

The Adoption of Knowledge Management Systems in Small Firms

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Abstract: Knowledge Management (KM) is a critical area for small business managers in today's competitive environment. However, there is a general consensus in relation to the fact that the benefits of KM have not been fully exploited by small firms. In fact, despite the wide literature on KM, there is an abundance of research describing how large companies are successfully practising KM, but little contributions on the critical success factors for KM adoption in SMEs. Indeed, empirical studies have been rarely conducted on this topic. The main aim of this paper is to shed light on the KM practices in small firms. To this purpose, the paper presents the preliminary results of an empirical investigation carried out in a cluster of 25 high-technology SMEs located in the eastern area of Naples City (Italy). The methodology adopted is based on the following two main stages: a) a literature review on knowledge management and its usage in small business has been carried out; b) a semi-structured questionnaire has been set up and validated in a number of focus group discussions. The questionnaire survey has been conducted through interviews with managers of small firms belonging to the cluster investigated. Survey findings highlight the following points: - the surveyed companies show significant KM needs, but they adopt mainly internal KMSs that involve relatively simple ICT tools; - knowledge exchanged is mainly tacit and it requires KM tools based on personal relationships and interactions such as work teams; - ENS firms express the need for both internal and external KMSs enabling collaborative relationships with other firms for developing common projects; - there are some relevant factors motivating the adoption of internal and external KMSs in firms investigated (such as innovation, operational management and market features) but also significant barriers (such as the protection of intellectual capital and cultural barriers).

Keywords: knowledge management practices, small and medium sized enterprises, high-technology sectors, empirical survey

1. Introduction

One of the most significant evolutions in the business environment over the past decade is the dawn of the new economy. The velocity and dynamic nature of markets has created a competitive incentive among many companies to leverage their knowledge assets as a means of creating value and achieving a competitive edge. The focus on knowledge management (KM) is a critical area also for small and medium sized enterprises (SMEs). In particular, the management of knowledge assets may provide small firms new tools for survival, growth and maintaining a sustainable competitive advantage (Omerzel and Antoncic, 2008).

There is a general consensus in business practices and academia on the fact that SMEs are falling behind large companies in developing KM practices and benefits of KM has not fully exploited by these firms. This is reflected in a literature gap where little research efforts have been carried out on this topic. Indeed, to date, there is an abundance of literature describing how various large companies are successfully practising KM, but the reasons why small firms show poor usage of KM tools are still unclear. In fact, little empirical studies have been conducted to identify the factors influencing KM adoption in SMEs (Finkl and Ploder, 2009). In addition, there is a growing need for qualitative analysis of the effects of knowledge management practices of networked SMEs (Valkokari and Helander, 2007).

The main aim of this paper is to shed light on the KM practices in small firms. The paper presents the preliminary results of an empirical investigation carried out in a cluster of 25 firms located in the eastern area of Naples city (Italy). The most part of this cluster comprises small firms located in the same area but operating in different high-technology sectors. The methodology adopted has been

organised into two main stages. Firstly, a literature review on KM and its usage in small business has been carried out. Secondly, the outcome of the literature review allowed to set-up a semi-structured questionnaire that has been validated in a number of focus group discussions involving SMEs' managers, academics and consultants.

The paper is organised into seven sections. Following this introduction, a literature review on KM (section 2) and KM in small businesses (section 3) is provided. Section 4 describes the context of investigation, while the methodology used is detailed in section 5. The main findings emerging from the empirical survey are presented in section 6. Conclusions and recommendations are outlined in section 7.

2. Knowledge and knowledge management

Research on knowledge and knowledge management spans the disciplines of economics, information systems, organizational behaviour and theory, psychology, strategic management, and sociology. This diversity has contributed to the rapid advance of research in specialised areas of inquiry that investigate different aspects of organizational learning and knowledge management.

Knowledge management, like knowledge itself, is difficult to define as concepts and practices evolved quickly through the 1990s. Two main issues are evident in this evolving path: i) knowledge is a critical resource, rather than land, machines, or capital (Drucker, 1993), and ii) organizations generally poorly managed it. If more attention were paid to creating, providing, sharing, using, and protecting knowledge, the promise was that organizational performance would improve (Earle, 2001).

Current definitions of knowledge reflect a range of standpoints. The following definition contains a comparatively broad approach because it includes a range of phenomena such as values, insight, and information: *"Knowledge is a fluid mix of framed experience, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information. It originates and is applied in the minds of knowers. In organisations, it often becomes embedded not only in documents or repositories but also in organisational routines, processes, practices, and norms"* (Davenport and Prusak, 1998).

An understanding of the concept of knowledge and knowledge taxonomies is important because theoretical developments in the knowledge management area are influenced by the distinction among the different types of knowledge. The literature offers a number of different knowledge taxonomies. Drawing on the work of Polanyi (1962, 1967), Nonaka (1994) explicated the most cited classification of knowledge distinguishing tacit and explicit knowledge dimensions. The author also views knowledge as existing in the individual or the collective. Other classifications (Alavi and Leidner, 2001) refer to knowledge as declarative (know-about or knowledge by acquaintance (Nolan Norton 1998), procedural (know-how), causal (know-why), conditional (know-when), and relational (know-with) (Zack 1998).

Likewise, research in the domain of knowledge management seems fragmented. According to Sveiby (1997) the expression "managing knowledge" appears for the first time in a context of artificial intelligence at the end of 1980s. Early research in the field of KM was interested on the possibility of using information technology to support the process of individual learning. Again, in the artificial intelligence community, Wiig (1993) was one of the first scholars to recognise the limits of a primarily technological approach and he defined KM in term of creation, learning, sharing (transferring), and using or leveraging knowledge as a set of social and dynamic processes that needed to be managed (Iandoli and Zollo, 2007). Almost at the same time, Nonaka and his research group conducted a number of studies on the management of innovation processes in large Japanese companies. These studies together with the total quality management movement and the concept of continuous improvement, re-evaluate the overall role that human resources play at all levels in organisations discovering what was not yet obvious in organisational practice: the centrality of the individual in the knowledge creation process and the consequent need to recognise the person's necessary level of competence and autonomy (Nonaka and Takeuchi, 1995). Most of the contributions in the vast literature on KM can be summarised to one of these two approaches or attempts to integrate the two perspectives (Iandoli and Zollo, 2007).

According to Davenport and Prusak (1998), most knowledge management projects have one of the following three aims:

- a) to make knowledge visible and show the role of knowledge in an organization, mainly through maps, yellow pages, and hypertext tools;
- b) to develop a knowledge-intensive culture by encouraging and aggregating behaviours such as knowledge sharing (as opposed to hoarding) and proactively seeking and offering knowledge;
- c) to build a knowledge infrastructure-not only a technical system, but a web of connections among people given space, time, tools, and encouragement to interact and collaborate.

Bhatt, (2001) defined KM identifying the different phases in which a KM project may be organised. In fact, the author defined KM as a process of knowledge creation, validation, presentation, distribution, and application. These five phases in knowledge management allow an organization to learn, reflect, and unlearn and relearn, usually considered essential for building, maintaining, and replenishing of core-competencies

In a broad sense, Quintas et al. (1997) define knowledge management as the process of continually managing knowledge of all kinds to meet existing and emerging needs, to identify and exploit existing and acquired knowledge assets and to develop new opportunities. Interestingly, the author pointed out that KM refers to the management of all kind of knowledge, but only for developing new opportunities.

However, the KM definition suggested by Landoli and Zollo (2007) has been considered the working definition for this paper as it simultaneously refers to objectives, knowledge involved, tools and phases of KM. According to this definition: *“KM is the process of creating, capturing, and using knowledge to enhance organisational performance. It refers to a range of practices and techniques used by organisations to identify, represent, and distribute knowledge, know-how, expertise, intellectual capital, and other forms of knowledge for leverage, reuse and transfer of knowledge and learning across the organisation”*.

As illustrated above, KM initiatives involve not only an implementation of ICT but also social and cultural facets. However, while ICT does not apply to all of the issues of knowledge management, it can support KM in different ways. In this sense, according to Alavi and Leidner, (2001), knowledge management systems (KMS) refer to a class of information systems applied to managing organizational knowledge. That is, they are IT-based systems developed to support and enhance the organizational processes of knowledge creation, storage/retrieval, transfer, and application.

3. Knowledge management in SMEs

Although introducing knowledge management systems into SME is a particular challenge because of the limited resources of these kinds of companies (Herrmann et al, 2007), the literature review on KM reveals that the most part of research in this field is focused on large companies. In fact, the understanding of the organizational theory and practice considerations of KM has mainly been derived from large company experiences. Consequently, the potential of KM seems not fully exploited by small firms and this is reflected in a literature void where little research contributions on this topic have been published. In addition, research on KM in SMEs highlights some relevant different features (Pillania, 2006 and 2008)

According to the review carried out by Thorpe et al (2005), research on KM in the SMEs context may be broken down into three distinct fields:

- 1. the knowledgeable SME manager or entrepreneur;
- 2. the knowledge systems and routines embedded within the context of the firm and their immediate networks;
- 3. the institutional and policy framework that is intended to support knowledge production within SMEs.

As asserted by Frey (2001), although major corporations have led the way in introducing and implementing KM, it is increasingly important for small businesses to manage their collective intellectual assets. In KM practices, issues that small businesses will face will not be simply a scaled-down replica of large-company experiences (Sparrow, 2001). Desouza and Awazu (2006) discuss five key peculiarities that differentiate knowledge management practices in SMEs and larger companies:

- in SMEs there is lack of explicit knowledge repositories. Instead, each manager/owner acts as the knowledge repository.
- Common knowledge possessed by members of the SMEs is deep and broad. This common knowledge helps in the organization of work by easing issues of knowledge transfer, sense-making, and application.
- SMEs by their nature and due to deliberate mechanisms are skilled at avoiding pitfalls of knowledge loss. The close social ties between members of the SME act as a deterrence against employees leaving the business. In cases where employees do leave the business, there are plenty of available knowledge resources that can be mobilized to quickly fill the void.
- SMEs have a knack for exploiting foreign sources of knowledge. Since they are resource constrained, and cannot spend efforts to create knowledge, they look outside the organization for knowledge.
- SMEs knowingly or unknowingly, manage knowledge the right way – the humanistic way. Technology is never made part of the knowledge management equation. The use of technology in an SME is mostly limited to acts of automation (such as the use of cash registers) and at times for informative purposes (storing of employee contact information in databases).

Similarly, McAdam and Reid (2001) firstly describe the key dimensions of KM (knowledge construction, knowledge embodiment, knowledge dissemination and knowledge use/benefit) and then, for each dimension, conduct a comparison between large firms and SMEs.

Sparrow (2001) indicates four components that figure strongly in small firm knowledge projects:

- the appreciation of personal and shared understanding;
- knowledge bases and knowledge systems;
- the integrated and contextualized action needed for knowledge projects in SMEs, and
- the knowledge and organizational learning processes in SMEs.

The author also suggests an emergent model of approaches towards developing knowledge management practices in SMEs. The model has as its most central tenet, the assertion that KM development in SMEs needs to be supported through a process that recognizes and incorporates the current thinking and priorities in the knowledge project.

Egbu et al. (2005) highlight that knowledge generated in SMEs is tacit in nature due to various reasons. In the context of SMEs some elements of KM are practiced but in an 'ad hoc' fashion. Indeed any technological infrastructure that is put in place to support KM must be adapted to the organisation's needs and not the other way round.

Another stream of KM research regards factors that can influence the success of KM implementation. Also in this area, most of research efforts are heavily focused on large companies as early adopters and superior performers of KM were large and multinational corporations. As such, existing factors are mainly large companies oriented, thereby reflecting their situations and needs. Directly applying these factors into the SMEs environment may not be sufficient without an understanding of their very own and specific conditions (Wong, 2005). By integrating the common factors and introducing some new ones, Wong (2005) and Wong and Aspinwall (2005), propose a more comprehensive model for implementing KM in SMEs based on the following 11 factors:

- management leadership and support;
- culture;
- IT;
- strategy and purpose;
- measurement;
- organisational infrastructure;
- processes and activities;
- motivational aids;
- resources;

- training and education; and
- human resources management.

The above set of critical success factors is important because of it can act as a list of items for SMEs to address and deal with when accomplishing KM. This helps to ensure that essential issues and factors are covered when small firms are planning and developing a KM strategy. It can also provide a basis for them to evaluate their KM practices (Wong, 2005).

4. The context of investigation

The empirical investigation on which this paper is based has been conducted in the East Naples high-tech enterprise system (ENS). This network of firms has been established in March 2007 and it comprises 25 companies. The total number of ENS employees is about 3,000 and the total turnover is about 400 million Euros in 2008. The ENS mainly consists of SMEs as shown in table 1. In the table, the latest EU definition of SMEs proposed by the EU Commission has been used (European Commission, 2005).

Table 1: ENS companies breakdown by employees' bands

Employees bands	N.	%
Micro 0-9	3	12
Small 10-49	10	40
Medium 50-249	11	44
Large ≥ 250	1	4
Total	25	100

Table 2 shows that ENS the most part of firms operates in the aerospace and ICT sectors.

Table 2: East Naples high-tech enterprise system: company sectors

Manufacturing companies	Aerospace	1	Aermec Sud
		2	ARM
		3	ASTRO Ind.
		4	Fox-Bit
		5	K4A
		6	Magnaghi Aeronautica
		7	Vulcan Air
	Engineering	8	Farina Impianti
		9	Mecfond
		10	AET
Service companies	Aerospace (Research & Development)	11	MARS
	ICT	12	Euro.Soft
		13	Intecs
		14	ITS
		15	Kell
		16	Naosys
		17	Null Pointer
		18	SRSe
		19	Form & ATP
	Management training and consulting services	20	Mater
		21	Protom
		22	Tecno-In
	Transport (system and service)	23	Ansaldo S.F.
		24	Lead Tech
	TLC	25	Canale Otto S.p.A.

It is worth to outline the working mechanisms of ENS. On the basis of a specific market opportunity, a firm proposes a project and it launches a call for adhesion. The firms that joint the project create a network inside ENS. They select a coordinator and develop the project. In this way, ENS is characterised by a set of peer temporary relationships orientated to specific projects. It is a dynamic network in which project collaboration relationships are continuously formed and reformed.

5. Methodology

After the literature review, a questionnaire survey has been conducted. The main aim of the survey is to shed light on the most relevant features characterising the usage of KM in ENS firms. The survey methodology has been organised into the following five steps:

a) *Definition of basic survey objectives and preparation of the draft questionnaire.* In this phase a draft version of the questionnaire has been prepared together with the basic survey objectives.

b) *Establishment of focus groups.* In order to test the suitability of the basic survey objectives and comprehensibility of the draft questionnaire a focus group involving 8 experts with different competence and professional background was established. The focus group has been developed in three different phases. Firstly, the topic investigated has been presented in order to make focus group participants familiar with it. Secondly, the draft questionnaire has been submitted to the panellists in order to get their useful feedback and comments. Finally, panellists' remarks have been discussed in a plenary session.

c) *Re-focussing of survey objectives and questionnaire.* On the basis of feedback received during the focus group discussion, the questionnaire has been finalised. Most of the questions included in the questionnaire are based on a Likert scale ranging from 1 to 9. Some other questions allow more qualitative answer in order to allow respondents to express their own personal opinion.

d) *Test of the questionnaire.* In this step, the final version of the questionnaire has been tested through 3 pilot interviews carried out in ENS firms.

e) *Survey implementation.* The survey has been conducted in spring 2008. The total number of respondents is 18 out of 25 companies with a response rate of 72%. The questionnaire has been submitted during face-to-face interviews involving at least two managers with different skills and role (e.g. a manager involved in the strategic firm decisions making process and a manager involved in the operation management). This allowed obtaining both strategic and operational perspectives.

In order to have a more comprehensive picture of the East Naples high-tech enterprise system, information from complementary sources (e.g. company websites, company reports and industry magazines) have been collected and analysed.

6. Findings

Firstly, according to the definition of KMS provided by Alavi and Leidner (2001), the survey indicated that the vast majority of the sample firms (83%) have a KMS in place (see figure 1).

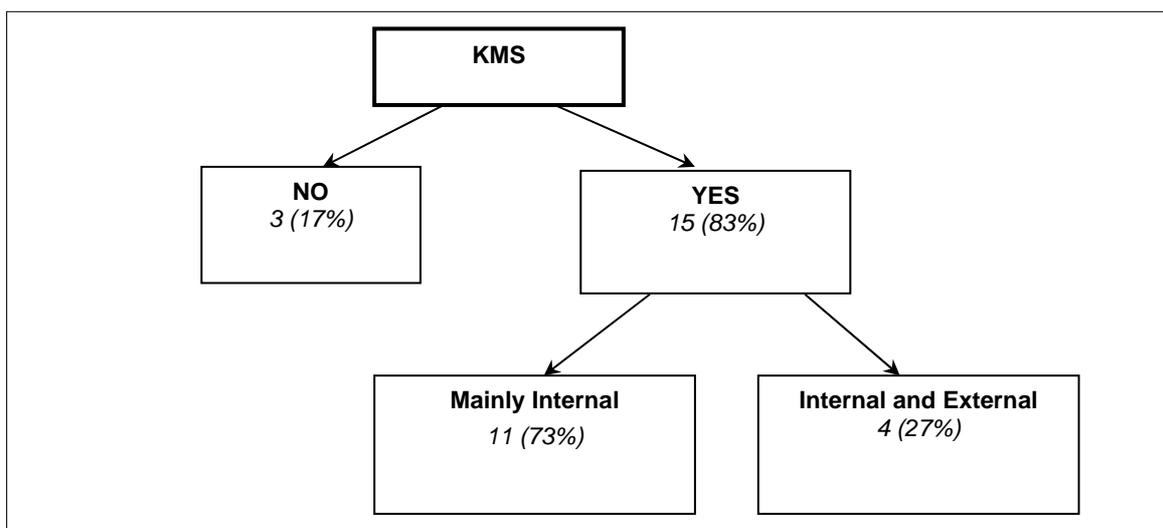


Figure 1: KMS adoption

73% of these companies adopt an internal KMS aimed at supporting knowledge management inside the firm. KMSs supporting the internal and external management of knowledge flows are implemented only in 4 firms (27% of 15 firms). This result is consistent with the tools used by ENS firms for KMS

implementation (see figure 2). The most widespread forms of KMS implementation are through the Internet website and work teams. In fact these are relatively simple tools that fit the needs of managing knowledge inside small firms. The high importance attached to work teams also suggests that, in high technology sectors, in addition to ICT, interactions and interpersonal relationships are a fundamental tool for exchanging and sharing knowledge, as suggested by the literature.

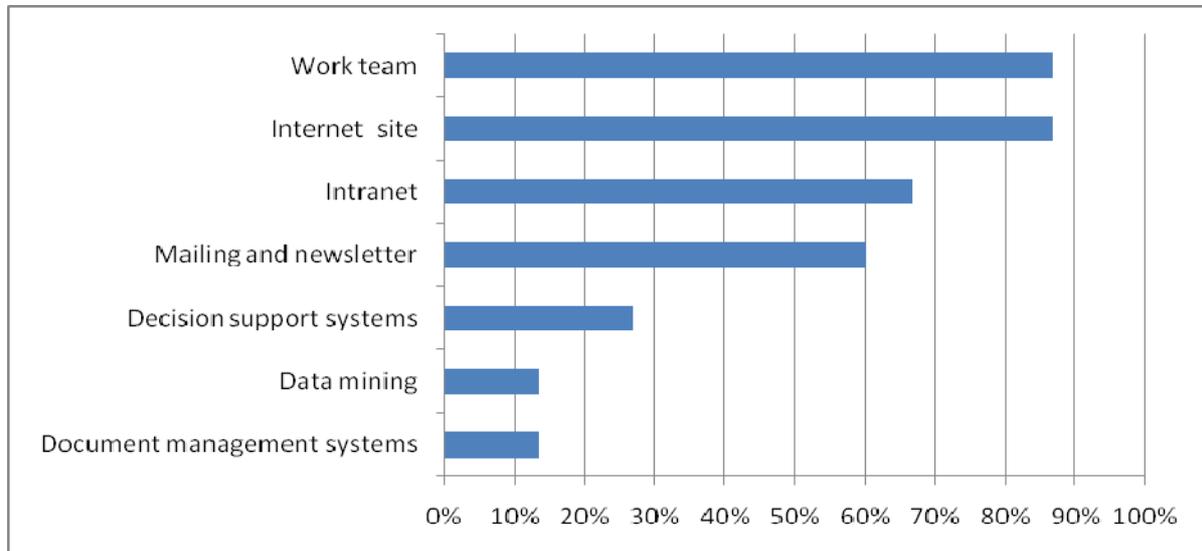


Figure 2: Tools for KMS implementation

Nevertheless, advanced and structured KMS equipped with a document management system, data mining, and decision support systems are rarely used. These tools are more suitable for the implementation of external and internal KMSs as they support knowledge management both inside and outside the firms.

Although only 4 firms use internal and external KMS, almost all firm investigated claimed for wider KMSs to support project collaboration relationships. These systems enable KM practices not only inside a single firm, but also among firms involved in a common project that continuously need to exchange and share critical knowledge. For this reason, the benefits of a KMS enabling project collaboration relationships have been analysed (see figure 3). In the figure the average value of importance for each expected benefit is reported.

The figure interestingly shows that internal and external KMSs may have a positive impact not only on the innovation and the operational management, but also on the identification of the market opportunities. These features further clarify the potential support that internal and external KMSs can provide to support project collaboration relationships. In fact, the exploitation of market and innovation opportunities are the main aim of the common projects carried out by ENS firms. In this context, operational management is a fundamental tool that allows projects to be implemented effectively.

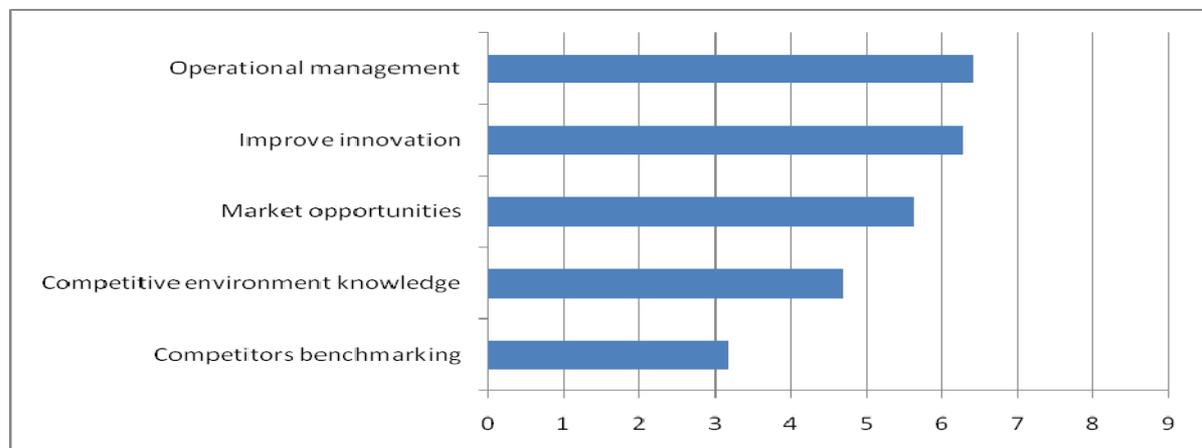


Figure 3: Expected benefits of internal and external KMSs

However, a number of barriers to KMSs implementation have been indicated (see figure 4). Interestingly, technological barriers and tacit nature of knowledge exchanged are the less relevant barriers. This may be explained considering that in the SMEs context, work teams allow sharing informal knowledge. Nevertheless, the unavailability of partners to share knowledge and the need to protect critical information are the most relevant barriers. This suggests that SMEs investigated seem oriented to preserve their own intellectual assets from the possible opportunist behaviour of potential partners.

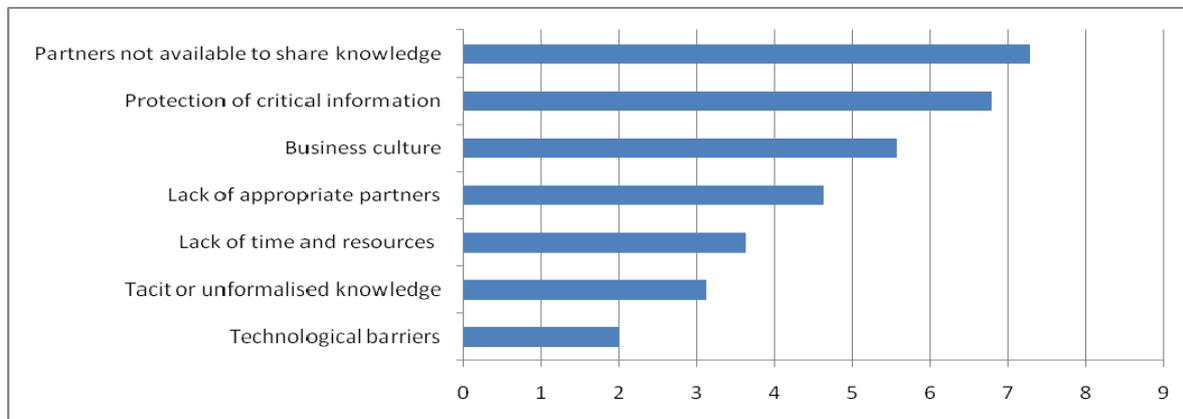


Figure 4: KMS implementation barriers

Another aspect investigated relates to information that companies are willing to share through the adoption of a KM platform as shown in figure 5. This platform may assume the structure of a complex knowledge base in which ENS firms involved in different projects may share critical information.

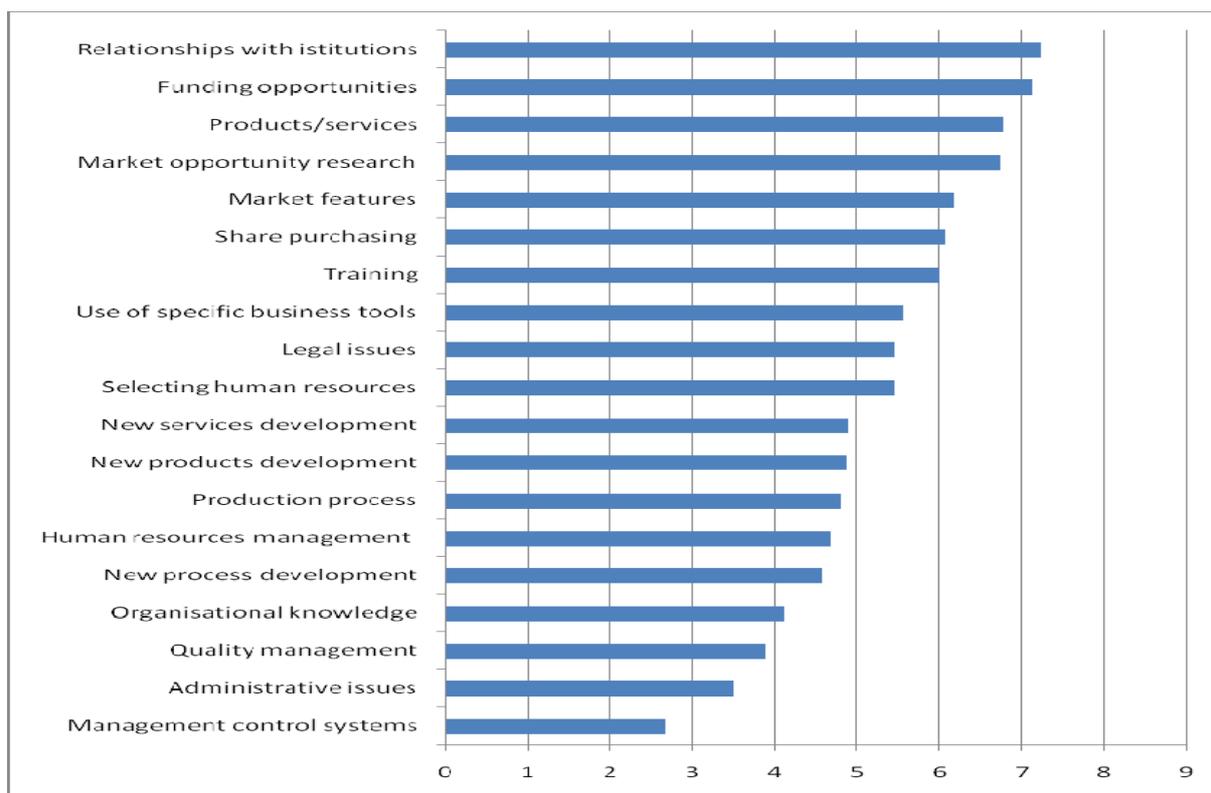


Figure 5: Information may be shared through a KM platform

The most important information that firms are willing to share are related to linkages with institutions and funding opportunities. This answer has been motivated by the lack of resources in SMEs that traditionally prevent these firms to manage effectively relationships with local authorities. Other important information are related to market. Firms attach significant importance to information about market features and opportunities because of they have to be able to recognise and exploit opportunities faster and more effectively in current dynamic business context. Indeed, as knowledge

assumes a critical importance in new product/service development, information of this kind are critical to be shared. Another interesting issue concerns the human resources management. In fact, as shown in the above figure, a KM platform can provide useful tools both in recruiting and training employees and new staff. Finally, ENS firms show a low interest in sharing information about management control systems, administrative issues and quality management. This may be explained considering that these information are generally firm specific and they don't need to be shared for the effectively development of common projects.

7. Conclusions and recommendations

This paper attempts to explore KM practices in small firms through an empirical investigation carried out in a set of eighteen SMEs located in the eastern area of Naples. The main preliminary findings of the survey indicate significant KM needs of the surveyed companies. In addition, it has been found that ENS firms adopt predominantly internal KMSs using simple ICT tools. The surveyed firms also show the need for wider (external) KMSs enabling inter-firm collaboration in developing collaborative projects.

On the basis of the above findings, it is possible to outline some recommendations for SME managers. The survey indicates the following three areas for developing KM practices.

- *Management of market knowledge.* KMS may support relationships with customers in order to facilitate both the exchange of relevant information and improving communication with them. Furthermore, a KMS should support the retrieval of information about market opportunities.
- *Management of technology knowledge.* This is a critical area for firms operating in high technology sectors. KM tools should support the circulation of critical information about know-how and technology. In the ENS context this appears particularly important as firms participate in collaborative projects aimed at developing new products and services. Practical examples may be the virtual sharing of design tools (e.g. or CAD, CAE e CAM) and management and control systems (e.g. MRP and ERP) related to the same project.
- *Management of relational knowledge.* In developing and managing collaborative projects it is important to have in place tools facilitating the collaboration among participants. Nevertheless, the adoption of these tools may be inhibited by the need to protect intellectual assets and cultural barriers. The ultimate goal of KMS in SME networks context should be to achieve an appropriate balance between individual needs and project partnership.

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