that a scientific theory can be falsified only by a new theory provided that it can explain the phenomena explained by the preceding theory and it can broaden its applicability to new phenomena.

Interpretive Research

The philosophical base of interpretive research is hermeneutics and phenomenology (Boland 1985). Its epistemological assumption is that our knowledge of reality is gained only through social constructions such as language, consciousness, shared meanings, documents, tools, and other artifacts (Klein 1999), therefore it attempts to understand phenomena through the

meanings that people assign to them (Boland 1985). Interpretive research does not predefine dependent and independent variables, but focuses on the complexity of human sense making as the situation emerges (Kaplan 1994). The principles for the conduct and evaluation of interpretive research were summarized in an MIS Quarterly paper by Klein and Myers (Klein and Myers 1999). Their meta-principle "of the hermeneutic circle", suggests - when aiming at understanding a "whole complex" - considering the interdependent meaning of parts and the whole that they form. The other six principles (contextualization, interaction between researcher and subject, abstraction and generalization, dialogical reasoning, multiple interpretations, suspicion) should be used by IS scholars to drive their choices in designing and carrying out research, in order to "improve the plausibility and cogency of their accounts" (Klein and Myers 1999, pg 79).

Critical research

The epistemological assumption of critical research is that social reality is historically constituted and that it is produced and reproduced by people. A point of reference in contemporary critical social theory is Jurgen Habermas (member of the Frankfurt School, which included figures such as Adorno, Horkheimer, Lukacs, and Marcuse), who is regarded by many as one of the leading philosophers of the twentieth century.

Critical research seeks to be emancipatory in that it aims to help people consciously act to change their social and economic conditions (Alvesson 1992; Hirschheim and Klein 2003). Nevertheless, critical researchers recognize that the ability of emancipation is constrained by various forms of social, cultural and political domination as well as natural laws and resource limitations (Klein and Myers 1999).

Research "orientation"

The framework reported in Figure 3.3 still needs improvements to represent with completeness the different IS research approaches. As synthesized by Hevner and March (2004), IS research is conducted in two complementary phases that correspond to two different - although inseparable - perspectives:

Behavioral science, that addresses research through the development and justification of theories that explain or predict phenomena related to the identified business need.

Design science, that addresses research through the building and evaluation of artifacts designed to meet the identified business need.

The goal of behavioral science research is truth, or problem understanding. The goal of design science research is utility, or problem solving (Hevner and March 2004).

Noteworthy, (Becker 2006) addresses these two perspectives as paradigms, and represents them accordingly using just the picture in Figure 3.3. However, a more appropriate modeling of the framework should take into the account the pragmatic nature of the contraposition between behavioral and design science. In other words, since the distinction between the two mainly concerns their objective, then they should be seen as different "orientations", different ways of specifying and translating a research paradigm according to a research goal (i.e. at the pragmatic level). Under this assumption a more general representation of the framework for IS epistemology is given in figure 3.4.

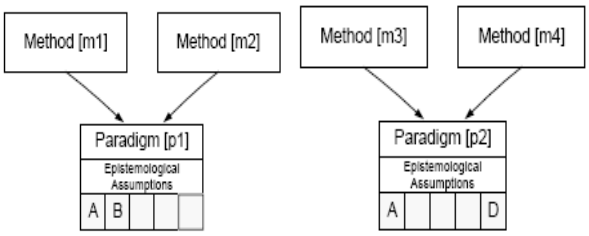

Figure 3.4: A general framework of IS epistemology (adapted from (Becker 2006)).

According to this representation, a research method corresponds to 'the how' a research activity is carried out on a piece of reality, while a research orientation is 'the why' (or to what aim) it is performed, and the research paradigm corresponds to what the reality is considered to be by the researcher.

Research methods

Research methods can be classified according to many different criteria as objective versus subjective, (Burrell and Morgan 1979), as being concerned with the discovery of general laws (nomothetic) versus being concerned with the uniqueness of each particular situation (idiographic), as aimed at prediction and control versus aimed at explanation and understanding, as taking an outsider (etic) versus taking an insider (emic) perspective, and so on. Nonetheless, the most common classification is likely to be the one that distinguishes between qualitative and quantitative methods.

Qualitative research methods

Qualitative research methods were developed in the social sciences to enable researchers to study social and cultural phenomena (Myers 2006). Examples of qualitative methods are action

research, case study research and ethnography. Qualitative data sources include observation and participant observation (fieldwork), interviews and questionnaires, documents and texts, and the researcher's impressions and reactions.

Qualitative research methods are designed to help researchers understand people and the social and cultural contexts within which they live. Kaplan and Maxwell (1994) argue that the goal of understanding a phenomenon from the point of view of the participants and its particular social and institutional context is largely lost when textual data are quantified.

Myers (Myers 2004; Myers 2006) lists 4 types of qualitative research methods as the most widely accepted in IS.

Action research, characterized by the joint collaboration, within a mutually acceptable ethical framework, of the researcher and the subjects directly involved in the object under study (Rapoport 1970). Action research tries at the same time to solve contingent problems of the context under study and to enlarge the theoretical knowledge (Clark 1972; Olesen and Myers 1999; Baskerville and Myers 2004; Lindgren, Henfridsson et al. 2004).

Case study research, that investigates a contemporary phenomenon, within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident (Yin 2002). According to this method the researcher lays the role of an external observer of the phenomenon in its real-life context. This method has a less wide scope than action research: it aims to extend the knowledge on the phenomenon, but provide no indication on how to solve the problems possibly faced by the observed subjects (Benbasat, Goldstein et al. 1987; Dube and Pare 2003; Paré 2004; Straub, Boudreau et al. 2004).

Ethnography, that imposes a complete immersion in the field for a significant amount of time, to interact with the people that the researcher is studying. It aims at placing the phenomena into their social and cultural contexts (Lewis 1985; Myers 1999).

Grounded theory. This method is "an inductive theory discovery methodology, which allows the researcher to develop a theoretical account of the general features of a topic, while simultaneously grounding the account in empirical observations or data". It seeks to develop theory, which is grounded in data, systematically gathered and analyzed, through a continuous interplay between data gathering and analysis (Myers 2006).

Quantitative research methods

Quantitative research methods were originally developed in the natural sciences to study natural phenomena (Myers 2006). Examples of quantitative methods now well accepted in the

social sciences include survey methods, laboratory experiments, formal methods (e.g. econometrics) and numerical methods such as mathematical modeling (Straub 2004).

Straub (Straub 2004) provides a neat characterization of quantitative methods, explicating their univocal relationship with the positivistic paradigm: “in all the quantitative research methods the underlying statistics (mainly T, F, and Chi-square statistics) deal with rejecting the null hypothesis of no effect. (The Chi-Square statistic in LISREL is an exception, although this method too applies the T statistic.) Viewed from a positivist point of view, the objective of statistics employed by the QPR methods is to falsify the null hypothesis, which is the assumption that the data in the dependent variable are not affected by the data in the independent variable or variables. Since each theoretical hypothesis (the hypothesis as stated in the theory) should be the exact opposite of its null hypothesis by predicting a difference in the dependent variable, it follows logically that if the null hypothesis is rejected, then presumably the theoretical hypothesis is supported. The theoretical hypothesis is supported in this case but not proven, because theory in the positivist philosophy cannot be proven, strictly speaking. The essence of the statistics also takes into account the positivist recognition of imperfect measurement; hence, statistics test the probability that the results could have been obtained due to randomness in the data given the nature of the sample. It is based on this probability that the null hypothesis is rejected and by implication that the theoretical hypothesis is supported”.

Straub, Gefen and Boundreau (Straub, Gefen et al. 2005; Straub, Gefen et al. 2006) reviewed the 8 quantitative research methods most frequently used in the IS community:

Field experiment. This method consists in the experimental manipulation of one or more variables within a naturally occurring system and the measurement of the impact of this manipulation on one or more dependent variables (Boudreau, Gefen et al. 2001).

Laboratory experiment. This method takes place in an artificial setting, especially created by the researcher for the investigation of the phenomenon. The researcher has expressly control over the independent variables and the random assignment of the research participants to the various treatment and non-treatment conditions (Boudreau, Gefen et al. 2001; Jarvenpaa 1988).

Free simulation experiment. This method implies that the researcher designs a closed setting to closely reproduce a natural context and measures the response of the subjects as they interact within the designed system. These interactions are partially stimulated by the researcher, while the rest are free initiatives of the studied subjects (Fromkin and Streufert 1976; Jenkins 1985).

Experimental simulation. This method uses a closed simulation model to reproduce a natural context, where the studied subjects are exposed to this simulation model and their responses are recorded. These responses are caused by events completely controlled by the researcher, who can determine the nature and the timing of these experimental events (Jenkins 1985)

Adaptive experiment. This method involves the collection of measures at the beginning of the experiment and after the introduction of the independent variables. It does not require the random selection of the sample of the experiment, and the complete definition of the model at the beginning (Jenkins 1985).

Field study. This method uses non-experimental inquiries to study what occurs in the natural systems. Field study does not allow the researchers to manipulate the independent variables or to control the influence of confounding variables (Klein and Myers 1999; Boudreau, Gefen et al. 2001).

Opinion research. This method implies asking the studied subjects to express their attitudes, opinions, impressions and beliefs via questionnaires, interviews or other opinion gathering instruments. The gathered data are used to test a priori hypotheses or to generate new hypotheses (Jenkins 1985).

Archival research. This method concerns the examination of any recorded data, mainly historical documents. The recorded data is examined a posteriori by the researcher to find causes and consequences of the events (Jenkins 1985).

Mixed methods research and Triangulation

To enhance construct validity it is suggested to mix or integrate different research strategies (qualitative and/or quantitative) in order to obtain a methodological **triangulation** and enhance the confidence in the outcomes of the study (Kaplan and Duchon 1988; Mingers 2001). An early empirical example of the use of triangulation in the IS field is shown in a study by Markus (Markus 1994) on electronic mail.

Research paradigms and research methods

According to a typical misunderstanding, interpretive research is confused with qualitative research, as well as positivist with quantitative research. However, as the figure below clearly points out, qualitative research can be done with a positivist, interpretive, or critical stance.

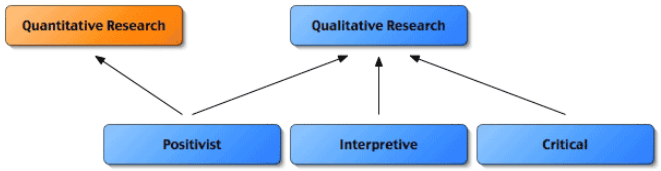

Figure 3.5: Research paradigms and their relationships with qualitative and quantitative research (Straub 2004).

For example, case study research can be positivist (Yin 1994), interpretive (Walsham 1993), or critical, just as action research can be positivist (Clark 1972), interpretive (Elden 1993) or critical (Carr 1986). Table 5.1 reports a comprehensive list of IS research methods (referred to as "methodologies") used in top-ranked IS journals (Palvia 2006).

While the relationships between methods and paradigms appear unambiguous, it is difficult to find in the IS literature dedicated to epistemology a schema as much as clear with regards to the relationship between methods and pragmatic orientations of the research. To this aim, a work that could be useful is the taxonomy of IS research models carried out by Palvia (Palvia 2006) in an article published by Communication of AIS, that represents the most updated step of a line of studies in the IS field that have been attempting to classify the different approaches to research models and methods in the IS literature.

N.	Methodology	Definition
1	Speculation/commentary	Research that derives from thinly supported arguments or opinions with little or no empirical evidence.
2	Frameworks and Conceptual Model	Research that intends to develop a framework or a conceptual model.
3	Library Research	Research that is based mainly on the review of existing literature.
4	Literature Analysis	Research that critiques, analyzes, and extends existing literature and attempts to build new groundwork, e.g., it includes meta analysis.
5	Case Study	Study of a single phenomenon (e.g., an application, a technology, a decision) in an organization over a logical time frame.
6	Survey	Research that uses predefined and structured questionnaires to capture data from individuals. Normally, the questionnaires are mailed (fax and electronic means are also used).
7	Field Study	Study of single or multiple and related processes / phenomena in single or multiple organizations.
8	Field Experiment	Research in organizational setting that manipulates and controls the various experimental variables and subjects.
9	Laboratory Experiment	Research in a simulated laboratory environment that manipulates and controls the various experimental variables and subjects.
10	Mathematical Analysis	An analytical (e.g., formulaic or optimization model) or a descriptive model (e.g., simulation) is developed for the phenomenon under study.
11	Qualitative Research	Qualitative research methods are designed to help understand people and the social and cultural contexts within which they live. These methods include ethnography, action research, case research, interpretive studies, and examination of documents and texts.
12	Interview	Research in which information is obtained by asking respondents questions directly. The questions may be loosely defined, and the responses may be open-ended.
13	Secondary Data	A study that utilizes existing organizational and business data, e.g., financial and accounting reports, archival data, published statistics, etc.
14	Content Analysis	A method of analysis in which text (notes) are systematically examined by identifying and grouping themes and coding, classifying and developing categories.

Table 3.1: IS research methods used in top-ranked journals (Palvia 2006).

Palvia proposes a taxonomy based on a preliminary distinction between Descriptive (D) and Prescriptive (P) research models, the first being "bare minimum models which describe the research question and list the various dependent and independent variables without specifying the relationships among these variables", the latter being "more complex, sometimes visual, representations which along with identifying dependent and independent variables, focus on the understanding of the explicit and implicit relationships among these variables". He subsequently proceeds to identify and classify - accordingly - 11 different research models.

N.	Name of the model	Desc.	Presc.	Description of the model
0	No Model			
1	Listing of Variables	x		Only the variables relevant to the research question are listed. This representation is descriptive in nature and can be in tabular or non-tabular format.
2	Listing of Variables & Levels	x		The various levels of the variables are also included. This representation also falls under the descriptive type of model as it does not focus on the relationships among variables.
3	Listing of Variables & Implicit Relationships	x	x	Along with specifying the variables, the relationships among (some of) these variables may be indicated implicitly. Thus, the model is both descriptive and prescriptive in nature.
4	Simple Influence Diagram		x	This model clearly delineates the dependent and independent variables and the relationships among them, usually in the form of a diagram. The simple influence diagram has two levels of variables: level 1 being the independent variables and level 2 the dependent variable(s). Each level can have more than one variable. Simple influence diagram is prescriptive in nature.
5	Multi-Tier Influence Diagram		x	It is an extension of simple influence diagram involving multiple levels. Level 1 consists of independent variables; the last level has the final dependent variables and other levels contain intermediate variables.
6	Temporal Influence Diagram		x	It shows time related relationships between various variables. In other words, events are ordered by time and certain events cannot occur until the preceding events have materialized.
7	Simple Grid	x	x	It is an easy, yet powerful, way of examining the effects of two independent variables. It makes comparisons between alternatives with multiple characteristics. While each variable may have many levels, in its simplest and most common form, each variable has only two levels giving rise to the 2x2 grid.
8	Complex Grid	x	x	It is an extension of the simple grid. When a simple grid is extended to three or more variables, it becomes a complex grid. Each variable may have several levels.
9	Venn Diagram	x	x	Adapted from the field of mathematics, offer a graphical representation of not only the objects/variables of interest, but also the interaction among them. Each object or group of objects is typically represented by a circle, with interactions between the groups shown by the overlap or intersection of the corresponding circles.
10	Mathematical Model		x	It uses mathematical functions or equations, contrary to a pictorial view in most models, to explain the relationships among various variables.
11	Combination	x	x	It is a combination of two or more of the research models discussed above. Typically, such models are fairly complex and may represent a large research agenda rather than a specific project.

Table 3.2: Taxonomy of research models (adapted from (Palvia 2006)).

Although at a first sight the distinction between descriptive and prescriptive models recalls the one between behavioral science and design science, it is evident that the items listed in the table above as "research models" actually refer to alternative representations of a research model.

However, a clarification of the role of the two orientations with respect to paradigms and methods goes far beyond the aims of this thesis. The next section will focus on proposing the methods that will be likely used to perform the research activities in this study, and will refer to Palvia's (Palvia 2006) classification of IS research methods (Table 3.1).

3.2 Research Methodology

The research questions are reported here for greater convenience:

RQ1 (overall RQ): what is the influence of IT capability on the relationship between IT expenditures and Business performance in SMEs?

> **RQ1.1**: Can a comprehensive definition of IT capabilities be developed and validated in the context of SMEs?
>
> **RQ1.2**: what are the relevant variables that allow measuring IT capability in SMEs and how can they be applied?
>
> **RQ1.3**: what are the variables allowing measurement of business performance in SMEs according to the aim of highlighting the role of IT capability as enabler?

RQ2: can a model be developed to assist SMEs to grow and fully exploit IT capability to achieve effective business performance?

In order to specify the methodological characteristics of this study, we will follow the suggestion reported in Straub's (2005): the first step a researcher should take to define the methodology is deciding the type of research to be conducted. With respect to the degree of innovation, a study can be classified as:

- **confirmatory** research, that seeks to test (confirm) a pre- specified relationship, or
- **exploratory** research, which define possible relationships in only the most general form and then allow multivariate techniques to estimate a relationship(s). In this case the researcher is not looking to "confirm" any relationships specified prior to the analysis, but instead allows the method and the data to define the nature of the relationships (Hair 1995).

Coherently with the discussion in chapter 1, the purpose of this thesis is not to re-invent the concept of IS success or IT effectiveness, we would rather "stand on the shoulders of giants", and exploit the amount of studies on IT capability and IT competence. With respect to the general model, the one represented in Figure 1.1 and transcribed in RQ1, the thesis will consist in a confirmatory research, since this model is somehow a corner stone in the Strategic

Information Systems literature and therefore can be considered a point of reference that does not need to be re-written.

On the other hand, the mainly theoretical nature of the previous research on this subject requires an exploratory study to operationalize the constructs of the research model (RQ1.2).

With regards to the IS epistemology framework, the study will be based on the positivist paradigm, essentially due to the competence developed by the candidate and in order to possibly compare the research results with the previous, mainly positivistic, research on this subject.

With respect to the research orientation, RQ1-RQ1.1-RQ1.2-RQ1.3, whose nature are inherently descriptive, fall under the behavioral science orientation, while RQ2 is characterized by a problem solving approach and as such implies a research activity with a design science orientation.

As to the research method, we plan to make use of different methods during the study that will evolve in five subsequent phases, detailed at the end of the present chapter.

3.2.1 Methodology

The epistemological foundation, from which the empirical research is informed, is the positivism. The guidelines of Straub (Straub, Boudreau et al. 2004) Igalens and Roussel (Igalens and Roussel 1998) and Evrard, Pras et al. (Évrard, Pras et al. 2003) are followed to promote the quality of the results.

This research combines complementary qualitative and quantitative research methods to provide a richer contextual basis for interpreting and validating results (Dennis 2001; Igalens and Roussel 1998; Wood, Daly et al. 1999).

The multi-method approach, which combines qualitative and quantitative research methods, has been particularly supported as potential provider of richer context for interpreting and validating results (Jick 1979; Wynekoop 1985; Kaplan and Duchon 1988; Wood, Daly et al. 1999).

Multiple methods should (Benbasat, Goldstein et al. 1987; Brewer and Hunter 1989; Igalens and Roussel 1998; Wood, Daly et al. 1999; Évrard, Pras et al. 2003):

- compensate the weaknesses inherent in each single individual method,
- provide more precise development of the hypotheses, investigation of these hypotheses, understanding of the results and more robust conclusions,
- favor the reliability and generalizability of the results.

Multi-method research can assume different perspectives (Bryman 1992). The one followed in this study is the evolutionary perspective. The evolutionary perspective is particularly useful when little research has been conducted so far on a particular phenomenon, or where research hypotheses require increased focus (Wood, Daly et al. 1999). This is just the case of this PhD study, where despite the amount of research carried out, scholars have not developed a general agreement even on the main concept of the investigation i.e. IT capability.

Given this overall architecture of the methodology, the first phase of the study, concerning the development of the construct, will be structured in two subsequent stages:

1. the development of a preliminary draft measure of IT capability and the application of this preliminary measure in a pilot study on a limited set of SMEs

2. the development of the final measure of IT capability, that will be tested in phase 2 through a survey on a larger set of SMEs.

The next subsections illustrate the reasons that support these methodological decisions.

Research method selection

Wood (Wood, Daly et al. 1999), proposed a set of criteria to support researchers in the task of identify the most appropriate method to conduct a study. These criteria can be summarized as follows:

- Internal validity: the extent to which some causal conclusions can be made from the study.
- External validity: the extent to which the results may be generalized to the population and to other contexts.
- Ease of replication: the ease with which the study can be repeated under the same conditions.
- Potential for theory generation: the potential to generate new theories.
- Potential for theory confirmation: the potential to test a theory and to provide supported findings.
- Cost per subject: the relative cost of the study.

With respect to the first stage in the **first phase** of the current study (i.e. the design and application of the preliminary measure of IT capability), two criteria mainly drove the choice of a case study research: the cost per subject and the potential for theory generation. In fact:

- the large amount of time that should have been invested in the detailed review of the literature, imposed to the author to limit the effort for the preliminary identification of a draft measure of IT capability. This constraint regarding the time available led to discharge action research, ethnography and grounded theory, methodologies that require a long time frame for completion (Myers 2006).
- in terms of potential for theory generation, case study research has been largely recognized as a method that could enlarge theoretical knowledge and generate new theories (Myers 2006).

Similarly, based on Wood's criteria, the method for the **second phase** of the study (i.e. the empirical test) is opinion research. In this case the criteria driving the decision was not the cost per subject, since opinions, although through a very structured questionnaire, were collected by means of direct interviews carried out on site and lasted - on average - one hour. However, this method appeared effective with respect to the other criteria: using appropriate statistical approaches it allows to achieve internal and external validity, it supports a good degree of ease of replication, since the method is highly formalized; finally, the data collected through an opinion research can be used, again through appropriate data analysis, to explore relationships among constructs not previously empirically tested, and eventually contribute to theory generation. These characteristics of the method are strongly coherent with the objective of the study, and - specifically - its explorative nature (as descride above in this chapter).

The integration of case study and opinion research has been performed (Blanchet and Gotman 1992; Gable 1994) and this assures the complementarities of research methods that is required to triangulate results.

Qualitative phase

The qualitative method is adopted to explore the factors characterizing IT capability, the possible measures of business performance and study the relationship that link IT investment to business performance.

The discussion in Chapters 1 and 2 supports the following four preliminary propositions:

P1: the level of IT investment has an influence on the performance of a business.

P2: the concept of IT resource can be described through a set of variables that range from technological infrastructures to psychological traits of the information system.

P3: the concept of IT capability is related to the concept of IT resource, but this relationship needs to be clarified, and the extent of their semantic overlap should be made explicit.

P4: the IT resources of a company have an influence on the performance of a business.

These propositions are explored by means of the qualitative method in order to reach a preliminary understanding of the measures of and relationships among the constructs listed above.

Case unit

The unit of analysis identifies what constitutes the "case" (Yin 1994 pages 21-24) and must be consistent with the research questions in order to generate adequate solutions (Darke, Shanks et al. 1998).

To answer the research questions mentioned above, the unit of analysis is the organization, with its IT capability and its IT investments. Organizations will be studied through the analysis of their IT capabilities, the assessment of the IT investments and the performance that the organization has been able to achieve.

Data collection and storage

The case unit is analyzed through the collection of primary and secondary data. Primary data sources are interviews, direct observation, and informal discussions. Secondary data sources are mainly a set of documents of the organization that are produced by the organizational information system.

A preliminary gathering of background information about the case precedes the collection of primary data (Darke, Shanks et al. 1998). The main source of information is the Internet web site of the organization. Supplementary, some internal secondary data is provided by the organizational referee.

After this preliminary step, the names and the positions of all the potential participants are obtained, in collaboration with the internal referee. The potential participants are contacted for an interview (Darke, Shanks et al. 1998).

The interviews are semi-structured interviews (Kerlinger 1964; Emory 1980). Due to cost-efficiency reasons, one person for each of the selected organization was interviewed.

The interview guide lists the main themes and sub-themes to discuss in the interview and is defined beforehand to find out the view of the different individuals. The complexity and the semantic ambiguity of the topic suggests to develop the guide at a high level of detail eventually including redundancies to enable clarify the interviewer point of view.

At the beginning of each interview an introduction on the reasons and the objects of the interview is performed (Blanchet and Gotman 1992 pag 75; Miles and Huberman 1994). This explanation is expected to reduce the researcher effects at the site, which biases the data collection (Darke et al. 1998; Miles and Huberman 1994).

The interview guide is designed to learn the characteristics of the interviewee and what is her/his view. In fact the interview guide includes a first draft measure of IT capability and a list of questions about the other two main constructs under investigation (IT investments and business performance).

The quantitative data are collected directly on a copy of the interview guide by the interviewer, while the qualitative data produced by the interview are synthesized in a report, immediately after each interview.

These reports, the quantitative data collected on the direct observation and the collected secondary data are archived in a repository.

Data analysis

The set of data produced by each interview is analysed in parallel with the prosecution of the other interviews in order to use the content of the previous interviews as source of questions to ask in the next interviews (Miles and Huberman 1994). This continuous refinement influences the depth of the interviews on specific aspects.

For the data analysis, the author assumes that interview data gives access to facts about the world (Silverman 1993 pages 90-91). The author processes the content to explain the characteristics of the information system, the IT resources that supposedly contribute to generate a SCA for the organization and the opinion of the interviewee about the effects that the IT investments have on the business performance.

Case selection

The combination of qualitative and quantitative methods should allow the triangulation of the data, which should cross-validate the achieved results, in case these results, coming from different sources, converge and are congruent (Kaplan and Duchon 1988; Myers 2004; Straub, Gefen et al. 2004). The different sources are related to the different studies of cases, as a mean to overcome the limitations of a single case study, reported by Lee (Lee 1989).

The empirical research, i.e. the qualitative and the quantitative phases, is applied in different contexts following the specification for a multiple-case study proposed by Yin (Yin 2002 page 54). The choice of a multiple case study aims at exploring the research questions in contrasting situations (Yin 2002 page 54). The author researches the theoretical replication, in contrasting situations, to strengthen the external validity of the findings (Yin 2002 page 54). If the findings, from different cases, support the hypotheses, then the external validity of these findings will be stronger than the external validity obtainable from a single case study.

It is generally suggested that one should select cases with contrasting characteristics (instead of seeking a direct replication in similar cases), because the external validity will be stronger than the external validity obtained from a multiple case study of similar cases (Mason 1996 pages 93-94; Yin 2002 page 54). However, the author is interested in the context of the aggregation of companies, and specifically in industrial districts, therefore the case study selection takes place within one of these contexts, specifically the textile industrial district of the Province of Varese and Alto-Milanese, in an area in Northern Italy, north to Milan.

The selection of the cases applies the theoretical replication principles (Eisenhardt 1989; Yin 2002 page 54), which means that the same methodology is replicated to find similarities and differences among the values of the independent and the dependent variables, and to find relationships between the cases.

So, the choice of the cases is accomplished looking for specific cases (Eisenhardt 1989; Silverman 2002 page 159), with respect to the theoretical framework, i.e. its main constructs: IT investments, IT capabilities, business performance.

In particular, given the exploratory nature of the investigation regarding IT capability (a construct that will be defined only later, during this PhD study) the search for particular cases on this second construct is performed looking for organizations characterized, more generally, by different IT resources.

The principle of theoretical replication implies that cases with different characteristics in these three elements are selected. On the other hand, this selection must take into account the limited resources available that limits the total number of cases and the difficulties in identifying organizations that wish to participate to this study.

For all the cases, data are analysed, firstly, by keeping separate the single cases, and, secondly, by comparing the cases (Eisenhardt 1989).

This sampling method gives the freedom to change the number of cases, in the multiple case studies, during the process of the research (Eisenhardt 1989; Silverman 2002 page 159). Therefore, the process of selecting interviewing transcribing the information collected from each case continued until the state of theoretical saturation is reached; where it was possible to comprehensively explain the findings of the case studies and no additional data can be collected, developed or added to improve the developed model (Eisenhardt 1989).

Quantitative phase

The quantitative method is adopted to:

a) explore the validity of the construct of IT capability built on the reuslts of the qualitative study and on the following literature review;

b) confirm the results coming from the qualitative exploratory method regarding the relationship between IT capability and business performance.

The empirical research model is corroborated through the test of the hypotheses rising from the qualitative phase and the conceptual model developed through a detailed literature review.

Constructs and Hypotheses

The main construct under analysis, by means of an exploratory approach, is represented by IT capability, described by Piccoli (2005) as “organizational resources difficult to be imitated” and thus that can be used at the core of a strategic initiative to build a barrier to erosion. The author assumes as a reference for the development of a measure of IT capability the threefold categorization of the construct, proposed by Piccoli (2005), that includes:

- Technical skills: the ability to design and develop effective information systems.
- IT Management Skills the ability to provide leadership for the IS function, manage IT projects, evaluate technology options

- Relationship Asset the mutual respect and trusting rapport established over time between the IS function and the business that enables IS specialists and users to work together more effectively.

A confirmatory approach is used to investigate a research model, where two hypotheses are tested:

H1: the amount of IT investments in a company positively influences the business performance

H2: the IT capability of an organization has a moderating effect on the relationship between IT investments and business performance.

Case unit

In the quantitative study the unit of analysis remains the same of the qualitative phase, while the level of analysis changes.

The single organization remains the unit of analysis, in accordance with the above-mentioned research questions, and the principles on the definition of the unit of analysis defined by Yin (Yin 1994 pages 21- 24) and Darke (Darke, Shanks et al. 1998).

In the quantitative study, and limitedly to the development of the IT capability construct, the level of analysis is represented by the IT staff of an organization, coherently to the specific aims of this part of the research.

Data collection and storage

At this phase, the required data is too specific to have the possibility to find appropriate secondary data sources. Exclusively primary data is collected and the instrument employed to collect it is a questionnaire (an example is reported in the appendices).

The questionnaire is composed of four parts:

1. company demographics;

2. existing measures regarding IT investments and IT staff related characteristics that the author evaluates as the most suitable to the research model;

3. the measure of IT capability, developed as a result of both the qualitative study and the detailed literature review;

4. existing measures regarding business performance that the author evaluates as the most suitable to the research model.

For each construct the existing scales are identified and then adjusted to the research object and to the context.

Questionnaire administration

The questionnaire was developed in English to preserve the consistency with the literature review that had originated it, then translated in Italian in order to allow its administration in a context of non-English speaking interviewees.

The questionnaire was preliminarily administrated in a set of six pilot companies, in order to get suggestion on adjustments to the terminology, and improve its fit to the organizational context of the study, i.e. textile and mechanical small-medium sized manufacturers.

These changes were implemented both in the Italian and the English version of the questionnaire. A database was developed in order to electronically record all the data collected.

The response to the questionnaire was promoted through phone calls to companies in a mailing list compiled by the author joining mailing lists of the CETIC research center at LIUC, of the Association of Textile companies (Tessili Vari, www.tessilivari.it) and of the mechanical firms belonging to the Association of Industrials of the Provinces of

- Varese (UNIVA. http://www.univa.va.it/anag.nsf/web_attivita_v3),
- Como (http://www.unindustria.co.it/associazione/elencoassociati.xml),
- Novara (http://www.ain.novara.it/).

The targeted individuals were either the entrepreneur, or the CIO (or the corresponding role in charge of decisions on IT investments in the company) or a top-level manager of the company. As a follow up to the positive calls the questionnaire was emailed to the targeted individuals, in order to prepare them about the contents of the interview.

The quantitative data are transcribed directly onto a copy of the paper questionnaire by the interviewer, and then stored in an electronic database..

Data analysis

Data are analyzed through Partial Least Square statistical technique but a preliminary analysis on the quality of data is performed before testing the structural model.

The data analysis is performed following the validation guidelines written by Straub, Bourdeau, and Gefen (Straub, Boudreau et al. 2004). These guidelines propose to assure:

- the content validity;
- the construct validity;
- the reliability;
- the manipulation validity;
- the statistical conclusion validity.

The statistical data analysis is supported by packaged software and SPSS was selected, after that, several packages were reviewed, directly and indirectly (Gefen et al. 2000; Straub et al. 2005; Straub et al. 2006). This software tool is chosen due to the extension of the statistical methods it features and due to the previous experience of the author on its use.

3.2.2 Research phases

The next chapters illustrate how the described methodology has been applied, and what research results were achieved. For the sake of clarity, it seems useful to structure the dissertation following the research process that progressively led to convergence of relevant outcomes. This process can be articulated in three main phases, detailed in the next sections.

Phase 1: Research modeling (Chapter 4)

In this phase we will preliminarily investigate the definition of IT capability and its relationship with business performance. On the basis of the work already carried out in the IS field we will perform a review of the literature to identify what specific variables fall under the broad label of "IT capability" (RQ1.2, in other words: what does it mean for a SME to be a competent user of IT) and to understand how the achievements in terms of IT capability influence the performance of a company (RQ1.3).

Phase 2: Case study (Chapter 5)

In this phase a first definition of IT capability and a preliminary understanding of its influence on corporate results will be achieved. The review of the literature presented in chapter 4 will lead to develop a semi-structured questionnaire, that will be the research tool to carry out multiple case studies on a limited number of SMEs belonging to the textile and mechanical industrial districts. This phase of the research will require semi-structured interviews with SME executives or key players within SMEs aggregations. The choice of the target organizations will take into account the need to collect information according to the threefold structure of the system under investigation (intra- organizational, organizational and inter-organizational levels, although the investigation will focus on the mid level, the others will be taken into account only

in terms of characterization respectively of the internal and external environment). The results of this empirical qualitative investigation will lead to the development of a first representation of IT capability and its role in the business.

Phase 3: Construct development (Chapter 6)

In this phase we will create survey items to measure the IT capability construct starting with a review of the literature. A detailed review of the scientific literature both in the IS and the adjacent research fields (those highlighted in Figure 3.1) will be carried out and discussed in depth to develop a measurement instrument for IT Capability.

Phase 4: Empirical test (Chapter 7)

In this fourth phase of the research we will validate the measurement instrument (RQ1.1) and measure the moderating effect of IT capability on the relationship between IT spending and firm performance (RQ1). We will use a survey on a sample of SMEs belonging to two different industrial aggregations. During this phase we will perform data analysis using statistical tools such as PLS or LISREL.

Phase 5: Development of a managerial tool (Chapter 8)

In this last phase we will develop a managerial tool (RQ2) following Henver's (2004, page 83) research guidelines for building a viable design artifact according to the design science orientation. In its simplest form, this artifact may consist of a check list of the guidelines an SME should follow in order to increase the awareness about, grow and exploit its IT capability.

3.3 Conclusions

This third chapter discussed the research methodologies used in the IS field in order to design the research process of this study. A review of the taxonomies presented in recent IS papers enabled the development of a comprehensive framework within which to position the methodological approach used in this research. The choice of a multi-method approach, although requiring a valuable effort, is almost imposed by the nature itself of the topic under investigation, whose relevance clashes with the unsatisfactory attempts of formalizing even a definition and a measure.

The qualitative and quantitative empirical analysis will be presented in the next chapters, following the same structure of the research process where the measure of IT capability is built by means of a progressive refinement through literature review, multiple case study analysis and a survey.

4 Chapter Four: Research modeling (defining the concepts of IT capability and business performance)

This chapter presents the first phase of the research, as defined in the previous section: the construct development that leads to building the research instruments for the empirical research of the study.

The objective of this chapter is to discuss and evaluate a set of studies and research results from the academic literature dealing with the concept that is the subject of this thesis, rather than just referring to the term "capability". In fact, this term has been subject to a number of different interpretations in different academic works, so that it is difficult to compare the several studies in the IS literature dedicated to it. The chapter draws an updated picture of the evolution of the semantics of "capability" and of IT capability, by reviewing the most relevant published research and review papers. A preliminary analysis highlighted the need to broaden the literature review to include those studies whose claimed focus is "IT competence". Several papers, belonging to the field of Organizational Science, use this expression to address concepts and theories that largely overlap the line of research originated by Barney's 1991 article. Papers from both the streams of research are discussed and a selection of the papers is used to limit the semantic borderline of “IT capability” in terms of its characteristics and its determinants.

The second reference concept of the study is represented by business performance, the dependent variable within the research model. The complexity of this concept does not lie in the ambiguity of the term, rather in the broadness of its use, that has led to a variety of indicators meant to measure it. The chapter presents a review of the IS research that deals at a general level with the impact of IT on the organization, and then restricts the target to those studies that discuss the influence of IT on business performance, with specific attention to the papers belonging to the stream of IT capability.

The outcome of this chapter is a pre-requisite to develop the research instrument for the qualitative study described in Chapter 5.

4.1 Preliminary literature review on the concept of IT capability

4.1.1 What is a "resource": only a question of terminology?

As anticipated in chapter one, in contrast with the maturity of the RBV, the meaning of its key term - resource - is far from being obvious or unanimous. To date, and starting from Barney's

foundational paper, the semantic of this term has been affected by changes and has been entwined with the evolution of other concepts, also originally suggested by Barney, such as assets, capabilities, skills and processes.

All these terms, in fact, were present in 1991 Barney's definition of resource: “firm resources include all assets, capabilities, organizational processes, firm attributes, information, knowledge, etc. controlled by a firm that enable the firm to conceive of and implement strategies that improve its efficiency and effectiveness (Daft 1983)” (Barney 1991, page 101). In the language of traditional strategic analysis, firm resources are strengths that firms can use to conceive of and implement their strategies (Learned 1969; Porter 1981).

The term “resource” is inherently ambiguous. In general, there are a number of different linguistic domains where the term “resource” is used, but even within the specific environment represented by the Management Science field no agreed interpretation of this term is recognizable. Therefore, it would be simply not feasible to operationalize the concept of “resource” with the aim of measuring resources' attributes if we don’t remove this ambiguity *in the first place*.

It is therefore rather surprising that even 10 years after his foundational paper, when editing the special issue of the Journal of Management retrospective on the RBV, Barney himself appeared not much concerned about the precision of the definition of resource. In the opening paper of this issue, resources are defined as bundles of tangible and intangible assets including a firm's management skills, organizational skills and routines, information and knowledge it controls (Barney 2001a, page 625). In another paper within the same issue, where Barney attempts to position RBV within classical managerial theories (Barney 2001b), resources and capabilities are very often mentioned as two sides of the same coin “resources and capabilities (what neo-classical microeconomists call factors of production) are elastic in supply..” (page 644), “some resources and capabilities can only be developed over long periods of time” (page 645).

4.1.2 The controversial issue of the concept of "capability"

This is the state of the research in Management Science. Within IS, and more precisely within Strategic Information Systems research, it is reasonable to assume as the point of reference on this subject a small group of papers published in MIS Quarterly. Nevertheless, even highly ranked publications within a range of few years provides contradictory definitions and - at best - leave unsolved the issue of ambiguity of the concept of "capability".

To show this, in the following section we compare and discuss one of the most recent review papers about IT capability published on MISQ (Wade and Hulland 2004) with the article that the same paper references as the basic source to define *asset* and *resource*. Then, we compare and discuss two research papers of the same author, apparently based on the same data set, that show contradictory definitions of resource and capability.

Resource vs asset

Within IS, and more precisely within Strategic Information Systems research, the point of reference on IT capability cannot be other than the two MISQ review papers mentioned in Chapter 1. The most recent one, Piccoli and Ives (2005), simply takes the decision to adopt the definition provided by Wade and Hulland (2004). The latter dedicate a section of their paper to discuss the evolution - along two decades and within the IS research - of the schemes to categorize resources.

With respect to Barney, Wade and Hulland appear more concerned with the multiple different categorizations developed by IS researchers using RBV. Nonetheless, it is at least difficult to understand the logic that brought them to this definition of resources starting from the references that they themselves mention. They refer to Sanchez and Mahoney (1996) and Christensen (2000), and define resources "as assets and capabilities that are available and useful in detecting and responding to market threats and opportunities" (Wade and Hulland 2004). Comparing their and Christensen's definition appears a useful exercise. According to Wade and Hulland:

Resources are defined as **assets** plus **capabilities**, where:

- **Assets** are "anything tangible or intangible a firm can use in its process to for creating producing and/or offering its products to a market" (this is the Christensen's definition of ***resource***);
    - assets can be input or output of processes;
    - assets can be divided in **tangible** (e.g. IS hardware, network infrastructure) and **intangible** (e.g. software patents, strong vendor relationships).
- **Capabilities** are "repeatable patterns of actions in the use of assets to create, produce, and/or offer products to a market" (this is the Christensen's definition of ***process***);
    - "capabilities transform inputs into outputs of greater worth";
    - "**capabilities** can include **skills** (e.g. technical or managerial ability) or **processes** (e.g. systems development or integration)".

(one may note that the factor named "**values**" in Christensen's 2000 article does not appear at all in Wade's framework).

Following Wade and Hulland's set of definitions listed above, only intangible assets and capabilities facilitate a Sustainable Competitive Advantage. Hence, the distinction between assets and capabilities is not particularly relevant to a discussion of RBV. Instead, what matters most should be the difference between:

- tangible assets;
- all the other types of resources: intangible assets plus capabilities; or - more precisely: intangible assets plus processes plus skills.

Resource vs capability

A similar comparison may help shed light on the controversial relationship between the concepts of resource and capability. The analysis of two studies from the same author Bharadwaj's 1999 paper presented at ICIS and the 2000 research paper in MISQ (Bharadwaj 2000) appears highly relevant.

In the 1999 paper, Bharadwaj focuses on IT capability building this construct as a set of 30 IT capabilities organized into 6 categories identified through a Delphi study. During the subsequent phase of the research "respondents were presented with the list of 30 items (see Table 4.1) and were asked to rate their firm's performance on each item, relative to other firms in their industry, using a five-point Likert scale ranging from "exceptionally well" to "poorer than most." In other words, the study measures the "relative quality level" reached by a firm in each of the 30 IT capabilities.

IT business partnerships	
IBP1	Multi-disciplinary teams to blend business and technology expertise
IBP2	Relationship between line management and IT service providers
IBP3	Line management sponsorship of IT initiatives
IBP4	Climate that encouraging risk taking and experimentation with IT
IBP5	Climate nurturing IT project championship
IBP6	IT-related educational initiatives for management
External IT linkages	
EIT1	Technology-based links with customers
EIT2	Technology-based links with suppliers
EIT3	We use IT-based entrepreneurial collaborations with external partners
EIT4	Leveraging of external IT resources (IT vendors and IT service providers)
Business IT strategic thinking	
BIT1	Clarity of vision regarding how IT contributes to business value
BIT2	Integration of business strategic planning and IT planning
BIT3	Management's ability to understand value of IT investments
BIT4	Funding for scanning and pilot-testing "next generation" IT
BIT5	Technology transfer mechanisms
IT business process integration	
BPI1	Consistency of IT application portfolios with business processes
BPI2	Restructuring of Business work processes to leverage opportunities
BPI3	Restructuring of IT work processes to leverage opportunities
IT management	
ITMI	Effectiveness of IT Planning
ITM2	IT project management Practices
ITM3	Planning for security control, standards compliance, and disaster recovery
ITM4	Systems Development Practices
ITM5	Consistency of IT Policies throughout the enterprise
ITM6	IT evaluation and Control Systems
ITM7	Adequacy of the skill base
IT infrastructure	
INF1	Appropriateness of the data architectures
INF2	Appropriateness of network architectures
INF3	Adequacy of architectural flexibility
INF4	Efficiency and reliability of IT operations
INF5	Processing capacities

'Items IBP6, EIT4, BIT4, and BIT5 were eventually dropped from the respective dimensions.

Table 4.1: Initial Structure of IT Capabilities' (Bharadwaj 1999)

A rather different approach is the one chosen by the same author in the study published one year later in MISQ, where considerable effort is made to position the research within the Strategic Management literature, and essentially refers to Grant's work (Grant 1991; Grant 1995):

“Although proponents of the resource-based view generally tend to define resources broadly, to include assets, knowledge, capabilities, and organizational processes, Grant (Grant 1991) distinguishes between resources and capabilities, where **resources** can be subdivided into:

- tangible resources, that include the financial capital and the physical assets of the firm such as plant, equipment, and stocks of raw materials.
- intangible resources, that encompass assets such as reputation, brand image, and product quality, while
- personnel-based resources, that include technical know-how and other knowledge assets including dimensions such as organizational culture, employee training, loyalty, etc.

Capabilities refer to an organization's ability to assemble, integrate, and deploy valued resources, usually, in combination or copresence (Amit 1993; Schendel 1994; Russo 1997).

While resources serve as the basic units of analyses, firms create competitive advantage by assembling resources that work together to create organizational capabilities. Capabilities subsume the notion of organizational competencies (Prahalad and Hamel 1990) and “are rooted in processes and business routines” (Bharadwaj 2000, page 171).

Extending the traditional notion of organizational capabilities to a firm's IT function, a firm's IT capability is defined here as the firm's ability to mobilize and deploy IT-based resources in combination or copresent with other resources and capabilities. Adopting Grant's (1995) classification scheme for resources, key IT-based resources are classified as follows:

- IT infrastructure: the tangible resource comprising the physical IT infrastructure components,
- Human IT resources comprising the technical and managerial IT skills, and
- intangible IT-enabled resources such as knowledge assets, customer orientation, and synergy.

As a consequence, "IT can be identified as an organizational capability created by the interaction of IT infrastructure, human IT resources, and IT-enabled intangible resources" (Bharadwaj 2000, page 172, partially rephrased).

Examining the definitions provided above, leads one at least to question how blurred the boundaries are that separate the ability to mobilize and deploy IT based resources (IT capability) by Human IT resources (that include skills), and also by intangible IT enabled resources. In other words, is it worth distinguishing between the concept of capability and the concept of resource as they are distinguished here?

Bharadwaj (Bharadwaj 2000) claims that it is not the resources that generate SCA but the ability to mobilize them. But, instead of measuring this ability (which is the aim of the paper, in order to study its impact on business performance) the author uses a proxy (indeed very questionable: firms' ranking in Information week), contrary to what was done in her previous study.

It is not the aim of this study to discuss terminology issues per se, nor to discuss how innovative is the topic of IT capabilities when defined in this way. Therefore - pragmatically - we choose to refer to the latest recognized perspective on the application of the RBV in IS research, the one presented by Piccoli in the MISQ review paper (Piccoli and Ives 2005).

In fact, before Piccoli's 2005 MISQ review, Bharadwaj's framework and definitions of key concepts appeared the most comprehensive and precise, to the point that a number of studies in the following years have made explicit reference to these definitions.

King (King and Marks 2002) provided a rather superficial definition of IT capability and did not clarify the constituting elements. Peppard (Peppard 2004) referred to Bharadway's definition, but then failed to identify the aspects in a firm that make it possible to develop such capabilities inside the firm.

More recently, Wade used Bharadway's definition together with Day's framework concerning firm's capabilities: inside out, outside in, and spanning capabilities (Day 1994). On this basis Wade et al. categorizes the IS resources identified in previous IS studies and - for each of them - assesses the values of the main attributes related to advantage creation and advantage sustainability (Wade and Hulland 2004).

According to their view, capability is developed thanks to procedures, enacted by the organization, aimed at creating produce and offering its product or service to market. Inside-out capabilities are generated by internal processes to respond to the market needs, examples are cost control and technology development activities. Outside-in capabilities are externally oriented and are originated by activities aiming at creating solid relationships with the customers, at anticipating the market needs and customers moves. Spanning capabilities derive from the process aiming at link the above mentioned activities, e.g., the relationship between the information system planning and management and the company's activities. Wade et al. argue that, since the capability originates from the specific resources of each single organization, then it is difficult to imitate by competitors: this assumption allows then to use the term "sustainable competitive advantage" to describe the effect of IT capabilities.

	Advantage Creation			**Advantage Sustainability**		
	Value	**Rarity**	**Appropriability**	**Imitability**	**Substitutability**	**Mobility**
Outside-In						
External relationship management	H	M - H	L - M	L	L - M	L
Market responsiveness	H	M - H	L - M	L	L - M	L
Spanning						
IS-business partnerships	H	M - H	L - M	L	L - M	L
IS management/ planning	H	M - H	L - M	L - M	L - M	M
Inside-Out						
IS infrastructure	M - H	L - M	H	H	L - M	H
IS technical skills	M - H	L - M	M	M	M - H	M - H
IS development	M - H	M	M	M	M - H	M

Cost efficient IS operations	M - H	L - M	M	L - M	M - H	M

Note: L = low; M = medium, H = high

Table 4.2: IS resource by attribute (Wade and Hulland 2004)

As noted above, this review helps in structuring the numerous previous contributions on the topic, but does not help to solve the dispute on the definition of IT capabilities for at least two reasons. The terms resource and capability are used as synonyms. Even more critical is the way Wade uses Day's framework, which classifies capabilities, in order to classify "resources" (page 112). Since capabilities are a subset of resources, the classification based on the subset likely excludes elements of the larger set of the resources.

4.2 Towards a definition of IT capability

The definition of IT capability in the current study is rooted in the critique of a large part of the literature about RBV and represents an attempt to merge two perspectives respectively belonging to two different disciplines and referred to by two different terms: IT capabilities and IT competence. The next paragraphs present these two perspectives and finally build the definition of IT capability that will be used in the rest of the thesis.

4.2.1 IT capabilities

The missing clarity in Wade's paper is somehow resolved by Piccoli's review. Although based on the definitions of resources, capabilities and assets given in Wade 2004, Piccoli provides a more consistent taxonomy of IS research on RBV.

Piccoli presents a framework to understand sustainable competitive advantage based on the concept related to IT-dependent strategies initiatives, defined as "strategic moves that rely heavily on IT (i.e., they cannot feasibly be enacted without investments in IT) and are intended to create added value" (Piccoli and Ives 2005). IT-dependent strategic initiatives do not simply entail building a system that provides superior returns until it is successfully replicated. Rather, they consist of the configuration of an activity system, enabled by IT, designed to create and appropriate value. Examples of such initiatives include business process reengineering, customer relationship management, electronic business and infrastructure initiatives.

A second core concept in Piccoli's framework is represented by barriers to erosion: IT investments can help sustain competitive advantage by enabling erecting barriers to imitation that prevent competitors from replicating strategic initiatives and finally erode and eventually cancel the competitive advantage gained by the company. Attempts of imitation by competitors

usually require efforts that take time (a response lag) to show their effects in terms of erosion of competitive advantage. Therefore, barriers to imitation should be designed to increase such response lag.

Piccoli identified four barriers to imitation (see table 4.3): IT Resources Barrier, Complementary Resources Barrier, IT Project Barrier, and Preemption Barrier. These four barriers contribute independently to the sustainability of competitive advantage by creating response lag and making it difficult, costly, or impossible for competitors to replicate the IT-dependent strategic initiative pioneered by the firm.

Barrier to Erosion	**Response Lag Drivers**
1. IT Resources Barrier	IT Assets • IT infrastructure* • Information repositories* IT Capabilities • Technical skills† • IT management skills† • Relationship asset *
2. Complementary Resources Barrier	Complementary Resources*†
3. IT project barrier	Technology Characteristics • Visibility • Uniqueness • Complexity Implementation Process • Complexity • Process change
4. Preemption Barrier	Switching Costs • Tangible co-specialized investments* • Intangible co-specialized investments* • Collective switching costs* Value System Structural Characteristics • Relationship exclusivity • Concentrated links

*Response-lag drivers subject to asset stock accumulation processes
†Response-lag drivers subject to organizational learning processes

Table 4.3: Barriers to erosion and relative response lag drivers (Piccoli and Ives 2005)

To meet the aims of this research, we are interested in the first type of barrier to erosion, defined as IT resource barriers. According to this framework, a firm carrying out an IT-dependent strategic initiative could leverage some (internal) preexisting IT resources to make imitation by competitors who don't possess such resources more difficult and expensive. The presence of these resources represents therefore a barrier that delays the effect of competitors' attacks to the firm's competitive advantage.

Piccoli identifies two categories of factors that can drive this response lag: IT assets and IT capabilities.

IT assets are defined by enumeration. They include:

- hardware components and platforms (e.g., a private satellite network);
- software applications and environments (e.g., a proprietary revenue management system using custom developed models);
- data repositories (e.g., a database of historical customer behavior);

this list is then reclassified and two principal IT assets are identified: IT infrastructure and Information Repositories.

IT capabilities are derived from the skills and abilities of the firm's workforce. They include Technical skills, IT management skills and Relationship assets.

- **Technical skills** refer to the ability to design and develop effective information systems. As such, they include proficiency in system analysis and design, infrastructure design, programming, and so on (McKenney 1995; Ross, Beath et al. 1996). As these skills are subject to organizational learning dynamics (Fichman 2000) and knowledge barriers (Attewell 1992), they are difficult to imitate, thus can be used at the core of a strategic initiative to build a barrier to erosion.

- **IT Management Skills** refer to the ability to provide leadership for the IS function, manage IT projects, evaluate technology options (Mata 1995), manage change (McKenney 1995), and envision creative and feasible technical solutions to business problems (Ross, Beath et al. 1996; Feeny and Willcocks 1998). Managerial IT skills influence response lag in two different ways: by reducing time and costs of IT development (Bharadwaj 2000) and by enabling envisioning and producing enhancements to existing IT-dependent strategic initiatives.

- **Relationship Asset** refers to a mutual respect and trusting rapport established over time between the IS function and the business (Ross, Beath et al. 1996) that enables IS specialists and users to work together more effectively. The systematic cooperation and coordination of IT specialists and their business clients on one hand allows executives to share the risk and accept the responsibility for IT projects, and on the other hand enables IS specialists to understand and eventually anticipate business needs (Ross, Beath et al. 1996; Feeny and Willcocks 1998). As the business and the technology partners develop mutual understanding and tighter relationships, the firm’s ability to enhance existing IT- dependent strategic initiatives, as well as deploy new ones, increases (Chan 2002).

In summary, these capabilities directly influence the response lag associated with IT-dependent strategic initiatives because they facilitate the technology's design and development. They also

play a fundamental role in enabling effective and timely implementation, maintenance, and utilization of the technology.

IT Resources	**Barrier**	**IT Assets**		**IT Capabilities**		
Citation	Methodology	Infra-structure	Information repositories	Technical skills	IT management skills	Relationship assets
(Attwell 1992)	Theoretical			x		
(Barton and Peters 1992)	Case study (s)	X			x	
(Bharadwaj 2000)	Archival	X		x	x	
(Broadbent and Weill 1997)	Theoretical	X		x	x	
(Broadbent et al. 1999a)	Case study (m)	X		x	x	
(Broadbent et al. 1999b)	Case study (m)	X		x	x	
(Clemons 1986)	Theoretical	X		x	x	
(Clemons and Row 1991 a)	Case study (s)	X	x			
(Copeland and McKenney 1988)	Case study (m)	X		x	x	
(Dehning and Stratopoulos 2003)	Archival	X		x	x	
(Duliba et al. 2001)	Archival				x	
(Duncan 1995)	Survey	X	x	x		
(Feeny 2001)	Theoretical	X				
(Feeny and Ives 1990)	Theoretical	X	x			
(Feeny and Willcocks 1998)	Theoretical	X		x		x
(Garud and Nayyar 1994)	Theoretical		x			
(Glazer 1991)	Theoretical		x			
(Henderson and Venkatraman 1993)	Theoretical	X		x	x	
(Jarvenpaa and Leidner 1998)	Case study (s)	X		x	x	
(Johnston and Carrico 1988)	Case study (m)					x
(Kettinger and Grover 1995)	Archival	X		x	x	
(Kettinger et al. 1994)	Archival	X	x			
(King et al. 1989)	Survey	X	x			
(Kotha 1995)	Case study (m)	X		x	x	
(Lindsey et al. 1990)	Case study (s)			x	x	
(Mata et al. 1995)	Theoretical	X		x	x	
(McFarlan 1981)	Theoretical			x	x	
(Monteiro and Macdonald 1996)	Theoretical	X	x		x	
(Pemberton et al. 2001)	Survey		x			
(Porter and Millar 1985)	Theoretical	X				
(Robertson and Gatignon 1986)	Theoretical			x		
(Ross and Beath 2002)	Survey	X	x	x	x	
(Ross et al. 1996)	Theoretical	X		x	x	x
(Santhanam and Hartono 2003)	Archival			x	x	
(Sambamurthy et al. 2003)	Theoretical	X	x	x	x	x
(Wade 2001)	Survey	X	x	x	x	x
(Weill et al. 2002)	Theoretical	X	x	x	x	
(Wiseman and MacMillan 1984)	Theoretical		x	x		
(Wixom and Watson 2001)	Survey	X		x		

We use the label “Case study (s)” to identify a single site case study and the label “Case study (m)” to identify a multisite case.

Table 4.4: IT resource barriers, review of the literature (Piccoli and Ives 2005).

By comparing Piccoli's framework with the one proposed by Wade it is possible to highlight some correspondences.

These overlaps are certainly inevitable, considering the common roots of the two papers. Nonetheless, the matching of the two approaches brings to evidence how, under the concept of lag drivers to erosion of IT Resource Barriers, Piccoli has been able to build a taxonomy that,

while maintaining compliancy with Wade's definitions, has the merit of eliminating the ambiguities between the key concepts of resource, asset, capability and skill.

		Piccoli and Ives, 2005		
Wade and Hulland, 2004		**IT capabilities**		
IS Resources type	**Resource**	**Technical skills**	**IT management skills**	**Relationship assets**
Outside- In	Manage external relationships		o*	oo
	Market responsiveness			
Spanning	IS-business partnerships (manage internal relationships)			ooo
	IS planning and change management		ooo	
Inside- Out	IS infrastructure			
	IS technical skills	ooo		
	IS development		ooo	
	Cost effective IS operations		ooo	

* "o" stands for scarce overlap between concepts from the two frameworks, "ooo" stands for high correspondence)

Table 4.5: Matching Wade's with Piccoli's frameworks

The research presented in this thesis takes this review as a starting point to carry out an updated literature review on the most recent works in the IS literature that make use of the term IT capability.

4.2.2 IT competence

Beyond "capability": the need to study "IT competence"

A simple analysis of the last statement of the previous section suggests that focusing the research on the term IT capability as defined by prior studies could turn out to be a major limitation of this PhD thesis.

In fact, definitions of IT capability available in IS literature not only differ in their degree of detail and meaning, authors often use a different name to refer to a similar key concept.

Croteau and Bergeron (2001) used the concept of ***technological deployment*** to describe the way firms plan and manage IT in order to benefit from it. Although this definition appears similar to the Bharadwaj's definition of IT capability, it is relevant to note that Croteau was interested in understanding how the IT department can support the firm, and studied the organization as a whole, with IT as a resource of the firm, potentially influencing its performance. In this paper Croteau presented a typology of the components of the technological deployment: this list includes both elements previously proposed by Bharadwaj (such as the technological and the organizational infrastructures), and other elements that represent resources/capabilities not

described by Bharadwaj, e.g. the strategic use of IT solutions, the role of the IT department, the administrative infrastructure.

Tippins and Sohi (2003) used the term ***competence*** defined as the skills owned by the company on IT and the effective use of technologies in managing information. They argue that since such competencies are specific for each firm, they are difficult to replicate by competitors, and thus can represent a source of sustainable competitive advantage. This concept is indeed very similar to Bharadwaj's IT capability, but Tippins and Sohi did not provide a description of the factors contributing to this "competence".

The term “competence” can be found also in Sambamurthy *et al*. (Sambamurthy, Bharadwaj et al. 2003). However, this paper refers to competence as a component, not an equivalent of IT capability. Among the factors constituting this competence, the authors identified the hardware infrastructure and the human resources that use such infrastructure (both were addressed as resources in Bharadwaj's framework) and the relationship between the IS department and the business (also identified by Wade as a factor to measure IT capability).

Another synthetic representation of the linkages between the concepts examined in this section is provided by Caldeira and Ward (2003). In their discussion of the empirical findings on 12 manufacturing SMEs, they adopt a classification introduced by McGrath (1995) and further developed by Lambert (1998), where such concepts are mapped into a three-layered domain-based framework (Figure 4.1) that allows distinguishing between **skills** (abilities at the individual level), which - by means of the processes - can be combined into **competences** (abilities at the organizational level). Processes - in turn – imply resources allocation that leads to convert sets of competences into **capabilities** (abilities at the business level).

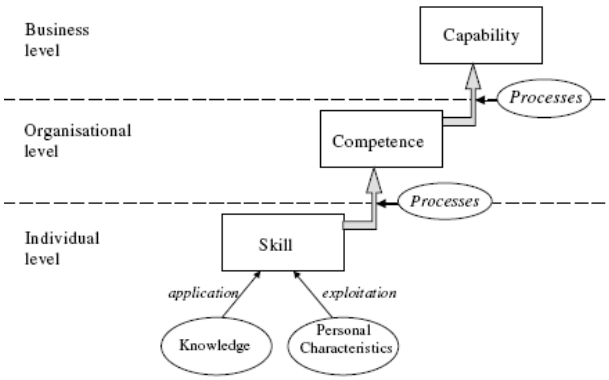

Figure 4.1: Relationships between capabilities, competences skills and knowledge (Caldeira and Ward 2003).

Finally, with regards to the term (and the concept of) competence, the same Wade and Hulland (2004) recognized the need for a clarification. Referring to Sanchez and Mahoney (1996), they consider the terms *capabilities*, *competencies*, and *core competencies* as essentially synonymous because "the only difference between these terms lies in the fact that core competencies are capabilities that achieve competitive advantage. Because we explicitly discuss only capabilities that lead to superior performance, in this paper the terms can be considered interchangeable." (Wade and Hulland 2004).

If we assume that this recognition is valid, then it is necessary to extend beyond the Strategic Information Systems the area of search of the literature review, in order to consider previous studies addressing the term or the concept of IT competence. The following sections present a preliminary review of the literature on this subject.

IT competence and CIO's competencies

The concept of competencies is generally attributed to the work of Klemp (1980) and the following improvements by Boyatzis (1982) and Spencer and Spencer (1993). According to their perspectives, competencies are defined as core characteristics of an individual that lead one to achieve a superior performance in a task or in a situation. This concept is properly applicable only to roles at the managerial level, where individual achievements can be easily linked to business performance.

This definition very closely matches the definition of capability provided by Wade, and when applied to the role of the Chief Information Officer (CIO), a manager often appointed to a top-executive position, at least partially overlaps with the concepts discussed previously in this chapter. Therefore, a preliminary review of the literature on IT competence can be focused on the subject of the competencies possessed by the CIO.

The CIO role appears to be definitely involved in the change in progress, and his/her competencies are continuously under discussion. The ever-changing technology (especially the Internet-based one) does not allow IT professionals to remain inactive. To stay on top of trends and to identify opportunities to use information and technology to radically change and create new markets and re- invent products, CIOs have to be proactive in mastering new programs, attending professional training, and updating their skill set.

In order to identify the most complete set of competencies able to effectively represent the current CIO profile we can use a classical taxonomy still very popular among researchers to represent the basis of any competence analysis model (Boyatzis 1982; Carretta 1993; Spencer

and Spencer 1993; Camuffo 2002). This framework defines the concept of competencies through three main "dimensions":

- **Know – how:** knowledge of the practices and solutions (the technical knowledge and skills required to do something);
- **Know – what:** knowledge of the work, tasks, methods, own role, the context, the company;
- **Know - "how to be":** mental, physics and basic sense attitudes, value system, factors linked to personal identity

A literature analysis has been carried out both in the field of IS research and in the field of socio- organizational research. A number of skills and competencies have been identified and results have been categorized according to the threefold schema, in 12 classes.

Know how to be

- **Interpersonal skills**: the ability to establish and maintain effective relationships and communication inside the company (with any staff member, regardless of organizational level) and towards possible external consultants (Lee, Trauth et al. 1995; Bidgoli 1997; DeLisi, Danielson et al. 1998; Feeny and Willcocks 1998).
- **Holistic vision**: the ability to see the organization as a whole (instead of the sum of the parts) all pursuing the same aims, instead of a set of separate functions (Heene and Sanchez 1997; DeLisi, Danielson et al. 1998; McCartney 1999).
- **Long term vision:** the ability to evaluate the consequences of long- term decisions and the strategic opportunities given by innovative technologies (Brown and Weitzel 1988; Bradley, Hausman et al. 1993; Earl 1993; Feeny and Willcocks 1998).
- **Effective leadership:** the ability to define the goals to be fulfilled and to make the whole company pursue the same aim. It also implies the ability to engender trust and commitment among top managers, peers and subordinates (Synnott 1987; Applegate and Elam 1992; Feeny, Edwards et al. 1992; King and McAulay 1997; Feeny and Willcocks 1998; DeLisi, Danielson et al. 1998; McCartney 1999).
- **Propensity to innovation**: the inclination to keep oneself up to date in order to interpret the significance of innovative IT to the business (Feeny, Edwards et al. 1992).

Know what

- **Managerial Knowledge**: Knowledge of managerial models and tools (i.e. business Critical Success Factors analysis, portfolio matrixes, Economic Value Added, …) (Feeny, Edwards et al. 1992; Benbasat, Dexter et al. 1980; DeLisi, Danielson et al. 1998; Feeny and Willcocks 1998; Hochstrasser 1990; Hochstrasser and Griffiths 1991; Lillrank, Leethovaara et al. 1995; McCartney 1999; Wiseman 1985).
- **Internal Business knowledge**: knowledge and/or experience of business processes: information flows, staff competencies, business activities (Benbasat, Dexter et al. 1980; DeLisi, Danielson et al. 1998; Earl and Feeny 1994; Feeny, Edwards et al. 1992; Lee, Trauth et al. 1995).
- **External Business knowledge**: knowledge of competitive environment (DeLisi, Danielson et al. 1998).
- **Technical Knowledge**: theoretical knowledge of IT opportunities and functionalities (Synnott 1987; Earl and Feeny 1994; King and McAulay 1997; Lee, Trauth et al. 1995; DeLisi, Danielson et al. 1998).

Know how

- **Technical Expertise**: practical expertise of IT use and application (Benbasat, Dexter et al. 1980; Synnott 1987; Earl and Feeny 1994; Feeny, Edwards et al. 1992; Lee, Trauth et al. 1995; King and McAulay 1997; Feeny and Willcocks 1998).
- **Planning capabilities**: the ability to plan the IS development in order to support the pursuit of main business objectives (Synnott 1987; Blanton and Watson 1992; Feeny, Edwards et al. 1992; King and McAulay 1997).
- **Organizational impacts assessment capability**: the ability to estimate the IT organizational and economic impacts on company processes, functions and organizational roles (Benbasat, Dexter et al. 1980; Wiseman 1985; Synnott 1987; Hochstrasser 1990; Hochstrasser and Griffiths 1991; Applegate and Elam 1992; Lillrank, Leethovaara et al. 1995; DeLisi, Danielson et al. 1998; Feeny and Willcocks 1998; McCartney 1999).

It is worth underlining that *interpersonal skills***,** *holistic vision***,** *long-term vision* and *effective leadership* have been positioned under the "to know how to be" group. In fact, these are aspects of human beings strictly linked to the personal identity and environmental factors and have a pervasive influence on the other competencies.

Finally, the difference between *knowledge* and *expertise* has to be noted. The term *knowledge* identifies the sum or range of what has been perceived, discovered, or learned while the term *expertise* identifies the skills derived from practice by virtue of possessing specific knowledge.

It is worth noting that the literature review focused on publications up to 2003. Papers published more recently, e.g. in MIS Quarterly (Bassellier 2004; Levina 2005), need to be analyzed and classified according to the threefold framework presented above. Also for this reason, the literature review on IT competence presented in this chapter is only the starting point of a work aiming at updating a definition of IT capabilities.

4.2.3 The definition of IT capability

The objective of this initial phase of the literature review was to highlight differences in the use of the term IT capability in some of the most recent relevant research papers, in order to identify areas of agreement and convergence among these studies and draw a first framework for the analysis of this topic.

In fact, this review allowed the building of a definition of IT capability and the identification of the practical dimensions which will form the basis for measurement.

After the analysis of the different perspectives of the research in the field of IT capability, it is now possible to draw a first definition of IT capability integrating the various approaches**: IT capability is the capacity, diffused within the whole organization, to plan, use and manage the resources based on IT - complementarily and jointly with the other resources and capacities of the organization - in order to achieve a specific organizational objective and obtain a competitive and sustainable advantage over competitors.**

IT per se, easy both to purchase on the market and to be replicated by competitors, does not guarantee an organization to achieve a SCA. However, through the Resource Based View, i.e. studying the complementarities between IT resources and other resources and capabilities of the organization, one may be able to estimate the contribution to competitive advantage that IT can supply.

The following sections take into account the results of the previous research to develop a first set of constructs to investigate the research model (Figure 4.2).

First we analyse the IT related resources that can enable a company to develop its IT capability, following Bharadwaj's (2000) taxonomy that distinguishes between tangible, intangible and

human IT resources. Secondly, in the subsequent paragraphs we synthesize some commonly agreed models used to explain and describe the influence exerted by IT on the business performance, and present a review of the IS literature dealing with the measurement of such influence using both qualitative and quantitative approaches.

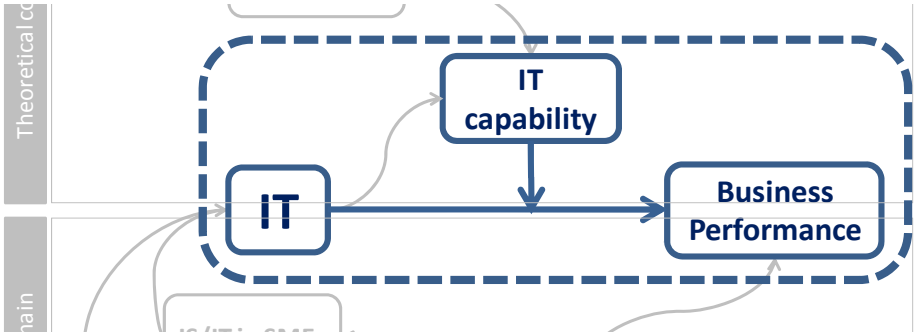

Figure 4.2: The research model of this study.

These two dimensions will be formalized in Chapter 5 in terms of the semi-structured questionnaire used in the first step of the empirical research.

4.3 Towards a measure of IT capability: the determinants of IT capability

This preliminary stage of the literature review preludes the first step of the empirical research, i.e. the multiple case study. In this first step of the empirical research, we aim at limiting the spectrum of meanings (and not at developing an actual measure of) IT capability and we aim at fulfilling the achievement of an integrated definition.

To such aim, we assumed that the taxonomy suggested by Bharadway (2000) (complemented by the constructs proposed by a limited number of scholars) - although not exempt from criticism - is loose enough to allow a non-biased exploration of what SMEs mean with the term IT capability

Bharadway (2000) analyses the sustainable competitive advantage by discussing what organizational resources can be affected by IT in the long term. The structure of her research model will be punctually portrayed and applied in the case study stage of the empirical research, presented in Chapter 5.

4.3.1 Tangible resources: the IT infrastructure

The IT infrastructure (represented by the hardware and software components, the networks and data processing architecture) is an essential support for any business. The elements of the IT

infrastructure should be integrated and compatible, and coherent with the requirements of the activities of the organization. Given the dynamics of the environment in which any business operates, this means also that the IT infrastructure should be flexible, to provide timely response to organizational changes.

Although the components are easily available on the market, the process of building an IT infrastructure with these three characteristics is time consuming and complex, and requires specific abilities. It is such abilities that represent a distinctive trait of the organization that cannot be easily appropriated by competitors nor quickly developed. In other words, the IT infrastructure is not an IT capability, but is a resource on which a company may build its IT capability (Bharadwaj, 2000; Croteau et al., 2001; Dehning et al., 2003; King 2002; Melville et al., 2004; Peppard et al., 2004; Sambamurthy et al., 2003; Tippins et al., 2003; Wade et al., 2004; Zhu, 2004).

4.3.2 Human resources

The human resources consist not merely of the individuals belonging to an organization, but more precisely are represented by their competences and the relationships among them, whose development can be driven by means of training activities.

When referring to the issue of IT capability, one should classify the competences in two categories: technical and managerial competences. Technical competences (often referred to as technical skills) include programming skills, systems analysis and design, development and use of specific applications, knowledge of features of the emerging technologies. Managerial competences relate to the managers' know-how and experience, and to the involvement in IT issues of managerial roles. They include the managerial abilities of organizational roles in charge of the IT department, the coordination and integration among the IT users, the management of IT projects and the ability to understand the IT future needs of the organization. Within SMEs, and more specifically the small companies, where the entrepreneur is often also the CIO, the managerial competences are likely to play a critical role. The entrepreneur influences the relationship between the organization and IT in both directions.

Another relevant characteristic of human resources is employees' resistance to change created through IT innovations. Adaptable employees support the organizational flexibility, which is one of the (typically claimed) strengths of SMEs.

Third, training activities are essential to keep human resources up to date on technological innovations and new strategies and policies to manage and use IT. A higher competence in IT

and its potential, leads also to a higher confidence in its use, which in turns drives employees to have more favorable reactions towards IT innovations.

Human resources exploit and achieve the potential value embedded in IT. If we project this potential in the long term considering the RBV, human resources, meaning as "individuals", are - to a certain extent - easily accessible on the job market. What is difficult to find and import into an organization or to imitate is the specific competences, often developed along time and strongly embedded within a specific organizational context. As a consequence they represent a fundamental resource for IT capability (Bharadwaj, 2000; Capaldo et al., 2003; Croteau et al., 2001; Dehning et al., 2003; Heckman, 2003; King, 2002; Melville et al., 2004; Peppard et al., 2004; Sambamurthy et al., 2003 ; Tippins et al., 2003 ; Wade et al., 2004).

4.3.3 Intangible resources: customer orientation, human capital and synergies

Intangible resources are inherently specific for each company and strictly linked to its evolution and culture, and as such they are intrinsically difficult to imitate by competitors. According to Bharadwaj (2000), the key intangible resources of an organization are the customer orientation, the intellectual capital and the synergies: IT plays a critical role for them all.

By means of IT organizations can collect and process information on clients and their expressed or tacit requirements, and develop tailored promotional campaigns and products that promote customer loyalty. The lasting relationships that a company can build through an effective CRM clearly have an impact on their competitive position and the possibility to maintain this over time. While CRM software systems (CRMS) can nowadays be labeled as off-the-shelf products, it is not obvious or inexpensive to integrate CRMS with the other components of the software system of an organization, and to manage effectively the information they process. Again, IT does not provide an advantage alone, but in concert with the other resources of the organization (Bharadwaj 2000; Zahay et al. 2004).

The intellectual capital, the set of information and knowledge owned by an organization, is the second main intangible resource, it is embedded in the experiences and the competences of the employees and can be developed through the processes of information acquisition, management and use, which take place in any organization (Bharadwaj, 2000). Tippins et al. (2003) use the concept of organizational learning to define this process that they subdivide into four phases: information acquisition, information distribution, shared interpretation and organizational memory.

The third intangible resource is represented by the synergies within an organization. Shared knowledge and information improve the organizational flexibility and its response time to changes in the environment (and, more specifically, in the competitive arena) where it operates. In a time of very dynamic markets and highly complex and distributed structures, IT is key in making synergies feasible. On the other hand, the nature of the synergies, based on the composition of the unique characteristics of the organization, makes it very difficult to imitate and represent another possible resource for a sustainable competitive advantage (Bharadwaj, 2000).

4.3.4 The IT strategic impact

In a description of the concept of IT capability the same Bharadwaj (1998) and, later, Wade et al. (2004) added to the three factors discussed in the previous paragraphs another element, the influence of IT at the strategic level. Similarly, Croteau et al. (2001) refers to the strategic use of IT as one of the variables enabling the technological deployment (a concept that closely resembles the concept of IT capability), which in turn, allows the organization to gain a competitive advantage. Other authors refer to the concept of IT strategic alignment, the reciprocal adaptation between the organizational strategy and the strategic use of IT (Cragg, 2002; Duhan et al. 2001).

4.3.5 IT investments

The last determinant of IT capability within this framework is represented by the IT investments. One may argue whether this determinant should be embedded in the previous one, since it is a major factor that enables one to achieve the potential strategic impact of IT. However, according to Bharadwaj (2000) the ability of a company to leverage the IT investments to obtain intangible benefits represents one of the specific resources on which the IT capability is built. Similarly, Sambamurthy et al. (2003) identifies the IT investment level as a contributor of the IT competence that leads to IT capability.

4.4 Understanding the impact of IT on the organization

Most of the IS literature agrees that IT has the potential to change, at the intra-organizational level, business processes and eventually the value that is created through them at the inter-organizational level, IT can influence the structure of an industry by changing the equilibrium between the strengths and threats operating in its competitive environment (McFarlan, 1984; Parsons, 1983; Porter et al., 1985). After having provided a reference definition of IT capability

and having examined the factors that enable its development within an organization, the following paragraphs present a review of the organizational impacts of IT.

4.4.1 The IT impact on business processes: the value chain model

The classical view of Porter's value chain assumes that IT can exert a relevant impact on business processes in terms of contribution to the value creation, which is the basic component of any study dealing with SCA. A lot of research has already showed that the effects of the use of IT are evident and measurable when focusing on the single operative processes (Barua et al., 1995; King, 2002; Melville et al., 2004; Peppard et al., 2004; Porter et al., 1985; Spanos et al., 2002; Wade et al., 2004; Zhu et al., 2002). A better performance of these processes improves, in turn, the overall results of the organization. To assess IT impacts it is therefore advisable to analyse the processes and the technologies that support them.

This representation (see Figure 4.3), and the underlying process-based view (opposed to a functional view) on which the representation is based, appears particularly suitable to the analysis of SMEs, whose organizational structure and roles are often not formalized and where employees carry out inter-functional tasks.

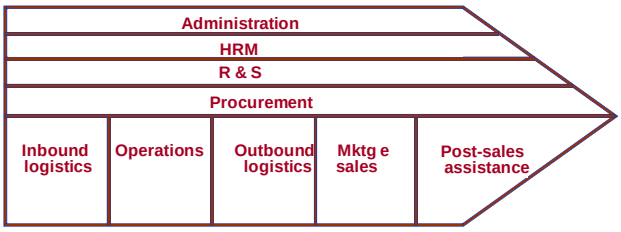

Figure 4.3: Porter's value chain (Porter 1985).

The explanatory power of Porter's view lies in the fact that IT can pervade the entire value chain: to carry out each activity a certain amount of data needs to be managed, i.e. collected, processed and transferred, thus generating information flows. So, to evaluate the impact of IT one should assess: a) how IT makes the management of these data more efficient and effective and b) how information flows supported by IT favors communication and collaboration among organizational units and across geographical distances.

The next step of this rationale consists in understanding the relationship between the IT support for the value chain and the achievement of a competitive advantage. Again, classical models may be of help to draw the general picture: IT can have an influence both on a cost-leadership strategy and on a strategy of differentiation (McFarlan, 1984; Parsons, 1983; Porter et al., 1985).

IT can decrease the costs of any process of the value chain, by means of an increase of efficiency in data management and communication, and a subsequent increase in the flexibility of the processes (Porter et al., 1985). IT can also enable economies of scale and transaction economies. Economies of scale are possible, for instance, when IT is used to overcome the limits of the local market and expand into larger ones, a higher production volume may bring the company to increase the degree of saturation of its plants and thus decrease the unitary product costs (Parsons, 1983). On the other hand, each time a company performs a transaction it has to bear costs due to the need to collect information about the parties involved in the transaction and due to the need to verify that the exchange takes place according to the (agreed) deal. Transaction economies derive from the reduction of these costs, related to the use and the control of the market: IT can help lower these costs by enabling the development of loyal relationships among the commercial partners and the proceduralization of routine transactions (Williamson 1985, Kumar et al. 1998). Whatever the origin of an IT-enabled decrease of costs, a cost leadership strategy can be fulfilled by offering the product/service at lower prices than the competitors and gaining a competitive advantage over them.

As to the second aspect, the strategy of differentiation, there are innumerable examples of the contribution of IT to the innovation of products (incremental and/or radical innovation), meant to address client needs that the competitors' products are not meeting. Within this line of thought we can position several concepts that along time have become popular in the marketing literature (and more generally in the managerial literature), such as mass-customization (Pine 1992, Kaplan et al. 2006) and long tail (Brynjolfsson et al. 2006). Once a company has been able to generate in the client a perception of a different value (an added value) of its offering, then it can transfer part at least of this value into a premium price, that the clients are assumed to be willing to pay (McFarlan, 1984; Parsons, 1983; Porter et al., 1985).

4.4.2 IT influence on performance: transparency and agility

A better communication among the organizational units and beyond the organizational boundaries (e.g. with clients or suppliers) makes an organization particularly flexible and places it in a better competitive position. Street et al. (2004) use the term transparency to describe the result of this intra- and inter- organizational information flow, which is an essential component of the business processes. IT has an evident role in the support of this immaterial component, but it has also a relevant influence on the activities of physical transformation and handling of products: the automation of manual leads to faster, more reliable and precise processes.

Another relevant impact of IT on the organization is pointed out by Sambamurthy et al. (2003): the agility, i.e. the ability of the organization to find new business opportunities by assembling - on time and in innovative ways - its resources, knowledge and relationships. Agile organizations have a superior capacity to forecast and anticipate the changes in the environment where they operate and a lower response time to such changes. Agility refers to the ability to create new operative processes or redesign the existing ones in order to follow the requirements of the market. Agility also refers to the relationship with clients, that can be used to continuously screen the evolution and the opportunities of the market. Finally, agility lies also in the relationships with business partners that can enable the company to build a network of strategic and dynamic alliances. IT can effectively influence each of these aspects when discussing the impact on the Value Chain.

To summarize, it appears that IT can exert a significant and profound influence at the organizational level, leading to changes in the organizational structure, business processes and the environment. It is therefore mandatory that top executives and entrepreneurs achieve an understanding of the opportunities and exploit the innovative potential of IT investments as well as of the risks of failure deriving from an inadequate use of IT.

Author	Impact of IT on the company
Barua *et al*., 1995; King, 2002; Melville *et al*., 2004; Peppard *et al*., 2004; Porter *et al*., 1985; Ravarini *et al*., 2002; Spanos *et al*., 2002; Tagliavini *et al*., 2003; Wade *et al*., 2004; Zhu *et al*., 2002.	The effects of the use of IT solutions for the company are visible and measurable particularly at the level of the single processes. In their turn, better results in terms of single processes positively affect the performance of the whole company. It proves thus more effective to measure the impact of IT not at a global level, but rather considering the various operative levels, where such technologies are actually used.
McFarlan, 1984; Parsons, 1983; Porter *et al*., 1985.	IT positively contributes to the achievement of a competitive advantage both when the company follows a differentiation policy and when it follows a policy aimed at cost reduction.
Porter *et al*., 1985.	Information technology is potentially able to reduce the costs in any process belonging to the Value Chain.
Parsons, 1983.	IT contributes to the achievement of scale economies. IT contributes to the achievement of transaction economies.
McFarlan, 1984; Parsons, 1983; Porter *et al*., 1985.	IT gives an important contribution to the creation of products or services that are substantially different from those offered by competitors.
Street *et al*., 2004.	IT contributes to the transparency, that is, the communication flow, within the organization, making the company particularly flexible.
Sambamurthy *et al*. (2003)	IT is able to affect the company's agility, that is, its skill at identifying new opportunities, promptly and unexpectedly assembling the resources, knowledge and relations necessary for such aim. Such agility can concern both the efficiency of the processes and the relationships with customers and partners. Information technology can also positively affect the company's quickness to act, that is, its capability to analyse the market and identify the opportunities, challenges and risks in it.
Tippins *et al*., 2003.	The impact of IT on the company's performance can be measured through the analysis of the effect that such technology has on the organizational learning and on the company's capability to acquire information concerning its customers and competitors.
Bharadwaj, 2000; Santhanam *et al*., 2003.	The positive impacts of IT can be measured through the company's financial performance, as the companies that develop better IT capability levels obtain higher results in terms of financial performance.

Table 4.6: Summary of the impacts of IT on firms

4.5 Towards a measure of the IT impact on business performance

It is claimed that the divergence in the conclusions of the studies about the impact of IT on the business performance should be ascribed not just to a dispute over the data but rather to deficiencies in the measurement system (Zurcher, 1998). In particular, many researchers argue that ROI, although an important indicator, is insufficient for measuring the business value achieved from investments in information technology (Bharadwaj et al. 1997; Kettinger et al. 1994; Sehti et al. 1994).

Research in the IS field has often dealt with this issue, and many different approaches to assess business performances has been developed. A broadly used approach is based on quantitative measures (in some cases based on a single indicator), such as traditional capital budgeting methods (Return on Investment, Return on Sales, Pay-back period, Discounted Cash Flow and Internal Rate of Return). Conversely, other research attempts to capture the multiple impacts of IT on the business by measuring performances through a combination of different quantitative and qualitative variables. Tallon (2006) discusses this difference as a reflection of a contraposition between financial measures and perceptual measures (Table 4.7 presents a taxonomy of the approaches).

As reported in Silvius (2006), financial measures are common practice for the CFOs, while there is evidence that the CIOs' use of such indicators is far less frequent, being that the latter are much more concerned with the effects from the investment, such as decreased costs and increased productivity.

In any case, besides this variety of quantitative measures, the IS literature is also rich in studies about IT impact on business performance, that emphasize one or the other aspect of the business. In general, we can refer to the classical taxonomy from Senn (1992), who states that investments in IT fall into three major categories - those which improve:

- efficiency (raising productivity);
- effectiveness (assisting leaders in choosing the right things to do);
- competitiveness (changing the way a business competes in the marketplace).

It is worth noting that these categories closely match the Venkatraman's hierarchal typologies for the IT contribution to value creation within an organization (Venkatraman 1994, Zurcher 1998):

- decentralized and/or isolated systems based on standard software, designed to serve a particular functional, operational need. The usual result is increased efficiency (doing the same work but at a lower cost or with greater speed).
- Internal integration, aimed at ensuring technical compatibility between existing computerized systems. Again, the primary goal appears to be more efficient operations.
- Business Process Redesign, where IT capabilities are used as an enabler of changing the way that work is done. This is an effectiveness issue and is where a business can begin to realize real value from the IT infrastructure.

- Business Network Redesign, intended to create interdependencies between interdependent organizations. This type of system has high potential for creating differentiation in the marketplace through building partnerships and alliances. The key benefit derived in these circumstances is customer/supplier retention. The cost of retaining an existing relationship is significantly lower than the cost of establishing a new one.
- Business Scope Redefinition, focused on building on core competencies and leveraging relationships to build on the core competencies of external organizations - to develop synergistic or symbiotic relationships.

In this list, a greater business value is achieved by using IT to support the latest - rather than the first - types of endeavor. In other words, the key theme of Venkatraman is that business value does not derive from the technology employed but rather from how the technology is employed.

Kettinger et al. (1994) directly examined the issue of measurement of performance related to IT investments and concluded that organizations with sustainable competitive advantage will show relatively better performance in the following key measures (as reported in Zurcher 1998), determined through a regression analysis of the impact of such measures on four assumed indicators of competitive advantage (relative profitability - measured as Return On Sales, relative market position, change in profitability and cash flow to investment):

1. Investment Intensity (Invested Capital/Sales);

2. Cash Flow (Firm Cash Flow/lnvestment);

3. Competitiveness (number of direct competitors);

4. R&D Intensity (R&D expenses/Sales);

5. Times Interest Earned (Operating Income/Interest Expense)

6. Cost Efficiency (Sales/Cost of Goods Sold);

7. Asset Base (Gross Value of Assets); and,

8. Working Capital (Working Capital/Sales).

According to Zurcher (1998), the main limitation of this measure lies in the fact that - to effectively use it - one would have to determine to what extent, any given IT application would impact one of these eight factors.

IT Business Value Measures

Objective / Financial Measures

Market Measures

- Tobin's question: Bharadwaj et al. (1999)
- Market Capitalization: Dos Santos et al. (1993); Hitt and Brynjolfsson (1996); Im et al. (2001); Tam (1998)

Profitability

- Return on Assets (ROA): Barua et al. (1995); Floyd and Wooldridge (1990); Hitt & Brynjolfsson (1996); Li and Ye (1999); Rai et al. (1996, 1997); Tam (1998)
- Return on Equity (ROE): Hitt and Brynjolfsson (1996); Rai et al. (1996, 1997); Tam (1998)
- Profit Margin (ROS): Byrd and Marshall (1997); Li and Ye (1999); Kettinger et al. (1994)

Costs

- Coordination costs: Shin (1997)
- Labor and SG&A: Bharadwaj (2000); Mitra and Chaya (1996)

Productivity / Output

- Revenues: Brynjolfsson and Hitt (1995); Dewan and Min (1997); Hitt and Brynjolfsson (1996)
- Value-added: Bresnahan et al. (2000); Brynjolfsson and Hitt (2000); Kudyba and Diwan (2002)

P**rocess Measures (compiled from objective criteria)**

- Food service sales: Banker et al. (1991)
- Inventory turnover: Barua et al. (1995)
- Mortality rates: Devaraj and Kohli (2000)
- Mail sorting (quality): Mukhopadhyay et al. (1997)
- Shipment discrepancies: Srinivasan et al. (1994)

Perceptual Measures

- Profit, sales, cash flow: Bergeron and Raymond (1995); Chan et al. (1997); Venkatraman (1989)
- Productivity gains: Grover et al. (1998)
- Customer service quality: Ray et al. (2004)
- Product development: Ravichandran and Lertwongsatien (2005)
- IS Effectiveness: Delone and McLean (1992); Ragowsky et al. (2000)
- Competitive advantage: Sethi and King (1994): instrument development paper (N=185). Dimensions:
  - primary activity efficiency, support activity efficiency, resource management functionality, resource acquisition functionality, threat, preemptiveness, synergy
- Strategic variables: Mahmood and Soon (1991): instrument development paper (N=31). Dimensions:
  - buyers and consumers, competitive rivalry, suppliers, search and switching costs, market, products and services, pricing, economics of production, internal organizational efficiency, interfirm efficiency

Table 4.7: IT Business Value Measures (Tallon 2006)

Another notable tool for measuring the beneficial impacts of the use of IT as part of a supporting infrastructure is the CAPITA (Competitive Advantage Provided by an Information Technology Application) Model proposed by Sehti et al. (1994). Through this model, the authors have endeavored to address the issue of "measuring the effectiveness of information systems" by taking a "trait approach which identifies the key traits or attributes that characterize competitive advantage" within the industry. The seven dimensions of the CAPITA Model (comprising 29 measures) eventually identified by Sehti and King (1994) included:

1. Primary Activity Efficiency (impact on the cost of inputs used in producing goods and services);

2. Support Activity Efficiency (impact on the cost of people management, general management and coordination activities);

3. Resource Management Functionality (impact on the ability to monitor the use of a resource, modify it, dispose of it or evaluate its effectiveness);

4. Resource Acquisition Functionality (impact on ability to acquire and assure proper resources received);

5. Threat (impact on bargaining power of customers and suppliers);

6. Preemptiveness (ability to define the rules by which the industry will compete);

7. Synergy (building on an intrinsic strength that competitors cannot readily duplicate).

Notably, the measures become less quantitative and more qualitative in the areas that Senn (1992) would classify as relating to “effectiveness” and “competitiveness”. To support managers in assessing IT investment opportunities it would be crucial to find appropriate quantitative measures of these factors, such as competitive efficiency, business value (profitability, market share, market size) or management productivity (return on management measures). Unfortunately, the CAPITA Model does not provide much assistance in this regard for those attributes that are contributors to “competitiveness” (threat, preemptiveness and synergy).

4.5.1 Measuring the IT impact: defining the unit of analysis

The diversity of the measures reflects the complexity of the measured entity which is, in turn, demonstrated by the contradictory results of the many empirical studies on IT impact, IT productivity, IS success. Much of the research in this area has used as the unit of analysis of the empirical investigation the whole organization.

A relatively smaller set of studies, however, have pointed out the limits of firm-level measures of IT impact, which - in the attempt of pursuing generality - show debatable results in terms of relevance for practitioners (Ray 2005). As clearly exemplified by Tallon (2006, pp. 998), "... for example, while a firm making an investment in CRM might expect to realize a positive impact on profit margin, market share or ROA, a more likely objective is that the system will be used to identify unique customer needs, reduce customer turnover, and secure more profitable deals with the benefit of knowing what individual customers want", and therefore managers responsible for such investments would be much happier to use metrics unambiguously related to the objectives of the investments. Taking into account this criticism IS scholars have identified intermediate impacts of IT, at the process level, and have developed the corresponding process-level measures. Table 4.8 presents a taxonomy of the process-level IT impacts discussed in various IS papers.

It is relevant to note that the papers mentioned in this list typically focus on one process in one type of organization. While this focus is essential to face the issue of relevance of the study, it is inevitable that this focus - in itself - jeopardizes the generality of the results. Again, Tallon

effectively summarizes this contradiction: “The net effect is that while there is a consensus among researchers that process research is necessary and important to understanding IT impacts, the objective metrics created by the extant process literature are expressly designed to fit a unique set of circumstances and firms and so lack relevance in other contexts.” (Tallon 2006).

Process-level IT Impacts

Planning & Support:
- Enhance decision making outcomes [Galbraith 1977]
- Improve organizational communication and coordination [Gurbaxani and Whang 1991; Malone 1987]
- Facilitate the design of new and improved business processes [Broadbent et al. 1999]

Supplier Relations [Inbound Logistics]:
- Coordinate supplier linkages in order to reduce search costs [Bakos 1991; McFarlan 1984]
- Facilitate closer ties with suppliers through EDI [Srinivasan et al. 1994]
- Enable closer monitoring of quality and improved delivery techniques [Kraemer et al. 2000]

Production & Operations:
- Enhance manufacturing techniques through computer-aided design [Kelley 1994]
- Create economies of scale through improvements in the production process [Porter 1985]
- Increase labor productivity through automation [Harris and Katz 1991a; Rai et al. 1996]

Product & Service Enhancement:
- Facilitate the development of new products and services [Brooke 1991; Parsons 1983]
- Enable products and services to be differentiated in a different ways [Bakos and Treacy 1986]
- Improve product and service quality [Barua et al. 1995]

Sales & Marketing Support:
- Enable a corporation to identify and serve new market segments [Pine et al. 1995]
- Track market trends and responses to marketing programs [Porter and Millar 1985]
- Monitor the effectiveness of pricing strategies [Beath and Ives 1986]

Customer Relations [Outbound Logistics]:
- Establish, sustain and improve relationships with customers [Ives and Learmonth 1984]
- Offer improved levels of customer service [Ives and Mason 1990; Ray et al. 2004]
- Improve customer responsiveness [Kraemer et al. 2000; Ray et al. 2004]

Competitive Dynamics:
- Alter the competitive dynamics of an industry [Bakos and Treacy 1986; McFarlan 1984]
- Improve competitiveness by enhancing product choice, selection, cost [Porter and Millar 1985]
- Facilitate the introduction of substitute products [Porter 1985]

Table 4.8: Process level IT impacts (Tallon 2006)

As introduced in the first chapter, one of the consequences of dealing with small-medium sized firms is in the simplification of the domain under analysis. The size of SMEs blurs the borderlines between the business processes listed in Table 4.8, therefore it is reasonable to consider the entire organization as a single-process system. With regards to defining the appropriate unit of analysis, SMEs represent an interesting compromise between the challenges of pursuing relevance rather than generality in the search of an understanding of IT impact on business performance.

4.5.2 IT and business performance in the IT capability related literature

In this last section we present a summary of a specific subset of studies related to the impact of IT: those based on the Resource Based View, and - more precisely - with the concept of IT capabilities. Only the studies following the paper from Bharadway (2000) were taken into account under the assumption that this article can be considered a point of reference for the IS

scholars facing the subject of this PhD study. 13 papers were identified in the IS literature and were classified using the taxonomy proposed by Tallon (2006). The result is presented in Table 4.9.

It is evident that the distinction between the objective vs the perceptual approach applies also to these studies. None of them makes use of measures belonging to both perspectives, probably due to the difficulty in merging the outcomes of two intrinsically different lenses of investigation. It is worth noting that the papers are equally distributed among the two perspectives, independent of the year of publication. This mapping highlights that - independent of the approach followed - the majority of studies used profitability and costs measures, with the exception of 3 papers that use objective metrics related to the performance of the process, and 3 papers that use perceptual metrics in the field of strategic advantage.

Most importantly, from the review of these papers we can infer that it is not very relevant defining business performance. The different domains in which business performance is studied and the different aims of research make it simply impossible to develop a general definition. Rather, what matters is to develop a comprehensive measure, that - pragmatically - targets the domain and the aim of a study driving the appropriate choice of the level of analysis, the perspective (financial vs perceptual), and a set of specific indicators.

In this thesis the domain is represented by SMEs, and the aim is to shed light on the influence of IT expenditures on business performance. As a consequence, the level of analysis of the business performance will be the whole organization, seen as a single business process thanks to the limited size of the companies within the domain of this study. With regards to the type of measures, the exploratory nature of the current study suggests using a broad range of indicators to capture the different possible impacts of IT capability on the organization.

		Papers	2000 MISQ Bharadwaj	2001 JSIS Andersen	2002 ISR Zhu	2002 EJIS Cragg	2002 SMJ Schroeder	2003 MISQ Santhanam	2003 SMJ Tippins	2004 MISQ Barua	2005 12 MISQ Ray	2005 MISQ Tanriverdi	2006 SCMIJ Jin	2006 IJOPM de Burca	2007 09 ISR Saraf
IT Business Value Measures	Objective / Financial Measures	Market Measures										Tobin's q	market share		
		Profitability	ROS; ROA; operating income to assets (OI/A); to sales (OI/S); to employees (OI/E)		Sales per employee; Gross margin			ROS; ROA; operating income to assets (OI/A); to sales (OI/S); to employees (OI/E)		ROA; ROIC (return on invested capital)		ROA	ROI; ROS; sales growth		
		Costs	Total operating expense to sales; Cost of goods sold to sales; Selling and general administrative expenses to sales		Costs of goods sold		Manufacturing cost as a percentage of sales	Cost of goods sold to sales (COG/S); selling and general administration expenses to sales (SGA/S); operating expenses to sales (OPEXP/S)							
		Productivity / Output								revenue per employee; gross profit margin					
		Process Measures			Inventory turnover		Scrap rate (conformance quality); % of deliveries customers receive on time; n° of days from receipt of raw materials to customer receipt (cycle time); Length of fixed production schedule (flexibility)						overall lead time		
	Perceptual Measures	Profit, sales, cash flow		organization's profitability and sales growth relative to close competitors		costs reduction; company image improvement; sales revenue improvement; profitability improvement			Profitability; ROI; sales growth					Growth in ROI; Growth in sales; Growth in earnings before tax; Growth in market share	more profitable; higher financial performance; higher sales growth than our competitors'
		Productivity gains				staff productivity improvement									
		Customer service quality							customer retention		Customer services performance (at the business-process level)				
		Product development													
		IS Effectiveness				quality of decision making improvement									
		Competitive advantage				Computers have helped us compete									
		Strategic variables		level of innovation in the organization		internal integration improvement									

Table 4.9: applying Tallon's (2006) taxonomy to map the measures of IT impacts in the IT capability related literature

The resulting measure of business performance consists of the composition of two financial indicators (the most easily available even in companies of smaller size) and - among the papers reviewed in Table 4.9 - the most detailed set of perceptual indicators developed for SMEs, the one proposed by Cragg (2002). Table 4.10 shows these indicators.

IT/IS strategic alignment	Please rate (for all the following assertions related to the strategy in your company in the past two years), to what extent you agree and how you think you could measure the competitive advantages achievable by using the IT currently available in your company. • differentiate with products with a higher quality than competitors • differentiate with products that are different from the competitors' ones • differentiate with new products • continuously improve the efficiency of production processes • differentiate from competitors with a large range of products • differentiate from competitors with customized products • differentiate from competitors with high quality services • win competition by means of strong marketing campaigns • pursue a growth strategy focusing on entering new markets	**IT effect on performance: subjective/qualitative measures**	Please rate the degree of satisfaction for each of the following issues. • To what extent are you satisfied with the increase of sales achieved thanks to IT? • To what extent are you satisfied with the increase of the market share of the company achieved thanks to IT? • To what extent are you satisfied with the increase of cash achieved thanks to IT? • To what extent are you satisfied with the improvement of the company image achieved thanks to IT?
IT impact on the firm	Please indicate which of the following you believe are the effects of the IT on your company in the past two years and to what extent you agree to the following assertions • reduce administrative costs • improve company's image • increase productivity • increase the quality of decisions • improve internal integration • improve external integration with suppliers and clients • improve the ability to compete • increase sales revenue • increase profit	**IT effect on performance: financial (objective) measures**	Please indicate the value of the financial data listed below • turnover in the past three years • profits in the past three years

Table 4.10: the indicators to measure IT influence on business performance

4.6 Conclusions

Several scholars have attempted to apply to information technology Barney's intuition about the sustainability of the competitive advantage. The heterogeneous and often contradicting definitions, as well as the few, and not satisfactory attempts to formalize a measure of IT capability, provide evidence of the complexity of this construct.

In this chapter we discussed in depth the factors that determine a sustainable competitive advantage from IT expenditures. The two disciplines originating the stream of research on IT capability, namely Management Science and Organizational Science, were taken into account to ensure the literature review was broad enough to capture the essence of the concept of *IT capability*, beyond the different meanings assigned to this term. Instead of choosing one definition among the many, we inferred the borders of the concept of IT capability by discussing the logical links between, on one hand, the sustainability of competitive advantage along time and against the competitors' attempts of imitation, and, on the other hand, the "capacities"

characterizing the CIO, and more widely the IT function, and extensively the whole organization and its partners.

We followed a similar process with regards to the other crucial concept of this study: business performance, and the impact of IT expenditures on business performance. The review of the broad IS literature about IT impacts on the firm led progressively to focus on a limited subset of studies dealing with IT capability. In this case, the variety of approaches and definitions available in literature suggested it was less relevant to discuss the concept of business performance in abstract, but, rather, to build a measure of IT impact of business performance (which is what is requested by the research model of this thesis).

The next chapter will introduce the semi-structured questionnaire deriving - as a preliminary synthesis - from this mainly theoretical work. This questionnaire was the instrument to carry out the first part of the empirical research, the qualitative research through a case study approach. The second part of Chapter 5 will describe the results of the case study and discuss its outcomes.

5 Chapter Five: The empirical research through a case study approach

This chapter presents the first approach to the empirical research in this work, carried out through a case study methodology. This phase of the study (in Chapter 3 we referred to it as phase 2) has two main aims:

1. to test the "readiness" of SMEs' managers to deal with (even in terms of mere understanding) the complex subjects of the tangible and intangible aspects of an Information System and with the relationship between IT investments and business performance;
2. to provide indications to develop a framework for IT capability both at the semantic level (identifying a shared vocabulary, cleaning up overlaps among different terms used to describe IT capability) and at the pragmatic level (generate a shared view on what is and what is not IT capability, aggregate different issues related to IT capability). Moreover, the results of the questionnaire make it possible to shed some light on how IT capability is managed and affects the results of the company although, at this stage, no definitive conclusions can be drawn.

To fulfill these aims, the articles dealing with the topic of IT capability and effectiveness of IT investments reviewed in the previous chapter enabled the identification of a first set of capabilities and consequently the development of a semi-structured questionnaire. This chapter, presents the questionnaire and the results of the empirical – qualitative – research performed by administering the questionnaire to a set of 11 SMEs belonging to the same industrial district defined by geographical (the Province of Como, Northern Italy) and organizational (the textile supply chain) borderlines. The collected data was used to draw a preliminary picture of the different approaches used by SMEs to develop and manage IT capability.

5.1 The research instrument

Based on the literature review presented in Chapter 4, it is possible to merge the different research works in a list that enumerates the elements and factors on which the IT capability is built:

1. the IT physical infrastructure (Bharadwaj, 2000; Croteau et al., 2001; King, 2002; Sambamurthy et al., 2003; Tippins et al., 2003; Wade et al., 2004),

2. the human resources in charge of IT, together with their technical and managerial abilities (Bharadwaj, 2000; King, 2002; Sambamurthy et al., 2003; Tippins et al., 2003; Wade et al., 2004),
3. the intangible resources, such as customer orientation, the intellectual capital and the synergies taking place within an organization (Bharadwaj, 2000),
4. the amount of IT investments (Bharadwaj, 2000; Sambamurthy et al., 2003),
5. the relationship between IT and the activities of the organization (Sambamurthy et al., 2003; Wade et al., 2004),
6. the strategic use of IT (Croteau et al., 2001; Wade et al., 2004),
7. the management of IT (Croteau et al., 2001; King, 2002; Wade et al., 2004),
8. the support of IT to process integration (Wade et al., 2004),
9. the role of the IT department (Croteau et al., 2001),
10. the organizational infrastructure (Croteau et al., 2001; King, 2002),
11. the administrative infrastructure (Croteau et al., 2001),
12. the external connections enabled by IT (Wade et al., 2004)
13. the technological control (Croteau et al., 2001).

In order to perform the preliminary - qualitative - field study a questionnaire was developed to investigate: 1) each of the aspects listed above, and 2) the effects (subjectively assessed and quantitatively determined) of these aspects on the business performances. Given the aim of this first empirical study, the questionnaire made use of a variety of the different metrics used in the research presented above.

Appendix A contains the questionnaire and, whenever possible, the references used for each question and/or parameter assessed. As such, the questionnaire aimed at discussing six main topics (or general assumptions), and a specific section of the questionnaire is dedicated to each of these assumptions:

1. the characteristics of the IT infrastructure are (possibly positively) related with the presence and the quality of IT capabilities;

2. the characteristics of the personnel (individuals' skills, relationships, and training) have a moderating role on making IT investments effective at the organizational level;

3. the characteristics of the intangible resources are (possibly positively) related with the presence and the quality of IT capabilities;

4. the extent to which the information system is aligned with the company strategy (i.e. the strategic alignment of the IS) is related with the presence and the quality of IT capabilities;

5. the presence and quality of IT capabilities is related with the effectiveness of the support of IT to the company's activities;

6. the presence and quality of IT capabilities is related with the impact of IT investments on business performance in terms of a) perceived improvements of performance qualitatively assessed by executives and b) in terms of improvement of financial indicators.

Considering the exploratory nature of this first phase of the empirical research, the definition of IT capability has been kept broad in order to facilitate an open discussion on the concepts and the terms of the interviews. Thus, here IT capability was defined as the capacity - spread through all the organization - to plan, use and manage ICT-based resources jointly with the other resources and capacities owned by a company in order to achieve a sustainable competitive advantage over the competitors.

This first research instrument has been the result of a combination (rather than an integration and a synthesis) of the different approaches to (and, whenever available, measures of) IT capability. Integration and synthesis of the approaches will be the objectives of the second phase of the measure development.

It was also a decision to perform the analysis at this stage, based on measures essentially qualitative that, according to Duhan (2001), is more appropriate to study SMEs. Whenever applicable, the interviewee was asked to rate their answers according to a 5-points Likert scale, with 5 choices, represented by fuzzy representations (“Not at all”, “To a Small Extent”, “To Some Extent”, “To a Large Extent”, “To a Great Extent”), that are assumed to make it simple for an individual to express an opinion on qualitative matters (Capaldo, 2003). Otherwise, multiple choice questions have been used to assess the presence and eventually the extent of the resources and/or capabilities within the company.

5.2 Data collection

The significance of the outcomes of this phase is influenced also by the comparability of the data collected and therefore by the similarities among the companies involved. To respect this constraint we chose to identify a limited number of companies belonging to the Silk Industrial

District of Como, defined by geographical (the Province of Como, Northern Italy) and organizational (the textile supply chain) borderlines.

The territory of this district includes 50 municipalities in the area of Lake Como (Northern Italy) where the manufacturing industry represents the predominant activity. In the area of the Province of Como, the textile industry employs 40% of the work force. Within this industry, a large number of companies operate in the Silk District, each of them typically focusing on a single stage of the textile manufacturing process: fiber winding, unraveling and throwing, warping, preparing the fiber for weaving, weaving, design, photoengraving, dyeing, printing, finishing, sewing, packaging and selling the product. The district system is strongly structured and fragmented with a large number of converters and SMEs.

The data collection started with a telephone contact to companies belonging to the District in order to explain the aims and the contents of the research: eleven companies agreed to be interviewed. The owner or the general manager of the company was the interviewee, this choice allowed a 360 degree picture of the role of IT within the company, at the same time, the small size of the companies implies that top executives roles have a direct input to IT related decisions (in some cases they are even in charge of such decisions).

The interviewees received a copy of the questionnaire about one week before the interviews. During each interview the interviewee had to face each question of the questionnaire, then to discuss it and finally to synthesize an answer to each question. The interviewer transcribed the synthetic answers and summarized the discussion for each question. The interviews required from 2 to 4 hours to complete.

5.3 Results of the case studies

The questionnaire was submitted to 11 enterprises belonging to the “serico-comasco” district (an industrial district located in the Province of Como, Northern Italy, focused on the production and processing of silk fabrics). According to the recommendation of the European Community Commission, come into force on 1st January 2005, which confirms the criteria for the classification of SMEs, 4 belong to the category of medium enterprises, while the other 7 are included in the category of small enterprises.

With respect to the six topics under investigation at this stage, the general assumptions of this questionnaire have all been confirmed except for the last one, the impact of IT capabilities on business performance. On one hand, the interviews have revealed that the performance improvements, as they are perceived by the executives, are mainly due to the role and personal

contribution of the owner in managing IT related issues. On the other hand, the eventual economic achievements of the companies are essentially ascribed to the dynamics of the textile industry and do not appear to correlate to IT investments.

These outcomes are inevitably biased - to some extent - by the subjectivity and possibly the shortsightedness of the interviewee (who was in fact claiming to be the main authority on the IT effectiveness). Nonetheless, these results confirm the need to accurately select the measure of business performance and suggest that the role of the entrepreneur in the phase of data collection of the survey should be carefully defined.

Secondly, the interviews provided a first picture of how IT capabilities are present and managed in SMEs. To this account, three different approaches have emerged:

a) SMEs "IT capability oriented", characterized by the awareness of the relevance of IT capability to pursue business results through IT investments. These companies have a relatively complex IT infrastructure but they also make a significant effort to nurture IT capabilities;

b) SMEs "IT reluctant", characterized by very scarce IT investments and a coherent scarce interest in developing any IT capability. Rather surprisingly, the three companies belonging to this subset are not of very small size (respectively: 80, 23, 32 employees);

c) SMEs "entrepreneur-driven IT capabilities": small-sized companies, whose IT capabilities are essentially concentrated in the role of the entrepreneur, who plays a relevant role in IT-related decisions.

ID	Company name	assessment after interviews (*)	industry	n. of employees	turnover (average last 3 years)	organizational role of the person interviewed
1	BOSETTI INDUSTRIA SERICA s.p.a.	b	Silk textile	80	12.000.000	General Manager
2	CIBIO S.p.A.	c	Textile	8	2.400.000	Co-owner - Chief of Production
3	EUROP MARCHINI s.r.l.	c	Textile	14	5.300.000	Owner
4	FIORETE GROUP s.p.a.	a	Home furnishing textile	228	28.400.000	General Manager
5	ORDITURA MILLEFANTI	b	Textile	23	2.000.000	Owners
6	PENTAGONO SETA s.p.a.	a	Textile	90	13.000.000	Co-owner
7	RADAELLI s.r.l.	a	Textile	25	4.250.000	Owner
8	SETIDEA s.r.l.	c	Tertiary (textile)	8	2.300.000	Chief Accountant
9	TESSITURA GALBIATI s.r.l.	b	Textile	32	6.000.000	Owner
10	TESSITURA PURICELLI s.r.l.	a	Textile	65	12.000.000	Owner
11	TESSITURA SESANA s.r.l.	c	Textile	42	6.000.000	Owner

Table 5.1: Basic data about the companies interviewed (* a: IT capability oriented; b: IT reluctant; c: entrepreneur driven IT capability)

The next sections of this chapter present a description of each group, with details about:

a) distinctive traits,

b) main characteristics of each company.

Before the detailed description of the companies of each group a table summarizes their profile according to the six topics on which structure of the questionnaire is based.

5.3.1 Group 1: SMEs "IT capability oriented"

According to the data derived from the analysis of the questionnaire submitted to the enterprises, the following companies are included in this group:

1. FIORETE GROUP s.p.a.,
2. PENTAGONO SETA s.r.l.,
3. TESSITURA PURICELLI s.r.l. e
4. RADAELLI s.r.l.

These companies are well equipped with the elements that make up IT capability and acknowledge its relevance for the achievement of the company's objectives.

In particular, in these companies the tangible and human resources are well developed, also as far as the care given to training activities is concerned. Similarly, the companies belonging to this group make effective use of IT solutions to pursue a customer-oriented attitude and to develop synergies mostly only among the functions within the organization. Also the intangible resources are thus developed.

In these companies, significant financial resources are invested in projects for the implementation of IT solutions, which highlights how the managers are able to acknowledge the potentialities of information technologies.

The companies of this group present a good strategic alignment between IT and strategy, and appreciate the positive impacts of IT on both the company's performance and the economic results.

Table 5.2 summarizes the main characteristics of the companies belonging to this group.

	FIORETE s.p.a.	PENTAGONO SETA s.p.a.	TESSITURA PURICELLI s.r.l.	RADAELLI s.r.l.
Activity	textile sector for home furnishing	whole process of silk production	production of silk and synthetic fibers	yarn dyeing
Number of employees	228	90	65	25
Number of users of the IS	about 100	70	16	15
presence and quality of IT capabilities related to the IT infrastructure	well equipped	well equipped	well equipped	well equipped
presence and quality of IT capabilities related to characteristics of the personnel	well equipped	well equipped	well equipped	well equipped
impact of IT on the intangible resources	medium-high (but scarce on external synergies)	medium-high (but scarce on external synergies)	Medium (and scarce on external synergies)	medium-high
perceived strategic alignment of the IS	High	High	Good	Good
effectiveness of the support of IT to the company's activities	High	High	High	High
impact of IT investments on business performance	Low	Very high	medium	High (except for the reduction of adm. costs)

Table 5.2: main characteristics of the companies belonging to the "IT capability oriented" group

FIORETE GROUP s.p.a. is located in the municipality of Fino Mornasco and works in the textile sector for home furnishing. This company, which employs 228 people, is the largest of all the interviewees. It is very well equipped as far as the components of the physical IT infrastructure and the human resources. It makes use of several software systems, and the Internet-based solutions are sophisticated. Besides a simple Internet site for its presentation, the company is equipped with a B2B e-commerce site and it also makes use of a marketplace (only case among all the interviewed companies).

The users of the information system are numerous (about half of the number of employees) and are well managed by the internal staff, who specifically deal with IT and possess high managerial skills. The value given to the importance of the company's skills in the field of IT is highlighted by the intense training activities, which are the highest among all the cases interviewed.

As far as the intangible resources are concerned, the company pursues medium-high levels of customer orientation, and the synergies within the organization are relevant as well. On the contrary, the external synergies, created with commercial partners, are scarce.

Although a development plan for IT does not formally exist, the level of investments in IT is very high, as well as the expenses for the staff employed in IT management, which proves the importance given by the company to the quality of the human resources connected to information technology.

The company's processes are well integrated thanks to the IT solutions, although the company does not posses a database that can be accessed by all software applications.

The strategic alignment of IT is high. All the activities that are considered as strategic are well supported by IT, although the competitive advantage that can be obtained through IT is considered, in general, at an average level.

As far as the impacts of IT on the company are concerned, the interviewee shows a high level of satisfaction only regarding the reduction of the administration costs and the improvement of the quality of the decisions made. Consistently, the impact of IT of the company performance is regarded as low, even considering the company's good financial results.

On the whole, this case shows that the great effort to develop IT capabilities has given significant operational results, but limited in the area of strategic alignment. On the other performance indicators, the interviewee was reluctant to consider the influence of IT investments as positive.

PENTAGONO SETA s.p.a. is located in the municipality of Maslianico and deals with the whole process of silk production, from the yarn to the final product. This company, like the previous, is very well equipped as far as IT infrastructure and human resources are concerned. It makes use of several software systems, while concerning the Internet tools the company has a simple presentation site.

The number of the users of the information system, compared to the number of employees, is even higher than the one of the previous company (70 employees out of 90 use the computer). Moreover, the users are well managed by the internal IT staff, who have very good managerial skills. This company, too, sets great value on education and training, even if lower than the previous company.

As far as the intangible resources are concerned, IT solutions effectively support the customer-oriented approach and the creation of inter-functional synergies while, on the contrary, the external synergies (with customers and suppliers) are considered as null.

Unlike the majority of the analyzed companies, in Pentagono Seta there formally exists a plan of IT development, and the level of the investments on information technology is high. It is important to note that, when required to give the reasons for IT investments, the interviewee assigned the highest value to all the reasons listed in the questionnaire, which can show the management's awareness of the importance and the potentialities of information technology.

As in the previous company, the company processes are well integrated, allowing sharing of activities and information among the different functions in the organization, although the company does not possess a database that can be accessed by all software applications.

The strategic alignment between IT and the company's activity is high. In fact, all the activities that are considered as strategic are very well supported by IT, and the competitive advantage that can be obtained through it is considered at a good level for all the activities, with the only exception of "advertising campaigns" and "entrance to new markets". The effect of IT on the company is considered as good on the whole, except for the increase of profits and revenues, where the impacts are considered as low.

With regard to the company's satisfaction for the performance obtained thanks to IT, the level is very high. The interviewee thinks that the company's negative economic results can be totally explained by the high taxation that it is subject to. Compared to FIORETE GROUP s.p.a. there is thus a higher satisfaction for the contributions IT gives to the company's activity.

TESSITURA PURICELLI s.r.l. is located in the municipality of Montano Lucino and produces silk and synthetic fibers materials.

Its dimensions are smaller than the previous ones (65 employees), but the company is nevertheless very well equipped as far as the components of the IT physical infrastructure and the human resources are concerned. The software systems support several company processes. Unlike the two companies described above, this one does not have an Internet site.

The users of the information system aren't numerous (16), but they are nevertheless well managed by one of the entrepreneurs, who possesses high management skills. This company lacks thus internal staff for IT management, which is outsourced in case of particular problems. This company, too, offers training activities, particularly on applications supporting specific activities. The number of training days per year, though, is lower than in the previous companies.

As far as the intangible resources are concerned, the company's customer-orientation is quite good, except for the data collection about the customers, which the entrepreneurs do not consider as relevant. As in the above described companies, the internal synergies are high, while the external synergies with commercial partners are null.

Although a plan for IT development does not formally exist, the level of investments in information technology is very high, and further investments are planned for the future.

The company processes are well integrated, and the different functions can share activities and information, although one only database accessible to all software applications does not exist.

The strategic alignment between IT and the company's activity is quite good, and the competitive advantage obtained thanks to IT is at a good level. The interviewee considers the impact of IT on the company in the last year as medium-high.

On the whole, the level of satisfaction for the impact of IT on the company performance is medium, while the economic results are good.

RADAELLI s.r.l. is situated in the municipality of Bulgarograsso and deals with yarn dyeing. This is the only small enterprise belonging to this subgroup. The small dimension (25 employees) has not prevented this company from developing very good equipment for IT infrastructure and human resources. The software systems in use are numerous while, like the previous company, there is no Internet site.

The users of the information system (15) are well managed by a single employee, who possesses high management skills. Radaelli's IT capabilities are characterized by the fact that the skills in information technologies are at a medium level but homogeneous among all the users. In the other companies, instead, these skills are generally concentrated in one group of people, though with higher competence. This company, too, offers training activities, particularly on applications supporting specific activities, but unlike the other companies belonging to this group, they are not carried out periodically, but only when necessary.

As far as the intangible resources are concerned, IT makes it possible to have a good customer-orientation and to develop internal synergies and – unlike the other companies – also external synergies (evaluated as fairly good).

The development of the information system is not based on a formalized development plan, but the level of investments in IT is very high, particularly considering the financial resources that are definitely lower than in the above described companies. Since these investments were carried out recently, no other expenses are foreseen in the short term.

The company processes are well integrated, given the high capability to share activities and information between the different functions, even if there is no database accessible by all software applications.

The strategic alignment of IT is considered as good, and the judgment on the contribution of IT to the achievement of the company's strategies that are considered as more important is extremely good. It should be noted that among the companies of this group, this one has the best evaluation with regard to the competitive advantage that can be obtained through IT.

The impacts of IT on the company are considered at a high level, with the exception of the reduction of administration costs, which is seen as average.

Summing up, the level of satisfaction for the effect of IT on the company performance is medium-high, while the economic results of the company are very good, particularly considering the dimensions, which are lower than the other companies of this group.

5.3.2 Group 2: SMEs "IT reluctant"

On the basis of the data gathered from the analysis of the questionnaire submitted to the companies, the following companies can be included in this group:

1. BOSETTI INDUSTRIA SERICA s.p.a.,
2. TESSITURA GALBIATI s.r.l. e
3. ORDITURA MILLEFANTI s.r.l.

In these companies the tangible resources and, above all, the human resources are evaluated as scarce. The training activities of this group are null or very limited, which affects the staff's skills and in general the quality of the human resources.

The customer orientation is considered as fairly good, as well as the synergies between the functions within these companies.

Compared to the *IT capability* oriented companies, the financial resources invested in projects for the implementation of IT solutions are much lower, which is probably caused also by the dimension and the economic conditions of the companies of this group.

Also as far as the strategic alignment between IT and company's strategy is concerned, in general, *IT reluctant* companies obtain results lower than the first group, and the evaluation of the impacts on the company's activity is lower as well.

On the whole, *IT reluctant* companies show limited development of the elements that build IT capability, so they can be assigned a low IT capability level.

Table 5.3 summarizes the main characteristics of the companies belonging to this group.

	BOSETTI INDUSTRIA SERICA s.p.a.	TESSITURA GALBIATI s.r.l.	ORDITURA MILLEFANTI s.r.l.
Activity	yarn weaving (esp. silk)	yarn weaving	yarn warping
Number of employees	80	32	27
Number of users of the IS	19	6	27
presence and quality of IT capabilities related to the IT infrastructure	scarce	Scarce	Medium
presence and quality of IT capabilities related to characteristics of the personnel	very limited	Scarce	Scarce
impact of IT on the intangible resources	Good	Fairly good (but scarce on external synergies)	Good
perceived strategic alignment of the IS	good	Good	Incomplete
effectiveness of the support of IT to the company's activities	High	Good	Good
impact of IT investments on business performance	from high to scarce depending on the parameter used	high on the reduction of administrative costs, null for the other parameters	Fairly good (no effect on competition and revenues)

Table 5.3: main characteristics of the companies belonging to the "IT reluctant" group

BOSETTI INDUSTRIA SERICA s.p.a. is situated in the municipality of Fino Mornasco and deals with yarn weaving.

In the last years, the company has been heavily affected by the negative conjuncture of its economical environment, which is shown by the poor economic results it obtained, even if recently the company seems to be recovering.

Although it is a medium-sized company (80 employees), its physical infrastructure has a scarce coverage of the company's activities. The only apparently positive remark is that the company has a web site.

Despite the absence of any training activity, human resources, too, are considered less valuable compared to the medium-sized companies of group 1. The number of users of the information system on the total of the staff is very limited (19 users out of 80 employees), but above all the management skills of those responsible for IT are very poor, though considered as satisfying by the interviewees.

The company has reached a fairly good level of customer orientation with IT support. The synergies within the organization, as well as the external ones with commercial partners, are also quite good.

A peculiar characteristic of the company is the absence of investments in IT solutions, both in the recent past and in the future, in the short and medium term. This is justified by the numerous financial difficulties that the company has faced in the last years.

The company's processes are quite well integrated, given the good capability to share activities and information among the different functions and the existence of a single database accessible by all software applications.

The strategic alignment between IT and company's activity is at a good level, as well as the contributions given by IT to the achievement of competitive advantage.

The impacts of IT on the company are considered at a high level, although the reduction of administrative costs and the improvement of internal integration due to information systems are deemed as scarce.

The satisfaction of the interviewee about the company's performance obtained thanks to IT varies on the basis of the parameter employed: it is high for the improvement of the company's image, good for the increase in the market share, fairly good for the increase in sales and scarce for any increase in liquidity.

TESSITURA GALBIATI s.r.l. is situated in the municipality of Villa Guardia and deals with yarn weaving. Although it has small dimensions (32 employees), it has several elements in common with the company described above.

The company is in fact scarcely equipped with components of the IT physical infrastructure. Only few software systems are in use and even the website is still only being set up. In this case, too, the absence of training activities goes together with a scarce evaluation of human resources. The number of the users of the information system is very limited (6 users out of 32 employees) and, above all, the management skills of those responsible for IT are on a medium level.

As far as the intangible resources are concerned, the customer orientation and the synergies created within the organization are considered as fairly good. On the contrary, the company declares that they have not developed any synergy with commercial partners.

The investments in IT solutions carried out in the last years are not very high, and no new expenses are foreseen in the short and medium term.

In this company, too, the company's processes are quite well integrated, given the fairly good capability to share activities and information among the different functions and the existence of a single database that can be accessed by all software applications. The strategic alignment between IT and the company's activity is at a good level, as well as the contributions given by IT to the achievement of the company's strategies.

With regard to the effect of IT on the company, a high evaluation is given only to the impact on the reduction of administrative costs, on the improvement of the company's image and on the

internal and external integration, while on the other factors examined the impact is considered as null.

On the whole, the interviewee has declared a scant level of satisfaction for the company's performance obtained thanks to IT, even considering the company's positive economic results.

ORDITURA MILLEFANTI s.r.l. is situated in the municipality of Oltrona San Mamette and deals with yarn warping. This small-sized company has reached good economic results in the last three years and, like the previous ones, it is scarcely equipped with components of the IT physical infrastructure and human resources. The software systems in use are limited, although the choice of implementing a B2B e-commerce site makes it more sophisticated than the other companies of the same group.

Although all the 27 employees are users of the information system (only case among all the interviewees), no one carries out the role of IT manager. In fact, the company makes use of external consultants, whose competence, though, is considered only as average, as well as the users' competence. The training activities are addressed only to the managers and are only a marginal part of their activities (5 hours per year on the average).

As far as the intangible resources are concerned, thanks to IT support the company has reached good levels of customer orientation. The synergies created both within the organization and with the commercial partners are good, that is, better than compared to other IT reluctant companies.

The investments in IT solutions are quite good, even if no new expenses in the short and medium term are foreseen. In this company, too, the processes are quite well integrated, given the good capability to share activities and information among the different functions, even if the company does not have a single database that can be accessed by all software applications.

Although the competitive advantage that can be obtained through the use of IT is considered as high, the strategic alignment of IT with the company's activity is incomplete, as the only strategic activities that are highly supported by IT are the operative ones, while the other strategic activities present a medium-low support.

The impact of IT on the company is considered as fairly good, on the average, but IT is seen as not having any effect on the improvement in competition and in the increase in revenues.

On the whole, the interviewee has expressed a good level of satisfaction for the company's performance obtained thanks to IT.

5.3.3 Group 3: entrepreneur driven IT-based efficiency

In a first analysis, the companies (all small-sized) in this group have been inserted into it by elimination. With a more careful examination, though, two relevant aspects in common emerge:

1. the elements used to evaluate IT capability (IT infrastructure, tangible and intangible resources) appear to be highly influenced by the choices of the entrepreneur, who is also the IT expert and the IT manager in these companies;
2. the entrepreneur knows the potential of IT, particularly with regard to the carrying out of the activities within the company, but he does not see technology as a possible competitive tool in the particular sector where the company works.

These companies make significant investments in IT (based on the budget availability) but, consistent with the lack of perception of the strategic relevance of IT, they address such investments only towards the improvement of the operational efficiency. If on one hand the non-strategic character of IT can be seen as a limitation, an opportunity which the company does not take, we have to acknowledge its capability to overcome the traditional reluctance of small-sized companies towards the innovation of non-core technologies. An explanation to this attitude (more evolved compared to IT reluctant companies) can be found in the entrepreneur's competence in information technology we described above.

The following companies belong to this group:

1. EUROP MARCHINI s.r.l.,
2. CIBIO s.p.a.,
3. TESSITURA SESANA s.r.l. e
4. SETIDEA s.r.l.

Table 5.4 summarizes the main characteristics of the companies belonging to this group.

	EUROP MARCHINI s.r.l.	CIBIO s.p.a.	TESSITURA SESANA s.r.l.	SETIDEA s.r.l.
Activity	Converter in the textile supply chain	Converter in the textile supply chain	Yarn weaving	Converter in the textile supply chain
Number of employees	14	8	42	8
Number of users of the IS	10	6	14	5
presence and quality of IT capabilities related to the IT infrastructure	Good	Scarce	Well developed	Fairly good
presence and quality of IT capabilities related to characteristics of the personnel	Good	Good	Well developed	Good
impact of IT on the intangible resources	From high (internal synergies) to null (external synergies and customer orientation)	Not applicable	Scarce	Good
perceived strategic alignment of the IS	Null	Incomplete	Null	High
effectiveness of the support of IT to the company's activities	Good	Scarce	Fairly good	Fairly good
impact of IT investments on business performance	null	very low (good only for the integration with customers and suppliers)	scarce	Fairly good (but scarce impact on reduction of adm. costs)

Table 5.4: main characteristics of the companies belonging to the " entrepreneur driven IT-based efficiency" group

EUROP MARCHINI s.r.l. is situated in the municipality of Como and carries out the role of converter in the supply chain of the textile industry: it purchases fabrics to resell them to the high fashion market.

The company has a high level of development of IT physical infrastructure and human resources. The software systems are used to support several activities and, in particular, commercial promotion is carried out also through the Internet site, which is updated with the information on the fairs and exhibitions the company takes part in. Out of 14 employees, 10 are also users of the information system. Their skills in this field are good and homogeneous, so no training activities are carried out. The development of the system and of its users is supervised by one of the two owners, whose management skills are considered as good.

As far as the intangible resources are concerned, the company is highly customer-oriented through activities of information gathering and customization. And yet, IT is considered as totally ineffective to better understand the customers' needs. The entrepreneur thinks that the state of the environment where the company works is too changeable to be understood and foreseen, particularly with technology.

The synergies within the organization are high, while the external synergies are null, which the entrepreneur thinks is due to the short-sightedness of the commercial partners.

In this company there is a plan of IT development, formally, even if the entrepreneur cannot foresee the amount of future investments, given the high dependence on the economic results that the company will achieve. The present value of the investments, particularly considering the small size of the company, is remarkable.

The company's processes are well integrated, given the high capability to share activities and information among the different functions and the presence of a single database that is shared by all software applications.

Two of the activities that are considered as strategic are not supported by IT at all, so the strategic alignment of IT can be considered as null. The other strategic activity, that is marketing and sales, is highly supported, but only through the above mentioned Internet site.

The competitive advantage that can be obtained thanks to IT is considered as null since, in the entrepreneur's opinion, the crucial element in the sector is the personal relationship that can be created with the customers. The entrepreneur acknowledges some positive impacts, at a low level, only with regard to the improvement of the decisions made and the integration, particularly the external one. Consistently, the interviewee declares a null level of satisfaction for the effect of IT on the company's performance.

CIBIO s.p.a. is a micro company (8 employees) situated in the municipality of Grandate, and carries out the role of converter. After purchasing the fabrics, it manufactures ties and foulards, and sells the finished product to its customers.

The company is scarcely equipped with elements of IT physical infrastructure, and makes use of few software systems (even if it has an Internet site). Despite this, most of the staff (6 people out of 8) use the computer and possess good basic computer skills. One of the two owners, who considers his capabilities of IT management as good, carries out the role of IT manager, supported by external consultants only for specific needs. When necessary, and only for applications of office automation, training activities are offered to the users.

The company is not interested in the development of intangible resources. Customer orientation is considered as useless for the company's activities, internal synergies are very scarce, while the synergies with the customers and suppliers are totally absent.

The investments in IT made in the period of the interview are fairly good, and the interviewee cannot make any forecast for the future. There is no development plan for the information

system, which is modified only to respond to specific needs and, in particular, to support the management activity and to ensure the security of the system.

The company's processes are not well integrated, although there exists a single database shared by all software applications.

The strategic alignment between IT and the company's activity is incomplete: only two of the activities that are considered as strategic are significantly supported by IT; operative activities are not very well supported, as they are carried out mostly manually.

The competitive advantage that can be obtained through IT with regard to the strategies considered as most important is deemed as very low. In general, the interviewee acknowledges a positive impact of IT on the company's performance only as far as the integration with customers and suppliers is concerned. With regard to all the other performance indicators, the influence of IT is considered as low or null.

TESSITURA SESANA s.r.l. is situated in the municipality of Minoprio and deals with yarn weaving. Although it is a small enterprise, with its 42 employees it is the biggest in this group.

The IT physical infrastructure and the human resources are considered as well developed. There are several software systems in use, even if the company does not have an Internet site.

A third of the employees are users of the information system and possess very good basic skills. Moreover, and quite unusual in this survey, they have a fairly good competence in programming IT solutions and designing systems. The company offers training activities for both the employees and the managers, based on specific needs.

The role of IT expert is carried out by the entrepreneur and some internal staff together, also supported by external consultants.

The impact of IT on the intangible resources is evaluated as scarce. The customer orientation is supported by IT only in the phase of information gathering; the internal synergies are high, while the external synergies are scarce, which is due, in the entrepreneur's opinion, to the short-sightedness of the commercial partners, as in the case of EUROP MARCHINI s.r.l..

This company formally has a plan of IT development, and the investments made in the last years are good. The company's processes are well integrated, given the high capability to share activities and information among the different functions, although there exists one database for each software application.

The strategic alignment between IT and the company's activity is null, because the entrepreneur cannot identify more important activities from a strategic point of view. In the interviewee's opinion, in fact, all the activities along the value chain are part of the normal management of the company's activity.

In the same way, the entrepreneur cannot identify one fundamental strategy, but he gives all an average importance, except for the strategy of advertising and selling campaigns, which he considers as null. The same values are given, for each strategy, also to the competitive advantage that can be obtained through IT.

The entrepreneur acknowledges fairly good impacts of IT on the company and, in particular, good with regard to the reduction of administrative costs but overall his satisfaction for the company's performance achieved thanks to IT is limited.

In short, with this company it seems that the characteristics for the development of IT capability are present, but that this does not happen due to a lack of conviction in the entrepreneur about the advantages that IT could give in this sector, which is considered as still reluctant to innovate.

SETIDEA s.r.l. is situated in the municipality of Villa Guardia and carries out the role of converter: it purchases the fabrics and resells them to its customers.

This company, which employs 8 people, is scarcely equipped with elements of the IT physical infrastructure. In fact, the software systems in use are scarce and the company does not have an Internet site.

Most employees (5 out of 8) are users of the information system and possess good basic computer skills; none of them, though, carries out the role of IT expert, which is outsourced to external consultants, whose management skills are deemed as very good. When necessary, the company offers training activities on Internet applications and applications supporting specific activities.

As far as the intangible resources are concerned, the role of IT in pursuing customer orientation, and also in facilitating internal synergies, is considered as good, while the external synergies are considered as average.

The company's processes are well integrated, given the good capability to share activities and information among the different functions and the presence of a single database shared by all software applications.

The present value of the investments in IT, particularly considering the small size of the company, is deemed as good. The alignment between IT and the company's activity is high, as the activities considered strategic are very well supported by IT. Nevertheless, the interviewee acknowledges only one type of competitive advantage that can be obtained through IT, that is, the differentiation through a wide range of products and the entrance to new markets.

The impact of IT on the organization is fairly good in the different fields analyzed, except for the reduction of administrative costs (scarcely affected by IT) and the improvement of the company's image. Consistently, the interviewee shows a fairly good satisfaction for the effect of the investments in IT on the company's performance.

5.4 A comparison of the groups

Of the four companies belonging to the first group three are medium-sized and one is small-sized. These companies are, in general, very interested in developing the resources examined in the survey, in both their tangible (also thanks to the systematic offer of training activities) and in their intangible component. In order to maintain adequate resources, the companies make significant investments in projects for the implementation of IT solutions.

Indeed, these investments prove effective: they enable the achievement of the strategic alignment of the information system and bring about positive impacts on both the company's performance and the economic results.

In these companies, the managers are able to acknowledge the potential of IT, and in particular the possible related competitive advantage. In other terms, these companies plan and develop IT capability to improve their performance. In this group, high levels of IT capability are associated with the company's size (which, in its turn, is closely connected to the presence of staff with good management skills), the complexity of the processes and the higher availability of economic resources.

Group 2 is made up of three companies: two are small-sized and one is medium-sized, but this suffers from a difficult economic situation, which significantly limits the possibilities of investments and innovation.

The condition of IT capability in these companies is diametrically opposed to the previous group. They have very limited development of their tangible and human resources (also due to the substantial lack of training activities), while the intangible resources are deemed as only average. It is no surprise then that the financial resources invested in projects of implementation

of IT solutions are much lower, which is probably influenced also by the size and the economic conditions of the companies of this group. Moreover, also with regard to the strategic alignment of the information system, these companies obtain in general lower levels compared to the first group. This makes it possible to underline the difference which is most significant for this work, that is, the different opinion that the executives have on the importance of IT (in these small companies, the role of the executive is carried out by the entrepreneur). They consider IT basically as a "necessary evil", and so they strongly limit the efforts in developing IT capability, even simply from the point of view of the technological infrastructure, and they direct the investments in IT according to strictly contingent needs, leading thus to an information system which is composed of a patchwork of few, poorly integrated elements and cannot support the strategic objectives.

The final result of this view of IT, that is, the scant impact of IT on company's performance, can be surely seen as the consequence of this reluctance towards IT, but it would be useful to more thoroughly investigate in order to understand whether it is rather a "self-fulfilling prophecy", an excuse from the management who are not able to make a quality jump so that the choices concerning IT are pragmatically oriented towards the company's long- term results.

Group 3 includes four companies, all of them small-sized. It is important to notice that three of them carry out the same activity: they work in fact as converters.

These companies have the most non-homogeneous aspects compared to the previous ones; for this reason, they cannot be classified into specific groups. In particular, their levels of IT capability are affected mainly by the entrepreneur's ideas and the characteristics of the sector where they operate.

In fact, though these companies are fairly well equipped with resources, it seems that these resources are used mostly to support the normal management, rather than as a competitive tool. The element characterizing IT capability is in this case the giving up – though aware, and not apparently irrational as in group 2 – of the use of IT with strategic objectives. The scarce IT capability is directly affected by the entrepreneur's personal view and by the characteristics of the sector where these companies operate, whose fundamental elements are still personal creativity and the direct relationship with the customer. Fabrics, to be appreciated, need to be seen and touched, and IT can do little to support this fundamental component of their competitive advantage.

5.5 Methodological implications of the empirical research

The questionnaire used for this study has made it possible to draw some important interpretations on the concept of IT capability and on the effect that IT capability has on a small-medium organization.

In this empirical study, the choice was made to investigate IT capability using variables that were not rigorously defined, thus leaving the ambiguity of the academic distinction between resources, capabilities and competence unsolved. On the contrary, assuming that the interviewee did not possess the necessary competence to discuss the semantics of these terms, a terminology was chosen that was closer to the immediate understanding of the interviewee, so that the concept of capability would emerge from the empirical survey itself.

With regard to this objective, the study of the eleven cases of SMEs of the textile district has made it possible to show that, in fact, there is widespread knowledge of the concepts used to describe the tangible and intangible resources, and the interviewees have a good familiarity also with the theme of the implications of IT in business, even when their evaluation of the impact of IT on performance is low.

Another critical issue that could emerge in the survey regarded the confidentiality of the information gathered. And yet in this case, too, the study did not meet any specific resistance, except for the section about the quantitative data on the company's economic results.

Furthermore, the questionnaire has made it possible to infer a variety of company profiles with regard to the management of their IT capability, which is a sign of the effectiveness of the tool employed for the survey.

On the whole, the questionnaire and its target appear to be consistent with the objectives of this survey, from the point of view of both the contents and the way it was submitted to the interviewees. SMEs are an appropriate sample group within which a survey on IT capability can be meaningfully applied. This leads to the development of the full empirical study as discussed in the following chapters.

5.6 Conclusions

This chapter described the first part of the empirical research of the study. The preliminary literature review summarized in Chapter 4 led to the development of a questionnaire applied in a multiple case study that involved eleven SMEs belonging to the so-called "silk industrial district" of the Province of Como, one of the dozens of the Italian industrial districts. The data

collected led to the identification of three subgroups where companies showed different performances and significant differences regarding the characteristics that we referred to as *IT capabilities* in chapter 4. One interesting inference is that what characterizes those SMEs able to effectively develop IT capabilities more than the structural aspects of the organizations (such as size or entity of the presence of IT) is the culture, and – more precisely – the business orientation of the person in charge of IT expenditures.

Equally important, besides this interpretation of the research model, the analysis proved that the choices undertaken in Chapter 4 to define the setting of the empirical research (namely: the use of the entire SME as the unit of analysis, the definition of IT capability and the measures of business performance) were appropriate. Nevertheless, we are aware of the limitations of the literature review performed in Chapter 4 and hence the inherent problems of generalizing from these outcomes. Therefore, the results from this first phase of the empirical research need to be broadened and also refined. This is the aim of Chapters 6 and 7. In Chapter 6 we report a new, more comprehensive yet targeted literature review about the basic constructs of the study, and then proceed in Chapter 7 to present the second phase of the empirical research, a quantitative study to be administered to a significantly larger set of SMEs belonging to industrial districts.

6 Chapter Six: Development of a Comprehensive Measure of IT capability

This chapter presents a detailed analysis of a selection of the papers related to the concept of IT Capability. This analysis follows the two-step timeline of the development of the research. In Chapter 4, the main recent articles were reviewed in order to build an integrated definition of IT capability and enable the development of a semi-structured questionnaire, to be used in the qualitative empirical research, the multiple case studies presented in Chapter 5.

This Chapter 6 presents the subsequent stage of review. It builds upon the definition of IT capability and draws a detailed semantic map of 38 selected papers specifically dealing with the concepts of IT capability and IT competence. The measure of "IT capability", one of the main outcomes expected by this PhD study, has been extracted from such a map, after reviewing and examining each of its elements.

The chapter is organized as follows. First, we explain the process followed to target and review a specific set of papers exploring and empirically researching the subject of this study. These papers have been classified either as belonging to the Management Science or the Organization Science discipline. The two subsets, respectively referring to the term IT capability and IT competence, are analytically presented in the second section of this chapter. For each paper the definition of IT capability / competence and a summary of results (where applicable) are provided. The outcome of this review process is also discussed in this second section. The initial list of 630 IT capabilities was reduced to a set of 67 significantly different capabilities through an analytical process of aggregation and synthesis: the last section of the chapter presents this set and shows how these capabilities fit within Piccoli's (2005) framework of IT capability.

In Chapter 4 we identified in Piccoli's review paper (2005) the theoretical framework that underpins this research study. Under this as a basis, the literature review was carried out in the six phases described below:

1. identification of the reading list: we started from the 40 articles indicated by Piccoli (see table 3.4) as a reference literature about IT resource barriers. Then we merged this list with the one (23 papers) built in the first phase of the literature review giving 56 papers after overlaps.

2. extension of the reading list: we performed a new search in the scientific literature - more precisely - in the two fields identified in the first section of this chapter, i.e. Management Science and Organizational Science. This work allowed both an update of the reading list (which was essentially based on journals in the Management field, where the topic of this PhD is mainly referred to as "IT/IS capability") and an extension of the reading list with articles from the Organizational Science field whose keyword is "IT competence". As a result, another 13 articles were added to the reading list, leading to an overall set of 69 papers.
3. first review and selection of the reading list: first we removed from Piccoli's list the papers dealing with IT assets and kept only those related to IT capabilities. From the resulting overall list we then removed the purely theoretical papers that researched the topic very generally, with a limited emphasis on the operationalization of the concept. The final list for review consisted of 27 papers.
4. set up a tool to support the detailed review of the papers: an electronic worksheet was set up in order to collect all the relevant information deriving from the review. The table below shows the structure of the worksheet, where, for each reviewed paper the following data were reported:
    - category, type of capability defined by the author (when present);
    - name of the capability defined by the author
    - measure of the capability (when present): this is a "quantity", a property of the organization that according to the author is a proxy of the corresponding capability
    - comments
5. detailed review of the papers: finally, we analysed each of the 27 identified papers. Some of these articles were based on empirical research: in these cases we just used the research instruments attached to the paper. Some other theoretical papers presented a detailed framework to describe the concept of IT capability or IT competence: in these cases we extracted the variables and (when applicable) sub- variables composing the framework and used them respectively as category and name of capability.
6. reclassification of capabilities: the database deriving from the analysis of the 27 papers contained 630 items, 630 capabilities showing many semantic overlaps. The items were reviewed and reclassified eliminating redundancy and highlighting similarities. To do so we

referred explicitly to the taxonomy proposed by Piccoli (2005), distinguishing between Technical Skills, Managerial Skills and Relationship Assets. As a consequence, 67 significantly different items were identified and subdivided into the three categories.

These 67 items represents the tentative measure of IT capability, and therefore will be administered as the core of a questionnaire in the second – quantitative – step of the empirical research, presented in the next chapter.

6.1 Literature review

6.1.1 Studies about "IT capability"

The literature review within the Management Science discipline identified 20 papers published between 1988 and 2005. They all have in common the RBV – or at least the concept of competitive advantage - as the theoretical background, although not all of them explicitly refer to the term capability.

Fifteen of these papers are based on an empirical research performed with different methodologies, the large majority being case study research.

"Developing Capabilities to Use Information Strategically" (Johnston and Carrico, 1988)

The authors focus on competitive advantage of the companies and the role that internal factors and capabilities play in achieving it. They identify five internal factors that are claimed to support the strategic use of IT: Leadership, integration of IT and of the strategic functions, direct contact between management and IS functions, capability in the IS functions, mechanisms for line influence on IT.

This study is based on an empirical research on a very heterogeneous set of 11 companies that belong to different industries (banks, supermarket chains, hotels, ..). Data collected through interviews to the managers of these companies supported the thesis that the competitive advantages achieved are strongly influenced by the interaction among capabilities and the factors mentioned above.

"Information Technology and Sustained Competitive Advantage: A Resource-Based Analysis" (Mata et al., 1995)

The authors develop and propose a model that specifies under which conditions IT can (or cannot) generate competitive advantages. Using the theoretical framework of the RBV, they identify four attributes of IT: Capital requirements, Proprietary Technology, Technical IT skills, Managerial IT skills. From a theoretical standpoint the model introduces and tests the variables

that should be used to study the relationship between IT and competitive advantage. At the practitioners' level, the authors use the proposed framework to analyze different types of IT investments and show how they reduce the risk of erosion of competitive gain to a company.

"Capturing Flexibility of Information Technology Infrastructure: A Study of Resource Characteristics and Their Measures" (Duncan, 1995)

In this mainly theoretical paper, the author carries out a study in two stages: first, a literature review on the meanings of the term "infrastructure" and how this is related to the ability to use IT competitively. The definition accepted is the one from Niederman: "IT infrastructure is a set of shared, tangible, IT resources that provide a foundation to enable present and future business applications" (Niederman 1991). The tangible resources the author refers to are: Platform technology (hardware and operating system); Network and telecommunication technologies; Key data; Core Data-Processing applications. Then the paper introduces the concept of flexibility (i.e. the "ability of the IS department to respond quickly and cost- effectively to system demands, which evolve with changes in business practices or strategy") as a key characteristic of an information system which enables the exploitation of competitive advantage.

The output of the study is a theoretical framework, that the author suggests should be used to develop future measuring tools to assess infrastructure flexibility.

"Develop long-term competitiveness through IT assets" (Ross and Beath, 1996)

The article focuses from a theoretical standpoint on the issue of IT and competitiveness, recognizing in three so-called assets the key elements to sustain competitive advantage gained through IT: Human assets (i.e. a strong IT staff), Technology Assets (i.e. a reusable technology base) and Relationship Assets (i.e. partnership between IT and business management). Building on this threefold framework, the authors demonstrate through examples that companies should take into account different strategies to have their IT assets affect business value in the long term.

"Management by Maxim: How Business and IT Managers Can Create IT Infrastructures" (Broadbent and Weill, 1997)

The paper introduces the concept of IT maxims, that "describe how a firm needs to connect, share and structure information and deploy IT through the firm" and presents a framework (named "management by maxims"), a model of a process aimed at helping managers in linking the IT infrastructure to business objectives. The authors identify five categories of IT maxims: expectations for IT investments in the firm, data access and use, hardware and software resources, communication capabilities and services, architecture and standards approach. The

paper also identifies 23 infrastructure services, i.e. services provided firmwide by IT investments, divided into core IT infrastructure services (e.g. manage corporate communication network services) and additional IT infrastructure services (e.g. perform IS project management).

The overall framework is then applied to two large US companies to show its effectiveness in highlighting gaps between what exist and what is desired by the IT infrastructure or in finding that it actually fulfills the business requirements.

"The Implications of Information Technology Infrastructure for Business Process Redesign" (Broadbent et al., 1999)

This exploratory case analysis on four firms (in the Petroleum and in the Retail industries) investigates the role that IT can play in business process redesign. The paper builds on the concepts of IT infrastructure and IT infrastructure services, already introduced in Broadbent's (1997) paper. In order to apply these theoretical constructs in a field study, the authors choose as the unit of analysis the business process, since according to them it is more suitable for identifying the impacts of the IT infrastructure and because changes in business process often involve relevant IT investments

Building on these constructs, the paper provides this definition of IT infrastructure capability: it "includes both the technical and managerial expertise required to provide reliable services. Because it can be shared across boundaries and because it can enable better business processes, IT infrastructure is different from other IT investments and applications that directly perform business processes in a particular functional area or business unit." (Broadbent et al., 1999). Moreover, IT capabilities can be assessed using three measures:

- The extent of the firm's infrastructure services
- The provision of boundary-crossing infrastructure services
- The firm's reach and range

The paper's contribution to the study of IT capabilities clearly does not lie in the measures mentioned above, that are extremely vague in their definition. However, this research goes beyond the development of a theoretical framework, a typical outcome of previous studies, and represents one of the first attempts to empirically test a framework of IT capability.

"Strategic context and pattern of IT infrastructure capability" (Broadbent et al., 1999)

The authors stress the concept of IT infrastructure, defined as "the base foundation of budgeted-for IT capability (both technical and human), shared throughout the firm in the form of reliable services, and centrally coordinated". The paper is built on the assumption that IT infrastructure is difficult to imitate and as such can be considered a firm resource according to the RBV.

The paper also describes IT infrastructure as composed of 4 dimensions: IT for business processes, shared IT services, human IT infrastructure and IT components. The authors claim that the achievable impact on sustainable competitive advantage decreases from investments on the first to the fourth dimension.

"IT capabilities: Theoretical perspectives and empirical operationalization" (Bharadwaj et al., 1999)

This paper, together with the following one, published in MIS Quarterly by the same authors one year later (Bharadwaj et al. 2000, 2001), has already been presented and discussed in depth in the previous chapters.

In this literature review it is worth highlighting the impact of the two articles by Bharadwaj on the IS field. In fact the MISQ paper (Bharadwaj 2000) is the very first empirical research on IT capability that seeks for statistical validity of the constructs proposed. Despite the limitations discussed in previous chapters, this study has undoubtedly the merit of taking the discussion on the IT paradox to a higher level. In fact, the study demonstrates that superior business performances are achieved by those companies that have developed high IT capabilities, defined as "a firm's ability to mobilize and deploy IT- based resources in combination or copresent with other resources and capabilities" (Bharadway 2000).

"An Empirical Investigation of the Factors Affecting Data Warehousing Success" (Wixom and Watson, 2001)

As in the article from Broadbent (1999), the research presented in this paper deals with the challenge of IT capability focusing on a specific domain. The context of the study in this case is the implementation of data warehouse systems, projects which are often complex and risky, and as such, very relevant to identify factors enabling or inhibiting their success.

The authors classify three aspects of the success of a project of Data Warehousing: Organizational Success (the ability of the project team to commit the company to the project), Project Success (the ability to complete the project on time) and Technical Success (the ability to overcome technical problems and obstacles that may arise).

A survey on 111 projects identified that there is a high correlation between data quality (quality and quantity of data available in the data warehouse) and system quality (flexibility, degree of integration with the IT infrastructure, time of response). Successful projects are characterized by the co-presence of these two qualities. Moreover, the analysis of data shows that the project success is also strongly influenced by support from the management, who can "help to address organizational issues that arise during warehouse implementations: resources, user participation, and highly-skilled project team members increase the likelihood that warehousing projects will finish on-time, on-budget, with the right functionality." (Wixom 2001).

"Appropriating Value from Computerized Reservation System Ownership in the Airline Industry" (Duliba et al., 2001)

The paper focuses on a specific business process (and the related system): the reservations system in airline companies. The authors discuss if and possibly how the large investments in computerizing such processes led to improved organizational performance. More specifically, the RBV is used to evaluate the appropriation of value by the owners of these systems from deploying systems in travel agencies. These benefits, beyond fees from travel agents, should be seen in the vendor airline's market share between cities and in the overall performance of the airline at an industry level.

The authors identify 5 different types of source of benefits from IT investments:

- Making it easier to do business with the innovator
- Encouraging business by using technology to transform the nature of the product that is consumed
- Creating demand-side network externalities for technology adopters through standard solutions
- Using information technology to provide outstanding customer service
- Using information technology to create biased markets

Using an econometric approach the authors perform a longitudinal study across the 80's on 10 airline companies. The results support hypotheses that computerized reservations systems ownership is positively related to airline performance. It appears that strong airlines have appropriated the benefits of their computerized reservations systems, turning them into highly specialized assets for further travel-related innovation.

"Building IT Infrastructure for Strategic Agility" (Weill et al., 2002)

In this theoretical paper Weill et al. propose a model of IT infrastructure (see figure 6.1) supporting long-term strategies in large companies. Basing on four previous studies, the authors prove that IT services represent a powerful concept to understand and manage IT. IT services are defined as the IT modules corresponding to the incremental modular IT investments that leading companies make - gradually - to establish their infrastructure. Through the analysis of the infrastructure services of several companies the authors map 70 different services in 10 so-called Capability Clusters.

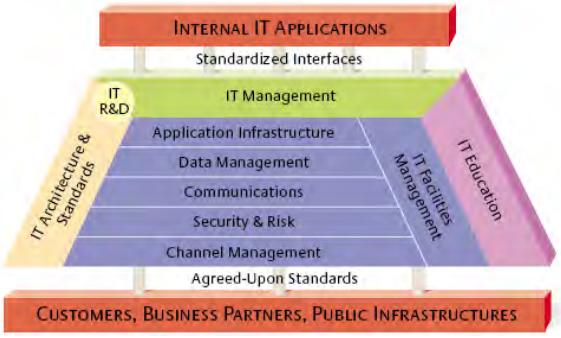

Figure 6.1: the layered representation of the IT infrastructure (Weill et al., 2002)

They found out that top performing businesses have studied and identified which capability clusters are crucial for agile implementation of any IT "initiative", and - in general - implementing different types of IT based business initiatives requires different high-capability IT infrastructures.

"A Process Model of Capability Development: Lesson from the Electronic Commerce Strategy at Bolse de Valores de Guayaquil" (Montealegre, 2002)

The paper applies the RBV to the case of a Latin American stock exchange. The "Bolsa" is studied in order to develop inductively a process model of capability development. Besides describing in detail the phases for such a process the author identifies the key capabilities developed at each phase of the model. Coherently with the previous literature on RBV, this case study shows that capability development is a gradual, cumulative, expensive and path-dependent process.

The proposed model addresses resources as the specific assets and competences used by firms to implement and develop business strategies. The author aggregates under this definition both tangible (e.g. financial assets, technology) and intangible (such as managerial skills, reputation) resources. With regards to the concept of capability, the model refers to Teece's (1997)

definition: “firm’s abilities to integrate, build, and reconfigure internal and external assets and competencies so that they enable it to perform distinctive activities”.

The author identifies five resources (Leadership, Organizational Culture, Information Technology, Long- Term view, Social Networks) as critical in supporting the process leading to the development of capabilities.

“Beyond the business case: New approach to IT investment” (Ross and Beath, 2002)

The article draws on a case study of IT management at United Parcel Services. Although the authors do not make any direct reference to the RBV, their analysis of the strategic advantages gained through IT investments lead to the identification of so-called "drivers" that have interesting similarities with the concept of IT capabilities

As noted in the paper, in order to tie IT investments to business objectives, executives should take into account two complementary dimensions: technology scope (that spans in a *continnuum* between business solutions and shared infrastructure) and strategic objectives (from short-term profitability to long-term growth). Basing on this theoretical framework, the authors identify four different types of IT investments, each of which is enabled by specific drivers:

- Transformation: A core infrastructure that is inadequate for desired business model
- Renewal: Opportunity to reduce cost or raise quality of IT services A vendor’s decision to stop supporting existing technology
- Process improvement: Opportunity to improve operational performance
- Experiments: New technologies, new ideas for products or processes, new business models

“Leveraging IT resources and capabilities at the housing and development board” (Teo and Ranganathan, 2003)

This paper presents an application of the RBV to the case study of the Singapore’s Housing and Development Board. The authors use the concept of business unit resource defined in Venkatraman et al. (1990). This concept is discussed and broken down into three main related components (IT resources, and the complementary human resources and business resources) and the related sub-components. The research model presented here provides important elements to the building of a structured definition of IT capability. Moreover, this paper (as mentioned in a previous chapter) is relevant to this PhD study because it aims to relate the proposed resources to the improvement of organizational performance.

"Determinants of a Sustainable Competitive Advantage Due to an IT-Enabled Strategy" (Dehning et al., 2003)

The paper focuses on the role of IT resources and capabilities (with no explicit differentiation between these two terms) in enabling a SCA. The authors' approach on the concept of IT capability is summarized in table 6.2, where the emphasis is put on the type of barriers to imitation that IT-enabled initiatives can raise.

Managerial IT skills	refer to management's ability to conceive, develop, and exploit IT applications (Mata et al., 1995)
Source of SCA because:	• they enable companies to manage the technical as well as market risks associated with investment in IT (Bharadwaj, 2000; Mata et al., 1995). • they are developed over time through the accumulation of experience (Katz, 1974). • they are tacit and causally ambiguous (Castanias and Helfat, 1991; Mata et al., 1995). • they are the result of socially complex processes (Mata et al., 1995)
Technical IT skills	refer to the expertise needed to build and use IT applications (Copeland and McKenney, 1988)
Source of SCA because:	• training and education are prime examples of a time consuming activity (time compression diseconomies) making them immobile (and therefore a source of sustainability) • IT employees are not interchangeable and cannot be replaced at will by purchasing them from the 'People Store' (Brooks, 1995; Demarco and Lister, 1987) • successful development of IS applications requires teams rather than individuals. This is a potential source of sustainability because building IT teams that will be receptive to new technology is a long-term investment; teams are less mobile than individuals, and team- embodied knowledge decays at a slower rate as it passes to new generations of team members (Bharadwaj 2000; Demarco and Lister, 1987; Schneider, 2000; Edmondson 1999)
IT infrastructure	"the base foundation of IT capability, delivered as reliable services shared throughout the firm and coordinated centrally, usually by the information systems group" (Weill and Broadbent, 2000).
Source of SCA because:	• it is a complex combination of technology and personnel: the creation of a deeply embedded IS may require a wide variety of socially complex links and may be imperfectly understood (Barney, 1986, 1991, 1997; Weill and Broadbent, 1998). • creation of successful IT infrastructure takes time and effort, often involves experiential learning, and has unique characteristics in each firm (Bharadwaj, 2000; Cash et al., 1992; Duncan, 1995; Neo, 1988; Venkatraman, 1991; Weill and Broadbent, 1998)

Table 6.2: Determinants of a Sustainable Competitive Advantage (Dehning et al. 2003)

This theoretical framework is used to compare in a longitudinal study "a set of companies that have a competitive advantage due to an IT-enabled strategy and their competitors who do not" (Dehning 2003). Such sets were identified from a list of companies that have been recognized for their effective use of IT in the late 1980s and the 1990s in an annual list compiled by ComputerWorld and InformationWeek.

Empirical evidence shows that IT can improve a company's performance and competitive position, in particular, managerial IT skills are positively related to sustainability, and competitor's knowledge of competitive advantage is negatively related to sustainability. On the contrary, there is no support for technical IT skills or IT infrastructure as a source of sustainable competitive advantage.

This paper represents an important point of reference for the present PhD thesis, given the similarities in its approach (the framework of IT capabilities and resources) and its aims. However, it is worth noting two relevant differences.

First, the dependant variable of the research is SCA and not organizational performance, although in presenting the research model the authors specify that SCA is essentially based on ROA, one of the most typical financial indicators of business performance.

Second, the factors used by the authors to measure the independent variables (shown in figure 6.2) are highly questionable since they are assessed indirectly. Essentially this study has the same approach as Bharadwhaj's 2000 paper discussed in the previous section, thus similar criticisms may apply.

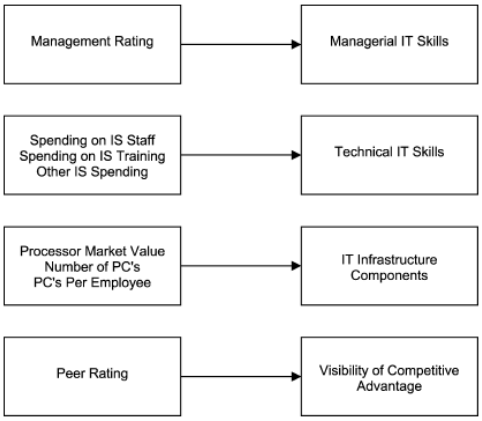

Figure 6.2: the Mapping of the ComputerWorldPremier 100 criteria to managerial IT skills, technical IT skills, IT infrastructure, and visibility (Dehning et al. 2003)

"Using resource-based theory to interpret the successful adoption and use of information system and technology in manufacturing small and medium-sized enterprises" (Caldeira and Ward, 2003)

The most interesting contribution of this paper, one of the very few within the stream of IS research related to IT capability that focuses on SMEs, is represented by the development of a layered framework to understand the effect of the adoption and use of IT/IS. This outcome is the result of a theoretical study that led to 12 in-depth cases studies on manufacturing SMEs (the majority being medium companies) located in Portugal.

As shown in the figure below (figure 6.3), at the individual level the authors decompose the concept of "IT capabilities" (the authors call them "IT skills") in three constructs: Technical IS/IT skills, Managerial IS/IT skills, Business and general Management Skills.

From the empirical evidence, two factors - primarily associated with the internal context of the organizations – appear to determine different levels of success in IS/IT adoption and use. These factors are: management perspectives and attitudes towards IS/IT adoption and use; development of internal IS/IT competences. As clarified in the conclusions of the paper: "..The firms that were more successful in adopting IS/IT did not rely on external solutions as an

alternative to the development of IS/IT knowledge and competences in-house. In these firms, access to unique software was not seen as critical to the business and some even sold their software to potential competitors. The objective of these firms was to stay ahead of competitors by using their IS/IT knowledge. Management viewed IS/IT as a dynamic, constantly changing variable, and to cope with this pace of change these firms developed IS/IT competences in-house, in order to ensure the core software permanently fitted the business requirements. Resources and knowledge developed were either in the organization or obtained from a closely associated IS/IT enterprise." (Caldeira 2003)

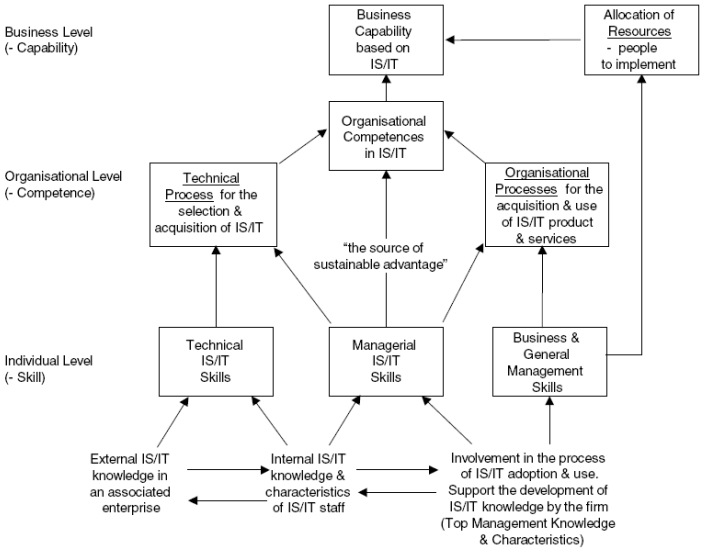

Figure 6.3: A resource-based model to understand the successful adoption and use of IS/IT in manufacturing SMEs (Caldeira, 2003)

"The resources-based view and Information system research: Review, extension, and suggestion for future research" (Wade and Hulland, 2004)

This paper has been broadly discussed in a previous chapter. Being a review paper, it does not provide any empirical evidence of the theory that it discusses. However, this is one of the two most important papers (together with Piccoli's (2005) article, which is largely based on this one) to develop the framework for empirically studying IT capabilities.

Despite the conceptual weaknesses the categorization of Information System Resources by Wade and Hulland represents a major contribution to the development of research on Strategic Information Systems.

"Strategic aspirations for net-enabled business" (Hackbarth and Kettinger, 2004)

The paper presents an empirical study where a model named NEBIC ("Net-Enabled Business Innovation Cycle") is applied on a set of 28 US companies belonging to different industries

(both "high- tech" and "low-tech") that describes a path by which firms employ dynamic capabilities to leverage net-enablement.

Dynamic capabilities are here defined as “sets of specific and identifiable enabling process such as product development, strategic decision making, and alliancing that are neither vague nor tautological” (Eisenhardt & Martin 2000). As such, they include also those capabilities that are related to the adoption and use of IT and IS.

The purpose of the NEBIC model is to contribute to the field of strategic management and strategic information systems, by “understanding the strategic target and associated paths of net-enablement aspirations”, i.e. to “predict and understand a firm’s capability to create customer value using digital networks, that encompasses a full range of organizational actions from recognizing emerging IT to measuring the customer value created through network enablement.” (Hackbarth 2004).

“Where do capabilities come from and how do they matter? A study in the software services industry” (Ethiraj et al., 2005)

The paper assumes that capabilities are a source of competitive advantage, and studies in detail what are capabilities, where do they come from and how they affect business performance.

Capabilities are defined as assets that generate "quasi rents", which, in turn, are defined by Peteraf (1993) as “the excess of an asset’s value over its salvage value or its value in its next best use”. Capabilities are the consequence of:

- the accumulation of experience due to routine (the repetition of similar operations/activities)
- the learning-by-doing
- intentional investments that an organizational system carries out that lead to constant increases of the effectiveness of routines

The authors study a large sample of detailed project-level data from a leading firm in the global software services industry and they identify two classes of capabilities that can lead to improved business performance: “Client-specific capabilities” and “Project management capabilities”. The first one is a function of repeated interactions with clients over time and across different projects: such repetition reduces project execution costs and helps improve project contribution. The second one is acquired through deliberate and persistent investments in infrastructure and systems to improve the firm’s software development process.

6.1.2 Studies about "IT competence"

Seven papers were classified as focussing on the topic "IT competence". These papers – published between 2000 and 2006 – show a theoretical background more heterogeneous than the previous ones. Some of them use RBV as a reference theory, but others refer more generally to concepts such as competitive advantage and its sustainability. What they do have in common is the focus within the research area of Organization Science, and precisely on the organizational impacts of IT, at the level of the IS function or the CIO / IT manager. All the papers in this group are grounded on an empirical study, carried out - in all cases but one - through a survey. Two studies are set in the SME environment.

"Whose job is it anyway?: organizational information competencies for value creation" (Peppard et al., 2000)

The paper examines the topic of value creation related to investments in Information Systems. Using Barney's RBV, the authors argue that IT can be a strategic asset, but to study this issue they claim it is more effective to adopt an organizational perspective, an approach broader than the majority of the literature, usually focusing on the IS function level.

To generate value from IT investments, it is argued that organizations should recognize and develop information competencies that, following Cross (1997), "comprise a blend of personal skills, knowledge and experience, roles and organizational process". And, focusing on IS professionals, they should be required "to have not just 'technical' skills but also 'business' and 'interpersonal' skills" (Peppard 2000).

Through a multi-method multi-phases study, where literature review is complemented by focus groups and case studies, the authors identify and define a set of competences that are coherent with the objectives mentioned above (see table 6.3 below).

Macro Competence	defined as the ability to:
Formulate strategy	Evaluate strategic information and technology based opportunities as part of the business strategy formulation process and define the decision-making environment
Design process and information	Translate the business strategy into business processes and information based needs
Define supply resources	Translate the business strategic vision into long-term information supply resource requirements
Develop supply resources	Create and maintain the information supply resource
Exploit and monitor	Develop and apply exploitation plan and monitor value creation
Develop, implement and operate solutions	Deploy resources to develop, operate and information solutions

Table 6.3: information macro competences identified (Peppard 2000)

"Benchmarking information technology practices in small firms" (Cragg, 2002)

This paper, already mentioned in the previous literature review on business performance, aims at developing a methodology, especially designed for the application within small firms, to

benchmark IT management practices. The contribution of this paper to our literature review is particular relevant first of all because the study explicitly takes into account the specific characteristics of SMEs. Second, the paper presents a detailed review of the literature on the variables characterizing successful IT practices. Third, it develops and applies in an empirical study (on 30 engineering SMEs firms with between 20 and 100 employees) a framework that synthesizes the different IT practices in small firms.

Both the main variables of the framework (the headers of the rows of the table below) and the same items to describe the single IT practices (the cells of the same table) represent an important point of reference for developing a measure of IT capability (see table 6.4).

		IT laggards		IT leaders
Senior management involvement	Role of IT within the business	IT assists with many processes but provides no or little advantage over competitors	Most IT provides value to the firm and some advantage over competitors	IT is viewed as strategic and provides considerable advantage over competitors
	Senior management commitment to IT	Some senior managers prefer to ignore IT issues unless in a crisis	Some, but not all, senior managers are enthusiastic about IT	All senior managers are enthusiastic about IT, regularly discuss IT issues, and share responsibility for IT projects when necessary
	Seeking out new uses for IT	Managers rarely explore possible new uses for IT	Managers occasionally explore possible new uses for IT	Managers regularly explore new uses for IT through discussions within and outside the firm, and at exhibitions and seminars, as part of the firm's commitment to continuous improvement
Technical capabilities	Customisation of new IT systems	Packaged systems are purchased and undergo no or little customisation	Packaged systems are purchased and undergo some customisation	Either bespoke systems are developed or packaged systems are purchased and undergo considerable customisation
	IT specialist	An employee with no formal IT training manages IT on a daily basis. IT problems are usually fixed by technical experts from another firm	Staff have developed sufficient technical expertise to fix most IT problems and manage most IT projects, but occasionally need to seek help from external experts	The firm employs an IT specialist with years of formal IT training. This makes the firm relatively independent of IT service providers
	IT development skills	No one within the firm can develop small systems with either database or spreadsheet software	We have sufficient hands- on skills to develop small databases and spreadsheets	Our system development skills allow us to customise new systems and build significant systems with database and spreadsheet software

Table 6.4: Proposed IT benchmarks for small firms with between 20 and 100 employees (Cragg 2002)

"Shaping Agility through Digital Options: reconceptualizing the role of Information technology in contemporary firms" (Sambamurthy et al. , 2003)

The purpose of this paper is to develop a comprehensive theoretical framework to understand the strategic role of IT in firms. To do so, the authors refer to three main theoretical streams: strategy, entrepreneurship, and IT management.

The strategic management literature identifies three logics of strategy (positioning, leverage, opportunity) that lead certain factors to be determinant in affecting firm performance. The logic named "opportunity" appears to be very frequent in recent times, and it is influenced by the

continuous development and coevolution of inimitable capabilities. The authors use Eisenhardt (2000) to define such capability-building mechanisms as dynamic capabilities: “the organizational and strategic routines by which firms achieve new resource configurations as markets emerge, collide, split, evolve, and die” (Eisenhardt 2000). By applying this concept to the domain of IT investments, the authors propose the construct of digital options as the “set of IT-enabled capabilities in the form of digitized enterprise work processes and knowledge system” (Sambamurthy 2003).

The second line of research is entrepreneurship, from which the authors import the concept of entrepreneurial alertness, i.e. the “capability of a firm to explore marketplace, detect areas of marketplace ignorance, and determine opportunities for action” (Sambamurthy 2003).

Finally, within the IT management literature, the concept of agility (i.e. the “ability to detect opportunities for innovation and sieze those competitive market opportunities“(Sambamurthy 2003)) is found relevant for the aims of this study.

As an independent variable in the research model, the author recognizes IT competence, defined according to Feeny's (1998) statement: “IT competence describes a firm’s capacity for IT-based innovation by virtue of the available IT resources and the ability to convert IT assets and services into strategic applications. Important elements of IT competence include the level of IT investments, the quality of the IT infrastructure (global connectivity and reliability), IT human capital (appropriate technical and business skills), and the nature of IS/business partnerships”.

As represented in figure 6.4 (below), the paper proposes that these three dynamic capabilities operates jointly to enable IT competence affecting the competitive actions and, finally, influence the financial performance of a firm.

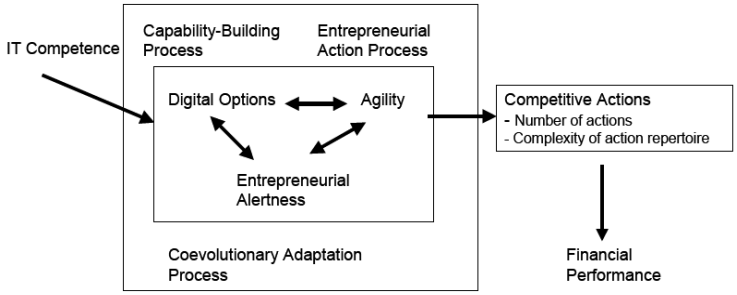

Figure 6.4: the so-called nomological network of relationships between IT competence and Firm performance (Sambamurthy 2003)

"IT competency and firm performance: is organizational learning a missing link?" (Tippins and Sohi, 2003)

This paper has already been discussed in a previous chapter in regard to the issue of measuring business performance. In this section it is useful to highlight the definitions and the variables that are used to frame the concept of IT competency.

The paper draws on the RBV, focusing on the characteristic of uniqueness that resources should possess to enable the achievement of a SCA. To explain such uniqueness, Lei's (1996) definition is used: "competencies are inimitable because of idiosyncratic development of resources that have little value outside the context of a specific firm. This inimitably can form the basis of competitive advantage". IT competency is then defined as "the extent to which a firms knowledgeable about and effectively utilizes IT to manage information within the firm. Included in this conceptualization is the assumption that firms also possess IT objects (software, hardware and IT personnel)" (Tippins and Sohi 2003). Under this definition, the authors recognize three components of IT competency: IT Knowledge, IT operations, IT objects.

The general assumptions of the research model of the paper are that IT is a useful tool that may facilitate competitive advantage only when combined with existing firm capabilities and organizational learning is one process that plays an important role in enhancing a firm's capabilities and competitive advantage. As a consequence, the paper explores - using a RB perspective – "how IT can be utilized to gain a competitive advantage by examining the mediating role of organizational learning on the linkage between IT competency and firm performance".

The empirical study, a survey on 271 firms, uses the measures represented below (table 6.5) for the main constructs and the fourth control variable.

1. IT Competency • IT knowledge • IT operations • IT objects	3. Firm performance • Customer retention • Sales growth • Profitability • Return on investment
2. Organizational learning • Information acquisition • Information dissemination • Shared interpretation • Declarative memory • Procedural memory	4. Market power • Market share • Firm size

Table 6.5: constructs to measure the impact of IT competency on firm performance (Tippins and Sohi 2003)

The results of the study confirm that firms have the potential to gain competitive advantage by developing an IT competency that can enhance organizational learning and, in particular that

"the knowledge acquired through organizational learning can mediate the effect of IT competency on firm performance".

"Experience-Based Top Management Team Competence and Sustained Growth" (Kor, 2003)

This paper develops and tests an experience-based model of top management team competence and its effects on a firm's capacity for entrepreneurial growth. Although dealing only partially with the core subjects of this PhD thesis, the paper provides a complementary contribution to it.

One interesting finding is that, in accordance with the RBV, firm- specific knowledge and skills can be a source of hard-to-imitate competitive advantage. Because industry-specific managerial experience usually can be acquired in the labor market and deployed in many firms in the same industry, its value added to competitive advantage (e.g., comparative entrepreneurial growth) is smaller than the contribution of founders' firm-specific knowledge, which is not transferable between firms.

As a second relevant aspect, this paper shows that a theoretical model of top management competence should capture management experience at multiple levels (e.g., firm, team, and industry). Each level of managerial experience is linked to a different knowledge base and produces a unique effect on the growth capacity of a firm.

"Business Competence of Information technology Professionals: Conceptual development and Influence on IT-Business Partnership" (Bassellier and Benbasat, 2004)

The paper deals with a subset of the concepts that represent the object of this thesis. The focus, here, is on the specific context of the relationship between IT professionals and their business clients. The authors identify the competences that can improve the partnership between these two categories of actors, and , finally, positively affect IT investments. The interest of the study is constrained to the not IT-related competences. The authors classify such competences according to two main categories: Organization-Specific Knowledge (Organizational overview, Organizational units, Organizational responsibility, IT-business integration) and Interpersonal and Management Knowledge (Knowledge networking, Interpersonal communications skills, Leadership skills).

The paper provides a relevant contribution to this literature review, because it develops and validates a measure of the competences defined.

"Information System Competencies in Small and Medium-sized Enterprises" (Caldeira et al., 2005)

The paper presents the results of an exploratory qualitative study on 9 SMEs where the resource based theory is used to study the relationship between IS competencies and IS satisfaction of firms.

Although not a journal paper, it represents one of the most recent efforts in the field of IT capabilities, and one of the few studies within this field applied to the context of SMEs.

It is interesting to note the distinction that the authors make among the main concepts (regrettably, the paper does not provide an equally clear definition of IS satisfaction.), coherently with their previous paper (Caldeira 2003):

- resources: "stocks of available factors that are owned by the firms" (Amit and Schoemaker 1993)
- capability: "the ability of an organisation to deliver a product or service into the market place" (Lambert and Bythewat 1998)
- competence: "the ability to develop, manage and deploy resources in support of a capability or capabilities" (Lambert and Bytheway 1998)

The authors apply the Peppard & Ward (2004) framework of 26 IS competencies (listed in table 6.6) in a series of interviews within Portuguese companies between 50 and 500 employees.

One relevant contribution of the study is the raising of the need to re-define some of the definitions of IS competencies presented in such frameworks. For example "instead of formal and detailed information architectures, the ability to develop basic information systems, data and process models was acceptable as an IS infrastructure competence at the small business level" (Caldeira 2005).

Competency domain (Peppard and Ward, 2004)	**IS Competencies** (Peppard and Ward, 2004)
1. Formulate strategy	1. Business strategy 2. Technology innovation 3. Investment criteria 4. Information governance
2. Define the IS contribution (IS strategy)	1. Prioritization 2. IS strategy alignment 3. Business process design 4. Business performance improvement 5. Systems and process innovation
3. Define the IT capability (IT strategy)	1. Infrastructure development 2. Technology analysis 3. Sourcing strategies
4. Exploitation	1. Benefits planning 2. Benefits delivery 3. Managing change
5. Deliver solutions	1. Applications development 2. Service management 3. Information asset management 4. Implementation management 5. Apply technology 6. Business continuity and security
6. Supply	1. Supplier relationships 2. Technology standards 3. Technology acquisition 4. Asset and cost management 5. IS/IT staff development

Table 6.6: The 26 Peppard and Ward (2004) IS Competencies

6.1.3 The outcomes of the literature review

The papers reviewed in the previous paragraphs use a very limited set of conceptual frameworks (and in particular the RBV and the organizational theories on competence). Nevertheless, such papers show relevant differences in the concepts they use, even when they are referred to by the same terms. In other words, the literature review confirms what was already pointed out in the first chapter, that the term "capability" is not universally interpreted and used in the IS field. It is worth noting that a very similar lack of convergence applies to "IT competence", as shown in the review dedicated to this concept in the previous section.

In particular, the term competency is used consistently by Peppard (2000) and Tippins (2003). This term appears also in Cragg (2002) and Caldeira (2005) but in the first case it is just mentioned in the introduction of the article, while in the rest of it the authors refer systematically to "IT management practices". In Caldeira (2005), contrary to what can be found in Caldeira (2003), the terms competence and competency are both used with no explicit reference to differences in meanings, leaving the impression that the authors simply consider the two words as synonymous.

The term competence is used in Sambamurthy (2003), adopting a definition from Feeny (1998), Kor (2003), Bassellier (2004) and Caldeira (2003). Such papers make a systematic use of this word, therefore one may infer that these authors are more aware of its specific meaning.

Nevertheless, in general the papers presented in this section pay little or no attention at all to the issue of the definition of competence. This is evident in the fact that only Caldeira (2003, 2005) (although with the contradictions highlighted above) discuss the concept of competence on the basis of a literature review rooted not exclusively within the IS field.

This outcome of the literature review confirms the appropriateness of the pragmatic approach chosen for this study: instead of following one definition of IT capability or of competence, we attempted to define the concept by means of the variables that describe it. These variables were extracted from the analytic review of the papers presented.

6.2 Review and reclassification of the IT capabilities

As anticipated above, the analysis of the articles generated a list of 630 capabilities that were reclassified according to the threefold taxonomy proposed by Piccoli (2005), distinguishing between Technical Skills, Managerial Skills and Relationship Assets. This classification allowed us to:

- eliminate items that were not related with the concept of IT capability, but dealing for example with *organizational capability, IS/IT performance, IT Infrastructure*

- point out significant semantic overlaps among the hundreds of items, leading to consistent reduction in their numbers.

However, the final set was still composed of 67 different items. To highlight the similarities among these items and thus to clarify the meaning of the three constructs proposed by Piccoli, we grouped the items into several subsets. The next paragraphs will explain analytically the resulting tree- shaped structure, synthesized as follows:

Management Skills:

- *Management of relation between IT and business process (ITBP)*
- *Management of IT function (MITF)*
- *Management of relation between IT and Strategy (ITSTRAT)*
- *Management of relationship of IT product/services (ITSOURC)*
- *Management of CBIS lifecycle (ITPM)*

Relationship Assets

- *External Relationship Assets (ERA)*

- *Internal relationship Assets (IRA)*

Technical Skills

- *Management of CBIS lifecycle (ITLC)*
- *Management of product/services of the IT function (ISPROD)*

The distribution of items among the three dimensions is far from being balanced. Only a limited amount of papers actually focus on the most abstract concept of "relationship", while typically dedicating significant effort to clarify managerial and technical aspects of IT capability. In fact, the number of different items characterizing MS suggests that managerial skills is a multi-faceted concept, and, the complexity of this sort of "soft-skills" can be captured only by splitting its various components. As a consequence, the measure of MS is subdivided into five subsets, that show relevant semantic differences. TS - the technology-related component of IT capability - is divided only in two categories, dealing either with skills regarding specific technologies (e.g. networking, specific applications such as ERP systems), or regarding the phases of the software life cycle (e.g. development, selection testing).

The 9 subsets of items listed above detail the concept of "IT capability". MS, TS and RA are defined in Piccoli and Ives (2005) as "IT capabilities" (the precise sentence they use is "IT capabilities ... include technical skills, IT management skills and relationship assets", page 10).

In this thesis we will address MS, TS, RA with the term "dimensions of IT capability" (we can refer to them as level-0 IT capabilities), MSITBP (and the like) will be referred to as a "sub-dimension" (level-1 IT capabilities") and each single item belonging to a sub-dimension will be referred to as "skill" (level-2 IT capabilities).

The following paragraphs detail the characteristics of each sub-dimension and list the related skills included in the proposed measure of IT capability.

6.2.1 Management Skills

Management of the relation between IT and Business Process and/or Organizational Units (MS ITBP)

	Item coding	Questions
		what is the level of knowledge of the IT manager on
MS	ITBP1	main challenges that different divisions in the organization face achieving their objectives
MS	ITBP2	the connections and interdependencies between the various division in the organization
MS	ITBP3	***How much does she/he participate in business activities that are not directly related to IT?***
MS	ITBP4	***How experienced is she/he at evaluating the organizational impacts of IT solutions?***
		How well can she/ he - To what extent is she/he able to
MS	ITBP5	coordinate the integrated infrastructure and manage its relationships with the business units
MS	ITBP6	integrate IT resources effectively with process reengineering initiatives
MS	ITBP7	design business operations and process required to deliver the business strategy

This category is formed by those skills that support the creation and the delivery of services that have a relevant organizational impact either at the business processes or at the function level.

Within this area, the reviewed papers refer to a set of skills that are defined under the general umbrella of the IT Business Process Integration. These skills help managers in supporting the changes deriving from IT-based innovations, and are expected to improve effectiveness and efficiency. To enable the achievement of such superior performances a manager has to know the portfolio of IT applications to be used in a business process (Bharadwaj 1999), what are the human and economic resources needed to support the process change (Mata 1995) and should look for the most up-to-date technologies to implement such change (Caldeira 2005).

Another relevant set of skills is related to what Duncan (2005) calls flexibility, i.e. the ability to redesign the business processes by means of IT. The IT manager needs to understand what are the opportunities to use IT/IS within the firm, and this, in turn, is possible only by developing a direct communication channel between the IT function and the line Managers (Johnston, 1988). Moreover, the IT manager is expected to assess the potential contribution of IT to the business processes. This can be done by developing IT- enabled best practices at the business process level, by identifying information requirements related to the implementation of strategic objectives into business process activities, by contributing to the R&D push towards products and services innovations (Caldeira 2005) and by developing an understanding of the relationships between the business units (Broadbent 1999; Bharadwaj 2000; Sambamurthy 2003)

Thirdly, a set of skills in this category lies in the ability of the IT manager to solve business problems generating creative and flexible solutions. The IT manager, together with her/his team should develop specific IT-based solutions to specific critical issues of the business processes (Wade 2004; Ross 2006).

By developing and using these skills, it is reported that a number of results could be achieved, such as reduced time to market for product/service, agility, ease in data access and use such as seamless and distributed access to data independent of the platform (Broadbent 1997; Hackbarth 2004).

Management of IT Function (MS ITF)

	Item coding	Questions
		How well can she/ he/your organization - To what extent is she/he/your organization able to
MS	ITF1	attract and retain high-caliber staff committed to the vision of the one corporate
MS	ITF2	define information management policies for the organization and the roles and responsibilities of general management and the IS/IT function
MS	ITF3	educate IT personnel on technological developments as well as business-related issues

This category aggregates the skills related to the ability to manage the organizational unit devoted to IT/IS. The quality of the work done by the IT function can have a very significant weight on the overall success of IT in a firm, for example because it should be directed towards guaranteeing the coherence among the different IT policies within the whole organization and reducing redundancy within the Information System (Bharadway 1999).

To manage the IT function requires - first of all - formulating the IT strategy, defining the roles and the responsibilities of the employees working in this function (Broadbent 1999; Bharadway 1999; Bharadwaj, 2000). Second, the IS/IT staff should be taken care of in terms of hiring, training and developing a team. If this is done appropriately the IT/IS staff can enjoy an environment that stimulates "intellectual productivity" and can keep high professional and technical skills creating "organizational learning" that can be effectively used to perform, in an effective and inimitable fashion, the activities in the IT function (Caldeira 2005; Broadbent 1997; Teo 2003).

Management of the relationship between IT and Strategy (MS ITSTRAT)

	Item coding	Questions
		To what extent in your organization
MS	ITSTRAT1	business strategic planning is integrated with IT planning
MS	ITSTRAT2	IT has a strategic role in achieving our firms objectives, rather than just a vehicle for cost displacement
MS	ITSTRAT3	your business is about creating new products/services using IT
MS	ITSTRAT4	IT is used to create biased market
MS	ITSTRAT5	IT is used to alter the linkages with supplier and customers
		How well can she/ he/your organization - To what extent is she/he/your organization able to
MS	ITSTRAT6	convert IT assets and services into strategic application
MS	ITSTRAT7	Incorporate the potential of new and emerging technologies in long term business development

This set of skills emphasizes the strategic changes induced by IT and the development and delivery of applications and services that have a high impact on the firm's strategy. More specifically, here we refer to the ability to understand the role of IT in the firm's internal (within the organization) and external (towards the markets) strategies. The CIO should develop a strong

knowledge of the internal opportunities and the competitive conditions that can lead the company to grow (Broadbent 1999; Kor 2003).

Several papers underline the need to have in the IT function highly developed managerial skills just because of the number of complex influences that the IT/IS staff can exert on the firm's strategy (Mata 1995; Sambamurthy 2003; Ross, 2000; Bassellier 2004; Kor 2003). In fact, such influence could take place in different ways:

- coordinate and support requests from suppliers and clients
- retrieve in the market the resources necessary to implement the firm's strategy
- assess the actual strategic impact of IT on the business
- convert IT assets and services into strategic applications aimed at supporting the strategy
- monitor and understand when an opportunity to apply new technology to the strategy raises
- understand firm's objectives, the core capabilities and critical success factor of the company
- contribute to the strategic positioning in the market of products and services

A first subset of skills in this area refers to the role of IT in the process of definition of the internal strategies. The IT manager is asked to understand the added value of the use of IT for the company (Bharadway 1997; Teo 2003) and to contribute to the development of new product and services (Johnston 1988), or to incorporate information efficiently and effectively in the strategic processes, to identify the critical elements in the business that limit the implementation of firm's strategies (Peppard 2000; Caldeira 2005; Johnston 1988). Some authors take a step forward emphasizing the need to integrate IT into the company strategies, in order to achieve several advantages, such as an increased quality service perceived by the customer, enablement of IT based innovation, introduction of new products and services (Broadbent 1997; Bharadway 1999).

From a different point of view, IT can also play a critical role for the strategies concerning the external environment of the organization. IT can enable identification of the market areas and segments to address, or, to avoid given the associated degree of risk or market discontinuity (Mata, 1995; Sambamurthy 2003).

Management of relationship with suppliers of IT products/services (MS ITSOURC)

	Item coding	Questions
		How well can she/ he/your organization - To what extent is she/he/your organization able to
MS	ITSOURC1	facilitate the contracts (ensuring the success of existing contracts for IS/IT services)
MS	ITSOURC2	identify the potential added value of IS/IT service suppliers
MS	ITSOURC3	co-operate with software-houses in IS analysis
MS	ITSOURC4	determine and evaluate supply sourcing options
MS	ITSOURC5	understand and manage cost of acquisition and ownership

Within this category of IT capabilities there are those skills enabling a proper management of the relationships between the firm and its provider of IT products and services. At first sight, this category may sound very similar to the third type of IT capabilities, i.e. Relationship Assets: this is not the case. In fact, this set of Mangerial skills is specifically focused on outsourcing activities, while the domain of the Relationship Assets is different and broader.

Among the skills mentioned in the reviewed papers, we found a first set of skills related to the issue of strategic sourcing. The IT manager should collect and analyze the information about the market of IT products and services, identify accordingly the technologies to be adopted and assess the corresponding added value for the firm (Feeny 1998; Caldera 2005; Peppard 2000). Besides these skills, that allow the company to carefully choose the IT outsourcers, the IT manager is also asked to manage ex-post the relationship with the IT suppliers, e.g. to negotiate contracts appropriately as well as to co-operate with the IT supplier in the definition of the system requirements (Broadbent 1999; Wade 2004).

IT project management (MS ITPM)

	Item coding	Questions
		what is the level of knowledge of the IT manager on
MS	ITPM1	co-ordinate IS/IT development and implementation
MS	ITPM2	estimate the effort and the duration of a project and identify appropriate resources (eg.: people with necessary skill, experience, availability)
MS	ITPM3	monitor, measure and evaluate the benefits derived from IS investment and use
MS	ITPM4	acting in a leadership role (establishing direction, directing people, motivating and inspiring)
MS	ITPM5	is flexible, eg by improving task performance through trial-and-error experimentation
MS	ITPM6	effectively manages cross-functional teams and ad-hoc structures
MS	ITPM7	the IT manager develops a personal social network

This set of skills includes the capabilities that enable the management of IT-enabled projects, thus the skills necessary to support the enactment of the CBIS lifecycle process. A large part of the reviewed literature deals with this aspect: in our analysis we found 92 different skills related to this field, that has been reduced to 7 after the reclassification process. Within this category it is possible to recognize three different areas of interest: IS/IT planning, management of relationships, IT skills development.

A relevant part of the items refer to planning activities that the IS management is supposed to carry out: investments in IT platforms require specific abilities in managing and planning,

including the identification of the most adequate solutions available in the market (Wade 2004; Sambamurthy 2003). The scheduling of IT projects requires the ability to assess the human and financial resources needed to complete these projects on time (Wixom 2001; Caldeira 2003; Ethiraj 2005). These resources can be identified only through the on-the-field experience of the managers and the data available of previous projects (Ethiraj 2005). On the other hand, it is important to select appropriately the project to develop, by accurately assessing the related costs and resulting benefits (Peppard 2000; Caldeira 2005).

Another critical aspect of a successful management of IT projects is the creation and development of a network of relationships. Although this issue is broadly mentioned, it is only marginally discussed in the reviewed literature. Basselier (2004) notes that interpersonal communication skills are important for the IT function since they allow improving the communication among individuals with different organizational aims, different cultural background and different semantics, and thus enable the creation of cross-functional teams to design and implement complex IT-based initiatives.

Finally, it is recognized that the IS/IT function should be governed through an effective leader, who can coordinate and manage different and complex IT projects, assess the adequacy at the company level of the technological alternatives and develop flexible solutions to the company problems (Bharadwaj 2000; Piccoli 2005).

6.2.2 Relationship Assets

External Relationship Assets (RA ERA)

	Item coding	Questions
		How well can she/ he/your organization - To what extent is she/he/your organization able to
RA	ERA1	relationship between line management and IT service providers is developed
RA	ERA2	the IT staff has developed productive customer partnerships based on long-term relationships
RA	ERA3	the IT staff has developed productive partnerships with supplier based on long-term relationships

Within this category we listed the items describing the relationships that the IS/IT function should be able to build with external partners of the firm: suppliers, clients or partners. The External Relationship Assets differ from the capabilities defined as MS ITSOURC (Managerial Skills - Management of the relationship with suppliers of IT products/services): in this case we refer to all the commercial partners of the firm and not only to the suppliers of IT-related services.

A first capability of this kind could be named "organizational overview": it represents the ability of the company to access (by means of IT) information about its partners and establish strong and lasting relationships (Broadbent 1999; Bharadwaj 2000; Sambamurthy 2003; Bassellier

2004; Ethiraj 2005). in particular, this asset is relevant whenever the company experiences problems at the business process level that could benefit from the support of a third party (Bassellier 2004; Wade 2004).

Other research focus on assets specifically related to the different categories of partners. One of these is the relationship with suppliers: a continuous interaction with suppliers enables developing and implementing IT services and infrastructures to support effectively the procurement. At the same time these relationships favor the growth of a strategic network and the development of "agile partnerships" (Sambamurthy 2003) to explore new market opportunities (Wade 2004; Sambamurthy 2003). On the other hand, it is important that the IS function develops the asset of a good relationship with clients, to gain a direct understanding about the interactions that take place among the actors, and to coordinate and negotiate effectively with clients (Broadbent 1997; Ross 2006). By developing a strong and lasting partnership with clients it is possible to help clients select the products and services they need and thus support them in developing their potential (Broadbent 1997).

Internal Relationship Assets (RA IRA)

	Item coding	Questions
		How well can she/ he/your organization - To what extent is she/he/your organization able to
RA	IRA1	***If you have a business question or problem that you (CIO) cannot solve alone, how confident are you about finding the right person to contact in your organization?***
		To what extent in your organization
RA	IRA2	managers are trained and educated about how to envision, invest in and use IT to create business value
RA	IRA3	managers understand the value of IT investments
RA	IRA4	line management is sponsor of IT initiatives
RA	IRA5	coordination and interaction with user community is developed
RA	IRA6	IT manager keeps people interested to the change of technologies
RA	IRA7	responsibility for the effective application of IT in the firm is shared

The Internal Relationship Asset (IRA) refers to the result of the networking activities performed by the IS/IT function towards the business. The intra-firm network of relationships that the IS/IT function should be able to build represents a distinctive and not easily replicable strength, very important, if not essential, to put into action IT investment decisions.

From the literature review, two different types of measure of this kind emerge. A first set of items aims to assess the extent to which the IS/IT function performs networking activities, such as keeping managers updated on recent IT innovations (Ross 2006) and training on creating business value from IT (Weill 2002), developing coordination with the community of the users (Bharadwaj 2000). These activities are supposed to develop an IT business partnership, an asset that is crucial when change of the IS is requested: the inevitable organizational resistance can be contrasted with a liaison with the business users, based on the knowledge of the potential of the technologies to be adopted (Feeny 1998; Bharadway 1999; Caldeira 2003; Ross 2006).

The second set of items takes into account the results of such an internal networking. The objective, here, is to measure the degree of knowledge that the IT staff and business managers reciprocally possess (Bharadwaj 1999; Basselier 2004) and to assess the extent the management undertake a share of the responsibility for the effective application of IT-enabled initiatives (Bharadwaj 1999; Ross 2006).

6.2.3 Technical Skills

Management of the CBIS lifecycle (emphasis on process) (TS ITLC)

	Item coding	Questions
		How well can she/ he/your organization - To what extent is she/he/your organization able to
TS	ITLC1	design of IT architecture.
TS	ITLC2	choose correct platform for a firm (hardware, network, and software standards)
TS	ITLC3	Identify IS/IT requirements
TS	ITLC4	software installation
TS	ITLC5	debugging and testing
TS	ITLC7	develop and deliver IS/IT solutions to the business
TS	ITLC8	maintain effectively technology, information and application assets
TS	ITLC9	define service level requirements to support the achievement of business benefits

The first subset of skills related to IT deals with the abilities to carry out the activities of the software lifecycle, or - more generally - of the computer based information system. The literature is rather rich also in this category, given the fact that software development lifecycle is a classical topic within the field of software engineering, and countless papers and books have been written to discuss its characteristics and how to perform it.

Nonetheless, one may argue that the activities to be performed along the lifecycle have been studied so in detail and "engineered" that they should be considered common knowledge. Following this logic, the ability to perform efficiently and effectively these activities could be considered easy to imitate or to develop at low cost through an appropriate training: as such, it should not be considered a "capability". On the contrary, the authors that claim this type of skills capable of building a SCA assume that the application of the general notions of software engineering to the specific context of a firm implies or requires specific abilities, that make the software lifecycle unique to some extent. Developing and delivering technological solutions to problems related to the business processes is in fact a complex and permanent process, characterized by a continuous planning to avoid bring unprepared when facing unexpected problems (Peppard 2000; Bassellier 2004; Caldeira 2005).

A first set of such skills regards the resources and the technologies required to develop the CBIS. To drive the firm towards appropriate IT investments, it is important to monitor the IT market to timely identify potential innovations to be introduced (Hackbarth 2004; Peppard 2000), and this activity, which inherits the dynamics of both the IT industry and the firm needs,

requires continuous training for the IT staff (Weill 2002). In particular, standard methodologies should be defined to minimize the cost, while preserving the quality, of the implementation of new IT applications (Caldeira 2005; Ross 2006).

The abilities in the field of system development are also essential: programming languages skills, familiarity with operating systems, with the applications already in place and with tools for integrating software systems allow the IT staff to build or extend the information system or - in case these activities are outsourced - to manage the specialists who carry them out (Mata 1995; Bharadway 1999; Wade 2004).

Management of products/services of the IT function (emphasis on products-services / IT artefacts) (TS ISPROD)

The last subset identified in this literature review aggregates the skills needed to manage the components and the services of the information system. This category is in fact rather similar to some of those previously presented.

While TS ITLC focuses on the differences among the different types of activities in which the process of IS management can be generally subdivided, TS ISPROD measures the technical abilities related to specific parts (such as networks and applications) of the information system, i.e. the products of that process. It is also noteworthy pointing out that this construct does not include these components of the IS in themselves: as previously noted, several studies refer to these technological components as "assets" and include them under the general definition of IT capability. Nevertheless, the definition adopted in this research is more constrained and leaves such items outside the research domain.

	Item coding	Questions
		How well can she/ he - To what extent is she/he able to provide the following infrastructure services?
TS	ISPROD1	Manage firm-wide (or group-wide) communications network and messagging services
TS	ISPROD2	Manage firm-wide or business-unit workstation networks (LANs, POS)
TS	ISPROD3	Implement security, disaster planning and business recovery services for firm-wide installations and applications
TS	ISPROD4	enforce standards for hardware and software selection and/or sw development to streamline resources requirements and reduce incompatibilities and costs
TS	ISPROD5	Perform IS planning for business unit
TS	ISPROD6	Develop business-unit specific applications
TS	ISPROD7	Manage business-unit-specific applications
TS	ISPROD8	Provide firm-wide or business-unit data management, including standards
TS	ISPROD9	Develop and manage electronic linkages to suppliers or customers
		How well can she/ he/your organization - To what extent is she/he/your organization able to
TS	ISPROD10	integrate system and make IT applications cost effective
TS	ISPROD11	customise systems
TS	ISPROD12	provide users support
TS	ISPROD13	provide IS/IT training
		what is the domain of application of the technical skills
TS	ISPROD14	Enterprise resource planning
TS	ISPROD15	Supply chain management
TS	ISPROD16	Customers relationship management
TS	ISPROD17	Product data management
TS	ISPROD18	Support accounting and budgeting
TS	ISPROD19	Support human-resources management
TS	ISPROD20	Electronically provide information to the top management (EIS)

The technical skills belonging to this category are therefore characterized by the type of technology they refer to:

- A first set of skills relates to networking technologies, whose development and management is essential to create and maintain channels within the organization and towards suppliers and clients. One of the critical issue of these technologies is the integration among the information subsystems, both at the infrastructural level (e.g. the physical and network protocols) and at the application level (e.g. video conferencing applications) (Broadbent 1999; Weill 2002).

- Another relevant area relates to the applications. The IT staff is expected to be able to plan and develop the application portfolio in order to deliver - efficiently - high quality IS service (Broadbent 1999; Dehing 2002; Ross 2002). At the same time, the familiarity with the domain of specific applications, such as ERPs, supply chain management systems, CRMs or Executive Information Systems, is considered critical to keep the IS applications available, develop their capabilities along time and to understand new opportunities or limits of their use (Ross 2002; Broadbent 1999).

- Finally, this category includes the abilities required to transfer to the users, by means of training or on-the- job support, the skills necessary to use IT products efficiently and effectively (Broadbent 1999).

6.3 Conclusions

The current chapter presented the process that led to the definition of a measure of IT capability, based on the threefold framework proposed by Piccoli (2005). The scientific literature making use of the Resource Based View applied to the domain of the information systems was reviewed according to a two-stage process. First a general overview on this topic was performed, followed by a thorough analysis of the studies that have contributed to the discussion on this issue. Research referring to the term IT capability and IT competence was taken into account in order to build a broad background and develop a comprehensive measure of the construct subject of this study. In fact, this detailed analysis of 27 papers showed how heterogeneous the research on this issue has been although it all refers to Barney's (1991) theory. Most of the papers present empirical studies which attempt to operationalize the concept of sustainability of competitive advantage as a consequence of IT expenditures. For the sake of simplicity we divided these articles in two subsets, highlighting the two different disciplines to which they mainly refer. To deal with this concept, most of the scholars have oriented their attention to the concept of business value of IT, following the core ideas contained in the resource based perspective of the firm (we classed these studies as "about IT capability"). Other researchers assumed it more effective to concentrate on the role of the IT manager and on the desirable characteristics of the individuals operating in the IT function (studies "about IT competence"). However - besides the already mentioned lack of rigor in the definition of IT capability - the perspectives chosen in each paper reviewed vary greatly: one can infer that exploration in this research area is still immature. In fact, only a few papers critically discuss the roots of IT capability from a theoretical viewpoint, and – according to our analysis - only Piccoli's (2005) framework shows the rigor and congruence necessary on which to found an empirical study and develop a measure of the construct.

Nevertheless, the same variety of focus and approaches represents an essential advantage for the aims of this thesis. The detailed analysis of the research instruments and of the theoretical frameworks used in the reviewed papers led to identification of 630 items, each of them representing a specific property of the IT capability construct. After eliminating the inevitable redundancies a set of 67 "capabilities" was identified, and they were organized into a conceptual framework that preserves the threefold framework introduced by Piccoli (2005), and develops such a framework at a higher level of detail.

This framework, resulting from the synthesis of the literature review, represents the construct whose explanatory power will be tested through a survey on SMEs. The next chapter presents in detail the application of the methodology in the survey and the outcomes of the data collection.

7 Chapter Seven: Results of the survey

In this chapter we present the outcomes of the quantitative phase of the empirical analysis, previously briefly described in section 3.1.2. A questionnaire developed through the case studies and the literature review presented in Chapter 6 has been used as the research tool to empirically validate a measure of IT capability and to study its influence on business performance.

This chapter presents the survey that was carried out on a sample of 77 SMEs belonging to a textile and a mechanical industrial district in northern Italy. The following sections describe the structure of the questionnaire, the demographics of the sample and the method of data collection. Afterwards, the chapter discusses the validity of the data collected and shows the outcomes of the statistical analysis.

7.1 The survey

7.1.1 The survey instrument

The research instrument employed in the quantitative empirical research was a questionnaire articulated in four main sections. The questionnaire is attached in the Appendix B of the thesis.

As explained within chapter 2, the position of CIO and an organizational unit devoted to IS very rarely exist in an SME (although IT investments are always made by someone, being an employee or a consultant), nevertheless we used these terms in the questionnaire (and in this chapter) for the sake of brevity. The questionnaire was administered by means of direct interviews, thus terms such as "IT manager", "CIO", "IS function" were thoroughly explained to the interviewees.

The questionnaire: general information

The first section deals with the general information about the company, essential to identify it as a small or medium enterprise. The following three sections of the questionnaire respectively investigate the three constructs of the research model (Figure 7.1).

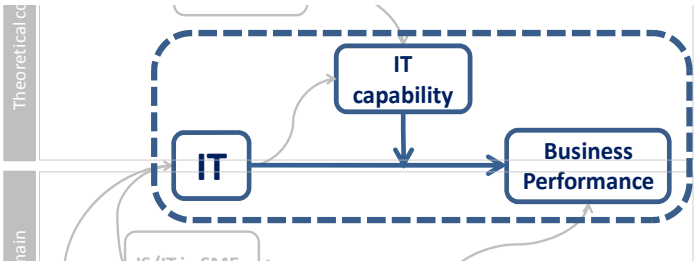

Figure 7.1: the research model of this study

The questionnaire: IT expenditure

The second section deals with the independent variable of the study, i.e. IT expenditure. The interviewee was asked to estimate the amount of the overall investments (their estimated present value, including installation expenses) and of the annual expenses. Nowadays, the IT infrastructure (i.e. the hardware and the operating system) can be considered a commodity in an SME, because of its irrelevant impact on the competitive advantage of the company. Thus, the related expenses were not taken into account in the study. On the contrary, data were collected about the expenses in the following areas: software business applications (e.g.: ERP system, CAD), data base management system (in case it was adopted separately from any software application), security management systems (e.g.: hardware or software firewalls), network hardware (e.g.: cables, network interfaces devices).

This section aimed also at profiling the human resources involved in the management and operations of IT, specifying the organizational position they occupy (CEO, manager, employee, consultant) and the amount (full-time vs part-time) of their involvement.

The questionnaire: IT capability

The third section of the questionnaire is the core of the study: here the 67 questions correspond to the 67 capabilities presented in chapter 6. This set of questions was then duplicated in two parallel sub-sections: the same questions had to be answered both by the CEO (or a top executive) and the IT manager. Each sub-section was then subdivided into three paragraphs corresponding to the three dimensions of the IT capability construct: Managerial Skills, Technical Skills and Relationship Assets.

The interviewee was asked to provide a separate assessment regarding both the internal IT staff and (in case the decisions about IT expenditures were not taken by company employees) the IT consultants/suppliers for each of the 67 items according to a Likert scale that ranges as follows: 0 = Not at all/very low, 1 = To a Small Extent/low, 2 = To Some Extent/moderate, 3 = To a Large Extent/high, 4 = To a Great Extent/very high. Table 7.1 lists the whole set of questions used to measure the IT capability construct.

	Item coding	Questions
		what is the level of knowledge of the IT manager on
MS	ITBP1	main challenges that different divisions in the organization face achieving their objectives
MS	ITBP2	the connections and interdependencies between the various division in the organization
MS	ITBP3	***How much does she/he participate in business activities that are not directly related to IT?***
MS	ITBP4	***How experienced is she/he at evaluating the organizational impacts of IT solutions?***
		How well can she/ he - To what extent is she/he able to
MS	ITBP5	coordinate the integrated infrastructure and manage its relationships with the business units
MS	ITBP6	integrate IT resources effectively with process reengineering initiatives
MS	ITBP7	design business operations and process required to deliver the business strategy
		How well can she/ he - To what extent is she/he able to
MS	ITPM1	co-ordinate IS/IT development and implementation
MS	ITPM2	estimate the effort and the duration of a project and identify appropriate resources (eg.: people with necessary skill, experience, availability)
MS	ITPM3	monitor, measure and evaluate the benefits derived from IS investment and use
MS	ITPM4	acting in a leadership role (establishing direction, directing people, motivating and inspiring)
MS	ITPM5	is flexible, eg by improving task performance through trial-and-error experimentation
MS	ITPM6	effectively manages cross-functional teams and ad-hoc structures
MS	ITPM7	the IT manager develops a personal social network
		How well can she/ he/your organization - To what extent is she/he/your organization able to
MS	ITSOURC1	facilitate the contracts (ensuring the success of existing contracts for IS/IT services)
MS	ITSOURC2	identify the potential added value of IS/IT service suppliers
MS	ITSOURC3	co-operate with software-houses in IS analysis
MS	ITSOURC4	determine and evaluate supply sourcing options
MS	ITSOURC5	understand and manage cost of acquisition and ownership
		To what extent in your organization
MS	ITSTRAT1	business strategic planning is integrated with IT planning
MS	ITSTRAT2	IT has a strategic role in achieving our firms objectives, rather than just a vehicle for cost displacement
MS	ITSTRAT3	your business is about creating new products/services using IT
MS	ITSTRAT4	IT is used to create biased market
MS	ITSTRAT5	IT is used to alter the linkages with supplier and customers
		How well can she/ he/your organization - To what extent is she/he/your organization able to
MS	ITSTRAT6	convert IT assets and services into strategic application
MS	ITSTRAT7	Incorporate the potential of new and emerging technologies in long term business development
MS	ITF1	attract and retain high-caliber staff committed to the vision of the one corporate
MS	ITF2	define information management policies for the organization and the roles and responsibilities of general management and the IS/IT function
MS	ITF3	educate IT personnel on technological developments as well as business-related issues
RA	IRA1	***If you have a business question or problem that you (CIO) cannot solve alone, how confident are you about finding the right person to contact in your organization?***
		To what extent in your organization
RA	IRA2	managers are trained and educated about how to envision, invest in and use IT to create business value
RA	IRA3	managers understand the value of IT investments
RA	IRA4	line management is sponsor of IT initiatives
RA	IRA5	coordination and interaction with user community is developed
RA	IRA6	IT manager keeps people interested to the change of technologies
RA	IRA7	responsibility for the effective application of IT in the firm is shared
RA	ERA1	relationship between line management and IT service providers is developed
RA	ERA2	the IT staff has developed productive customer partnerships based on long-term relationships
RA	ERA3	the IT staff has developed productive partnerships with supplier based on long-term relationships
		How well can she/ he - To what extent is she/he able to provide the following infrastructure services?
TS	ISPROD1	Manage firm-wide (or group-wide) communications network and messaging services
TS	ISPROD2	Manage firm-wide or business-unit workstation networks (LANs, POS)
TS	ISPROD3	Implement security, disaster planning and business recovery services for firm-wide installations and applications
TS	ISPROD4	enforce standards for hardware and software selection and/or sw development to streamline resources requirements and reduce incompatibilities and costs
TS	ISPROD5	Perform IS planning for business unit

TS	ISPROD6	Develop business-unit specific applications
TS	ISPROD7	Manage business-unit-specific applications
TS	ISPROD8	Provide firm-wide or business-unit data management, including standards
TS	ISPROD9	Develop and manage electronic linkages to suppliers or customers
		How well can she/ he/your organization - To what extent is she/he/your organization able to
TS	ISPROD10	integrate system and make IT applications cost effective
TS	ISPROD11	customise systems
TS	ISPROD12	provide users support
TS	ISPROD13	provide IS/IT training
		what is the domain of application of the technical skills
TS	ISPROD14	Enterprise resource planning
TS	ISPROD15	Supply chain management
TS	ISPROD16	Customers relationship management
TS	ISPROD17	Product data management
TS	ISPROD18	Support accounting and budgeting
TS	ISPROD19	Support human-resources management
TS	ISPROD20	Electronically provide information to the top management (EIS)
		How well can she/ he/your organization - To what extent is she/he/your organization able to
TS	ITLC1	design of IT architecture.
TS	ITLC2	choose correct platform for a firm (hardware, network, and software standards)
TS	ITLC3	Identify IS/IT requirements
TS	ITLC4	software installation
TS	ITLC5	debugging and testing
TS	ITLC7	develop and deliver IS/IT solutions to the business
TS	ITLC8	maintain effectively technology, information and application assets
TS	ITLC9	define service level requirements to support the achievement of business benefits

Table 7.1: the list of items composing the proposed measure of IT capability (MS: Managerial Skills, RA: relationship Assets, TS: Technical Skills)

The questionnaire: Business performance

The fourth section contains the measures of business performance. For this construct we employed the same measures used in the qualitative phase of the empirical research. In the case study, the last section of the questionnaire was divided in 5 parts:

1. motivations for IT investments;
2. IT/IS strategic alignment;
3. competitive advantages achievable by using the IT currently available;
4. effects of the IT on your company in the past two years;
5. IT effect on performance: subjective/qualitative measures and financial/objective measures (and precisely: net margin and profit in the past three years).

As noted at the end of chapter 5, these questions found the interviewees competent and on average collaborative. The only exceptions were the financial measures of IT effect on performance, where the majority of the interviewees were reluctant to provide precise data.

For the questionnaire of the survey, the choice of the questions on business performance was a compromise between two different aims. On one hand we needed to avoid an excessive length of the questionnaire (already conditioned by the high number of items to measure IT capability,

the core construct of the study). On the other hand it was desirable to have a redundant set of questions to deal with the highly problematic and debated issue of how to measure business performance (thoroughly discussed in chapter 4), and the IT impact on business performance. The resulting questionnaire contained - unaltered - the parts numbered above as 1 and 5 from the case study questionnaire, while the parts numbered 2-3-4 were aggregated, by eliminating some semantic overlaps.

In detail, the last section of the questionnaire includes:

- two sets of questions to investigate the effects of IT on business performance on a Likert scale ranging from 0 to 4 with the same semantics explained above;
- the assessment of two financial indicators (namely the net margin and the profits) related to the past three years.

7.1.2 Sample and demographics

The quantitative data were collected through the administration of the questionnaire in a sample of SMEs located in Northern Italy.

A set of 417 targeted companies was created, starting from mailing lists of different sources:

- Tessilivari (www.tessilivari.it), an Italian association of textile companies operating in the field of special fabrics and in the fashion accessories segments.
- UNIVA, UNICOMO, UNINOVARA, the industrial associations that confederate the firms respectively located in the three contiguous provinces in the geographical area north of Milan:
    - Varese (http://www.univa.va.it/anag.nsf/web_attivita_v3),
    - Como ((http://www.unindustria.co.it/associazione/elencoassociati.xml)
    - Novara (http://www.ain.novara.it),

  These three associations are the local affiliated of Confindustria, the most important (and most politically influential) industrial association in Italy. The firms belonging to this association reflect the typical Italian economical environment, where the large majority of companies have small-medium size and employ the majority of the Italian workforce.
- CETIC, the research center on Information Systems of the Università Carlo Cattaneo, Italy, that has developed a network of relationships with companies in the provinces mentioned above, due to the empirical research it carried out in the past 15 years.

After a process of data collection whose characteristics are detailed in the next section, 77 companies agreed to participate and provided valid data to the survey.

7.1.3 Survey administration

The surveyed sample of companies was created by extracting from these mailing lists those companies that followed two criteria: companies belonging to the mechanical or the textile industry and companies located in the provinces of Varese, Milan, Novara, Lecco, Como and Biella. In fact the textile and mechanical industrial districts described in Chapter 2 lie in the territory of such provinces.

To manage the high number of firms to be contacted, 3 post-master students were trained in order to contact by phone and email each company on the list in the period between March 2007 and March 2008. A protocol for the phone calls was established. Upon request the phone calls were followed by an email with a message presenting the aims of the research and the questionnaire as an attachment. For the companies belonging to Tessilivari this was accompanied by an email or a fax from the association stating that the research was sponsored by Tessilivari.

The process of contacting firms typically required several follow ups to identify, in each organization, the individual(s) that were most appropriate for the research, and to set up an appointment for a direct interview. In several cases the contacted company wanted to restrict themselves to a phone interview. The complexity of the topic to be investigated, and the intrinsic ambiguity of the underlying terminology (broadly highlighted in this thesis) strongly suggested avoiding this data collection method and to perform exclusively direct interviews. Accordingly, the same group of graduated students (who contacted the companies in the first place) was trained to perform the interviews in order to ensure a shared understanding of the questionnaire and to share the same approach in conducting the interviews. In particular, these research assistant were assigned to read a selection of the reviewed papers (on two topics: IT capability and IS in SMEs) and write a short essay to formalize their understanding of the concept of IT capability. Each essay was then individually discussed with the PhD candidate in order to highlight the critical aspects of the concept of IT capability and to raise the awareness of the specific characteristics of the SMEs context. Finally, the research assistant were given the questionnaire that was discussed during two meetings, one after the first set of phone calls (to share the first reactions and comments from the individuals contacted) and the second just before the beginning of the survey, to set up a common approach to conduct the interviews.

During the survey, check-point meetings where regularly held to share the issues possibly emerged.

Overall, 417 companies were the initial survey sample (figure 7.2).

The targeted individuals were either the entrepreneur or the CIO (or the corresponding role in charge of decisions on IT investments in the company) or a top-level manager of the company. After each positive call the questionnaire was emailed to the targeted individuals before the interviews. The length of the interviews varied significantly from 40 minutes to 2,5 hours, reflecting evident different degrees of interest from the participants to the survey. The interviewer read the questions from a copy of the questionnaire, while the interviewee was reading the questions on his own copy. The interviewers marked on their copy the answers and on the same piece of paper reported the comments from the interviewees. The quantitative data were then stored in a database developed for the purpose to keep an electronic copy of the collected data and enable the subsequent data analysis with software tools.

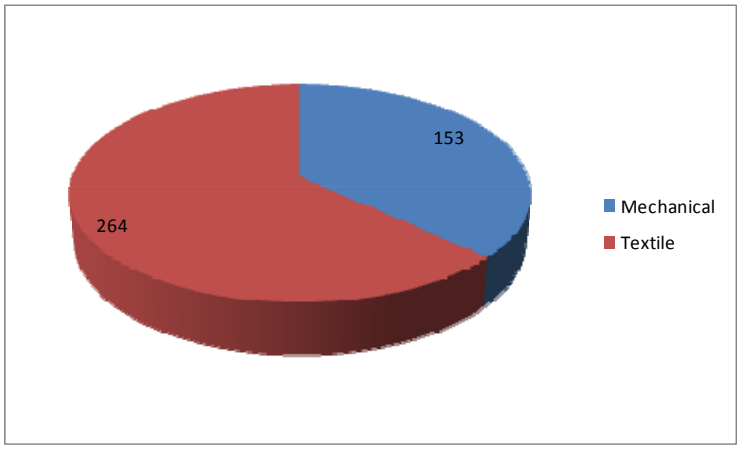

Figure 7.2: the distribution of the 417 firms of the initial survey sample

7.1.4 Sample size and demographics

Despite what was originally planned, it was impossible to perform two interviews per each surveyed firm, due to the difficulty in finding both the IT manager and a top-executive available for the survey even with different schedules. In only 22 cases data were collected from both the individuals, while in 55 other companies the entrepreneur and the IT manager were the same individual. In fact, the large majority of interviewees were IT managers (or a corresponding organizational role), and we decided to exclude from the further step of data analysis those data collected from non-IT managers.

As a result, the final sample of the survey was composed as follows: 41 firms from the textile industry and 36 firms from the mechanical industry. The graphs below show the basic demographics of this sample (figure 7.2).

As already explained, the data analysis of this research had two main aims. First, to identify a measure of IT capability; secondly: to study the relationship between IT investments and business performance, and the influence of IT capability in this relationship.

However, while the quality of the collected data was in general very high, the completion of the questionnaire was sometimes partial or evidently 'guesstimated' with respect to:

- the question in the second section devoted to quantification of the IT investments and the annual IT expenses;
- the question in the fourth sections devoted to quantification of business performance through the financial measures of the annual net margin and profits.

As a consequence, the data corresponding to these two questions needed to be dropped: this implied modifying the research model and the data analysis, as explained in paragraph 7.4.1.

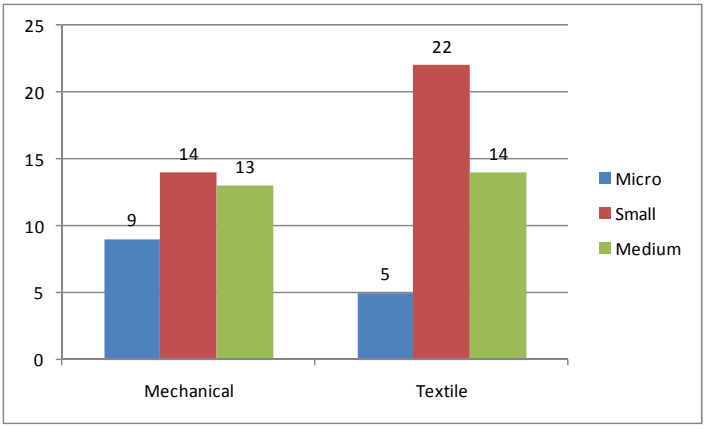

Figure 7.2: the 77 firms of the sample

The rest of the chapter will present the statistical analysis according to the following structure: the next sections will show the methodology followed to perform the validation of the measure of IT capability, then, the statistical tools will be applied to analyze the relationship between this construct and impact of IT on business performance.

7.2 Development of a measure of IT capability

7.2.1 Statistical analysis

The result of the literature review was a structured list of items that – according to previous research and empirical findings – are expected to represent to a high degree of completeness the conceptual subject of this study. In order to transform this list into a measure of IT capability, i.e. to identify the items that are not relevant to explain the concept of IT capability (and therefore shall be dropped from the list), the first step to be performed is to analyze the collected data to identify structural relationships among latent constructs. This can be done by statistically relating covariation between the latent constructs and the observed variables used to measure these latent unobserved constructs (Borsbom et al. 2003).

7.2.2 Exploratory Factor Analysis

As already discussed in section 3.2, the development of a measure of IT capability (i.e. the RQ1.2 of this research) requires an exploratory study, due to the lack of convergent existing research results on this measure.

In this part of the study the objective is to develop a measure of IT capability (and not to validate it or to assess its reliability, which are the typical aims of a confirmatory study). The measures of IT capability mentioned in the literature review cannot be considered as "stable" constructs whose validity can be tested, because as previously discussed they are affected by the ambiguity (or even by a misinterpretation) of the concept of IT capability. Recognizing this ambiguity motivated the literature review and the related discussion presented in previous chapters.

Therefore, to perform the exploratory study on IT capability the chosen statistical tool is exploratory factor analysis. We will use confirmatory statistical tools to perform the analysis of the general research model.

Generally speaking, to perform a statistical analysis in an exploratory study, there are two main alternatives: principal component analysis (PCA) and factor analysis. Although PCA is the default method of extraction in many statistical software packages (such as SPSS and SAS), in the psycho-social academic literature the effectiveness of PCA is highly debated, and there is disagreement about when it should be used, if at all (Costello ad Osborne 2005). According to Costello (2005) the popularity of PCA is due to the fact that when it was introduced the limited processing power of CPUs used to make it a "quicker, cheaper alternative to factor analysis". Its main limitation is represented by the assumption that "a researcher collects and analyzes data

without an a priori idea about how the variables are related". This situation occurs rarely (Costello et al. 2005) and clearly does not occur in the current study.

Costello et al. (2005) in their review of recent studies using exploratory factor analysis, propose a best practice for conducting such a study.

The first step is the choice of an extraction method for factor analysis, among the alternatives typically available in the statistical software packages. References on pros and cons of these methods are scarce and not conclusive, thus it is suggested - as a general rule-of-thumb - that ML (maximum likelihood) should be used in case data are generally normally-distributed, and PAF (principal axis factoring) should be the choice when data are significantly non normal (Costello et al. 2005). In this PhD study, there is no assumption on the normal distribution of the data, coherent with the limited size of the sample in an exploratory analysis, therefore PAF is the chosen extraction method.

The second step is to decide the number of factors to retain for rotation. The usual default method implemented in the packaged software is to retain all factors with eigenvalues greater than 1.0, however Velicer et al. (1990) found this to be one of the least accurate methods. Thus, limiting the choice only to methods implemented in the software, the best choice is represented by the scree test (Costello et al. 2005). By examining the graph of the eigenvalues one shall look for a break point in the data, where the curve flattens out: the number of factors to retain is then equal to the number of data points above such a break point. In this study we want to use packaged software to perform the statistical analysis, therefore, the chosen method to assess the number of factors retained is the scree test.

The third step is the choice of the rotation method, whose aim is clarifying the data structure. Also for this aspect there are several alternatives and a most common practice: Varimax, quartimax rotation, and in general the orthogonal rotation methods generate results that are conventionally considered easier to be interpreted, while, oppositely, oblique rotation has the advantage to provide more accurate results (Costello et al. 2005). Oblique rotation output is slightly more complex, but - contrary to orthogonal rotation – allows that the factors resulting from the rotation are correlated. In other terms, oblique rotation allows the researcher to capture a characteristic of the factors (likely to be present in a research in social science) that orthogonal rotation would completely miss. For this reason in this study we use an oblique rotation method.

The fourth and final step relates to the sample size. In their survey on PsychINFO articles that reported the use of principal components or exploratory factor analysis, Costello et al. (2005)

highlighted the existence of very different practices. The parameter "subject to item ratio" (i.e. the ratio between the number of surveyed entities and the number of the items composing the constructs to be analyzed) varies from less than 2:1 to 100:1, and it was less than 5:1 for the large majority of the papers surveyed. The adequacy of the sample size depends (also) on the strength of the data: a large sample is not necessary if data are strong, i.e.:

1. the items communalities are uniformly high – all greater then 0.8 - without cross loadings;
2. several variables load strongly (a “crossloading” item is an item that loads at .32 or higher on two or more factors); or
3. more items load strongly on each factor.

However, these conditions can be rare (Widaman, 1993). Thus, although it is always preferable a larger sample, even relatively small sample can produce accurate results (Costello et al. 2005).

In this study, the subject to item ratio is below 2:1 (77 surveyed companies and a measure of IT capability built on 67 items). It is reasonable to assume that the accuracy of the process to identify the items and of the administration of the survey compensate to some extent the relatively limited size of the sample.

7.2.3 The measurement model: formative vs reflective

Once the type and characteristics of the exploratory analysis have been identified, a fundamental choice must be taken about the measurement model. The definition of a construct can be performed according to very different views: reflective (typical in psychological and management sciences) and formative (more common in economics and sociology) (Coltman et al. 2008).

A reflective measurement model assumes that there is a causal relationship flowing from the latent construct towards the indicators: a change in an (observed) indicator is a reflection of (is determined by) the change in the latent construct. In other words, the single item belonging to the set whose validity is under investigation (e.g. in this study: IS1staff) is considered to be the expression of the latent variable (e.g. in this study: ITBP): the researcher measures the value of the item because it is not possible to directly measure the latent variable. A reflective model is typically used to measure complex constructs, difficult to structure and formalize, such as writing skills.

A formative (also called causal) measurement model assumes that there is a causal relationship flowing from the indicators towards the latent construct: the construct is determined (or formed)

by a number of (observed) indicators without any assumptions as to the patterns of inter-correlation between these items. In other words, the latent variable (e.g. ITBP) represents the consequence (or the synthesis) of the changes in the single items (e.g. IS1staff).

As reported by Coltman et al. (2008) a large part of the literature in Management Science assumes prejudicially that the correct measurement model is a reflective one, while the formative perspective prevails among studies in economics and sociology. Instead, the decision to adopt one of these alternative measurement models should be carefully considered, since it is relevant in order to properly assign meaning to the outcomes of the statistical analysis, i.e. the relationships implied in the structural model.

The constructs to be measured in this study (MS, TS, RA) are characterized by a high degree of complexity: even the definition of the concept of IT capability is the subject of discussion among researchers, thus it is not possible to directly measure the constructs (MS, TS, RA) in which this concept is decomposed. As a consequence, the measurement model cannot be other than a reflective one.

7.2.4 The modeling technique

In order to carry out an exploratory factor analysis on the constructs of this study according to a reflective logic (in synthesis: an analysis on reflective constructs, or reflective factors) partial least square (PLS) was the selected choice.

PLS is a latent structural equation modeling technique that uses a component-based approach for estimation purposes and - unlike LISREL, another popular technique - can handle formative factors. Moreover, PLS has few restrictions on measurement scales, sample size (unlike structural equation modeling, SEM) and residual distributions (Lohmoller 1989, Chin 2003, Pavlou 2006). With respect to SEM and LISREL, implemented (like PLS) in the most diffused statistical software packages such as SPSS and SAS, these characteristics make PLS particularly suited for this study, being based on a large number of items “forming” the constructs under investigation and on a relatively limited number of surveyed companies.

Moreover, the logical decomposition of the concept of IT capability into three main constructs and several subconstructs – described in detail in Chapter 4 – determines an important requirement of the statistical analysis: it is necessary to estimating path models with higher-order constructs. PLS can be used to this aim, and in fact it is often chosen just because of its ability to estimate complex models (Chin 2003). Two approaches are suggested in the literature: the Two-Stage Approach and the Hierarchical Components Approach (Wilson 2007).

In the Two-Stage Approach (TSA) the analysis is performed in two seps:

- the latent variable scores are estimated without the second-order construct present, but with all of the first-order constructs only within the model,
- these scores are used as indicants in a separate higher-order structural model analysis.

TSA is claimed to offer advantages when estimating higher-order models with formative indicants (Diamantopoulos and Winklhofer 2001; Reinartz, Krafft and Hoyer 2004), while conversely, any construct that is investigated in stage two is not taken into account when estimating the latent variable scores at stage one. This could encourage "interpretation confounding" (Burt 1973).

According to the Hierarchical Components Model (HCM), introduced by Wold (1982), a second order factor is directly measured by observed variables for all the first order factors (Reinartz et al. 2004). Latent scores are saved during analysis to be used within future analyses.

HCM (figure 7.3) is broadly used when estimating higher order constructs with PLS (Wilson and Henseler 2007, Zhang 2006) probably also because it has been used and clearly explained by prominent PLS methodologists, e.g., Wold and Lohmöller (Wilson et al. 2007). Nonetheless, also HCM shows the disadvantage of possibly biasing the estimates by relating variables of the same type together via PLS estimation, in other words, "the exogeneous variables in effect may become the endogenous variables" (Wilson et al. 2007).

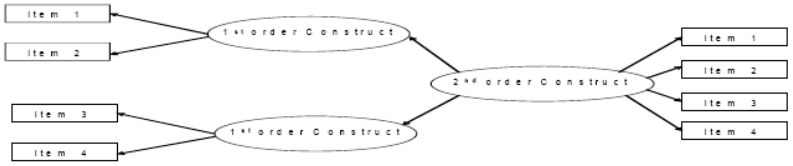

Figure 7.3: Conceptual Representation of Hierarchical Components Model (Wilson et al. 2007)

The fact that TSA is particularly suited for formative models makes HCM the modeling technique more suited to the characteristics of this study. By applying this technique to the constructs under investigation the PLS analysis can be represented as in figure 7.4.

In the following section the decisions about the statistical analysis described above are implemented and a measure of IT capability is derived accordingly.

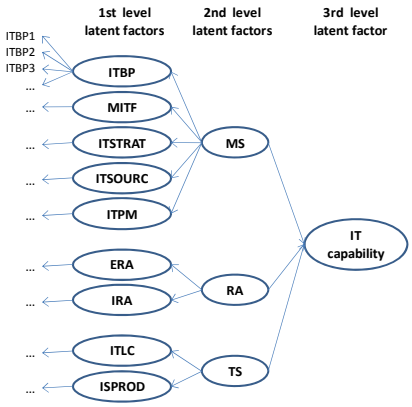

Figure 7.4: the Hierarchical Components Model applied to the reflective construct IT capability

7.3 Development of a measure of IT capability: the outcomes of the data analysis

7.3.1 The research model and the limitations induced by the data collection

After having defined the methodological approach to develop a measure of IT capability, it is necessary to apply it to the specific content of this study. However, using PLS to develop a measure of IT capability cannot leave aside the whole research model presented in Chapter 1 and reported hereafter (figure 7.5).

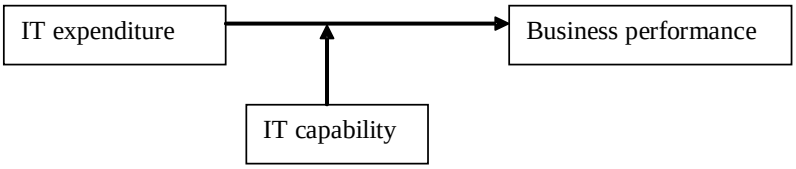

Figure 7.5: The general research model of the study

More precisely, using the HCS modeling technique in this study would lead to the conceptual representation of the research model shown in Figure 7.6.

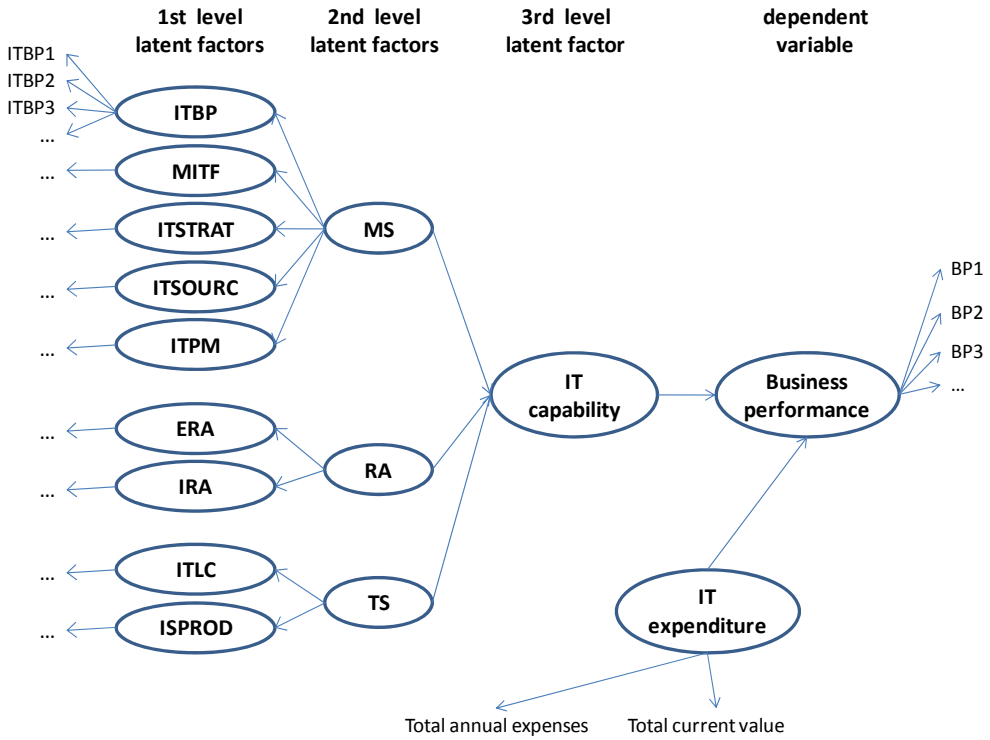

Figure 7.6: The general research model of the study

The details of this analysis will be explained later, in the specific paragraph focused on the data analysis of the whole research model.

Nevertheless, in this section it is necessary to anticipate the main outcomes of such analysis, since they influenced the way the development of the IT capability measure was performed. The PLS modeling technique was applied to the general research model where the construct Business Performance was measured by the average annual turnover over the three years before the survey. Unfortunately, the high number of missing values made it impossible even to start the bootstrap of the data analysis. The questionnaire included two different questions aiming at quantitatively measuring the financial performance of the companies (annual turnover and annual income), nevertheless the surveyed companies showed a general reluctance to provide precise values for these financial indicators (see figure 7.7).

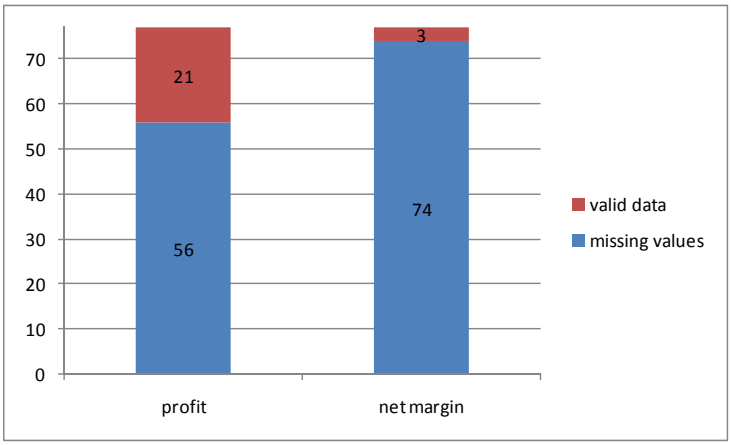

Figure 7.7: missing values for the financial indicators (dependent variable of the research model)

Similarly, the data collected for the independent variable of the study, namely the total annual expenses and the total current value of the IT assets were not complete enough to perform an appropriate statistical analysis.

The resulting research model needed to be simplified accordingly. The problem of the missing values seemed limited to the financial aspects of the questionnaire, while the interviewees proved more inclined to answer to non-economics questions about business performance.

The construct consisting of 24 items measuring the effects of the IT on the company in the two years before the survey was therefore used as the dependent variable of the study. In other words, due to the limitations in the data collection, instead of studying the moderating effect of IT capability (thus seen as a moderating variable) on the relationship between IT expenditure (seen as the independent variable) and business performance (seen as the dependent variable), the collected data allowed only a study of the relationship between IT capability (seen as the dependent variable) and the effect of IT on business performance (seen as the dependent variable). Figure 7.8 (below) shows the derived research model that was used for the data analysis, and thus, more specifically, for the development of the measure of IT capability.

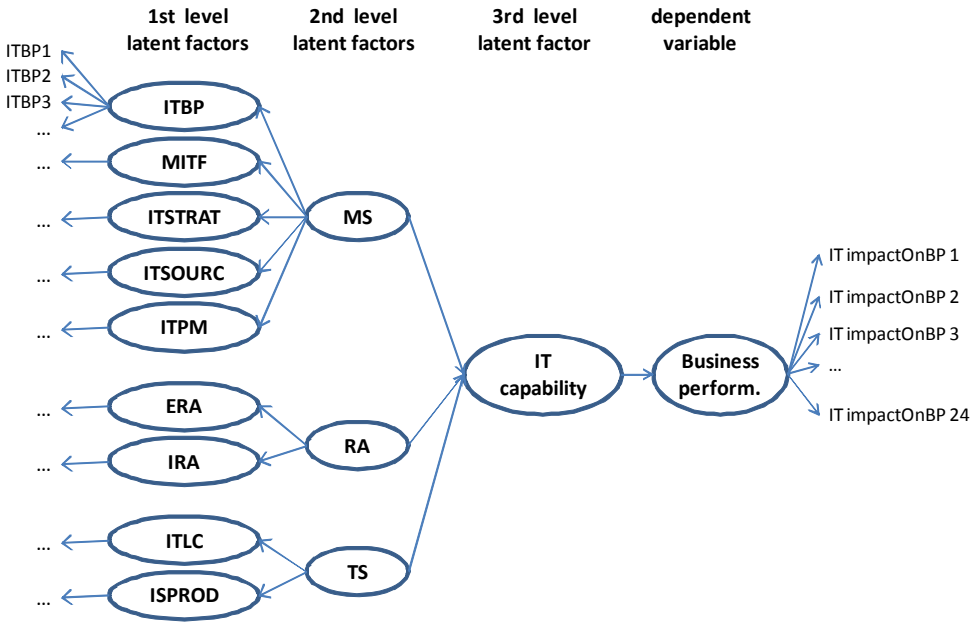

Figure 7.8: The research model subject of the data analysis (after the simplification due to the limitations of the data collection)

7.3.2 The data analysis on the refined research model: developing a measure of IT capability

In this paragraph we present the data analysis performed to validate a measure of IT capability. The structural relationships of the research model were examined next (see the subsequent paragraph 5.4.3 for the details about the data analysis) using factor scores.

As discussed in the previous paragraphs the nomological validity of the IT capability construct was assessed using:

- an Exploratory Factor Analysis (rather than a Confirmatory Factor Analysis);
- a reflective measurement model (rather than a formative one);
- Partial Least Squares as the modeling technique (rather than LISREL, for instance);
- the Hierarchical Components Model (rather than a Two-Stage Approach) as the approach for applying PLS, where the measure for IT capability consisted of third-level factors.

With regards to the software tool used for the data analysis the choice fell on SmartPLS, a free software application for (graphical) path modeling with latent variables that uses the partial least squares (PLS) method (Ringle 2005).

Exploratory factor analysis was performed in order to filter the set of items representing the candidate measure of IT capability, with two main aims: the first was to drop from the list the

items with a high number of missing values in the collected data, the second was to identify latent variables that aggregate items highly correlated.

The following paragraphs show a synthesis of the process leading to identifying the latent variables and their composing factors. For each of the three constructs emerged from the literature review (MS, TS and RA) the following paragraphs present: (a) the items that were removed, (b) the application of the Principal Axis Factoring method, (c) the tests about the significance of the outcomes of the factor analysis, in particular we performed the Kaiser-Meyer-Olkin (KMO) and Bartlett's test, that measures the sampling adequacy which should be greater than 0.5 for a satisfactory factor analysis to proceed (lower scores were obtained when retaining more items).

Within the tables showing the outcomes of the Principal Axis Factoring cells can have coloured backgrounds to highlight specific ranges of values of the coefficients (below 0,3 there is no cross-loading of the factor on the item):

- a pink background highlights coefficients above 0,50,
- a yellow background highlights coefficients between 0,30 and 0,50.

Management Skills

The analysis of the items belonging to the MS variable led to remove three items (ITPM4, ITPM6, and ITF1) due to the excessive number of missing values. The item ITBP3 was removed for low communality. Table 7.2 shows the outcome of the extraction of the factors referred to the dataset after removing such items.

By recursively dropping those items that were standalone components it was possible to reduce the number of items and to proceed to the extraction as shown in Table 7.3. The KMO’s tests (Table 7.4) applied on these outcomes confirmed the possibility to proceed with the factor analysis.

Pattern Matrix Factor

		1	2	3	4	5	6	7	8	9
ITBP	ITBP1	0,00	-0,07	-0,06	0,07	0,32	0,60	0,04	0,01	0,04
	ITBP2	0,06	-0,09	-0,08	0,03	0,09	0,73	-0,20	0,01	-0,05
	ITBP3	-0,04	0,06	0,05	0,07	0,07	0,21	-0,46	-0,02	0,02
	ITBP4	-0,11	0,13	0,05	0,04	0,57	0,28	0,16	-0,13	0,18
	ITBP5	0,13	0,20	0,21	0,26	-0,08	0,57	-0,09	-0,09	0,12
	ITBP6	0,18	-0,07	-0,11	0,37	-0,04	0,45	0,24	-0,29	-0,03
	ITBP7	-0,02	0,01	0,27	0,02	0,06	0,59	0,05	0,04	0,28
ITPM	ITPM1	0,07	0,14	0,03	0,29	0,18	0,10	0,53	-0,04	0,04
	ITPM2	-0,09	-0,08	0,44	0,04	0,12	0,24	0,29	0,14	0,30
	ITPM3	0,00	0,08	0,89	-0,08	0,16	-0,15	-0,14	0,07	0,14
	ITPM5	0,01	-0,02	-0,06	0,74	-0,10	0,11	-0,10	0,00	0,12
	ITPM7	0,22	-0,05	-0,09	0,19	0,00	0,01	0,02	0,04	0,85
ITSOURC	ITSOURC1	0,45	0,08	0,07	0,23	-0,11	0,12	0,06	-0,04	0,26
	ITSOURC2	0,51	0,07	0,25	-0,12	0,23	0,20	-0,05	0,06	0,14
	ITSOURC3	0,09	-0,02	-0,04	-0,06	0,85	0,05	-0,09	0,01	-0,07
	ITSOURC4	0,53	-0,03	0,02	0,05	0,14	0,12	0,27	-0,12	0,22
	ITSOURC5	0,57	-0,08	0,18	0,50	0,22	-0,27	-0,31	-0,13	0,09
ITSTRAT	ITSTRAT1	0,14	0,05	0,08	-0,29	-0,09	0,08	-0,21	-0,51	0,42
	ITSTRAT2	-0,08	0,04	-0,08	-0,05	0,04	-0,03	0,04	-0,98	-0,07
	ITSTRAT3	-0,15	0,91	0,06	-0,04	0,03	-0,07	0,16	-0,01	0,12
	ITSTRAT4	0,16	0,73	-0,08	0,03	-0,08	-0,02	-0,27	0,00	-0,29
	ITSTRAT5	0,39	0,30	-0,10	-0,10	0,17	0,07	0,05	-0,13	0,02
	ITSTRAT6	0,12	0,07	0,29	0,25	0,32	-0,13	0,13	-0,35	-0,24
	ITSTRAT7	0,18	-0,04	0,52	-0,02	-0,16	0,11	0,08	-0,05	-0,21
ITF	ITF2	-0,06	-0,10	0,07	0,58	0,13	0,10	0,19	0,13	-0,01
	ITF3	-0,30	0,00	0,46	0,25	0,00	0,02	-0,10	-0,23	-0,01

Table 7.2: Pattern matrix for the MS variable. Extraction Method: Principal Axis Factoring. Rotation Method: Oblimin with Kaiser Normalization (rotation converged in 84 iterations).

Table 7.5 shows the final result of the factor analysis for the MS construct. This outcome strongly supports the aggregation of items derived from the literature review: out of the five subsets of items for MS, four (namely ITBP, ITPM, ITSOURC, ITSTRAT) respectively correspond to four factors composing the MS variable. On the contrary, the remaining subset (ITF) was completely dropped out of the model.

In order to quantitatively assess the significance of this outcome, we calculated the total variance explained by the MS variable (Table 7.6) and we computed the correlation matrix (Table 7.7). With respect to the first aspect, the four factors are capable to explain about 56% of the total variance, which is just below the typical threshold of acceptance (this indicator is considered good when factors explain about 70%-80% of the overall variance and acceptable when they explain about 60%). The correlation matrix shows that Factors 1 (ITBP) and 4 (ITSOURC) present a negative – although limited – correlation. The presence of a correlation between factors – definitively not desirable in factor analysis – can be regarded, nonetheless, as a marginal problem, especially considering the exploratory nature of the study.

Factor

Pattern Matrix

		1	2	3	4	5
ITBP	ITBP1	0,15	-0,17	-0,11	0,17	0,62
	ITBP2	0,27	-0,14	-0,10	0,18	0,32
	ITBP4	0,04	0,06	0,07	-0,04	0,83
	ITBP5	0,45	0,04	0,19	0,24	0,23
	ITBP6	0,22	0,09	-0,06	0,59	0,27
	ITBP7	0,40	-0,30	0,19	0,00	0,42
ITPM	ITPM1	0,00	0,04	0,05	0,28	0,45
	ITPM2	0,17	-0,44	0,38	-0,05	0,39
	ITPM3	0,13	-0,09	0,91	-0,38	0,05
	ITPM5	0,17	-0,08	0,08	0,61	-0,04
	ITPM7	0,74	-0,28	-0,07	0,05	0,06
ITSOURC	ITSOURC1	0,60	0,07	0,05	0,25	-0,04
	ITSOURC2	0,53	0,07	0,14	-0,11	0,26
	ITSOURC3	-0,04	0,14	0,00	-0,06	0,62
	ITSOURC4	0,52	0,09	-0,02	0,17	0,24
	ITSOURC5	0,40	0,26	0,27	0,37	-0,09
ITSTRAT	ITSTRAT1	0,56	0,25	0,10	-0,20	-0,10
	ITSTRAT2	0,05	0,58	0,11	0,14	0,01
	ITSTRAT3	0,03	0,46	0,05	-0,30	0,23
	ITSTRAT4	0,02	0,65	-0,06	-0,13	-0,06
	ITSTRAT5	0,33	0,45	-0,15	-0,06	0,23
	ITSTRAT6	-0,19	0,48	0,42	0,30	0,27
	ITSTRAT7	0,05	0,03	0,44	0,07	-0,07
ITF	ITF2	-0,13	-0,22	0,15	0,53	0,26
	ITF3	-0,10	0,01	0,57	0,14	0,00

Table 7.3: Pattern matrix for the MS variable. Extraction Method: Principal Axis Factoring. Rotation Method: Oblimin with Kaiser Normalization. Rotation converged in 17 iterations.

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		,678
Bartlett's Test of Sphericity	Approx. Chi-Square	374,310
	Df	105,000
	Sig.	,000

Table 7.4: Kaiser-Meyer-Olkin and Bartlett's Test for the MS variable.

Factor

Pattern Matrix

		1	2	3	4
ITBP	ITBP1	0,81	-0,03	-0,06	0,02
	ITBP2	0,67	-0,05	-0,17	-0,05
	ITBP4	0,59	0,19	0,24	0,01
	ITBP5	0,56	0,13	0,08	-0,30
	ITBP6	0,57	-0,09	-0,14	-0,29
	ITBP7	0,70	-0,02	0,28	-0,01
ITPM	ITPM2	0,43	-0,21	0,57	0,03
	ITPM3	-0,18	0,05	0,79	-0,24
ITSOURC	ITSOURC1	0,16	0,01	0,05	-0,55
	ITSOURC2	0,20	0,12	0,23	-0,49
	ITSOURC4	0,29	0,01	0,03	-0,52
	ITSOURC5	-0,13	-0,06	0,06	-0,85
ITSTRAT	ITSTRAT3	0,07	0,88	0,19	0,21
	ITSTRAT4	-0,18	0,73	-0,20	-0,11
	ITSTRAT5	0,13	0,40	-0,08	-0,31

Table 7.5: Pattern matrix for the MS variable. Extraction Method: Principal Axis Factoring.Rotation Method: Oblimin with Kaiser Normalization. Rotation converged in 10 iterations.

Factor	Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings[a]
	Total	% of Variance	Cumulative %	Total
1	4,844	32,290	32,290	4,068
2	1,729	11,525	43,815	1,692
3	1,037	6,912	50,727	1,783
4	,911	6,076	56,803	3,152

Table 7.6: Total Variance Explained by the MS variable. Extraction Method: Principal Axis Factoring.
(a) when factors are correlated, sums of squared loadings cannot be added to obtain a total variance.

Factor	1	2	3	4
1	1,000	-,009	,229	-,425
2	-,009	1,000	,037	-,188
3	,229	,037	1,000	-,162
4	-,425	-,188	-,162	1,000

Table 7.7: Factor Correlation Matrix for the MS variable. Extraction Method: Principal Axis Factoring. Rotation Method: Oblimin with Kaiser Normalization.

Technical Skills

The literature review identified variable Technical Skills (TS) as based on 29 items, grouped within two subsets named ISPROD and ITLC. The first step of the data analysis consisted in the cleaning the dataset from the numerous items of this variable that were affected by a relevant number of missing values: items ISPROD5, ISPROD6, ISPROD 7, ISPROD 8, ISPROD9, and ITLC7, ITLC8 were removed from the variable, then the extraction was run to build the first pattern matrix shown below (Table 7.8). By recursively dropping the items with low loadings on multiple components it was possible to identify 4 potential factors for the TS variable (Table 7.9).

		Factor				
		1	2	3	4	5
ISPROD	ISPROD1	0,60	0,08	0,04	0,06	0,08
	ISPROD2	0,58	-0,03	-0,32	-0,09	0,18
	ISPROD3	0,18	0,04	-0,20	-0,14	0,64
	ISPROD4	-0,12	0,03	-0,19	-0,51	0,52
	ISPROD10	0,29	0,13	-0,22	-0,34	0,13
	ISPROD11	0,61	0,22	0,07	-0,23	-0,07
	ISPROD12	0,11	0,02	0,02	-0,76	0,04
	ISPROD13	-0,03	0,17	0,07	-0,66	0,05
	ISPROD14	0,26	0,44	-0,07	-0,13	-0,19
	ISPROD15	-0,02	0,75	-0,21	-0,06	-0,10
	ISPROD16	-0,12	0,70	-0,11	-0,11	0,10
	ISPROD17	0,05	0,67	-0,05	0,07	0,02
	ISPROD18	0,07	0,68	-0,13	-0,13	-0,06
	ISPROD19	0,00	0,49	0,12	-0,01	0,03
	ISPROD20	0,32	0,49	0,16	0,19	0,32
ITLC	ITLC1	0,15	0,20	-0,36	-0,25	-0,10
	ITLC2	-0,13	0,26	-0,66	-0,22	-0,06
	ITLC3	0,03	0,11	-0,88	0,00	0,04
	ITLC4	0,49	-0,15	-0,13	-0,61	-0,04
	ITLC5	0,57	-0,12	-0,38	-0,20	-0,01
	ITLC9	0,09	-0,06	-0,70	0,17	0,20

Table 7.8: Pattern matrix for the TS variable. Extraction Method: Principal Axis Factoring. Rotation Method: Oblimin with Kaiser Normalization. Rotation converged in 25 iterations.

	Factor			
	1	2	3	4
ITLC3	0,85			
ITLC9	0,82			
ITLC2	0,55			
ISPROD3	0,51			
ISPROD2	0,45		-0,43	
ISPROD4	0,42			-0,36
ITLC5	0,42		-0,39	-0,33
ITLC1				
ISPROD15		0,76		
ISPROD18		0,71		
ISPROD17		0,69		
ISPROD16		0,68		
ISPROD19		0,49		
ISPROD14		0,44		
ISPROD1			-0,74	
ISPROD11			-0,55	
ISPROD12				-0,84
ITLC4			-0,34	-0,69
ISPROD13				-0,66
ISPROD10	0,30			-0,36

Table 7.9: Pattern matrix for the TS variable. Extraction Method: Principal Axis Factoring. Rotation Method: Oblimin with Kaiser Normalization. Rotation converged in 13 iterations.

The KMO and Bartlett's test run on this subset of items was significant (Table 7.10), thus new rounds of factorization were performed. The result is synthesized in Table 7.11: two factors emerged from the exploratory study, but they did not match exactly with the two subsets identified from the literature review for the TS variable. The items of the TS variable seem to have been re-arranged according to a logic that distinguishes between the types of services provided (Factor 1), and the domains of application of the technical skills (Factor 2). We can thus rename these factors respectively as IT services skills (Factor 1) and IT applications skills (Factor 2).

To test the quality of the outcomes of this factor analysis we computed the analysis of the correlations: from the correlation matrix the two factors appear to be positively correlated (table 7.12). This can be considered a common behavior and possibly suggesting a second order construct. Such second order construct may be just the suggested Technical skills variable.

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		,795
Bartlett's Test of Sphericity	Approx. Chi-Square	394,695
	Df	78,000
	Sig.	,000

Table 7.10: Kaiser-Meyer-Olkin and Bartlett's Test for the TS variable

Pattern Matrix

		Factors	
		1	2
ITLC	ITLC5	0,86	
	ITLC3	0,81	
	ITLC4	0,75	
	ITLC9	0,64	
ISPROD	ISPROD3	0,56	
ITLC	ITLC2	0,55	
ISPROD	ISPROD12	0,50	
	ISPROD11	0,45	
	ISPROD1	0,38	
	ISPROD17		0,79
	ISPROD18		0,76
	ISPROD15		0,76
	ISPROD16		0,65

Table 7.11: Pattern matrix for the TS variable. Extraction Method: Principal Axis Factoring. Rotation Method: Oblimin with Kaiser Normalization. Rotation converged in 5 iterations

Factor	1	2
1	1,000	,495
2	,495	1,000

Table 7.12: Factor Correlation Matrix for the TS variable. Extraction Method: Principal Axis Factoring. Rotation Method: Oblimin with Kaiser Normalization.

Relational Assets

The variable Relationship Assets was the one with the least number of items, due to the limited interest shown by the reviewed literature in the value for the IT function of building relationships within and outside the organization.

All the ten questions about RA asked in the survey received a relevant number of answers and therefore all the items constituting this variable were processed through the EFA.

The KMO and Bartlett's test run on these items was significative (Table 7.13).

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		,705
Bartlett's Test of Sphericity	Approx. Chi-Square	129,997
	Df	45,000
	Sig.	,000

Table 7.13: Kaiser-Meyer-Olkin and Bartlett's Test for the RA variable.

Contrary to the previous two variables, none of the items of the RA variable was removed through the application of the EFA. The pattern matrix shows that the items are aggregated around three factors (Table 7.14):

- Factor 1: including all the items dealing with the relationships between the IT function and the organization, except the item (IRA1) upon which Factor 3 converged.
- Factor 2: including all the items referring to the relationships between the IT function and external entities, such as company's clients and suppliers and the IT services providers
- Factor 3: corresponding to just one item that refers to internal relationships: "If you have a business question or problem that you (CIO) cannot solve alone, how confident are you about finding the right person to contact in your organization?"

Factor 1 and 3, although both dealing with internal relationships, are in fact characterized by a rather different focus. Factor 1 refers to general capabilities that enable an effective relationship between the IT function and the organizational roles (namely managers and users) that are directly or indirectly involved in the IT investments decisions. Factor 3 is focused on the CIO and measures not just the capability of the organization but rather the actual impact of the presence of good internal relationships. We can then rename the factors as follows: Internal Relationship Assets (Factor 1), External Relationship Assets (Factor 2), and Business Support (Factor 3).

Factor

Pattern Matrix

		1	2	3
IRA	IRA6	0,77		
	IRA2	0,72		
	IRA5	0,56	-0,30	
	IRA4	0,56		
	IRA7	0,52		
	IRA3	0,51		
ERA	ERA1	0,45		0,42
	ERA2		-0,99	
	ERA3		-0,65	
IRA	IRA1			0,63

Table 7.14: Pattern matrix for the RA variable. Extraction Method: Principal Axis Factoring. Rotation Method: Oblimin with Kaiser Normalization. Rotation converged in 14 iterations.

The analysis of correlation of the three factors (Table 7.15) shows that they are only partially correlated, and the higher correlation occurs between Factors 1 and 2. Factor 3 appears not correlated with Factors 1 and 2, result that further justifies the opportunity to keep this factor distinct from the other two.

Factor	1	2	3
1	1,000	-,307	,051
2	-,307	1,000	-,087
3	,051	-,087	1,000

Table 7.15: Factor Correlation Matrix for the RA variable. Extraction Method: Principal Axis Factoring. Rotation Method: Oblimin with Kaiser Normalization.

7.4 Assessment of the PLS model

The descriptive statistics for the construct IT capability are shown in Table 7.16. The following paragraphs focus on the assessment of the PLS model. This is generally done in two separate steps: the assessment of the reliability and the validity of the measurement model and the assessment of the structural model (Tenenhaus 2005). This approach makes sure that the researcher has reliable and valid measures of the constructs before conclusions about the nature of the construct relationships are drawn (Hulland 1999, p. 194).

Construct	mean	std dev
Managerial Skills (MS)	2,51	1,19
Technical Skills (TS)	2,40	1,33
Relationship assets (RS)	2,31	1,27
Performance IT (BP)	2,14	1,26

Table 7.16: Descriptive statistics for the research constructs. All constructs are 5-point-scales with the anchors 0 = Not at all, 1 = To a Small Extent, 2 = To Some Extent, 3 = To a Large Extent, 4 = To a Great Extent.

7.4.1 Assessing the measurement model

The adequacy of a reflective measurement model is assessed by evaluating (Hulland 1999, White et al. 2003):

- the reliability of single items,
- the convergent validity (also referred to as internal consistency) between items that are expected to measure the same construct,
- the discriminant validity between constructs.

Individual items reliability

A measure is reliable to the extent that independent but comparable attempts to capture the same attribute or construct agree. A measure is valid on the condition that the indicators or the construct accurately measures what they are supposed to measure (Berghman 2006).

For the assessment of individual item reliability the loadings (or simple correlations) of the measures on their corresponding constructs are inspected. A rule of thumb recommends accepting items with loadings of at least 0.7. This implies that there is more shared variance between the construct and its measure than error variance, or stated differently, it indicates that more than 50% of the variance in the item (i.e. the square of the loading) is due to the construct (Hulland 1999). However, a reliability score of at least 0.5 might be acceptable if other items related to the construct have higher reliability scores (Chin 1998). In practice, single loadings between 0.5 and 0.7 can be found especially when new items or newly developed scales are employed (Hulland 1999).

This is in fact the case of our study. Table 7.17 shows the aggregated results of the factor analysis**.** The cells with a pink background contain coefficients higher than 0.50, while the yellow background highlights the coefficients between 0.30 and 0.50. All the item loadings are higher than 0.50, with the only exception of ITSOURC2 (whose loading is 0.49, just slightly below the threshold), therefore the individual item reliability is confirmed.

MS: Pattern Matrix		Factor			
		1	2	3	4
ITBP	ITBP1	0,81	-0,03	-0,06	0,02
	ITBP2	0,67	-0,05	-0,17	-0,05
	ITBP4	0,59	0,19	0,24	0,01
	ITBP5	0,56	0,13	0,08	-0,30
	ITBP6	0,57	-0,09	-0,14	-0,29
	ITBP7	0,70	-0,02	0,28	-0,01
ITPM	ITPM2	0,43	-0,21	0,57	0,03
	ITPM3	-0,18	0,05	0,79	-0,24
ITSOURC	ITSOURC1	0,16	0,01	0,05	-0,55
	ITSOURC2	0,20	0,12	0,23	-0,49
	ITSOURC4	0,29	0,01	0,03	-0,52
	ITSOURC5	-0,13	-0,06	0,06	-0,85
ITSTRAT	ITSTRAT3	0,07	0,88	0,19	0,21
	ITSTRAT4	-0,18	0,73	-0,20	-0,11
	ITSTRAT5	0,13	0,40	-0,08	-0,31

TS: Pattern Matrix		Factor	
		1	2
ITLC	ITLC5	0,86	
	ITLC3	0,81	
	ITLC4	0,75	
	ITLC9	0,64	
ISPROD	ISPROD3	0,56	
ITLC	ITLC2	0,55	
ISPROD	ISPROD12	0,50	
	ISPROD11	0,45	
	ISPROD1	0,38	
	ISPROD17		0,79
	ISPROD18		0,76
	ISPROD15		0,76
	ISPROD16		0,65

RA: Pattern Matrix		Factor		
		1	2	3
IRA	IRA6	0,77		
	IRA2	0,72		
	IRA5	0,56	-0,30	
	IRA4	0,56		
	IRA7	0,52		
	IRA3	0,51		
ERA	ERA1	0,45		0,42
	ERA2		-0,99	
	ERA3		-0,65	
IRA	IRA1			0,63

Table 7.17: Pattern matrixes for the three constructs, to assess the reliability of the single items.

Convergent validity

Convergent validity (also referred to as internal consistency) measures the degree of association between items belonging to the same construct. The items belonging to the domain of a certain construct are assumed to have an equal amount of common core. Thus, responses to those items should be highly inter-correlated (Berghman 2006).

Convergent validity assures relevant and appropriate measures, and the unidimensionality of a construct (Benamati & Lederer 2000, Hulland 1999). Researchers using PLS generally report **Cronbach's alpha** and/ or the **Composite Reliability** measure developed by Fornell & Larcker (1981) as measures for convergent validity (Fornell & Larcker 1981, Hulland 1999). The same authors argue that the Composite Reliability measure is superior to Cronbach's alpha since it is estimated within the context of the causal model (Fornell & Larcker 1981, Hulland 1999). Moreover, Cronbach's alpha a priori presumes that the indicators of a construct contribute equally (i.e. the loadings are set to unity). In other words, Cronbach's alpha can be considered as a lower bound of convergent validity (Eom et al, 2006). Nevertheless, the minimum requirements for both measures are similar. Convergent validity is considered acceptable when the values of both measures exceed the threshold of 0.6 recommended by Bagozzi and Yi (1988), or respectively 0.7 as suggested by Nunnally (1978). More precisely, Cronbach's alpha should be greater or equal to .80 for a good scale, .70 for an acceptable scale, and .60 for a scale for exploratory purposes.

A third measure, **AVE** (average variance extracted), is recommended by FornelI & Larcker (1981). AVE measures the amount of variance captured by the construct, relative to the amount of variance due to measurement error. If AVE shows values less than 0.5 this means that the

variance due to measurement error exceeds the variance captured by the construct, making the validity of the indicators and the validity of the entire construct questionable. For this reason, AVE should exceed values greater than 0.5 (Fornell & Larcker 1981).

Similarly to AVE, the **communality** measures the average percent of variance in the indicators for a row factor explained by that row factor and is sometimes interpreted as the reliability of row factor.

R-square is the overall effect size measure, as in regression, indicating what percentage of a variable is explained by the model. It is not used with exogenous latent factors, thus no R^2 is shown for MS, TS RA and ITCap. Following Chin's suggestion (1998) R^2 values above 0.67, 0.33 and 0.19 are to be considered "substantial", "moderate" and "weak" respectively.

The **redundancy** coefficient measures the percent of variance in the indicators for the dependent factor (e.g. ITCap) explained by the exogenous factors (e.g. MS, TS, RA). This may modify the evaluation of R^2 as a model fit measure.

Table 7.18 shows the results of the assessment of convergent validity. All the variables appear to meet the requirements, with the only (and partial) exception of ITSTRAT, whose values for Composite Reliability and AVE are rather below the thresholds suggested for acceptability (Chronbach's alpha is much closer to this threshold), while the R Square meet the requirements indicated.

Constructs and Factors	Cronbachs Alpha	Composite Reliability	AVE	Communality	R Square	Redun-dancy
Managerial Skill	**0,8782**	**0,906**	**0,4641**	**0,4641**		**0,3924**
ITBP	0,9313	0,9458	0,7443	0,7443	0,8864	0,655
ITPM	0,7761	0,8947	0,8098	0,8098	0,4694	0,3576
ITSOURCE	0,8815	0,9185	0,739	0,739	0,6771	0,4912
ITSTRAT	*0,4852*	*0,1352*	*0,3673*	0,3673	0,3312	0,0758
Technical Skills	**0,9195**	**0,9335**	**0,5321**	**0,5321**		**0,4229**
Factor1	0,9347	0,9471	0,6712	0,6712	0,9508	0,636
Factor2	0,8136	0,8774	0,6421	0,6421	0,4667	0,2919
Relational Assets	**0,7311**	**0,6685**	**0,2455**	**0,2455**		**0,1164**
IT Perf	0,9048	0,9131	0,3983	0,3983	0,2509	0,0575
ITCapability	0,9178	0,9305	0,3397	0,3397		0

Table 7.18: indicators for the assessment of the convergent validity.

Discriminant validity

Discriminant validity represents the extent to which measures of a specific construct differ from measures of other constructs. A criterion for discriminant validity is that a construct should share more variance with its indicators than it shares with other constructs in a given model

(Hulland et al. 1999). To assure discriminant validity Fornell & Larcker (1981) suggest that the average variance shared (AVE) between a construct and its measures should be greater than the variance shared (i.e. the squared correlation) between the construct and other constructs (Hulland 1999). Discriminant validity implies that the constructs can be adequately discriminated and that it is appropriate to view them as separate theoretical entities.

Table 7.19 reports (on the diagonal) the values of AVE of each construct and (in the cells below the diagonal) the variance shared between such construct and the other constructs. Also in this case, the measurement model is in general validated. The assessment of discriminant validity shows only two weaknesses in the model highlighted in "bold" in Table 7.19, where Managerial Skills appears rather much more correlated with ITBP (0.94) than with itself (0.68) and Relational Assets appears correlated with ITPerf. It is worth noting that due to the number of missing values in the data set for ITBP, the actual relevance of the correlation between MS and ITBP is rather limited.

	TS: Factor1	TS: Factor2	MS: ITPM	MS: ITSOURCE	MS: ITSTRAT	Managerial Skill	Relational Assets	Technical Skills	IT Perf	ITBP
TS: Factor1	0,82									
TS: Factor2	0,54	0,81								
MS: ITPM	0,34	0,40	0,90							
MS: ITSOURCE	0,77	0,54	0,34	0,86						
MS: ITSTRAT	0,39	0,67	0,37	0,58	0,67					
Managerial Skill	0,74	0,26	0,69	0,82	0,58	0,68				
Relational Assets	0,64	0,63	0,47	0,53	0,60	0,63	0,50			
Technical Skills	0,98	0,68	0,30	0,80	0,35	0,69	0,55	0,73		
IT Perf	0,37	-0,12	0,18	0,42	0,42	0,46	**0,70**	0,28	0,63	
ITBP	0,64	0,94	0,63	0,63	0,42	**0,94**	0,53	0,57	0,42	0,86

Table 7.19: assessment of the discriminant validity: interconstruct correlations. The shaded numbers on the main diagonal are the square root of the variance shared between the constructs and their measures. Off diagonal elements are the correlations among constructs.

7.4.2 Assessing the structural model: data analysis on the refined research model (the relationship between IT capability and Business performance)

After having completed the assessment of the psychometric properties of the scales of the measurement model, the object of the assessment becomes the structural model.

As anticipated, the data collection did not bring the hoped for results. The questions requiring an economic quantification of IT expenditures (the independent variable in the original research model) and Business Performance (the dependent variable in the original research model) went largely unanswered: the consequent high number of missing values did not allow PLS to be performed on the original research model.

However, just because we had expected - to some extent - the reluctance (or incapacity) of the interviewees to provide quantitative data (which typically affects empirical studies on SMEs), we kept in the questionnaire of the survey the set of questions about the impact of IT on business performance. The number of missing values of this set of questions was irrelevant, therefore we have data available to assess the dependent variable of the study.

In a PLS structural model, the loadings of measures of each construct are interpreted as loadings in a principal component factor analysis, and paths are interpreted as the beta coefficients (beta weights) in a regression analysis (Agarwaal et al. 2000). The standardized beta-coefficients are a measure of the strength of a relationship between the independent and the dependent variable when the effects of the remaining independent variables are kept constant. R^2 represents the squared multiple correlation coefficient, showing the proportion of variance on a dependent variable explained by all the variables jointly (Berghman 2006).

The chosen software tool to analyse the structural model through a PLS regression was SmartPLS (Ringle et al. 2005). To perform the analysis, SmartPLS offers four different computational algorithms: a) *PLS Algorithm* have the model computed in the default manner, b) *FIMIX-PLS* is recommended when the data are not homogenous but require segmentation into groups as part of analysis (Hahn et al. 2002), c) *bootstrapping* uses resampling methods to compute PLS coefficients, d) *blindfolding* utilizes a cross-validation strategy and reports cross validated communality and cross validated redundancy for constructs as well as indicators (Ringle et al. 2005).

Since the data under investigation did not need segmentation, the computational algorithms chosen for the analysis were the PLS algorithm and the two resampling techniques: bootstrapping and blindfolding. The next paragraphs show the results generated by the statistical software tool.

The application of the PLS Algorithm allows to identify the path coefficients for the research model. Figure 7.9 and Table 7.20 show the main outcomes of this procedure (i.e. only the loadings for the IT capability dimension), while the complete graph of the path coefficients generated by SmartPLS and the outer model loadings of the other items on their respective constructs are reported in Appendix C (Figure C.1 and Table C.1).

The analysis confirms the relevance of the relationship between IT capability and the three constructs identified through the assessment of the measurement model. IT capability explains 85.2% of the variance of MS, 79.5% of TS and 56.5% of RA. This finding is consistent with the

definition and the assumptions of Piccoli's (2005) review about IT enabled sustainable competitive advantage. IT performance, i.e. the business performance due to IT investments, is explained at 25% by IT capability. Noteworthy, the path coefficients show that all these relationships are significant at 0.001.

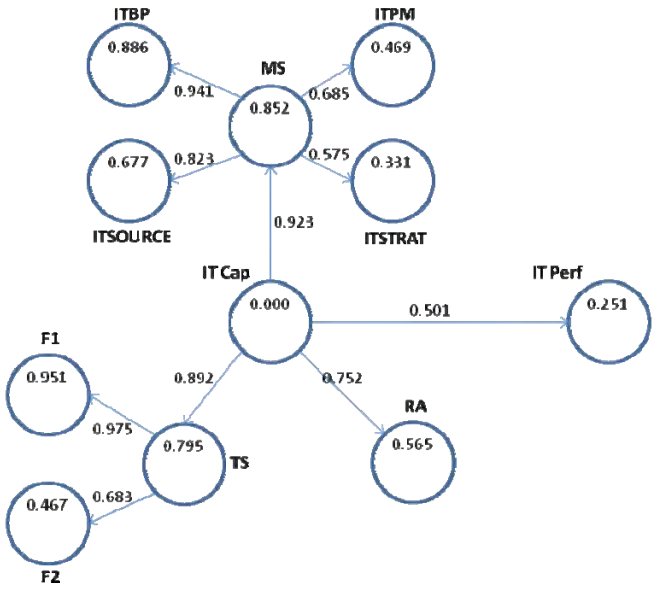

Figure 7.9: PLS results (path coefficients and Rsquare) for the structural model.

	Factor1	Factor2	IT Perf	ITBP	ITCapability	ITPM	ITSOURCE	ITSTRAT	Manag. Skill	Relat. Assets	Tech. Skills
Factor1											
Factor2											
IT Perf											
ITBP											
ITCapability			0,501						0,923	0,752	0,892
ITPM											
ITSOURCE											
ITSTRAT											
Managerial Skill				0,941		0,685	0,823	0,575			
Relational Assets											
Technical Skills	0,975	0,683									

Table 7.20: Path coefficients for the structural model

The significance of PLS parameters was assessed using bootstrapping and blindfolding procedures.

The bootstrap samples are built by resampling with replacement from the original sample. The procedure produces samples consisting of the same number of units as in the original sample. The number of resamples – that is required to be specified - was 200 as suggested by Tenenhaus (2005) in order to lead to more reasonable standard error estimates. The results of the

application of the resampling with bootstrapping are shown in Table 7.21. The relationships between all the variables involved in the structural model show high p-values, in particular, the relationship under investigation with the research model (the causal relationship between IT capability and IT business performance) is highly significant.

The only exceptions are the correlations referred to ITSTRAT with IT capability and Managerial skills, for which the bootstrapping calculated higher p-values (respectively 0.10 and 0.09).

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	Standard Error (STERR)	T Statistics (|O/STERR|)	p-value
ITCapability -> Factor1	0,87	0,88	0,03	0,03	27,25	0,00
ITCapability -> Factor2	0,61	0,60	0,13	0,13	4,61	0,00
ITCapability -> IT Perf	**0,50**	**0,60**	**0,09**	**0,09**	**5,41**	**0,00**
ITCapability -> ITBP	0,87	0,87	0,04	0,04	19,78	0,00
ITCapability -> ITPM	0,63	0,63	0,10	0,10	6,14	0,00
ITCapability -> ITSOURCE	0,76	0,76	0,07	0,07	10,29	0,00
ITCapability -> ITSTRAT	0,53	0,47	0,32	0,32	1,65	***0,10***
ITCapability -> Managerial Skill	0,92	0,92	0,04	0,04	23,30	0,00
ITCapability -> Relational Assets	0,75	0,77	0,06	0,06	11,88	0,00
ITCapability -> Technical Skills	0,89	0,90	0,03	0,03	25,91	0,00
Managerial Skill -> ITBP	0,94	0,94	0,01	0,01	63,11	0,00
Managerial Skill -> ITPM	0,69	0,69	0,11	0,11	6,39	0,00
Managerial Skill -> ITSOURCE	0,82	0,83	0,05	0,05	15,92	0,00
Managerial Skill -> ITSTRAT	0,58	0,51	0,34	0,34	1,68	***0,09***
Technical Skills -> Factor1	0,98	0,98	0,01	0,01	142,30	0,00
Technical Skills -> Factor2	0,68	0,67	0,13	0,13	5,11	0,00

Table 7.21: total effects p-value indirect.

The application of the resampling with blindfolding allows assessing the cross validated communality (cv- communality) and the cv-redundancy. SmartPLS computes the sum of squares of observations (SSO) and the sum of squared prediction errors (SSE). The complement to 1 of the ration between SSO and SSE represents the cross validated indicator.

The mean of the cv-communality indices can be used to measure the global quality of the *measurement model* if they are positive for all blocks, taking into account the measurement model. The mean of the various cv-redundancy indices related to the endogenous blocks can be used to measure the global quality of the *structural model* if they are positive for all endogenous blocks, taking into account the measurement model.

Tables 7.22 and 7.23 confirm the good quality of both the measurement and the structural model. Again, the only (partial) exception is represented by ITSTRAT, that shows a low value (although positive) for cv-communality, and a negative value for cv-redundancy.

	SSO	SSE	cv-communality 1-SSE/SSO
Factor1	198	65,096824	0,671228
Factor2	88	31,493627	0,642118
IT Perf	396	238,281178	0,39828
ITBP	132	33,703224	0,744673
ITCapability	836	552,035473	0,33967
ITPM	44	8,389309	0,809334
ITSOURCE	88	22,95697	0,739125
ITSTRAT	66	52,460456	***0,205145***
Managerial Skill	330	177,567768	0,461916
Relational Assets	220	165,972809	0,245578
Technical Skills	286	133,829637	0,532064

Table 7.22: Construct Crossvalidated Communality

	SSO	SSE	cv-redundancy 1-SSE/SSO
Factor1	198	72,075231	0,635984
Factor2	88	62,311402	0,291916
IT Perf	396	373,262668	0,057418
ITBP	132	45,09465	0,658374
ITCapability			0,33967
ITPM	44	28,087788	0,361641
ITSOURCE	88	44,820155	0,49068
ITSTRAT	66	66,746552	***-0,011311***
Managerial Skill	330	200,697789	0,391825
Relational Assets	220	194,400397	0,116362
Technical Skills	286	165,013108	0,423031

Table 7.23: Construct Crossvalidated Redundancy

7.5 Summary of the results of the IT capability measure validation

The following paragraphs summarize the outcomes of the survey concerning the measure of IT capability and discuss the differences between the measure developed through the literature review and the measure validated through the exploratory factor analysis.

The cells marked in red indicate the items that have not been included in any factor after the validation, the cells marked in green indicate the items that are included in the same factor that was identified through the literature review, the cells marked in yellow indicate the items that were included in the measure, but in a different factor than the one identified through the literature review.

7.5.1 Management skills

Four out of the five subsets originally proposed through the literature review for defining Management skills were validated by the exploratory factor analysis. The only subset that does not corresponds to a factor in the IT capability measure is MS ITF (Management of the IT Function). A simple explanation of this outcome can be found in the absence of a structured IT function in most of the surveyed companies: as often happens with companies of this size, SMEs rely on IT providers to take care of the design and maintenance of the computer based information system. Similarly, those items referring to the management of IT specialists within the subset named MS ITPM (IT Project Management), were dropped, and the resulting MS ITPM factor address the issues of monitoring and assessing IT projects.

This interpretation is in fact coherent with the significance of the subset MS ITSOURC (Management of the relationship with suppliers of IT products/services). The analysis showed that IT outsourcing is common among SMEs, and the competence of managing the relationship with IT solution providers is a critical factor in determining the effectiveness of IT expenditures.

On the contrary, it is rather surprising that surveyed SMEs recognize the strategic impact of IT, as pointed out by the MS ITSTRAT (Management of the relationship between IT and Strategy) factor. Notably, what seems to matter is not just the explicit inclusion of strategic planning into IT management (the related items in the MS ITSTRAT subset were dropped), but rather the ability to use IT to affect strategically the company environment (products, markets, suppliers).

- Management of the relation between IT and Business Process and/or Organizational Units (MS ITBP)

	Item coding	Questions
		what is the level of knowledge of the IT manager on
MS	ITBP1	main challenges that different divisions in the organization face achieving their objectives
MS	ITBP2	the connections and interdependencies between the various division in the organization
MS	ITBP3	How much does she/he participate in business activities that are not directly related to IT?
MS	ITBP4	How experienced is she/he at evaluating the organizational impacts of IT solutions?
		How well can she/ he - To what extent is she/he able to
MS	ITBP5	coordinate the integrated infrastructure and manage its relationships with the business units
MS	ITBP6	integrate IT resources effectively with process reengineering initiatives
MS	ITBP7	design business operations and process required to deliver the business strategy

- Management of IT Function (MS ITF)

	Item coding	Questions
		How well can she/ he/your organization - To what extent is she/he/your organization able to
MS	ITF1	attract and retain high-caliber staff committed to the vision of the one corporate
MS	ITF2	define information management policies for the organization and the roles and responsibilities of general management and the IS/IT function
MS	ITF3	educate IT personnel on technological developments as well as business-related issues

- Management of the relationship between IT and Strategy (MS ITSTRAT)

	Item coding	Questions
		To what extent in your organization
MS	ITSTRAT1	business strategic planning is integrated with IT planning
MS	ITSTRAT2	IT has a strategic role in achieving our firms objectives, rather than just a vehicle for cost displacement
MS	ITSTRAT3	your business is about creating new products/services using IT
MS	ITSTRAT4	IT is used to create biased market
MS	ITSTRAT5	IT is used to alter the linkages with supplier and customers
		How well can she/ he/your organization - To what extent is she/he/your organization able to
MS	ITSTRAT6	convert IT assets and services into strategic application
MS	ITSTRAT7	Incorporate the potential of new and emerging technologies in long term business development

- Management of relationship with suppliers of IT products/services (MS ITSOURC)

	Item coding	Questions
		How well can she/ he/your organization - To what extent is she/he/your organization able to
MS	ITSOURC1	facilitate the contracts (ensuring the success of existing contracts for IS/IT services)
MS	ITSOURC2	identify the potential added value of IS/IT service suppliers
MS	ITSOURC3	co-operate with software-houses in IS analysis
MS	ITSOURC4	determine and evaluate supply sourcing options
MS	ITSOURC5	understand and manage cost of acquisition and ownership

- IT project management (MS ITPM)

	Item coding	Questions
		what is the level of knowledge of the IT manager on
MS	ITPM1	co-ordinate IS/IT development and implementation
MS	ITPM2	estimate the effort and the duration of a project and identify appropriate resources (eg.: people with necessary skill, experience, availability)
MS	ITPM3	monitor, measure and evaluate the benefits derived from IS investment and use
MS	ITPM4	acting in a leadership role (establishing direction, directing people, motivating and inspiring)
MS	ITPM5	is flexible, eg by improving task performance through trial-and-error experimentation
MS	ITPM6	effectively manages cross-functional teams and ad-hoc structures
MS	ITPM7	the IT manager develops a personal social network

7.5.2 Technical Skills

The two subset of items identified through the literature review to describe Technical skills were largely revised by the exploratory factor analysis. The ERA showed that Technical skills can be explained by two factors, but their meaning is very different than the ones foreseen after the literature review. The outcomes of the data analysis suggest to radically rethink technical skills by adopting a business perspective as opposed to the traditional academic perspective. They suggest a shift from the traditional decomposition of technical skills in technical components to a pragmatic classification of the business impacts of IT applications. In fact, almost all the specialized technical skills listed in the subset TS ISPROD (Management of products/services of the IT function) were dropped by the ERA. The resulting structure shows two factors, that can be named as *IT services skills* and *IT applications skills*.

- Management of the CBIS lifecycle (emphasis on process) (TS ITLC)

	Item coding	Questions
		How well can she/ he/your organization - To what extent is she/he/your organization able to
TS	ITLC1	design of IT architecture.
TS	ITLC2	choose correct platform for a firm (hardware, network, and software standards)
TS	ITLC3	Identify IS/IT requirements
TS	ITLC4	software installation
TS	ITLC5	debugging and testing
TS	ITLC7	develop and deliver IS/IT solutions to the business
TS	ITLC8	maintain effectively technology, information and application assets
TS	ITLC9	define service level requirements to support the achievement of business benefits

- Management of products/services of the IT function (emphasis on products-services / IT artifacts) (TS ISPROD)

	Item coding	Questions
		How well can she/ he - To what extent is she/he able to provide the following infrastructure services?
TS	ISPROD1	Manage firm-wide (or group-wide) communications network and messagging services
TS	ISPROD2	Manage firm-wide or business-unit workstation networks (LANs, POS)
TS	ISPROD3	Implement security, disaster planning and business recovery services for firm-wide installations and applications
TS	ISPROD4	enforce standards for hardware and software selection and/or sw development to streamline resources requirements and reduce incompatibilities and costs
TS	ISPROD5	Perform IS planning for business unit
TS	ISPROD6	Develop business-unit specific applications
TS	ISPROD7	Manage business-unit-specific applications
TS	ISPROD8	Provide firm-wide or business-unit data management, including standards
TS	ISPROD9	Develop and manage electronic linkages to suppliers or customers
		How well can she/ he/your organization - To what extent is she/he/your organization able to
TS	ISPROD10	integrate system and make IT applications cost effective
TS	ISPROD11	customise systems
TS	ISPROD12	provide users support
TS	ISPROD13	provide IS/IT training
		what is the domain of application of the technical skills
TS	ISPROD14	Enterprise resource planning
TS	ISPROD15	Supply chain management
TS	ISPROD16	Customers relationship management
TS	ISPROD17	Product data management
TS	ISPROD18	Support accounting and budgeting
TS	ISPROD19	Support human-resources management
TS	ISPROD20	Electronically provide information to the top management (EIS)

7.5.3 Relationship Assets

With regards to the Relationship Assets, the ERA essentially validated the outcomes of the literature review. The only item dropped from the subset named RA ERA (External relationship assets) refers to the relationship between line managers and IT service providers. Similarly to what has been noted previously, this may be interpreted as a consequence of the limited complexity of the organizational structure of the surveyed SMEs.

Finally, the emergence of a further factor to describe the Relationship Assets (i.e. Business Support) confirms that business understanding from IT people is perceived relevant, as also emphasized by the factor MS ITBP (Management of the relation between IT and Business Process and/or Organizational Units).

- Internal Relationship Assets (RA IRA)

	Item coding	Questions
		How well can she/ he/your organization - To what extent is she/he/your organization able to
RA	IRA1	***If you have a business question or problem that you (CIO) cannot solve alone, how confident are you about finding the right person to contact in your organization?***
		To what extent in your organization
RA	IRA2	managers are trained and educated about how to envision, invest in and use IT to create business value
RA	IRA3	managers understand the value of IT investments
RA	IRA4	line management is sponsor of IT initiatives
RA	IRA5	coordination and interaction with user community is developed

RA	IRA6	IT manager keeps people interested to the change of technologies
RA	IRA7	responsibility for the effective application of IT in the firm is shared

- External Relationship Assets (RA IRA)

	Item coding	Questions
		How well can she/ he/your organization - To what extent is she/he/your organization able to
RA	ERA1	relationship between line management and IT service providers is developed
RA	ERA2	the IT staff has developed productive customer partnerships based on long-term relationships
RA	ERA3	the IT staff has developed productive partnerships with supplier based on long-term relationships

- Business Support

	Item coding	Questions
		How well can she/ he/your organization - To what extent is she/he/your organization able to
RA	IRA1	***If you have a business question or problem that you (CIO) cannot solve alone, how confident are you about finding the right person to contact in your organization?***

7.6 Conclusions

In this chapter we presented the survey, the detailed methodological approach that was chosen according to the aims of the research and to the characteristics of the sample and the outcomes of the statistical analysis.

The quantitative analysis performed in this step of the research led to the validation of a measure of IT capability and proved - to a certain extent - the influence that this construct has to the perceived effect of IT investments on business performance. Although not without limitations (the most critical one being the non-availability of objective and quantitative data on business performance), these outcomes cover in fact a lack in the existing IS literature.

After discussing (in the previous chapters) the limits of the available studies about the sustainability of competitive advantage deriving from IT expenditures (or IT-enabled SCA, to use Piccoli's (2005) terms), we were able to develop and validate a measure of IT capability that avoids the ambiguity intrinsic in previous research. The choice to follow a bottom-up approach, exploiting all the available work about this concept independently of the terms used to define the concept, proved to be a successful one.

From the academic point of view, this result was achieved through a *rigorous* approach. In the introductory section of this chapter (7.2 Development of a measure of IT capability) we discussed in detail the available alternatives to carry out the analysis of the data collected through a survey. A review of papers focused on the use of exploratory factor analysis shed light on the fact that too frequently superficiality undermines the choices about the methodology in empirical research published even in major IS journals. On the contrary, we explained carefully each of the choices that underpins the exploratory factor analysis of the collected data.

We also have achieved two *relevant* results within the IS research field. First, the measure of IT capability covers a lack that - as we demonstrated through the literature review – affects the studies both on the organizational and the managerial side of the IS discipline. We expanded the definition of Piccoli et al. (2005), introducing a second level of detail in his threefold structure:

- Managerial Skills, subdivided into:
  - Management of relation between IT and business process
  - Management of relation between IT and Strategy
  - Management of relationship of IT product/services
  - Management of CBIS lifecycle
- Technical skills, subdivided into:
  - IT services skills
  - IT applications skills
- Relational assets, subdivided into:
  - Internal Relationship Assets
  - External Relationship Assets
  - Business Support.

As a second relevant outcome, we were able to use this measure to prove a positive correlation between IT capability and the impact of IT on business performance. Data show that the more developed the IT capability as above defined, the more IT expenditures can influence long terms results of an organization. Although indirectly (we could not use a direct measure of IT expenditures nor of business performance due to missing values in the collected data), this outcome supports the thesis proposed by Barney in his seminal article about RBV: IT capability is a determinant of Sustainable Competitive Advantage.

These results are not exempt from limitations. The number of companies surveyed (with respect to the number of items to measure IT capability) is probably sub-optimal, but we provided theoretical support for the reliability of a sample of this size. Second, the original research model included two separate constructs (besides IT capability): IT expenditures and Business Performance. This structure aimed at studying the moderating effect of IT capability on the influence of IT investments on business results. Regrettably, the surveyed companies were not able to provide consistent quantitative data (if any data at all) about these two constructs. The choice of studying the direct relationship between IT capability and IT impact on business performance was meant to provide for this limitation, and while this does not allow making any

inference about the moderating effect, can, in fact, support the thesis that IT capability is a source of sustainable competitive advantage.

The next chapter, besides discussing such limitations, will compare the results emerging from the literature analysis, the multiple case studies and the survey, and will draw the conclusions of this study on IT capability.

8 Chapter Eight: Discussion and conclusions

8.1 Introduction

The study presented in this thesis aimed at clarifying how IT capabilities impact long term results within small and medium organizations. To do so, the Resource Based View (RBV) has been used as the theoretical framework, and - within such framework - the concept of sustainable competitive advantage has been used as a point of reference. IT capability, a term often mentioned in the scientific literature dealing with the applications of RBV in the IS field, has been the subject of this study. Within such literature, IT capability is addressed as an essential factor (or asset, or resource, or competence) able to considerably influence the effectiveness (i.e. the effect on business performance) of IT expenditure in the long term. Nevertheless, the relevance of this factor clashes with the difficulty that scholars have found in agreeing to a common definition for IT capability.

The intuition motivating the current research was that the complexity of defining the concept of IT capability could be mitigated by empirically studying within the context of the SMEs the relationship between IT expenditure and business performance (Figure 8.1).

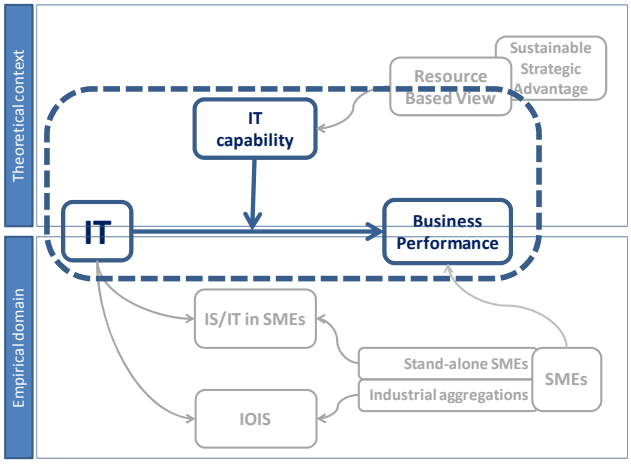

Figure 8.1: the research model of the study (within the dotted line), its theoretical context and empirical domain.

Compared to large enterprises, which are the typical subject of research in management and organizational studies, SMEs have a limited number of employees, a limited turnover, a limited organizational structure, a limited complexity of business processes, a limited IT infrastructure. It is generally assumed that all these "limitations" lead to an overall limited complexity of the organization, and this – with respect to the current study – suggests that the influence of any

organizational variable on the business performance may be studied more effectively because of the limited moderating effect of other variables.

At the same time, it is necessary to take into account the multiple business interactions amongst SMEs located in a geographical area, that can make them part of a supra-organizational entity called an industrial district. Within these aggregations of companies it would be an oversimplification not to consider the inter-organizational information flows, which are claimed to be an essential aspect to understand the behavior and the characteristics of the single organizations. For this reason, while the unit of analysis to study IT capability was the stand-alone SME, the industrial aggregations to which SMEs belong represent a necessary element to contextualize the results of the study.

The following paragraphs discuss the outcomes of the research that were presented in the previous chapters and for the sake of clarity, the chapter is structured around the research questions.

RQ1.1: Can a comprehensive definition of IT capabilities be developed and validated in the context of SMEs?

This question was answered from a theoretical point of view in Chapter 4, and found empirical support in Chapter 5.

RQ1.2: what are the relevant variables that allow measurement of IT capability in SMEs and how can they be applied?

The development of a measure was the object of Chapter 6 and its empirical validation was performed in Chapter 7.

RQ1.3: what are the variables allowing measurement of business performance in SMEs according to the aim of highlighting the role of IT capability as enabler?

Within Chapter 4 (more precisely, in section 4.3.2) the theoretical foundations to answer this RQ were introduced. The outcomes of the investigation presented respectively in Chapter 5 and 7 provided the empirical evidence to discuss the appropriateness of the variables chosen to assess business performance.

RQ1: what is the influence of IT capability on the relationship between IT expenditures and Business performance in SMEs?

The main research question of the study can be answered in this chapter, by cross matching the results of the multi-method approach for the empirical studies presented in Chapters 5 and 7.

RQ2: can a model be developed to assist SMEs to grow and fully exploit IT capability to achieve effective business performance?

In the final part of this work, the descriptive approach that drove the entire study will give way to a normative perspective. This Chapter 8 will build on what was learned in order to formulate general guidelines that should drive choices about IT capability within organizations of any size.

The answers to these questions will be presented in the following paragraphs, both in general terms, and also - whenever possible – they will be discussed in the light of the characteristics of the context where the research took place in order to discuss how the characteristics of the domain (the company size, the possible strategic relevance of IOIS) may help explain the results.

8.2 A workable definition of IT capability (RQ1.1)

The main difficulty in designing a study on IT capability was recognized in the practical absence of an unambiguous definition for this term. The preliminary literature review allowed identification of two conceptual frameworks enabling the contextualization of the concept of IT capability.

The first framework has its roots in the field of Organization Science. Caldeira and Ward (2003) were able to map the relationships between IT capability and other terms commonly used in the scientific literature to refer to "soft" factors influencing the effectiveness of IT investments (skills, competences, capabilities). With respect to this framework, IT capabilities are abilities that qualify the business level of an organization, enabled by the allocation of resources at the organizational level, which is characterized by competence, which, in turn, derive by the composition of skills, i.e. individual abilities (figure 8.2).

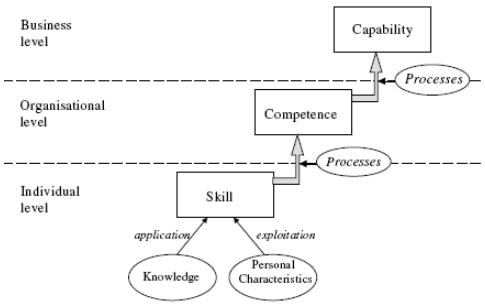

Figure 8.2: Caldeira and Ward's (2003) framework for capabilities.

The other foundational framework derives from the Strategic Management field. It is represented by Piccoli et al.'s (2005) review paper that discussed the determinants of sustainable

competitive advantage (in coherence with the overall model of the RBV) for IT-dependent strategic initiatives. Among other factors, Piccoli et al. (2005) identified IT capabilities as one of the critical barriers to imitation that an organization can exploit and/or build, distinguishing this barrier from the "IT assets" barrier, the latter being (together with IT capabilities) part of a more general barrier named "IT resources" (figure 8.3).

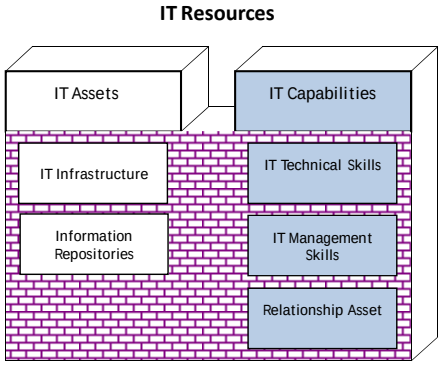

Figure 8.3: the IT resources barrier to imitation in an IT-dependent strategic initiative (Piccoli et al. 2005).

The analysis of the different perspectives led to draw a first definition of IT capability integrating the various approaches: **IT capability is the capacity, diffused within the whole organization, to plan, use and manage the resources based on IT - complementarily and jointly with the other resources and capacities of the organization - in order to achieve a specific organizational objective and obtain a competitive and sustainable advantage over competitors.**

Nevertheless, while the general frameworks reviewed help clarify the differences between IT capability and other associated concepts belonging to Management and Organization Science, neither of them provides an unambiguous definition of IT capability or a research instrument to investigate IT capability. The consequent assumption (of this first step of the empirical research) was that IT capability is a notion so difficult to capture, that a bottom-up approach is the best one to come up with an adequate definition. Hence, we proceeded to identify a broad set of organizational resources - entities which are subject to managerial decisions and investments - that are related with IT, and studied their effects on business performance. The result of this review is the list of "elements and factors on which IT capability is built" (presented in section 5.1 of this thesis and reported hereafter in Table 8.1), which represented the basis of the semi-structured questionnaire for the case studies.

Given the exploratory nature of this first phase of the empirical research, this set is inevitably very general and thus largely independent of the domain of study. Evidently this set does not represent a "definition" of IT capability as requested by RQ1.1, but it provided a scope and context for the search for such a definition. At this stage, the papers reviewed did not explicitly focus on SMEs or IOIS, therefore the size of the organization and its inter-organizational links were only indirectly taken into account (as an example, inter-organizational relationships are considered when dealing with two of the elements of this set, namely *intangible resources* and *external connections enabled by IT*).

IT physical infrastructure	human resources in charge of IT
intangible resources (e.g. customer orientation)	amount of IT investments
relationship between IT and the activities of the organization	strategic use of IT
management of IT	support of IT to process integration
role of the IT department	organizational infrastructure
administrative infrastructure	external connections enabled by IT
technological control	

Table 8.1: the first draft structure of the construct: elements and issues related with IT capability

In fact, at this stage, the contextualization of the study was inferred from the choice of the domain of the case study: an industrial aggregation of SMEs. The eleven companies which were the subjects of the case study, belonging to the Silk Industrial District, showed that IT capability – although a concept difficult to "capture" into a definition by SMEs managers – is indeed perceived as an essential factor in making IT expenditures effective, even when – or maybe especially when – the IT budget is scarce. The three approaches which emerged from the empirical study were different in their underlying principles about the role of IT in the organization, but all of them showed that the management (or the entrepreneur) has been taking decisions about IT capability coherent with such principles:

a) SMEs "IT capability oriented", characterized by the awareness of the relevance of IT capability to pursue business results through IT investments; these companies have a relatively complex IT infrastructure but they also make a significant effort to nurture IT capabilities;

b) SMEs "IT reluctant", characterized by very scarce IT investments (although these companies are not of small size) and a consistent lack of interest in developing any IT capability;

c) SMEs "entrepreneur-driven IT capabilities": small-sized companies, whose IT capabilities are essentially concentrated in the role of the entrepreneur, who plays a relevant role in IT-related decisions.

8.3 A measure of IT capability (RQ1.2)

The case studies were not meant to develop a definition of IT capability but rather to provide a context for the further detailed literature review in chapter 6: thirty-eight papers focused on the concept of IT capability were analyzed in detail. An initial set of 630 items defining the different aspects of capability was synthesized and refined until a final set composed of 67 different items was obtained. The review of the 630 initial items showed the extent of heterogeneity among the studies dealing with so-called "IT capability" issues. To some extent, the amount of redundancies and the different classifications that had been used for very similar items provide evidence of the need to step ahead on the road drawn by Piccoli's (2005) review. To highlight the similarities among these items - and thus to operationalize the three constructs proposed by Piccoli - we grouped the items into several subsets, leading to the three-level structure shown in Table 8.2.

	from Piccoli et al. (2005)	structure of the construct emerging from the literature review
IT Capability	Management Skills	Management of relation between IT and business process (ITBP) Management of IT function (MITF) Management of relation between IT and Strategy (ITSTRAT) Management of relationship with suppliers of IT product/services (ITSOURC) Management of CBIS lifecycle (ITPM)
	Technical Skills	Management of CBIS lifecycle (ITLC) Management of product/services of the IT function (ISPROD)
	Relationship Assets	External Relationship Assets (ERA) Internal relationship Assets (IRA)

Table 8.2 first- and second-level components of the construct IT Capability identified after the literature review

Most of the identified items referred to Management and Technical skills, pointing out the difficulty for IS researchers to translate into practice such an abstract concept as Relationship Asset. Just because of this it is noteworthy that the validation of the measure by means of the survey confirmed the essence of the construct built on theoretical basis. The analysis of the data collected from 77 SMEs belonging to the textile and the mechanical industrial district confirmed the three-fold structure of IT capability and made it possible to detail its definition. IT capability, as a barrier to imitation of IT-dependent initiatives, is made of three components that are described in the following paragraphs and synthesized in Table 8.3.

8.3.1 Management Skills

IT is not just one of the many tools that make companies work. From a managerial standpoint, IT can enable gaining a SCA under two conditions:

- the interrelations between IT and the business shall be known and "managed", both at the strategic level (i.e. the relationships between IT and long term results) and at the operational level (i.e. how IT supports business processes);

- the activities of the IT function shall be carried out rigorously according to a designed lifecycle, where – in a time where ad hoc solutions are a rarity and CBIS are the result of strong efforts of system integration - critical attention must be dedicated to the suppliers of IT products and services.

8.3.2 Technical Skills

From a technical standpoint, what makes IT a strategic weapon is not the technology itself, as provocatively pointed out by Carr's (2003) paper in HBR. Organizations willing to achieve SCA by means of IT need to own the "ability to design and develop effective information systems" (Piccoli et al. 2005). Rather interestingly, the literature review had emphasized the need to develop specialized competence in each phase of the IS lifecycle (these skills had been aggregated into the sub-construct ITLC, Management of CBIS lifecycle). However, the measure of IT capability validated through the survey indicates that attention should shift from the specialization of the activities of IS lifecycle management towards the *breadth of the outcomes* of such activities. We may interpret this as a shift of the focus from the efficiency to the effectiveness of IT activities, a shift that is in fact very coherent with the concept of IT capability. Organizations should direct the use of technical skills to:

- manage the IT staff as a provider of services and - coherently - increase the number and the quality of the IT services delivered (we synthesized this with the sub-construct named IT services skills);
- cover the wider possible range of business areas with the support of IT services (IT applications skills).

A practical implication of this result is that the shift of focus towards the same two types of skills shall be applied also to the measurement of the performance of the IT staff.

8.3.3 Relationship Assets

The third fundamental capability is in the area of what we earlier called the "know- how to be" competences (see for reference paragraph 4.2.2 IT competence). IT staff shall nurture the relationships with the client of the IT services, both at the managerial and at the end-user level, not only in order to gain a better understanding of business priorities and information needs but also to oversee the user acceptance of new IT tools and gain their collaboration in each phase of the IS lifecycle. Similarly, long-term relationships with company's suppliers and customers would enable the IT staff to own a direct knowledge of the constraints and opportunities of the environment where the company operates. Managing this external relationship asset would help

internalize essential aspects of the information requirements in the IT staff and enable collaboration for any IT project with inter-organizational implications. One may note that this third component of IT capability is particularly relevant in highly interconnected business environments, such as the industrial districts where the study took place.

	from Piccoli et al. (2005)	final structure of the construct validated through the survey
IT Capability	Management Skills	Management of relation between IT and Strategy Management of relation between IT and business process Management of CBIS lifecycle Management of the relationship with suppliers of IT product/services
	Technical Skills	IT services skills IT applications skills
	Relationship Assets	External Relationship Assets Internal relationship Assets Business Support

Table 8.3: first- and second-level components of the measure of IT Capability validated through the survey.

8.4 Business performance as a dependent variable for IT capability assessment (RQ1.3)

Business performance is likely the most used dependent variable in research within the IS discipline. Since the advent of computers in business environments, researchers and practitioners have struggled to measure the effects of the use of IT. In this thesis we did not have the presumption to look for the answer to such a debated issue. However, for the aim of this work, it was necessary to choose among the countless models and measures of business performance those that fit more tightly with the key topics of this study, i.e. the sustainability of competitive advantage.

Chapter 4 (and precisely sections 4.5 and 4.6) presented an overview of several approaches regarding IT impact on business performance, starting from the more general (about IT Business Value) and then focusing on the fewer studies dedicated to IT capability: thirteen papers were mapped within a general framework developed by Tallon (2006) to classify the measures of IT impacts. However, this analysis did not identify one preferred measure of business performance. On the contrary, the highlighted heterogeneity of subjective and objective metrics available in the IS literature and the exploratory nature of this study suggested using a comprehensive measure, capturing the different implications of IT capability on the organization. The measure of business performance consists therefore of the composition of two financial indicators (the most easily available even in companies of smaller size) and the most detailed set of perceptual indicators developed for SMEs, proposed by Cragg et al. (2002) and recalled in Table 8.5.

IT/IS strategic alignment	Please rate (for all the following assertions related to the strategy in your company in the past two years), to what extent you agree and how you think you could measure the competitive advantages achievable by using the IT currently available in your company. • differentiate with products with a higher quality than competitors • differentiate with products that are different from the competitors' ones • differentiate with new products • continuously improve the efficiency of production processes • differentiate from competitors with a large range of products • differentiate from competitors with customized products • differentiate from competitors with high quality services • win competition by means of strong marketing campaigns • pursue a growth strategy focusing on entering new markets	**IT effect on performance: subjective/qualitative measures**	Please rate the degree of satisfaction for each of the following issues. • To what extent are you satisfied with the increase of sales achieved thanks to IT? • To what extent are you satisfied with the increase of the market share of the company achieved thanks to IT? • To what extent are you satisfied with the increase of cash achieved thanks to IT? • To what extent are you satisfied with the improvement of the company image achieved thanks to IT?
IT impact on the firm	Please indicate which of the following you believe are the effects of the IT on your company in the past two years and to what extent you agree to the following assertions • reduce administrative costs • improve company's image • increase productivity • increase the quality of decisions • improve internal integration • improve external integration with suppliers and clients • improve the ability to compete • increase sales revenue • increase profit	**IT effect on performance: financial (objective) measures**	Please indicate the value of the financial data listed below • turnover in the past three years • profits in the past three years

Table 8.5: the indicators to measure IT influence on business performance (Cragg et al. 2002).

8.5 Contribution of the study

Looking back at the results achieved overall through the study, it is now possible to synthesize the contributions of this thesis in four different areas covering both the literature on IT capability and on the more general literature on IT and SMEs.

8.5.1 An updated representation of the role of IT within SMEs

Although the multiple case study was not supposed to generate what we can now call a threefold taxonomy of approaches to IT capability management within SMEs, the identification of the three types of SMEs represent in itself a relevant result of the thesis. From an academic point of view, this taxonomy shows that the limited organizational complexity of SMEs does not prevent them by being aware and manage a complex business issue as the sustainability of IT-dependent strategic initiatives. Within the IS literature SMEs - and specifically small size enterprises - are often portrayed as an example of scarce ability in managing IT, merely pursuing efficiency gains, and essentially incapable of a vision about the strategic implications of IT expenditures, a kind of "IT incapability" champions. The analysis of the eleven SMEs in the silk district show,

instead, that such generalization is at least imprecise. In fact the case study brings to light a quite different representation: SMEs can show well developed IT capabilities. This study suggests that such capabilities are associated with the competence of the entrepreneur (SMEs "entrepreneur-driven IT capabilities") and are not necessarily related to company size or to the amount of IT expenditure (SMEs "IT capability oriented"). The conditions under which SMEs develop IT capabilities were not the subject of this research, thus it is not possible here to claim the evidence of a causal link between these organizational characteristics and the SCA achieved through IT. nevertheless this outcome suggests possible areas for further research in this direction.

8.5.2 A definition and a measure of IT capability

The thorough literature review, extended beyond the borders of the IS field, showed the many limits of the available studies about the sustainability of competitive advantage deriving from IT expenditures (or IT-dependent SCA, to use Piccoli's (2005) terms). In this thesis we recognized and justified the limit of a top-down approach to define IT capability and - on the contrary - proved the effectiveness of a bottom-up approach, that led to develop and validated a measure of IT capability that avoids the ambiguity intrinsic in previous research.

This result brings two relevant contribution to the IS literature. First, the measure of IT capability covers a lack that - as we demonstrated through the literature review – affects the studies both on the organizational and the managerial side of the IS discipline. We expanded the definition of Piccoli et al. (2005), introducing a second level of detail in his threefold structure.

As a second relevant contribution, we proved a positive correlation between IT capability and the impact of IT on business performance. Data show that the more developed the IT capability as above defined, the more IT expenditures can influence long terms results of an organization. Although indirectly (we could not use a direct measure of IT expenditures nor of business performance due to missing values in the collected data), this outcome supports the thesis proposed by Barney in his seminal article about RBV: IT capability is a determinant of Sustainable Competitive Advantage.

8.5.3 The role of IT capability on business performance (RQ1)

Defining IT capability is just the first half of the work in this study. The development of the measure of IT capability was carried out rigorously and the measurement model was assessed according to the standards of quantitative research. Nevertheless, the expected relevance of this study is highly related to the test of the research model. IT capability – as defined in theoretical

terms – is one of the barriers that enable gaining a sustainable competitive advantage through an IT based initiative. Does this theoretical definition apply also to the IT capability construct as it has been defined by the exploratory factor analysis? Does such IT capability construct actually represent a factor that enable IT expenditures to generate positive effects on the long term results of an organization?

To answer these questions, or – in other words – to discuss the research model proposed (and represented in Figure 8.1) we can now triangulate the results of the PLS analysis of the data collected through the survey of the 77 SMEs of the textile and mechanical districts (presented in Chapter 7) and the outcomes of the multiple case study on the eleven SMEs of the silk district near Como (discussed in Chapter 5). Both these methodologies showed that the more developed the IT capability as above defined, the more IT expenditures can influence long terms results of an organization.

More precisely, due to the limitations of the data collected through the survey, the quantitative study proved a positive correlation between IT capability and the impact of IT on business performance. Through the qualitative study, we identified three types of SMEs whose perceived impact on the business of IT investments was coherent with their efforts in promoting and develop IT capability.

Although the survey did not aim at confirming the correctness of the specific three-tier classification of SMEs approaches to IT capability highlighted by the case study, at a more general level the outcomes of the qualitative and the quantitative study converge. IT capability essentially refers to: (a) an updated knowledge of the business (using Boyatzis' (1982) classification this competence can be addressed as "know-what"), and (b) the ability to grow relationships with business people (Boyatzis' "know-how to be"). We may refer to these two components all together as "***business orientation***". In fact, as pointed out in the conclusions of Chapter 5, the case study showed that more than the structural aspects of the organizations (such as size or the entity of the presence of IT) what characterizes the SMEs able to effectively develop IT capabilities is just the business orientation of the person in charge of IT expenditures. Similarly, the research model validated through the survey showed that a significant part of the IT impact on business performance is explained by the Management Skills and Relationship Assets (besides the Technical Skills) of the IT staff (Figure 7.8 provides an effective synthetic representation of this outcome). And it is noteworthy that even Technical Skills, following the meaning of the measure validated by the quantitative study, have to be seen through what we

may call a “business oriented” perspective: not as the sum of specialized technical skills owned by the IT staff, but as the means to deliver to the business the IT services the organization needs.

8.5.4 Guidelines for IT capability management (RQ2)

The whole study described in this thesis has been qualified as *explorative* for what the definition of IT capability concerns and *confirmatory* with respect to its moderating effect on the relationship between IT expenditures and business performance. Without claiming to introduce a *normative* section to the study, it is possible to draw some practical implications of the results of the study just by changing the perspective of the previous discussions.

After having reliably defined IT capability and proven its impact on SCA, we can here briefly discuss how an organization can exploit the moderating effect of IT capability by putting in place explicit procedures to design, develop and maintain IT capability. In other words, we may argue the necessity to introduce policies and practices of *IT capability management*.

Companies of all sizes are experiencing difficulties in innovating through IT. A recent CIO Magazine survey of 600 CIOs worldwide (CIO Executive Council 2009) pointed out that the majority of CIOs are focused on control and compliance instead of innovation and the IT staff are often support, database administrators and network managers, who provide infrastructure support and not innovation support. In this survey, “innovation” does not refer to the mere technological innovation, but to the innovation that leads the business towards better performances. Based on the results achieved in this thesis, we can state that one of the key factors leading to difficulty in innovating with IT is the lack of business orientation of the IT staff, and predominantly of CIOs.

It is almost common sense that good management starts from good metrics. Therefore, the problems in IT innovation do not come as a surprise if we assume that the management of IT staff has been carried out on the basis of a definition of IT capability as weak as it has been until now.

In fact, what emerges from our study is that the entire career of the CIO and the IT staff should be shaped taking into account the variables that determine IT capability. The validated measure of IT capability presented in this thesis should now be used to drive the selection of CIO candidates, the training, the performance measurement and the policies of economic incentives of the IT staff.

It is noteworthy that this outcome largely diverges from (if not even contradicts) the efforts undertaken to define and promote IT curricula within the academic and practitioners community of IT experts.

As a relevant example, we may take the EUCIP (European Certification of Informatics Professionals) standard, that describes three certification programmes: 1) EUCIP Core, an introductory-level three-part ICT professional certification; 2) EUCIP Professional, corresponding to 21 different job profiles; 3) EUCIP IT Administrator, a stand-alone certification focusing on the typical skills of an IT administrator of an SME (CEPIS 2010). To design these job profiles almost 3000 different micro-IT skills were identified and then aggregated by CEPIS. But such a big analytical effort for the EUCIP certifications clashes against the evidence of the study portrayed in this thesis (figure 8.4).

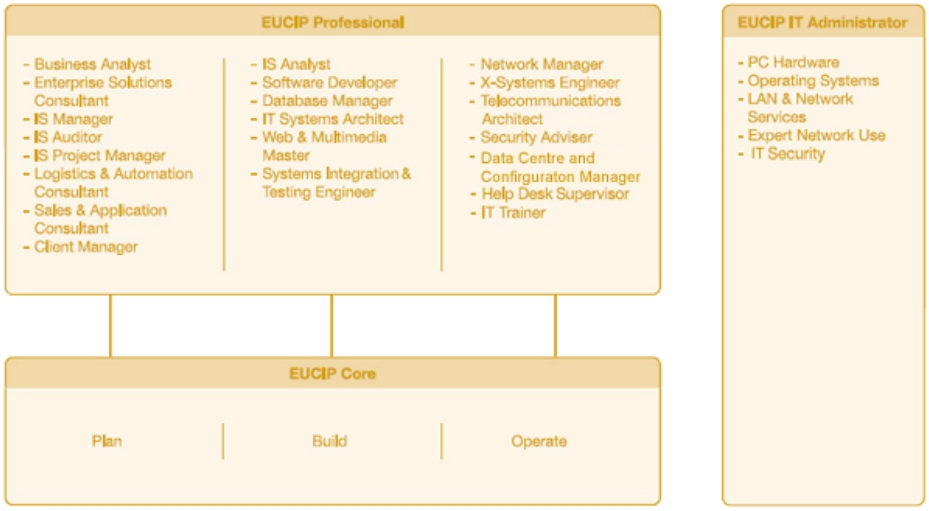

Figure 8.4:the EUCIP job profiles (CEPIS 2010).

In this thesis we learned that IT capability can influence the effectiveness of IT expenditure, and such effectiveness is defined in terms of the gain of a sustained competitive advantage. Following Basselier's et al. (2004) definition, we used the term *IT-enabled strategic initiative* (Piccoli et al. 2005 introduces a slightly different term: "IT-dependent strategic initiative") to describe the initiatives that leverage on IT capability to achieve a SCA. In other words, in this thesis we learned that a *business orientation* in the skills of the IT staff (and specifically of the CIO) is key for the effectiveness of IT spending (figure 8.5).

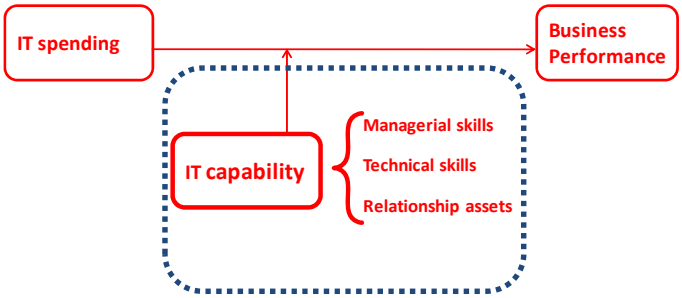

Figure 8.5: the effect of IT capability: IT-enabled strategic initiatives

The EUCIP approach seems an extremely detailed application of the traditional decomposition of IT skills: this is exactly the opposite of what is suggested here. In fact, this thesis suggests that if a company underestimates the relevance of IT capability and develops and manages IT related competences only following a strictly technology-oriented approach then the IT staff, instead of acting as a reference point and channelling the impacts of IT expenditures, may become a primary obstacle to the implementation of IT-dependent initiatives. We may then refer to the term IT-inhibited strategic initiative, to stress the fact that an IT staff with such a "purely *technological orientation*" can be a major obstacle to the implementation of strategic decisions (figure 8.6).

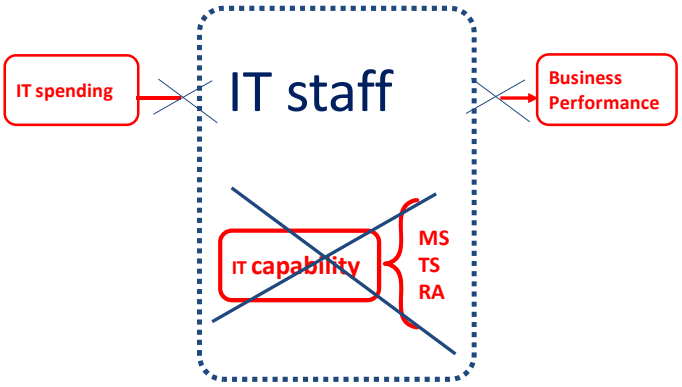

Figure 8.6: a possible effect of avoiding to develop and manage IT capability: IT-inhibited strategic initiatives.

8.6 Study limitations and further research

The study carried out and discussed in this thesis presents limitations as well as possible future improvements and developments.

The quantitative study would have certainly benefited by a higher cardinality of the surveyed sample (taking into account the high number of items to measure IT capability). However, there is theoretical support to the reliability of a sample of the size used in this study.

Another critical aspect of this thesis is represented by the difference between the original research model and the research model that we were able to test in the field. The original research model included two separate constructs besides IT capability: IT expenditures and Business Performance. This structure aimed at studying the moderating effect of IT capability to the influence of IT investments on business results. As we had feared during the design of the quantitative study, the surveyed companies were not able to provide consistent quantitative data (if any data at all) about these two constructs. The choice of studying the direct relationship between IT capability and IT impact on business performance was meant to provide for this limitation, and while it does not allow making any inference about the moderating effect, it does support the thesis that IT capability is a source of sustainable competitive advantage.

In spite of these limitations, we have proved the rigor of the method followed to obtain the outcomes of this study and we have shown the relevance of such outcomes. Nonetheless, much can be done in future research to extend the results achieved and increase their usefulness.

Now that a measure of IT capability has been validated in the simplified context of the SMEs, it should be used in large companies, or within portions of large companies (e.g. within single business processes) to verify how reliable it is also in such contexts, and - if so - to study more complex research models where other independent variables, besides IT expenditures, and other moderating variables, besides IT capability, are determinants of business performance.

Another possible line of research may be directed to the concept of IT governance. The importance of business orientation as the most qualifying aspect of the IT capability may drive from the practitioners' standpoint a review of the existing models of IT governance (e.g. ITIL), from an academic standpoint it may suggest a re-think of the role of the CIO and the IT function within the organizational structure, and to further expand the guidelines for IT capability management just outlined in the paragraphs above.

Finally, the results of this research could be used to study a wider unit of analysis. In this thesis we adopted as the unit of analysis the single SME, although recognizing the relevance of its interrelations within an inter-organizational environment. For the sake of simplicity, we limited the presence of inter-organizational information systems by considering only SMEs belonging to industrial districts and treating the inter-organizational relations as embedded into the unit of analysis. In future research one may choose to adopt a whole industrial aggregation (e.g. an industrial district) as the unit of analysis, and replicate the whole study at that level of granularity. Since we can assume it would be possible to estimate IT expenditures of a whole industrial district and since there are studies that discuss business performance at the inter-

organizational level, it would be interesting to study a concept like “district IT capability”, as a factor enabling a sustainable competitive advantage of the district.

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10 Appendix A: the questionnaire for the case study

1	number of employees of the company	
2	turnover	
3	industry	

N°	Q&A	References for Q&A	IT capability / IT resources aspect investigated	Reference for the IT capability / IT resources aspect investigated
IT infrastructure components				
4	Which type of software is the company using for operation and logistics management ?	Buonanno *et al.*, 2002; Thong *et al.*, 1995; Yap *et al.*, 1997	IT infrastructure: SW components	Bharadwaj 2000; King, 2002; Tippins et al., 2003; Zhu, 2004.
	CAD (Computer-Aided Design)			
	CAE (Computer-Aided Engineering)			
	CAM (Computer-Aided Manufacturing)			
	MRP (Material Requirement Planning)			
	System gestionale			
	ERP (Enterprise Resource Planning)			
	SCM (Supply Chain Management)			
5	Which type of software is the company using for content and knowledge management ?	Buonanno et al., 2002	IT infrastructure: SW components	Bharadwaj 2000; King, 2002; Tippins et al., 2003; Zhu, 2004.
	DMS (Document Management System)			
	CMS (Content Management System)			
	LMS (Learning Management System)			
6	Which type of software is the company using for decision process support?	Buonanno et al., 2002	IT infrastructure: SW components	Bharadwaj 2000; King, 2002; Tippins et al., 2003; Zhu, 2004.
	generic reporting support system			
	CRM system			
7	Which Internet based systems is the company using ?	NetConsulting, 2004	IT infrastructure: network components	Bharadwaj, 2000; Zhu, 2004.
	web site (brochureware)	NetConsulting, 2004		
	e-commerce B2C web site	NetConsulting, 2004		
	e-commerce B2B web site	NetConsulting, 2004		
	Marketplace	NetConsulting, 2004		
8	Which type of database architecture is the company using?		IT infrastructure: databases	Bharadwaj, 2000; Zhu, 2004.
	a database for each single software application			
	one single database shared between all the software applications			
	a few databases shared among some software applications			

Human resources				
9	who is in charge of IT investments decisions ?	Buonanno *et al.*, 2002; Cragg, 2002	IT human resources	Bharadwaj, 2000; Capaldo *et al.* 2003; Tippins *et al.*, 2003; Wade *et al.*, 2004.
	the entrepreneur			
	a manager	Cragg, 2002		
	an employee	Cragg, 2002		
	a staff	Buonanno et al., 2002		
	no one			
	external consultant	Buonanno et al., 2002		
10	how many are the users of the CBIS?	NetConsulting, 2004	IT human resources	Bharadwaj, 2000; Capaldo *et al.* 2003; Tippins *et al.*, 2003; Wade *et al.*, 2004.
11	how are the IT skills spread among the CBIS users?	NetConsulting, 2004	IT human resources	Bharadwaj, 2000; Capaldo et al. 2003; Tippins et al., 2003; Wade et al., 2004.
	mainly concentrated in just one person	NetConsulting, 2004		
	mainly concentrated in a group of users	NetConsulting, 2004		

	homogenously spread among all users	NetConsulting, 2004		
12	In case there is an individual (an employee or a consultant) responsible of IT management, what are her/his managerial skills?		IT human resources: managerial skills	Bharadwaj, 2000; Capaldo *et al.*, 2003; Croteau *et al.*, 2001; Dehning *et al.*, 2003; Heckman, 2003; Igbaria *et al.*, 1997; King, 2002; Peppard *et al.*, 2004; Tippins *et al.*, 2003.
	she/he is able to align IT strategy with company strategy			
	she/he is able to identify IT investments opportunities			
	she/he is able to lead the IT/IS function			
	she/he is able to coordinate and interact with the CBIS users			
	she/he is able to manage design and development of IT solutions			
	she/he is able to manage contracts for IT (out)sourcing			
	she/he is able to support employees to use IT	Igbaria *et al.*, 1997.		
	she/he is aware of the potential benefits for the business by the use of IT	Igbaria *et al.*, 1997.		
	she/he promotes and motivate the use of IT	Igbaria *et al.*, 1997.		
	she/he is favorable to innovation			
13	What are the technical skills related to IT of the users of the CBIS?		Human resources: technical skills	Bharadwaj, 2000; Croteau *et al.*, 2001; Dehning *et al.*, 2003; King 2002; Tippins *et al.*, 2003.
	users can use simple SW applications			
	users can program			
	users can perform the analysis and design of IT systems			
	users are update and competent in using emerging technologies			
14	Is there any training activity on IT?	NetConsulting, 2004	Human resources: technical skills, training	Bharadwaj, 2000.
	Yes	NetConsulting, 2004		
	No	NetConsulting, 2004		
15	If so, who is involved in these training activities?		Human resources: technical skills, training	Bharadwaj, 2000.
	employees			
	managers			
16	If so, what are the topics of the training?	Igbaria, 1997; NetConsulting, 2004	Human resources: technical skills, training	Bharadwaj, 2000.
	Office automation applications	NetConsulting, 2004		
	Internet-based applications (website navigation, email)	NetConsulting, 2004		
	function related applications (eg.: CAD, ERP, CMS...)	NetConsulting, 2004		
17	are the users able to adapt timely and successfully to the new procedures deriving by the adoption of new IT solutions?		Human resources: technical skills: change management capability	Bharadwaj, 2000.
	not at all a little rather a lot completely			

Intangible resources and process integration				
18	To what extent the IT solutions allow the company to perform the following activities oriented to the clients?		Intangible resources: orientation to customer and organizational learning	Bharadwaj 2000; Gold *et al.*, 2001 ; Tippins *et al.*, 2003.
	collect information on clients	Gold *et al.* 2001.		
	store information on clients to be used in the future			
	spread information on clients within the organization	Gold *et al.* 2001.		
	achieve a better understanding on clients' needs			
	customize the information provided to clients			
19	Please rate to what extent the IT solutions allow the company to share information and activities		Intangible resources: synergies and process integration	Bharadwaj 2000; Tippins *et al.*, 2003, Wade *et al.*, 2004.
	among the different functions			
	between the company and its commercial partners			

IT investments				
20	Does a plan for the IT development in the company formally exist?	Buonanno et al., 2002	IT investments: entity	Barua *et al.*, 1995; Bharadwaj, 2000; Buonanno *et al.*, 2002; Sambamurthy *et al.*, 2003; Senn, 2002; Yap *et al.*, 1997.
	Yes			
	No			
21	Is a budget for IT investments defined on an annual base?	Buonanno *et al.*, 2004; NetConsulting, 2004	IT investments: entity	Barua *et al.*, 1995; Bharadwaj, 2000; Buonanno *et al.*, 2002; Sambamurthy *et al.*, 2003; Senn, 2002; Yap *et al.*, 1997.
	fill in a table			
22	Please rate to what extent you agree with the following sentences related to the motivations of IT investments in your company		IT investments: motivations	Bharadwaj, 2000; Barua *et al.*, 1995; Sambamurthy *et al.*, 2003; Senn, 2002.
	strategic motivations, i.e. To achieve a competitive advantage, increase the market share or increase the sales			
	to achieve productivity improvements by means of the automation of commercial transactions			
	availability of the infrastructure necessary to manage and carry out activities such as: planning, control, budgeting, communication, accounting, finance			
	to guarantee the security of the IT infrastructure			
	to improve production activities			
	to support the R&D function			
IT/IS strategic alignment				
23	Please indicate the activities that are - most strategically relevant for the company, - supported by IT (to what extent)	Buonanno *et al.*, 2002	IT/IS strategic alignment	Croteau *et al.*, 2001; Parsons, 1983; Peppard *et al.*, 2004.
	Inbound Logistics			
	Operations			
	Outbound Logistics			
	Marketing and Sales			
	Customers' Assistance and Services			
	HR management			
	Infrastructural activities			
	Research and development			
24	Please rate (for all the following assertions related to the strategy in your company in the past two years), to what extent you agree and how you think you could measure the competitive advantages achievable by using the IT currently available in your company.	Cragg *et al.*, 2002.	IT/IS strategic alignment	Croteau *et al.*, 2001; Parsons, 1983; Peppard *et al.*, 2004.
	differentiate with products with a higher quality than competitors	Cragg *et al.*, 2002.		
	differentiate with products that are different from the competitors' ones	Cragg *et al.*, 2002.		
	differentiate with new products	Cragg *et al.*, 2002.		
	continuously improve the efficiency of production processes	Cragg *et al.*, 2002.		
	differentiate from competitors with a large range of products	Cragg *et al.*, 2002.		
	differentiate from competitors with customized products	Cragg *et al.*, 2002.		
	differentiate from competitors with high quality services	Cragg *et al.*, 2002.		
	win competition by means of strong marketing campaigns	Cragg *et al.*, 2002.		
	pursue a growth strategy focusing on entering new markets	Cragg *et al.*, 2002.		

IT impact on the firm				
25	Please indicate which of the following you believe are the effects of the IT on your company in the past two years and to what extent you agree to the following assertions	Buonanno *et al.*, 2002; Cragg *et al.*, 2002.	IT impact on company variables	Santhanam *et al.*, 2003.
	reduce administrative costs	Cragg *et al.*, 2002.		
	improve company's image	Cragg, 2002; Cragg *et al.*, 2002.		
	increase productivity	Cragg, 2002.		
	increase the quality of decisions	Cragg, 2002; Cragg *et al.*,		

		2002.		
	improve internal integration	Cragg, 2002; Cragg *et al.*, 2002.		
	improve external integration with suppliers and clients			
	improve the ability to compete	Cragg, 2002; Cragg *et al.*, 2002.		
	increase sales revenue	Cragg, 2002.		
	increase profit	Cragg, 2002.		
IT effect on performance: subjective/qualitative measures				
26	Please rate the degree of satisfaction for each of the following issues.	Cragg *et al.*, 2002.	IT impact on performance	Croteau *et al.*, 2001.
	To what extent are you satisfied with the increase of sales achieved thanks to IT?	Cragg *et al.*, 2002.		
	To what extent are you satisfied with the increase of the market share of the company achieved thanks to IT?	Cragg *et al.*, 2002.		
	To what extent are you satisfied with the increase of cash achieved thanks to IT?	Cragg *et al.*, 2002.		
	To what extent are you satisfied with the improvement of the company image achieved thanks to IT?	Cragg *et al.*, 2002.		

IT effect on performance: financial (objective) measures				
27	Please indicate the value of the financial data listed below		IT impact on performance	Bharadwaj, 2000; Croteau *et al.*, 2001; Santhanam *et al.*, 2003.
	net margin in the past three years			
	profits in the past three years			

11 Appendix B: the questionnaire for the survey

IT capabilities within SMEs

Information on the person interviewed

Surname and Name _____ telephone _____

Position _____ e-mail _____

The company: general information

1. Name: _____
2. Address: street_____ n° ____ Place_____ ZIP _____ Prov ____
3. website_____
4. year of foundation _____
5. Industry ❑ Manufactoring ❑ Services ❑ Commerce
6. Which phases of the textile process are performed by the company?
   ❑ fiber manufacturing ❑ spinning ❑ warping ❑ weaving ❑ tufting
   ❑ knitting ❑ dyeing and finishing ❑ printing ❑ cut and sew
   ❑ other:_____ ❑ other:_____ ❑ other:_____
7. Societary configuration ❑ the company belongs to an industrial group ❑ the company does not belong to a group
8. Number of employees:
9. Number of others (e.g.: consultants):
10. Annual turnover in the past three years (in million of Euros): 2004 _____ 2005 _____ 2006 _____

INFORMATION SYSTEM

11. Could you provide an estimate on the overall expenses in IT, excluding the expenses in computer hardware and operating systems?

Type of expense	INVESTMENTS *estimated* present value including installation expenses (thousands euros)	ANNUAL EXPENSES e.g.: updates, maintenance, .. (thousands euros)
Software business applications (e.g.: ERP system, CAD)		
Data Base Management System (in case it was adopted separately from any software application)		
Security management systems (e.g.: hardware o software firewalls)		
Network hardware (e.g.: cables, network interfaces devices)		
Other (please specify)_____		
Other (please specify)_____		

12. Within the organizational structure of the company, how would you describe the relationship between the CEO (Chief Executive Officer) and the CIO (Chief Information Officer) / IT manager?
    ❑ IT manager and CEO are the same person ❑ the IT manager reports directly to the CEO
    ❑ the IT manager reports to a manager who – in turn – reports to the CEO
13. Please state who is in charge of the management of IT within the company, and what is the effort she/he dedicates to this activity

	Full-time	Part-time
the CEO	❑	❑
a manager	❑	❑
one or more employees	❑ number of employees: _____	❑ number of employees: _____
no one	❑	❑
external consultants / IT suppliers	effort performed by IT consultant/suppliers vs. total effort of IT management ____%	

IT CAPABILITIES

Please answer the following questions. For each question please provide a separate assessment of the IT capabilities of:

(a) the internal IT staff

(b) IT consultants and/or preferred IT suppliers, in case you outsource some of the IT/IS management activities

Please choose only one among the following alternatives:

0 = Not at all/very low, **1** = To a Small Extent/low, **2** = To Some Extent/moderate, **3** = To a Large Extent/high, **4** = To a Great Extent/very high

Managerial Skills

	Questions	(a) Internal IT Staff	(b) IT Consultants / suppliers
	what is the level of knowledge of the IT manager on		
14.1	main challenges that different divisions in the organization face achieving their objectives	0 1 2 3 4	0 1 2 3 4
14.2	the connections and interdependencies between the various division in the organization	0 1 2 3 4	0 1 2 3 4
14.3	*How much does the IT staff participate in business activities that are not directly related to IT?*	0 1 2 3 4	0 1 2 3 4
14.4	*How experienced is she/he at evaluating the organizational impacts of IT solutions?*	0 1 2 3 4	0 1 2 3 4
	To what extent is the IT staff able to:		
14.5	coordinate the integrated infrastructure and manage its relationships with the business units	0 1 2 3 4	0 1 2 3 4
14.6	integrate IT resources effectively with process reengineering initiatives	0 1 2 3 4	0 1 2 3 4
14.7	design business operations and process required to deliver the business strategy	0 1 2 3 4	0 1 2 3 4
14.8	co-ordinate IS/IT development and implementation	0 1 2 3 4	0 1 2 3 4
14.9	estimate the effort and the duration of a project and identify appropriate resources (e.g.: people with necessary skill, experience, availability)	0 1 2 3 4	0 1 2 3 4
14.10	monitor, measure and evaluate the benefits derived from IS investment and use	0 1 2 3 4	0 1 2 3 4
14.11	acting in a leadership role (establishing direction, directing people, motivating and inspiring)	0 1 2 3 4	0 1 2 3 4
14.12	is flexible, e.g. by improving task performance through trial-and-error experimentation	0 1 2 3 4	0 1 2 3 4
14.13	effectively manages cross-functional teams and ad-hoc structures	0 1 2 3 4	0 1 2 3 4
14.14	the IT manager develops a personal social network	0 1 2 3 4	0 1 2 3 4
14.15	facilitate the contracts (ensuring the success of existing contracts for IS/IT services)	0 1 2 3 4	0 1 2 3 4
14.16	identify the potential added value of IS/IT service suppliers	0 1 2 3 4	0 1 2 3 4
14.17	co-operate with software-houses in IS analysis	0 1 2 3 4	0 1 2 3 4
14.18	determine and evaluate supply sourcing options	0 1 2 3 4	0 1 2 3 4
14.19	understand and manage cost of acquisition and ownership	0 1 2 3 4	0 1 2 3 4
	To what extent in your organization:		
14.20	business strategic planning is integrated with IT planning	0 1 2 3 4	0 1 2 3 4
14.21	IT has a strategic role in achieving our firms objectives, rather than just a vehicle for cost displacement	0 1 2 3 4	0 1 2 3 4
14.22	your business is about creating new products/services using IT	0 1 2 3 4	0 1 2 3 4
14.23	IT is used to create biased market	0 1 2 3 4	0 1 2 3 4
14.24	IT is used to alter the linkages with supplier and customers	0 1 2 3 4	0 1 2 3 4
	To what extent the IT staff is able to:		
14.25	convert IT assets and services into strategic application	0 1 2 3 4	0 1 2 3 4
14.26	Incorporate the potential of new and emerging technologies in long term business development	0 1 2 3 4	0 1 2 3 4
14.27	attract and retain high-caliber staff committed to the vision of the one corporate	0 1 2 3 4	0 1 2 3 4
14.28	define information management policies (e.g. norms for the access to data) and define the roles and responsibilities of the IS/IT function	0 1 2 3 4	0 1 2 3 4
14.29	use training activities to learn both about technological developments as well as business-related issues	0 1 2 3 4	0 1 2 3 4

Technical Skills

	Questions	(a) Internal IT Staff	(b) IT Consultants / suppliers
	To what extent the IT staff is able to provide the following infrastructural services?	0 1 2 3 4	0 1 2 3 4
15.1	Manage firm-wide (or group-wide) communications network and messagging services	0 1 2 3 4	0 1 2 3 4
15.2	Manage firm-wide or business-unit workstation networks (LANs, POS)	0 1 2 3 4	0 1 2 3 4
15.3	Implement security, disaster planning and business recovery services for firm-wide installations and applications	0 1 2 3 4	0 1 2 3 4
15.4	enforce standards for hardware and software selection and/or software development to streamline resources requirements and reduce incompatibilities and costs	0 1 2 3 4	0 1 2 3 4
15.5	Perform IS planning for business unit	0 1 2 3 4	0 1 2 3 4
15.6	Develop business-unit specific applications	0 1 2 3 4	0 1 2 3 4
15.7	Manage business-unit-specific applications	0 1 2 3 4	0 1 2 3 4
15.8	Provide firm-wide or business-unit data management, including standards	0 1 2 3 4	0 1 2 3 4
15.9	Develop and manage electronic linkages to suppliers or customers	0 1 2 3 4	0 1 2 3 4
	To what extent the IT staff is able to:	0 1 2 3 4	0 1 2 3 4
15.10	integrate system and make IT applications cost effective	0 1 2 3 4	0 1 2 3 4
15.11	customize systems	0 1 2 3 4	0 1 2 3 4
15.12	provide users support	0 1 2 3 4	0 1 2 3 4
15.13	provide IS/IT training	0 1 2 3 4	0 1 2 3 4
	To what extent the technical skills of the IT staff belong to the following domains of application?	0 1 2 3 4	0 1 2 3 4
15.14	Enterprise resource planning	0 1 2 3 4	0 1 2 3 4
15.15	Supply chain management	0 1 2 3 4	0 1 2 3 4
15.16	Customers relationship management	0 1 2 3 4	0 1 2 3 4
15.17	Product data management	0 1 2 3 4	0 1 2 3 4

15.18	Support accounting and budgeting	0 1 2 3 4	0 1 2 3 4
15.19	Support human-resources management	0 1 2 3 4	0 1 2 3 4
15.20	Electronically provision of information to the top management (EIS)	0 1 2 3 4	0 1 2 3 4
	To what extent the IT staff is able to:	0 1 2 3 4	0 1 2 3 4
15.21	design of IT architecture	0 1 2 3 4	0 1 2 3 4
15.22	choose correct platform for a firm (hardware, network, and software standards)	0 1 2 3 4	0 1 2 3 4
15.23	identify IS/IT requirements	0 1 2 3 4	0 1 2 3 4
15.24	software installation	0 1 2 3 4	0 1 2 3 4
15.25	debugging and testing	0 1 2 3 4	0 1 2 3 4
15.26	develop and deliver IS/IT solutions to the business	0 1 2 3 4	0 1 2 3 4
15.27	maintain effectively technology, information and application assets	0 1 2 3 4	0 1 2 3 4
15.28	define service level requirements to support the achievement of business benefits	0 1 2 3 4	0 1 2 3 4

Relationship Assets

	Questions	(a) Internal IT Staff	(b) IT Consultants / suppliers
16.1	*If the IT manager has a business question or problem that you (CIO) cannot solve alone, how confident are you about finding the right person to contact in your organization?*	0 1 2 3 4	0 1 2 3 4
	To what extent in your organization:	0 1 2 3 4	0 1 2 3 4
16.2	mangers are trained and educated about how to envision, invest in and use IT to create business value	0 1 2 3 4	0 1 2 3 4
16.3	managers understand the value of IT investments	0 1 2 3 4	0 1 2 3 4
16.4	line management is sponsor of IT initiatives	0 1 2 3 4	0 1 2 3 4
16.5	coordination and interaction with user community is developed	0 1 2 3 4	0 1 2 3 4
16.6	IT manager keeps people interested to the change of technologies	0 1 2 3 4	0 1 2 3 4
16.7	responsibility for the effective application of IT in the firm is shared	0 1 2 3 4	0 1 2 3 4
16.8	relationship between line management and IT service providers is developed	0 1 2 3 4	0 1 2 3 4
16.9	the IT staff has developed productive customer partnerships based on long-term relationships	0 1 2 3 4	0 1 2 3 4
16.10	the IT staff has developed productive partnerships with supplier based on long-term relationships	0 1 2 3 4	0 1 2 3 4

IT SUPPORT TO THE BUSINESS

17. Please answer the following questions regarding the processes of your organization:

a) is the process strategic for your company?
b) to what extent are the activities of that process supported by IT?

Please choose only one among the following alternatives:
0 = Not at all, **1** = To a Small Extent, **2** = To Some Extent, **3** = To a Large Extent, **4** = To a Great Extent

Process	(a) Is this process strategic for your company?	(b) extent of IT support to the process
Inbound Logistic	❑	0 1 2 3 4
Outbound Logistic	❑	0 1 2 3 4
Operation	❑	0 1 2 3 4
Marketing and Sales	❑	0 1 2 3 4
Post-sales support	❑	0 1 2 3 4
Procurement	❑	0 1 2 3 4
Human Resource Management	❑	0 1 2 3 4
Research and Development	❑	0 1 2 3 4
Infrastructural activities	❑	0 1 2 3 4

18. Please rate to what extent you agree with the following statements about the motivations of IT investments in your company.
Please choose only one among the following alternatives:
0 = Not at all, **1** = To a Small Extent, **2** = To Some Extent, **3** = To a Large Extent, **4** = To a Great Extent

The company invests in IT in order to:	
Achieve a competitive advantage, increase its market share or increase sales	0 1 2 3 4
Achieve productivity improvements by means of better commercial transactions	0 1 2 3 4
Have available the information infrastructure necessary to carry out activities such as planning, control, budgeting, communication, accounting, finance	0 1 2 3 4
Guarantee the security of the information infrastructure	0 1 2 3 4
Achieve improvements in the production	0 1 2 3 4
Support the Research and Development function	0 1 2 3 4

Business performance

19. Please indicate which of the following you believe are the effects of the IT on your company **in the past two years** and to what extent you agree to the following assertions. Please choose only one among the following alternatives.
0 = Not at all, **1** = To a Small Extent, **2** = To Some Extent, **3** = To a Large Extent, **4** = To a Great Extent

IT has allowed to:	
reduce administrative costs	0 1 2 3 4
Increase product conformity (decrease waste)	0 1 2 3 4
Increase the percentage of on-time deliveries to clients	0 1 2 3 4
Decrease the cycle time (number of days from the receipt of the materials to the delivery to the client)	0 1 2 3 4
Decrease the fixed times for the production (increase flexibility)	0 1 2 3 4
Decrease adimnistrative costs	0 1 2 3 4
Improve company's image	0 1 2 3 4
Increase productivity	0 1 2 3 4
Increase the quality of decisions	0 1 2 3 4

Increase internal integration	0 1 2 3 4
Increase external integration with clients and suppliers	0 1 2 3 4
Better Compete against competitors	0 1 2 3 4
Increase turnover from sales	0 1 2 3 4
Increase profits	0 1 2 3 4

20. Please rate to what extent you agree with the following statements.
Please choose only one among the following alternatives:
0 = Not at all, **1** = To a Small Extent, **2** = To Some Extent, **3** = To a Large Extent, **4** = To a Great Extent

I am satisfied with the increase of sales achieved thanks to IT?	0 1 2 3 4
I am satisfied with the increase of the market share of the company achieved thanks to IT?	0 1 2 3 4
I am satisfied with the increase of cash achieved thanks to IT?	0 1 2 3 4
I am satisfied with the improvement of the company image achieved thanks to IT?	0 1 2 3 4

21. Please indicate the value of the financial data listed below:
a. net margin in the past three years: 2004_____ 2005_____ 2006_____
b. profits in the past three years: 2004_____ 2005_____ 2006_____

PRIVACY ISSUES

Information regarding the Article 10 of the Italian Law n. 675/96

All the collected data will be treated according to the Italian Law n. 675/96.

In particular, personal data regarding the interviewee will be treated uniquely in order to send her/him the final report, containing the main outcomes of the research. Data will be not sent to anyone else.

Data about the interviewed company will be treated only for the purposes of Scientific Research, and analyzed through statistical methodologies and tools. No specific information on the single company will be diffused. Only the names of the companies taking part in the survey will be made known.

Data will be archived in paper and electronic format and preserved through adequate security measures.

According to the Article 13 of the Italian Law n. 675/96, who provides the data has the right to ask confirmation of the existence of the data related to her/him, to modify or update such data, to cancel or to oppose the processing of such data for legitimate reasons.

Agreement to the treatment of data according to the Article 10 of the Italian Law n. 675/96

I authorize the processing of the data I provide for the aims and via the methods specified above.

Date _____ Signature _____

12 Appendix C: Detailed output of the data analysis

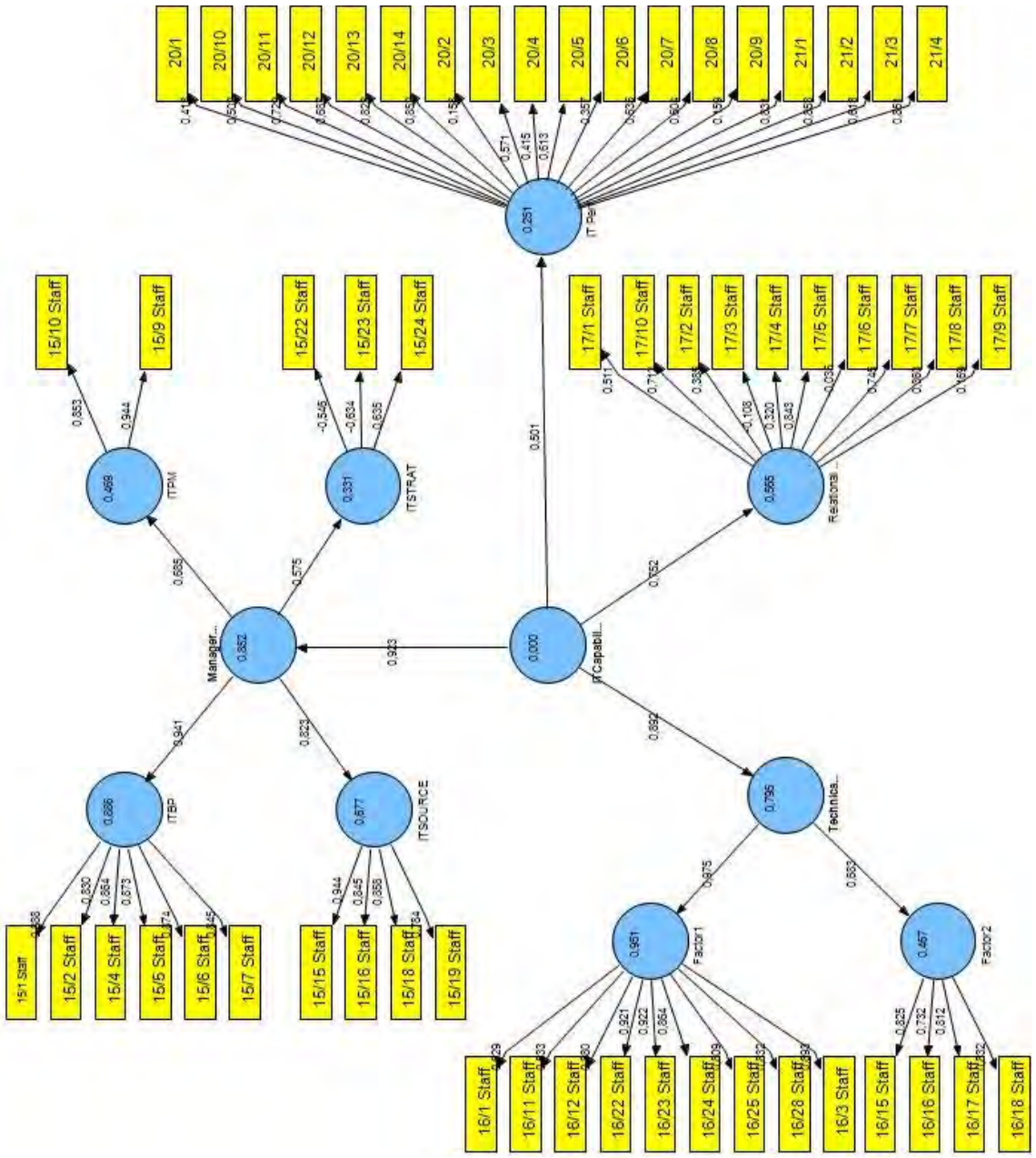

Figure C.1: path coefficients resulting from the application of the PLS algorithm.

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	Standard Error (STERR)	T Statistics (|O/STERR|)	p-value
15/1 Staff <- ITBP	0,89	0,88	0,03	0,03	25,55	0,00
15/1 Staff <- Managerial Skill	0,82	0,81	0,04	0,04	19,07	0,00
15/1 Staff <- ITCapability	0,69	0,68	0,10	0,10	7,21	0,00
15/10 Staff <- ITPM	0,85	0,83	0,12	0,12	6,83	0,00
15/10 Staff <- Managerial Skill	0,46	0,45	0,18	0,18	2,56	0,01
15/10 Staff <- ITCapability	0,38	0,37	0,18	0,18	2,07	0,04
15/15 Staff <- ITSOURCE	0,94	0,94	0,02	0,02	60,13	0,00
15/15 Staff <- Managerial Skill	0,75	0,75	0,06	0,06	12,12	0,00
15/15 Staff <- ITCapability	0,81	0,81	0,04	0,04	18,58	0,00
15/16 Staff <- ITSOURCE	0,84	0,84	0,05	0,05	18,69	0,00
15/16 Staff <- Managerial Skill	0,72	0,72	0,07	0,07	10,33	0,00
15/16 Staff <- ITCapability	0,77	0,77	0,06	0,06	13,69	0,00
15/18 Staff <- ITSOURCE	0,86	0,86	0,04	0,04	23,50	0,00
15/18 Staff <- Managerial Skill	0,78	0,78	0,07	0,07	11,14	0,00
15/18 Staff <- ITCapability	0,81	0,80	0,08	0,08	9,70	0,00
15/19 Staff <- ITSOURCE	0,78	0,77	0,13	0,13	6,18	0,00
15/19 Staff <- Managerial Skill	0,54	0,54	0,15	0,15	3,52	0,00
15/19 Staff <- ITCapability	0,53	0,54	0,17	0,17	3,08	0,00
15/2 Staff <- ITBP	0,83	0,83	0,04	0,04	19,22	0,00
15/2 Staff <- Managerial Skill	0,74	0,73	0,07	0,07	11,34	0,00
15/2 Staff <- ITCapability	0,61	0,60	0,09	0,09	6,54	0,00
15/22 Staff <- ITSTRAT	-0,55	-0,25	0,54	0,54	1,02	0,31
15/22 Staff <- Managerial Skill	-0,05	-0,05	0,20	0,20	0,26	0,79
15/22 Staff <- ITCapability	0,01	0,00	0,18	0,18	0,07	0,95
15/23 Staff <- ITSTRAT	-0,63	-0,37	0,56	0,56	1,13	0,26
15/23 Staff <- Managerial Skill	-0,37	-0,37	0,19	0,19	1,93	0,05
15/23 Staff <- ITCapability	-0,38	-0,38	0,17	0,17	2,27	0,02
15/24 Staff <- ITSTRAT	0,63	0,53	0,38	0,38	1,65	0,10
15/24 Staff <- Managerial Skill	0,39	0,39	0,16	0,16	2,50	0,01
15/24 Staff <- ITCapability	0,36	0,36	0,14	0,14	2,56	0,01
15/4 Staff <- ITBP	0,86	0,86	0,04	0,04	24,05	0,00
15/4 Staff <- Managerial Skill	0,74	0,74	0,06	0,06	12,72	0,00
15/4 Staff <- ITCapability	0,55	0,56	0,12	0,12	4,49	0,00
15/5 Staff <- ITBP	0,87	0,88	0,03	0,03	29,53	0,00
15/5 Staff <- Managerial Skill	0,82	0,83	0,04	0,04	20,72	0,00
15/5 Staff <- ITCapability	0,74	0,74	0,07	0,07	11,17	0,00
15/6 Staff <- ITBP	0,87	0,88	0,02	0,02	38,01	0,00
15/6 Staff <- Managerial Skill	0,90	0,90	0,02	0,02	36,52	0,00
15/6 Staff <- ITCapability	0,81	0,81	0,05	0,05	14,76	0,00
15/7 Staff <- ITBP	0,84	0,85	0,05	0,05	15,72	0,00
15/7 Staff <- Managerial Skill	0,84	0,83	0,07	0,07	11,30	0,00
15/7 Staff <- ITCapability	0,82	0,80	0,09	0,09	8,87	0,00
15/9 Staff <- ITPM	0,94	0,95	0,06	0,06	14,57	0,00
15/9 Staff <- Managerial Skill	0,73	0,72	0,10	0,10	7,20	0,00
15/9 Staff <- ITCapability	0,58	0,57	0,14	0,14	4,28	0,00
16/1 Staff <- Factor1	0,63	0,63	0,10	0,10	6,45	0,00
16/1 Staff <- ITCapability	0,49	0,49	0,11	0,11	4,37	0,00
16/1 Staff <- Technical Skills	0,55	0,56	0,12	0,12	4,60	0,00
16/11 Staff <- Factor1	0,53	0,54	0,17	0,17	3,08	0,00
16/11 Staff <- ITCapability	0,54	0,55	0,15	0,15	3,73	0,00
16/11 Staff <- Technical Skills	0,52	0,54	0,18	0,18	2,86	0,00
16/12 Staff <- Factor1	0,88	0,88	0,05	0,05	19,08	0,00
16/12 Staff <- ITCapability	0,84	0,84	0,05	0,05	16,49	0,00
16/12 Staff <- Technical Skills	0,90	0,90	0,04	0,04	23,06	0,00
16/15 Staff <- ITCapability	0,31	0,30	0,21	0,21	1,45	0,15
16/15 Staff <- Technical Skills	0,54	0,51	0,17	0,17	3,10	0,00
16/15 Staff <- Factor2	0,83	0,79	0,17	0,17	4,93	0,00
16/16 Staff <- ITCapability	0,48	0,47	0,15	0,15	3,21	0,00
16/16 Staff <- Technical Skills	0,60	0,59	0,12	0,12	4,82	0,00
16/16 Staff <- Factor2	0,73	0,74	0,12	0,12	6,00	0,00
16/17 Staff <- ITCapability	0,25	0,24	0,22	0,22	1,15	0,25
16/17 Staff <- Technical Skills	0,49	0,46	0,17	0,17	2,83	0,00
16/17 Staff <- Factor2	0,81	0,78	0,17	0,17	4,79	0,00
16/18 Staff <- ITCapability	0,27	0,27	0,19	0,19	1,45	0,15
16/18 Staff <- Technical Skills	0,54	0,51	0,14	0,14	3,77	0,00

16/18 Staff <- Factor2	0,83	0,81	0,14	0,14	6,07	0,00
16/22 Staff <- Factor1	0,92	0,92	0,02	0,02	39,22	0,00
16/22 Staff <- ITCapability	0,84	0,84	0,03	0,03	24,77	0,00
16/22 Staff <- Technical Skills	0,90	0,90	0,03	0,03	33,33	0,00
16/23 Staff <- Factor1	0,92	0,92	0,03	0,03	36,56	0,00
16/23 Staff <- ITCapability	0,87	0,87	0,03	0,03	27,06	0,00
16/23 Staff <- Technical Skills	0,88	0,89	0,03	0,03	27,35	0,00
16/24 Staff <- Factor1	0,86	0,86	0,05	0,05	16,14	0,00
16/24 Staff <- ITCapability	0,71	0,70	0,13	0,13	5,44	0,00
16/24 Staff <- Technical Skills	0,87	0,86	0,05	0,05	16,20	0,00
16/25 Staff <- Factor1	0,81	0,81	0,06	0,06	13,65	0,00
16/25 Staff <- ITCapability	0,80	0,79	0,06	0,06	12,45	0,00
16/25 Staff <- Technical Skills	0,78	0,78	0,07	0,07	11,96	0,00
16/28 Staff <- Factor1	0,83	0,82	0,08	0,08	10,71	0,00
16/28 Staff <- ITCapability	0,84	0,83	0,08	0,08	10,22	0,00
16/28 Staff <- Technical Skills	0,77	0,77	0,10	0,10	8,08	0,00
16/3 Staff <- Factor1	0,89	0,89	0,04	0,04	22,77	0,00
16/3 Staff <- ITCapability	0,80	0,79	0,07	0,07	10,96	0,00
16/3 Staff <- Technical Skills	0,90	0,89	0,04	0,04	22,02	0,00
17/1 Staff <- Relational Assets	0,51	0,47	0,15	0,15	3,30	0,00
17/1 Staff <- ITCapability	0,37	0,38	0,14	0,14	2,75	0,01
17/10 Staff <- Relational Assets	0,71	0,70	0,10	0,10	6,83	0,00
17/10 Staff <- ITCapability	0,57	0,58	0,10	0,10	5,72	0,00
17/2 Staff <- Relational Assets	0,38	0,33	0,36	0,36	1,06	0,29
17/2 Staff <- ITCapability	0,10	0,12	0,21	0,21	0,49	0,62
17/3 Staff <- Relational Assets	-0,11	-0,14	0,36	0,36	0,30	0,76
17/3 Staff <- ITCapability	-0,28	-0,27	0,19	0,19	1,49	0,14
17/4 Staff <- Relational Assets	0,32	0,29	0,29	0,29	1,11	0,27
17/4 Staff <- ITCapability	0,19	0,20	0,18	0,18	1,05	0,30
17/5 Staff <- Relational Assets	0,84	0,78	0,14	0,14	6,16	0,00
17/5 Staff <- ITCapability	0,57	0,57	0,13	0,13	4,45	0,00
17/6 Staff <- Relational Assets	-0,04	-0,01	0,32	0,32	0,11	0,91
17/6 Staff <- ITCapability	-0,15	-0,13	0,19	0,19	0,80	0,42
17/7 Staff <- Relational Assets	0,74	0,71	0,13	0,13	5,59	0,00
17/7 Staff <- ITCapability	0,55	0,55	0,16	0,16	3,54	0,00
17/8 Staff <- Relational Assets	0,36	0,29	0,34	0,34	1,05	0,30
17/8 Staff <- ITCapability	0,15	0,16	0,22	0,22	0,68	0,50
17/9 Staff <- Relational Assets	0,17	0,15	0,25	0,25	0,68	0,49
17/9 Staff <- ITCapability	0,11	0,11	0,17	0,17	0,66	0,51
20/1 <- IT Perf	0,41	0,37	0,21	0,21	1,94	0,05
20/10 <- IT Perf	0,50	0,47	0,18	0,18	2,84	0,00
20/11 <- IT Perf	0,73	0,65	0,22	0,22	3,38	0,00
20/12 <- IT Perf	0,69	0,59	0,25	0,25	2,76	0,01
20/13 <- IT Perf	0,82	0,74	0,19	0,19	4,30	0,00
20/14 <- IT Perf	0,85	0,78	0,16	0,16	5,49	0,00
20/2 <- IT Perf	0,16	0,10	0,24	0,24	0,66	0,51
20/3 <- IT Perf	0,57	0,46	0,29	0,29	1,96	0,05
20/4 <- IT Perf	0,42	0,41	0,16	0,16	2,56	0,01
20/5 <- IT Perf	0,61	0,52	0,25	0,25	2,47	0,01
20/6 <- IT Perf	0,36	0,31	0,23	0,23	1,54	0,12
20/7 <- IT Perf	0,64	0,61	0,12	0,12	5,17	0,00
20/8 <- IT Perf	0,60	0,53	0,22	0,22	2,76	0,01
20/9 <- IT Perf	0,16	0,11	0,23	0,23	0,69	0,49
21/1 <- IT Perf	0,83	0,75	0,20	0,20	4,05	0,00
21/2 <- IT Perf	0,85	0,80	0,13	0,13	6,72	0,00
21/3 <- IT Perf	0,61	0,61	0,10	0,10	5,93	0,00
21/4 <- IT Perf	0,85	0,80	0,13	0,13	6,35	0,00

Table C.1: p-value Outer (model) Loadings.