

SPATIAL AND ORGANIZATIONAL DYNAMICS

DISCUSSION PAPERS

New Approaches to Management

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Knowledge transfer and the 'academic enterprise' in the algarve:
Contributions from social studies of science and technology to the understanding of university-firm relations
Transferência de conhecimento e a 'empresa académica' no algarve:
Contribuições dos estudos sociais de ciência e tecnologia para a compreensão das relações universidade-empresa
Hugo Pinto

Aligning technology with business: A continuous effort
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Localised assets and small-firms' technological capabilities
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Marisa Cesário and Maria Teresa de Noronha Vaz

Use of social networks in small and medium enterprises: The case of Algarve
Uso de redes sociais nas pequenas e médias empresas: O caso do Algarve
Ana Belo, Guilherme Castela and Sílvia Fernandes

DISCUSSION PAPERS N° 12: SPATIAL AND ORGANIZATIONAL DYNAMICS

New Approaches to Management

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KNOWLEDGE TRANSFER AND THE 'ACADEMIC ENTERPRISE' IN THE ALGARVE: CONTRIBUTIONS FROM SOCIAL STUDIES OF SCIENCE AND TECHNOLOGY TO THE UNDERSTANDING OF UNIVERSITY-FIRM RELATIONS

TRANSFERÊNCIA DE CONHECIMENTO E A 'EMPRESA ACADÉMICA' NO ALGARVE: CONTRIBUIÇÕES DOS ESTUDOS SOCIAIS DE CIÊNCIA E TECNOLOGIA PARA A COMPREENSÃO DAS RELAÇÕES UNIVERSIDADE-EMPRESA

Hugo Pinto

ABSTRACT

University's everyday life is today transformed in an encompassing domain where different types of actors are connected and interrelated. Nevertheless, academic science often feels threatened by the new emerging paradigm characterized by knowledge transfer and the economic exploitation of public research results. This paradigm relates to what can be defined as the 'academic enterprise', the creation of spin-offs, applied research contracts and licensing of industrial property rights of the university. This article explores university-firm relations and tensions, discussing the increased relevance of knowledge transfer. The ideas of Ludwik Fleck, intellectual precursor of Social Studies of Science and Technology, contribute to the understanding of the difficulties of communication between different collectives, their styles of thought and the relevance of 'marginal individuals' in connecting different institutional spheres. Based on a qualitative approach to the case study of the University of Algarve (Portugal) and its attempts to create bridges with the business world, the text illustrates differences between collectives of thought in the 'academic science' and the firm, the recent institutionalization of commercialization of research, and findings for policy-making and management of knowledge transfer activities.

Keywords: Knowledge Transfer, Fleck, Collective of Thought, Marginal Individuals.

RESUMO

A vida quotidiana da Universidade está hoje transformada num domínio abrangente, onde diferentes tipos de atores estão ligados e inter-relacionados. No entanto, a ciência académica sente-se muitas vezes ameaçada pelo novo paradigma emergente caracterizado pela transferência de conhecimento e pela exploração económica dos resultados da investigação pública. Este paradigma relaciona-se com o que pode ser definido como a 'empresa académica', a criação de *spin-offs*, contratos de investigação e licenciamento de direitos de propriedade industrial da universidade. Este artigo explora as relações e as tensões universidade-indústria, discutindo o aumento da relevância da transferência de conhecimento. As ideias de Ludwik Fleck, intelectual precursor dos Estudos Sociais de Ciência e Tecnologia contribuem para a compreensão das dificuldades de comunicação entre os diferentes colectivos, os seus estilos de pensamento e a relevância de 'indivíduos marginais' em conectar diferentes esferas institucionais. Com base numa abordagem qualitativa de estudo de caso da Universidade

do Algarve (Portugal) e das suas tentativas de criar pontes com o mundo da empresa, o texto ilustra as diferenças entre os colectivos de pensamento na ciência académica e na empresa, a recente institucionalização da comercialização da investigação, e contributos para a elaboração de políticas e gestão das actividades de transferência de conhecimento.

Palavras-chave: Transferência de Conhecimento, Fleck, Colectivo de Pensamento, Indivíduos Marginais.

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1. INTRODUCTION

The 'third mission' of the university includes the new mode of knowledge production, the idea of the triple helix and the importance of science in innovation systems, underlining the focus given to organizations and institutions related to innovation. A different logic has emerged where the role of knowledge networks is underlined with various actors interacting in the public and private sectors. Recent decades witnessed the growing difficulty in separating between public good and industrial property. These two spheres were initially distant but are now closer, which has led to the emergence of 'academic enterprise' with new regulatory and normative schemes and cognitive values centred in a systematic effort to strengthen the short-term economic value of research and facilitate commercialization of inventions (Larsen, 2011). The emergence of 'academic enterprise' results largely from dissatisfaction with the direct and measurable benefits of public science. This fact, noted by Pavitt (2001) as the search for greater relevance of public science, was the first justification for the university to seek the firm. The second justification for this new relationship has been the sharp decline in public funding for academic research associated with the increasing costs of research.

These themes, explored in Regional Science, normally benefit from quantitative approaches (Bergman, 2010). It is common for studies on university-industry relations to focus certain metrics and use econometric approaches to ascertain the determinants of this relationship, both from the perspective of firms and public science actors (Larsen, 2011). However, Regional Science would benefit in their understanding of the process of knowledge transfer if it incorporates concepts and approaches from areas such as the Social Studies of Science and Technology (SSST) that have also given attention to these phenomena, yielding important policy implications for science and technology (S&T).

This article seeks to deepen the debate on knowledge transfer and university-firm relations. The text is an example of a qualitative approach, centred on the actors and the specific processes of knowledge transfer that can add valid contributions to the studies that focus primarily on innovation metrics, such as registration and licensing of patents or the number of new spin-offs.

The text is organized into four main sections. The first section discusses the notions of knowledge transfer and its emergence as a central aspect of contemporary change in the role of science. Then, the main ideas of Fleck, the precursor of SSST, are presented emphasizing relevant aspects to the understanding of knowledge transfer. Finally, it presents an empirical study analyzing the specific case of the interaction of the University of Algarve (UAlg) and the regional business fabric, the attempts to understand differences between collectives of thought of researchers and entrepreneurs, and how these groups comprise the

role of university's knowledge transfer office in mediating the relationship between these two institutional spheres.

2. LITERATURE REVIEW OF POLICY STUDIES OF INNOVATION AND KNOWLEDGE TRANSFER

2.1. The New Role of the University and the Importance of Transfer

The intense attention over the last half-century that innovation policies had as a development tool, particularly in developed countries, gave central importance to scientific knowledge for economic progress. Characterizing contemporary societies as being organized around knowledge generated through scientific research and technological development brought to the centre of discussions the importance of knowledge and its impacts, as well as emphasizing notions such as a knowledge society, knowledge economy and risk society (Estanque and Nunes, 2003). The role of universities became more relevant than in the traditional view of innovation where the firm was the main target of attention. Several theories highlighted the new role of knowledge and the university as the Mode 2 of knowledge production (Gibbons *et al.*, 1994), the triple helix (Etzkowitz and Leydesdorff, 1997) or the regional innovation systems (Cooke, 1998) emphasizing that the university is currently characterized by a new mission of its effective participation in territorial dynamics. In this 'third mission', transferring knowledge is assumed to be a central aspect for competitiveness and cohesion of territories, particularly in the explicit and structured interconnections between actors within innovation systems.

The idea of knowledge transfer is distinguished from other similar activities such as the dissemination of technology or the diffusion of innovation. It is based on an active and predominantly formal process of voluntary engagement, between a diversity of actors (research centres, universities, businesses, governments or communities) to the appropriation of new knowledge for mutual benefit in order to improve material, human, and environmental well-being. This broad definition, inspired by Bozeman (2000) and Molas-Gallart *et al.* (2002), is different from others commonly used that limit the transfer of knowledge to a sub-group of activities with financial goals and business benefits.

The formal character of the transfer of knowledge is embedded in protocols, agreements, payments that originate contracts, patents and technology-based companies. Several authors (inter alia, D'Este and Patel, 2007; Debackere and Veugelers, 2005; Bercovitz and Feldman, 2005) identify the formal mechanisms of knowledge transfer: the creation of start-ups and spin-outs, the development and exploitation of industrial property rights, research and development projects, and other channels, such as cooperation in education and training, advanced training to business staff, or student internships. In addition, formal relations are based on personal networks, which increase the likelihood of knowledge exchanges. These informal relationships are difficult to quantify but central to the future formalization of the transfer. Only a minority of university-industry relations are directly connected to commercialization; however, the mobility of human resources, consulting services, collaborative projects and informal contacts have less attention than patent licensing or spinning-out, commonly referred to as the most important channels, because of their potential in attracting additional revenues for the university in times of economic downturn.

2.2. Dilemmas in University-Firm Relations

Several new tensions emerge with the change in the reality of science, which are illustrated by the ongoing debate between the costs and the benefits from knowledge commercialization. There are obvious benefits in terms of profits, incentives and recognition, which can be

directed to other research projects, even of a fundamental nature. The existence of patents and applied R&D projects may lead, for example, to new products and processes that improve the range of availabilities for individuals and firms, enhancing consumer society and improving productivity. But there are less positive aspects, considered by Bok (2003) among others, as costs, often speculative and intangible, that result in breaches of academic standards. For example, a project with little scientific value, which is developed only because it results in the entry of financial resources for the university, damages the academic community with tensions and divisions where few existed before. Professors who work hard in their academic activities may be disregarding extraordinary incomes achieved by colleagues in consulting or spinning-out. Disputes for intellectual property rights (IPR) may emerge. Scholars may accuse the coordinators of their centres of stealing ideas to benefit a company in which they have economic interests. The increase in cash flows may increase competition for private interests, which damages the academia, because it supposedly works better in a comfortable climate of trust and sharing. Risks to the reputation of the university and to the integrity of academic interests emerge. The university was for a long time considered the main source of disinterested knowledge. If this lack of interest is diluted, due to an objective and measurable interest in monetary units, informed opinion begins to blur, a function that universities could formerly ensure. A corollary of this type of criticism is that the public may lose confidence in the objectivity of researchers because they are limited by their own private interests and by what university customers prefer to be told.

The emergence of a patenting culture as a way of marketing knowledge also created limits for scientific credibility (Packer and Webster, 1996). The conversion of academic science to patenting raises new questions for researchers in the recognition of their knowledge networks, as they are increasingly moving between different social worlds to be rewarded for their academic achievements and patenting results. There are important limits to the behaviour of the scientist, in particular, when we recall the Mertonian ethos with the principles of universalism, communalism, disinterestedness and organized scepticism, which guaranteed the 'good science'. The vision of Nelson (2004) and Santos (2008) underlines the dangers of patenting, a process that has been particularly intense in the last decade in the scientific areas with the greatest economic potential, such as biotechnology; this has changed relationships within the academy, often blocking free discussion and open results, jeopardizing the production of new knowledge and distorting the research agenda setting.

Shapin (2008) enters this discussion with another perspective. In the twentieth century, the world of science was transformed into an interesting job market, and in some areas, the ability of an individual to ascend to high levels of wealth through science has become a reality. Thus, there is a great moral heterogeneity, and there is room to think that there is more than only one location, the university, where the good scientific life can be found. The business environment can also be adequate for freethinking leading to the generation of scientific knowledge transferable to the market. The new 'scientist-entrepreneur' intends to evolve rapidly and have access to the more interesting decisions and wage levels compatible with individual capabilities, something that is contradicted by the public, science logic where time and hierarchy are central determinants in personal valorisation. Funders of public research proposals are commonly conservative, in line with the objectives of disciplinary mainstreams. The excessive competition for financial support and the stressful routine of 'publish or perish' are usually referred to as disadvantages of the university, compared to the actual situation of the firm in which the freedom to R&D is greater. Steven Shapin presents examples of how current ideas based on scientific knowledge achieve business potential. Platforms such as those obtained by knowledge transfer offices (KTOs) in universities are essential to the process of maturing, supporting and developing ideas that structure contact among entrepreneurs, investors, business partners, and between different groups, linking

scientific knowledge to its market potential and sharing aspirations and virtues. The world of science in late modernity, using the expression of Shapin, is complex and composed of actors from different spheres, scientists, engineers, managers of major companies, business angels, venture capitalists, industrial property agents, technology transfer managers, heads of universities and research centre members.

Several types of organizations have emerged in the boundary areas, where institutional spheres of academia and firm overlap, functioning as intermediary structures: technology centres, laboratories and certification testing, technology parks, science parks, services to support research and innovation, technology platforms, patent centres, and business incubators. KTOs in universities are an example of this type of entity that tries to suppress communication gaps to approach the market and technology expertise with business demand. Guston (1999) showed how these organisms are boundary organizations that characterize the view advocated by the principal-agent theory. A boundary organization runs a stabilization mechanism that internalizes the contingent nature of science in their everyday practice, creating boundary objects for cooperation between principals and agents. These offices are organizations that provide common ground, legitimizing the creation and use of boundary objects, such as patents, and originating the participation of key actors where they appear as expert mediators. Siegel *et al.* (2003) summarize the main stakeholders and their organizational cultures in knowledge transfer overlapping areas:

- Scientists with an academic organizational culture attempt to produce new scientific knowledge, motivated by peer recognition, for additional financial gains and funding for research;
- The companies/entrepreneurs with an entrepreneurial organizational culture expect to commercialize new technology, benefit financially, and maintain ownership of knowledge and technology;
- The knowledge transfer offices, which have a bureaucratic organizational culture, work with universities and industry to structure cooperation, protect and commercialize intellectual property of the university, facilitate communication, ensure technological diffusion, and secure additional funding for research.

3. CONTRIBUTIONS FROM SSST TO KNOWLEDGE TRANSFER

3.1. The Interest in Ludwik Fleck within SSST

Since its almost random discovery, the monograph “Entstehung und Entwicklung einer wissenschaftlichen Tatsache”, translated as “Genesis and Development of a Scientific Fact” and written in 1935, has been the subject of much academic interest. Robert Merton, the great instigator of this translation, found in Ludwik Fleck clues about his personal interest in the influence of the social structure in the production of scientific knowledge. Fleck wrote texts that were largely ignored. In 1935, he wrote an essay about scientific observation and perception in which introduced the idea of style of thought; he then extended the discussion of collectives of thought with his 1936 essay “On the Crisis of ‘Reality’”. However, most of his ideas are well presented in the monograph. In 1960, Fleck wrote “Crisis in Science” that is considered his last writing and was rejected by the journal *Science*.

Fleck remained forgotten until the seventies of the twentieth century when his work was translated into English reaching a much wider audience than the German edition allowed. Fleck (1896-1961) devoted himself to medicine and bacteriology, and he became interested in science as a subject of research in the interdisciplinary environment at the University of Lwów, then part of Poland and now Ukraine, where he participated in various scientific circles. Fleck, a Polish Jew imprisoned during World War II in concentration camps, was

obliged to create vaccines for Nazi forces, which allegedly were tested on other prisoners. This mysterious character of Fleck's biography has boosted interest in not only exploring his theoretical contributions but also his life.

Despite the late discovery, the influence and impact of Fleck in SSST have been enormous. Fleck is currently presented as a thinker ahead of his time, a forerunner of the constructivist approach that blended practical knowledge with academic reflection. Kuhn was one of the first to recognize the importance of Fleck. In the preface to the first edition of the book "The Structure of Scientific Revolutions" in 1962, he wrote "[through] random exploration [...] I have encountered almost unknown Fleck's monograph [...] an essay that anticipates many of my own ideas." In the prologue to the English translation of this monograph, Kuhn explains his story with Fleck and how a footnote in another book aroused the interest of reading a book with a title so suggestive for his own research interests. Kuhn was particularly stimulated by the difficulties of transmission of ideas between collectives and the possibilities and limitations of participation in different communities. Theories of collectives and styles of thought made crucial contributions to an understanding of how society restricts the genesis and development of a scientific fact. Many comparisons have been made between Fleck and Kuhn. The fundamental difference between these authors is that Kuhn focuses on the foundations of the science system of ideas and the theoretical framework that governs the scientific community. The paradigm defines a regular and stable structure in order to crystallize a determined theoretical structure governed by fixed principles in periods of normal science. New results can only cause a revolution when there is a disturbance in the established order. For Fleck, science is associated with knowledge and practical experience. A style of thought is alive, adapts and evolves to constant change.

With great importance in the School of Edinburgh, Fleck currently attracts increasing interest from researchers who focus their work in laboratory and discursive practices (Lowy, 1994). The reception of Fleck and his influence on SSST, as underlined by Nunes (2008), ranges from the epistemographic readings of Dear and praxiographic readings of Mol, social studies of biomedicine, and the issue of coexistence and articulation of incommensurable styles and collectives to "thinking with eyes and hands" (Latour, 1988), the inscriptions and the materiality of science (Latour and Woolgar, 1979), the biomedical platforms, the enactment of biomedical entities and their ontologies, boundary concepts and objects (Star, 1989), and the elaboration of the concept of style in philosophy and history of science and the question of the disunity of science (Galison and Stump, 1996).

For example, Bruno Latour, one of the instigators of Actor-Network-Theory (ANT), presents Fleck as the founder of the sociology of science (Latour, 2005). The conceptual framework proposed by Actor-Network-Theory, which benefits from the ideas of Fleck, appears to understand other dimensions of knowledge transfer. Several authors think that ANT is an appropriate approach to analyze 'black-boxing' in the innovation process (eg, McMaster, Vidgen and Wastell, 1997; Oliveira, 2008; Pinto *et al.*, 2011). The idea of transfer easily connects with the central notion of ANT, translation, which is the process in which actors constantly engage to transfer their languages, problems, identities and interests to others. "*Translating is transferring*": transferring interests, purposes, devices, applications. The transfer allows the consideration of a set of practices that produce change (Corcuff, 2001). The notion of network points to stabilization among different types of actors, individuals, groups or objects in ANT. Translation is the central mechanism that creates the actor-network, which defines the group's network of relationships and where the actor and the network are mutually constitutive. This is a central process in the construction and deconstruction of reality. Latour proposes that actors are followed in the process of translation, achieved through different activities, competing strategies, trials of strength, mobilization and recruitment, preparation of commitment devices and obligatory passage

points to consolidate alliances and bring out spokespersons. The network is the result of a relatively stable balance of power in the translation process. Actors, people, and objects are not fixed and only achieve meaning through relationships with other actors. It is the network that allows players to increase power and influence. At the beginning of translation the worlds of the university and the firm are separate without communication; in the end there is a discourse about shared objectives and common activities (Colyvas and Powell, 2006; Berman, 2008).

The comparative epistemology of Fleck offers a unique set of tools to look at the production and circulation of knowledge in contemporary societies, allowing the construction of a geography of intellectual fields, describing not only the people and places but also the change happening (Rochel of Camargo, 2002). The approach to science and Fleck's philosophical concepts are rooted in practical experience as a medical bacteriologist. The interest in Fleck also lies in its ability to study various types of communities and their interactions with knowledge. The fact that Fleck comes from the Health sector makes it particularly attractive for application in this field of science, in particular the use of the concepts of style of thought, in order to understand the community, its connection to practice and instruments used. By underlining the differences between styles of different groups, his ideas reveal the centrality of 'marginal individuals' and may contribute to an explanation of relevant processes of knowledge transfer between universities and firms.

3.2. Main Contributions from Fleck's Monograph

In his monograph, Fleck describes the evolution of the concept of syphilis, stressing that science must be seen as a historically bounded activity by the existence of different collectives. Fleck shows how a disease can be seen as a social construction and how physicians find it impossible to describe an infection, an event of great complexity involving the interaction of at least two complex systems, parasite and host, by a simple causality. This type of causality is only meaningful when framed by a common style of thought. The style of thought not only determines how the object is observed but highlights certain elements while neglecting others. The scientific facts have a genesis and development and are the result of scientific activity in the context of specific thinking frameworks. The relevance of social and cultural dynamics originates the need for a comparative historical epistemology. The present and past knowledge is the starting point for the genesis and development of new knowledge. The distinction between truth and error can only make sense in the context of styles of thought and certain collective thinking. There are continuities between common sense, scientific thinking and their languages that cannot be neglected, such as the heuristic nature of proto-ideas. The study of science should be understood in a relativistic way taking into account social and axiological assumptions.

The construction of knowledge should not only be considered a bilateral relationship; rather, the subject should also still consider the state of latent knowledge in the collective as a way to connect object and subject. A quote from the Descriptive Analysis of the English translation of Fleck's monograph, a summary of an unpublished work in 1961 "Towards a Free and More Human Science", refers that "[b]etween the subject and the object there exists a third thing, the community. It is creative like the subject, refractory like the object, and dangerous like an elemental power." Cognition is thus a function of these three components: the subject, the object and the collective thinking in which the subject acts.

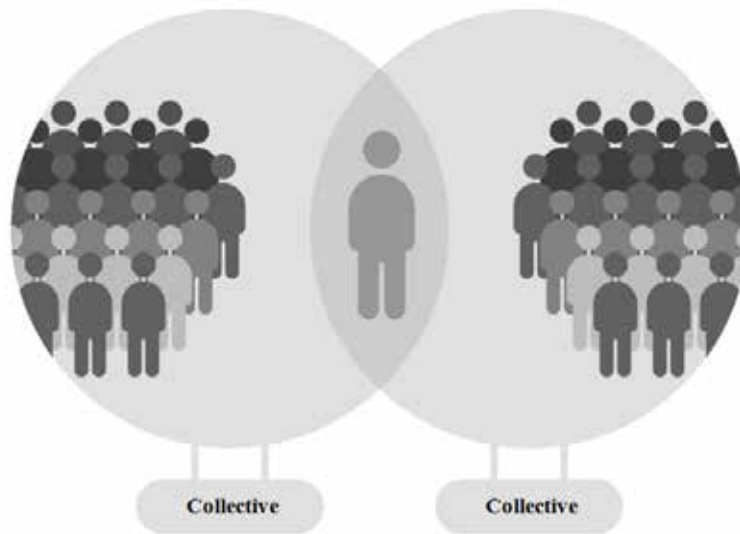
Fleck (1935|1986a) states that each style of thought characterizes a certain collective. The style of thought is a collective function that fits the historical development of a field of thought and leads to a specific stock of knowledge and cultural characteristics. The style of a group is the result of the theoretical and practical education of a particular individual, the transfers between teachers and students, and the relationships with the community.

Importantly, it is not an optional process but rather an imposition that happens during the process of socialization (Rochel de Camargo, 2002). Individuals with the same references belong to the same collective of thought. Fleck interconnects the relationship between observation, theory and construction of scientific fact. The scientific fact is understood within the style of thought, linked to the concepts of observation and experience, giving diversity to collectives of thought. Fleck argues that there is a connection between styles and relevant concepts existing at a particular time, so there is a constraint on the historical development of thought. The different styles of thought can coexist but are restrictions to the understanding of each new scientific discovery. Fleck (1936|1986b) notes that the technical terms of a collective of thought not only express the meaning assigned to them by the members but also assume a symbolic, almost “sacred” connotation for practitioners, unreachable for the uninitiated, that transmits a specific power. A collective of thought can thus be understood as a community of people exchanging ideas and maintaining an intellectual interaction within the same style of thought. In each collective there is an esoteric circle, experts who produce knowledge, and an exoteric circle, educated amateurs, where Fleck sometimes includes the general public. There is tension between the two circles, as members of the esoteric circle tend to repel non-members (Rochel de Camargo, 2002). However, advances in science are often a result of contacts between the circles. Acceptance into the group occurs after a learning period in which power and authority play a relevant role. In this process, the increased ability to recognize certain phenomena accompanies a reduction in the ability to recognize and use certain other, technical capabilities (Lowy, 1994).

There is a limited ability to communicate between groups, but there are some styles that are closer to each other than others, which facilitate communication between collectives, e.g., between physicians and biologists or between economists and managers. Therefore, varieties of styles and varieties of collectives exist that vary in degrees of closeness with each other. A particular style of thought determines the perception and creation of tools and techniques, as well as the interpretation of results. The determination of the phenomena incorporating a common classification depends on the beliefs and practices in each historic period. Communication between collectives depends on the circulation of facts and concepts. The facts do not exist, *per se*; they only make sense as they adapt to style. Events produced by a particular group are assimilated by other collectives through translation processes to their own styles. Translation is always damaging, modifying facts and ignoring and emphasizing certain aspects in order to adapt to the style of the receiver. The relationship between collectives is carried out by ‘marginal individuals’ who belong to more than one collective and move at the intersections between different groups, favouring the creation of new ways of thinking, and increasing the generation of proto-ideas, the genesis of inventions (Figure 1).

Many scientific facts are born from these initial ideas. This complex process of interaction between collectives leads to deterioration of the systems view; the change in styles of thought opens up new possibilities for the creation of new facts. In Fleck’s framework, there are two phases in the development of the ideas: the first, classicism, in which all the facts agree and adapt to the existing theory, and the second, reinterpretation, where theory becomes increasingly inappropriate and facts lack reinterpretation in light of new theories. In this process, there are two types of observation: the confused observation, an inaccurate look at the phenomenon, and the formative and direct observation, requiring scientific training and constituting the basis of styles of thought.

Figure 1. The 'Marginal Individual' between collectives of thought



Source: Pinto (2012)

This short insight into the ideas through which Ludwik Fleck emphasized the importance of combining theory and practice reveal the fallacies that occur when these elements in science are lacking (Pfuetzenreiter, 2003). The “*mythology*” of Fleck was challenged by Hedfors (2008, 2007, 2006) and answered by Amsterdamka *et al.* (2008). The subject of the debate was that this first author indicated that there was no reason for so much attention to the ideas of Fleck. The argument is based on the assumption that their epistemological ideas were not ignored but rejected by their peers. The aim of Fleck’s arguments was, according to Eva Hedfors, to legitimize his questionable scientific practices. The author also raised questions about the ethical dimension of Fleck’s research, suggesting that he was involved in different criminal experiments during his imprisonment in Nazi concentration camps in World War II. Despite this controversy, Fleck is an author of great importance; he is a pioneer in the way he formulated debates with depth that remain central to SSST, implicitly arguing that scientific knowledge is a result of a collective process of construction, reproduction, socialization and learning.

4. SYNTHETIC PRESENTATION OF THE CASE STUDY: KNOWLEDGE TRANSFER IN THE ALGARVE

The Algarve is certainly not known nationally and internationally for its innovative capacity or its scientific and technological profile (Pinto, 2009). It is a tourism destination that has benefited much in terms of economic development from its particularly productive specialization transforming from a region considered poor on the European scene to one of the most developed in national standards (Guerreiro, 2008). For the European structural funds allocation in the period of 2007-2013, the region abandoned the group of convergence regions; and, for 2014-2020, it will maintain this status, now designated as a ‘region in transition’.

The concentration of resources and investments in tourism caused some lack of attention to other activities; but, from the standpoint of strategy, regional actors have tried to engage in efforts to diversify the regional economy (Barreira, 2009). Note, for example, the attention given by the Regional Strategy 2007-13 (CCDR Algarve, 2006) or the Regional Innovation

Plan (UALg, 2007a), where it is assumed that the challenge is to transform the Algarve into a knowledge-based region. This path is not easy because several obstacles need to be overcome for the consolidation of regional innovation dynamics (Pinto and Guerreiro, 2010).

In this vision of a more innovative region, the University of Algarve is a central actor (Pinto *et al.*, 2012). UAlg is the only public higher education institution in the region. Despite its short existence, created in 1979, the University has an interesting regional dynamic in assuming a role not only as a centre of qualification of human capital but also as the most important research institution in this region. An evaluation of UAlg performance in R&D and cooperation in services between 2000 and 2006 (Cruz, 2006) highlighted that the expertise is concentrated in the fields of natural sciences, particularly in marine sciences, an area in which the University presents a significant critical mass in terms of the existence of excellence centres, training of human resources and market linkages. The merit in this field was one of the main drivers for UAlg demonstrating a good capacity of knowledge production measured by international scientific publications (Sousa Lobo, 2005). In parallel, the coexistence in the same institution of the university and polytechnic subsystems have also been identified as important for the strong relationship with the region itself (UALg, 2007b). This regional “monopoly” assured to UAlg a relationship with the firms that tried to invest in knowledge and innovation in recent years.

Since 2003, the UAlg has structured a knowledge transfer office, the Regional Centre for Innovation of the Algarve (CRIA). It was a device for participating in various networks underpinning the national level, e.g., the offices for industrial property promotion (GAPI) and the technology transfer and knowledge offices (OTIC), with the aim of consolidating relations between the university and industry, while supporting and promoting the use of mechanisms for protecting intellectual property. The intervention of this office was recognized by relevant regional and national partners, with their participation in several networks and the preparation of strategic studies on the topic of innovation. The low density of innovation actors in this region gave this KTO excessive relevance, broader than in comparable cases of academic intermediation bodies (Pinto, 2012). It has assumed a central role in the connectivity of the entire innovation system (CCDR, 2006). At the European level, the relevance of this office was also recognized with awards from the European Commission and ERIK Network, both in 2007, and the participation in multiple projects in European cooperation programs in areas related to innovation and knowledge transfer.

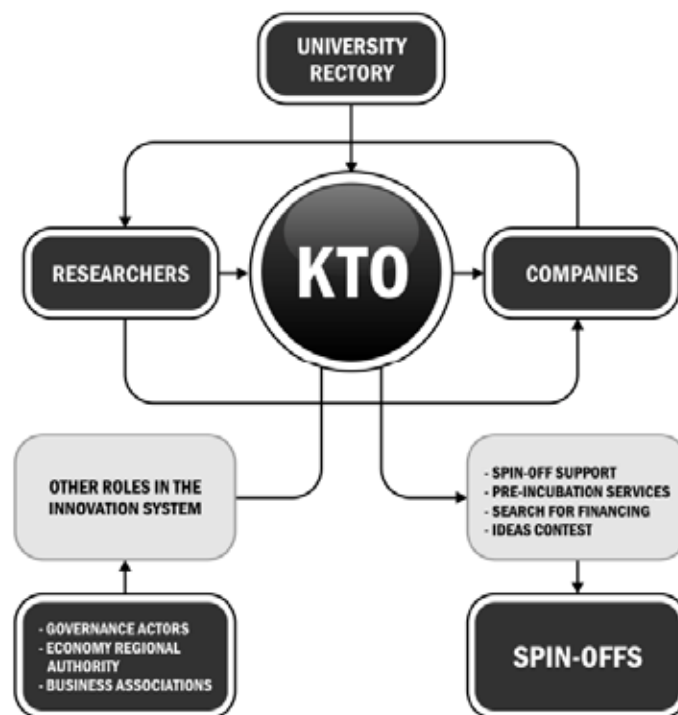
The dependence on structuring partnerships in the context of INTERREG 2007-13 programmes was a distinguishing factor from other national offices, including even the leadership of a project focused on knowledge transfer in the maritime clusters. In January 2010, with the changes introduced by the creation of new Statutes of the University of Algarve (approved by *Despacho Normativo n.º 65/2008, 11 de Dezembro*, published in *Diário da República, 2.ª série, n.º 246, 22 de Dezembro de 2008*) to respond to the new legal framework of higher education institutions, UAlg absorbed the KTO into its functional structure. CRIA was then established as a formal division of the University, the Division of Entrepreneurship and Technology Transfer, inside the UAIC - Support Unit of the Scientific Research and Postgraduate Training (Regulation n.º 57/2010).

The analysis of the knowledge transfer activities for linking the university to the firm, presented in detail in Pinto (2012), facilitate the understanding of the four main channels used by this KTO:

- i. the implementation of initiatives to increase the levels of entrepreneurship inside the academia;
- ii. direct support to business consolidation based on scientific knowledge;
- iii. the support for the establishment of partnerships with firms seeking university; and
- iv. the support to researchers seeking solutions to transfer R&D results to firms.

The focus of the KTO connects with academic entrepreneurship, where the office has collected relevant expertise particularly linked to the sciences and technologies of the Sea, creating a diversity of ‘boundary objects’. These artefacts reside across borders of different ‘social worlds’, allowing a more effective communication among groups with differing perspectives (Star, 1989) as the support to spin-offs, the creation of pre-incubation services, seeking funding and competition of ideas. The office, hierarchically dependent on the Rectory, seeks to connect university research with companies; however, the reverse also occurs, as companies try to meet the demand for knowledge from regional firms, assuming a role of connection in the regional innovation system, in particular for the creation of advanced enterprises. Figure 2 outlines the workflows, the role of the actor in the innovation system, and the relative attention to certain activities. The comparison between this and other innovation intermediation actors can be found in Pinto (2012).

Figure 2. The organization of knowledge transfer in the KTO



Source: Pinto (2012)

5. TENSION IN UNIVERSITY-FIRM RELATIONS: PERCEPTIONS FROM BOUNDARY AREAS

5.1. Methodological Notes

The literature review allows, at this point, the emphasis of two central aspects: i) the transfer of knowledge between universities and companies is a central process in the dynamics of innovation, and ii) the contact between collectives is made more effective by ‘marginal individuals’, which facilitates the translation process.

The innovative profile of the Algarve, synthetically presented in the previous section, showed contrasts between the collectives of thought of the thirty-year-old university and the regional firms based on tourism-related activities and often characterized by the low intensity of scientific knowledge and limited value added. Thus, this case can be considered a ‘strategic research site’ (Merton, 1987). The ‘strategic research materials’ are places,

objects, or events which present the phenomena to be explained or interpreted with such an advantage and in an affordable way that allows the research to understand problems previously inaccessible. It is assumed that the characteristics of the regional structure of the Algarve provide clear evidence of the tensions between academia and enterprise. This section frames a more applied empirical study, seeking to understand the problems that emanate directly from reality and proposing concrete action (Fernández-Esquinas, 2006). The empirical study seeks to highlight the importance of approaches grounded in SSST to understand the transfer of knowledge. The analysis discusses two critical issues. The first is whether the differences between entrepreneurs and researchers shape different collectives of thought in Fleck's perspective. The second question refers to the findings of the importance of 'marginal individuals'. For this, the section presents the vision of these groups about the knowledge transfer offices. To analyze these issues there were different moments for gathering information, based on formal attempts of the University of Algarve, to create a stable platform between both groups to increase the effectiveness of transfer.

The first moment of data collection was through participant observation in Faro in June 2007 at a workshop on financing opportunities for small and medium enterprises in R&D, which sought the creation of consortium research projects. This event brought together about one hundred and twenty people, of whom about two-thirds came from the business world. The speakers and entrepreneurs reported their experience. They were very argumentative of the reality of European projects in consortium. Firstly, this was because projects were not based on strong relationships of trust and sharing, which affected the implemented activities. Secondly, it was because the large time for approval, payments and implementation of activities was not adapted to business reality. The approval of the project took so long that there were often cases of approvals which no longer held interest to the current activities of the company. They also criticized the relatively minor presence of the academic research participants in the event, as they seemed less concerned about collaborations of this kind. The information collected was complemented with interviews of eight participating companies seeking to understand their main objectives, the scientific capacity and topics of interest, the R&D work, previous cooperation with the University, benefits and results they expected to achieve.

In December 2007, the University organized the INOVA 2007 - Exhibition and Conference on Innovation and Technology Transfer in the Algarve. This event tried to address issues related to creating a more favourable environment for innovation. On the first day a number of transversal issues to the theme of innovation were discussed, such as the consolidation of a regional innovation system in the Algarve. On the second day the catalogue of skills and services of laboratories and R&D centres of the University was presented, a tool that tried to expose the research potential, favouring the transfer of knowledge. A number of university-company meetings were held during the event, where the main objective was to create bridges between these two worlds facilitating the promotion of collaborative R&D. Parallel sessions were related to key-areas: agro-food technologies and tourism, alternative energy, sea and golf. These meetings between researchers, entrepreneurs, and elements of regional institutions had about one hundred and thirty participants. The result of this initiative was a group of ideas, which were developed and later gave rise to projects submitted for funding opportunities, in particular in the framework of the Regional Operational Programme Algarve 21. Under each topic there was a University staff member that framed the research work in the area followed by a participant from the business world who presented a particular view. The special session of agro-food technologies was the second moment of collecting information through observation. The second event involved a moment of an extended exchange of ideas and multilateral meetings, which sought to strengthen personal contacts

and informal knowledge creation to facilitate an understanding of the convergent interests of the participants.

Finally, one final moment for data collection was a work session on the connection between the university and companies in the region, inserted in the meetings of the Institute for Competitiveness Support to Small and Medium Enterprises and Innovation (IAPMEI), held in Faro in December 2009. This event brought together twenty-seven participants, nineteen companies and even more facilitators (researchers and technicians from the University, as well as representatives of relevant agencies in the region). The organizers prepared a report with the main results (IAPMEI, 2009). There were three working groups, one of which focused explicitly on “Strategies for Leveraging Technology and Knowledge Transfer for Companies”. A focus group methodology was employed with two moderators, one of whom was the author, essentially looking to confirm the problems of the university-firm identified above, highlighting critical factors of these problems and making proposals to overcome them. The results were eminently confirmatory of previous collection moments.

5.2. Dimensions of Tension between Collectives of Thought

The analysis shows the misaligned positions and allows the highlighting of central topics to the relationship of the business world and academia. Based on the notes taken at these meetings, it was possible to systematize the positions on some issues for both groups. The empirical analysis carried out allows the emphasizing of four main dimensions of tension between entrepreneurs and researchers with contrasting styles of thought.

5.2.1. University-Firm Relations

There is a general mistrust between the two collectives. Entrepreneurs think that researchers approach companies only when they do not have resources to fund their research. In the current economic context, the constantly repeated statement is that the approach of the universities to the business world is due only to the precarious financial situation of public scientific research in Portugal, in particular with universities, something that seems to be a small part of what actually occurs. On the contrary, however, researchers find that when their research arouses interest in business, it is because its value is clearly superior to what the company is offering to pay to fund R&D. Often, speculatively, their activities become more expensive, leading to shrinkage of the initial private interest.

It was noted that the university often promotes research that the firms or market do not demand. There is a gap between what researchers want to investigate and what companies actually need. According to the general opinion of the participants in the focus group, this gap between what is sought by companies and the provision of advanced services was usually related to a lower sophistication of companies, which originated the lack of interest by the university in conducting research to the business fabric. On the other hand, many researchers believe that focusing research on the needs of companies does not allow them to engage in scientific production of an excellence level required on international terms, the main criteria of their current assessment exercises. Universities also have few channels to detect what firms need. An improvement of enterprises' capacities can come through collaborative projects with the university, in particular applied research that may favour the creation and definition of strategic innovation. The university should strengthen itself organizationally for a professionalized and consistent approach to knowledge transfer.

However, both groups consider it important to boost university-firm relations, as there are very positive aspects that can result from this. Companies referred mainly to their ability to access the expertise, infrastructure and equipment to which they would otherwise not have access. This allows them to participate in interesting projects for their productive activity, enabling them to have an image in the market of innovation and differentiating them from

their competitors, obtaining competitive advantages. The aspect most highlighted by the researchers was that collaboration with companies helps to approach the empirical reality, giving them a greater capacity to understand basic science, discovering clues and directions for research, and enabling the entry of additional financial resources which can be directed towards new research.

Even with the accumulated knowledge and the geographical proximity of the university with companies, a limited threshold of protocols and partnerships between research units and companies continues to exist. The criticisms from researchers and entrepreneurs supported by intermediary organizations, such as KTOs, are weaker. Usually, those who obtain support from these entities are members of overlapping areas from each of the groups, with interest in working together. This frequently occurs in repeated cooperation, and these experiences can gradually generate trust and social capital throughout the collectives of the organizations. Both researchers and firms showed appreciation of the existence of an intermediate body. Value is placed on the emergence of a new actor focused not on specific objectives for any of the collectives but on targets linked with the success of the interconnection between the two groups.

5.2.2. The Role of Science

There are doubts about the relationship between the 'academic science' and the activities of the 'academic enterprise'. Starting with the academic world, there is no consensus about the definition and role of science in society. Professors have difficulty realizing what is required from them in adapting education, particularly the first cycle of Bologna, with the basic research activities that they must perform. Professors, when involved in projects, are often burdened with administrative and financial issues that affect time availability, eliminating the possibility of knowledge being applied in tasks that were more important. The university is fractured. On the one hand, some argue that the importance of research and 'academic science' is the main mission of the university and the basis and reference for all the knowledge either applied or not applied. On the other hand, many argue that science has to approach the problems of empirical reality by engaging with companies and that the study of "*transcendent*" phenomena should not monopolize the time of researchers.

The first group sees applied research as a distortion of the role of 'academic science' in which disinterest is necessary, while the latter thinks that science only moves forward with its application and only makes sense when generating economic and social returns. For the latter, the test in applied fields allows access to more robust responses, confrontation of theoretical models with empirical reality, finding errors in the theories formulated or new problems that require new solutions. These extreme views of science are in agreement with the proposal of Lam (2010). In the view of entrepreneurs, the role of science is "*to advance knowledge*." However, there are major questions about the behaviour of scientists. Entrepreneurs do not understand the reason why researchers have so much freedom at work. Many entrepreneurs pointed out that this flexibility generated no need to deliver results. In parallel, even those who were presenting results produced it in a form that was not understandable to laymen, usually as scientific articles. Entrepreneurs do not understand why researchers travel so much, why they go to conferences, seminars and workshops, why they give lessons at other universities and why they remain different lengths of time in R&D centres abroad. The 'academic science' is viewed with great suspicion, because it often "serves no purpose". They consider that research should be more focused on the problems that exist in firms' day-to-day life and the search to overcome these issues. Some entrepreneurs consider themselves the component that creates value in society, revealing a suspicion for members of the academy who are characterized with passive behaviour.

5.2.3. Profit, Times and Deadlines

Profit from research activities remains difficult to see for some members in the academy. Professors that engage in entrepreneurial projects, applied R&D and consulting remain easy targets of criticism from their peers. This criticism regards the provision of services, in which the analysis is oriented to the conclusions that the contracting entity wants to reach. Professors allocated to research can be accused of forgetting their teaching responsibilities and focusing on their “private” business. This was previously enhanced by the absence of reference frames in Portugal, something that begins to be limited with the creation of internal regulations for external services, IPR frameworks, and guidelines for the creation of spin-offs and start-ups.

Entrepreneurs have a focus on profit; however, it is too often focused on a short-term profit, limiting horizons and the dynamics of creating added value. A businesswoman quoted Milton Friedman [“The Social Responsibility of Business is to Increase its Profits” by Milton Friedman in *The New York Times Magazine*, September 13, 1970], stressing that corporate social responsibility is only about making profit, paying wages to workers and fulfilling commitments to suppliers. She was forgetting the role of the company to provide qualified employment and a sustainable economic growth at an aggregate level.

Another problem mentioned by entrepreneurs about researchers is that the response time is often considered too long. In parallel, researchers suggest that entrepreneurs who have an immediate interest, and who are much less concerned with the overall validation of the results of research, are focused on understanding and gradually permitting the building of economic advantages to be appropriated by the company. According to the information from the firms, in addition to the researchers’ difficulties in meeting deadlines, the functioning of the public university presents itself with a very high amount of negative bureaucracy, which slows and threatens all collaborative processes.

5.2.4. Human Resources Training

The essential role of the university remains the training of human resources. This is a central channel for transferring knowledge because the inclusion of qualified personnel improves not only the competitiveness of the company but also its ‘absorption capacity’ of new knowledge. Furthermore, in the opinion of the participants, the fact that a company employs former students creates a proximity that induces additional contacts with the university. Many collaborative relationships are based on these previous, informal contacts.

However, participants on the business side stressed that the university does not train students for specific regional companies limiting their preparation for working life. The lack of students for the business fabric of the region remains high. The insertion of students is limited, despite being an essential mechanism for the increased absorption capacity in companies, restricting the existence of qualified people who can interact with advanced knowledge.

The university as a source of recruitment continues to fail, missing the connection paths with business. The creation of mechanisms to support student recruitment and entry into employment is important, emphasizing the relevance of professional internships, extinguished in practice with the implementation of the Bologna process. The link between employability and knowledge transfer mechanisms should be a target for additional attention.

5.2.5. Proposals for the Effectiveness of Knowledge Transfer

Overcoming these dimensions of tension requires some action such as the examples that the group suggested. University-firm relations need a more effective dissemination of the knowledge supply and existing technology and a deeper understanding of business needs.

Researchers should be encouraged to establish agreements and partnerships between the university, research centres and skills and the local business.

Within the university, it is crucial to set up offices or cells within each school and/or faculty to assess the knowledge developed and related business demand. This can be very useful for identifying companies' skills to stimulate the sophistication of their strategies, in particular innovative activities, thereby enhancing competitiveness. Regularly translating scientific research developed and published in specialty magazines for non-expert audiences is fundamental in order for knowledge to be detected by the entrepreneurial system and seized by citizens in general. The successful communication of science can have positive impacts on the absorption capacity of individuals and firms.

To promote the university as a source of recruitment, an emphasis should be placed on a technical component, which has been more sought by companies with greater connection to practice. Another aspect is to focus on a greater involvement of firms in education pathways, participation in training events, internships for students and re-structuring of curricula.

Unanimously, there is a required action for organizational strengthening within the university regarding the transfer of knowledge. It is very important to develop regulations and standards for creating relationships with start-ups and academic spin-offs, for the adaptation to the teaching service of these activities, for the new role of the university and for the protection, management and licensing of IPRs. In parallel, the autonomy and professionalism of knowledge transfer services must be guaranteed. According to the vision of the participants and with the support of the university, particularly in the financial aspect, the KTOs should be free of project perspectives, stabilizing and qualifying their staff to ensure higher decisional autonomy. Finally, the office should institutionalize its activities. This issue conditions all the success of the new role of the university in view of the participants.

6. CONCLUDING REMARKS

Knowledge transfer has had the attention of decision makers in stimulating regional development on different scales of intervention, from the regional operational programs to the European Policy. This article underlined that the transfer of knowledge deserves a closer look from other approaches, since it has been a theme highly explored by references imported from Economics or Management to Regional Science. The contributions from the social studies of S&T can be crucial to understand what goes on inside these 'black boxes' that we have come to see just like indicators and, increasingly, as goals: a created new product, a new technology-based company, a licensed patent, and a research project in collaboration. It is crucial to understand what happens until the transfer goes ahead. It is this attempt to realize the transfer process, the role of the actors and the structure of the networks that may be enriched by the contributions of the SSST to create more satisfactory knowledge about what conditions enhance a successful, university-firm relationship.

The discussion highlighted the contributions of Fleck in social studies of science and technology. His contributions allowed the understanding of the current context of the scientific world where the production, dissemination and transfer of knowledge encompasses a broad range of actors. These actors belong to distinct collectives of thought characterized by specific styles, as proved to be the case for individuals from academia and the business world. The transfer of knowledge requires a translation between these collectives that is neither easy nor free from lapses. The empirical analysis of the Algarve emphasizes the importance of 'marginal individuals' in the contact, migration and cross-fertilization of concepts between collectives of thought and reinforces the role that interface organizations assume as mediators in the process of knowledge transfer. Tensions illustrated with the styles

of thought of the firm and the university tend to be overcome with the emergence of hybrid actors, 'marginal' in the designing of Fleck, who can talk with the various groups.

Knowledge transfer offices, as mediators that focus both collectives, must contain elements in their staff who can understand different styles of thought, specifically the university and the firm, in order to facilitate an effective translation. Members of staff of these intermediate bodies require increasingly new types of entrepreneurial skills and a mix of business people from the academy with a new type of researcher. These individuals need to maintain a quasi-firm activity based on highly competitive R&D and should be more concerned with the issues of transfer while being able to translate their own interests.

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REFERENCES

- Amsterdamska, O., Bonah, C., Borck, C., Fehr, J., Hagner, M., Klingberg, M., Löwy, I., Schlünder, M., Schmaltz, F., Schnelle, T., Tammen, A., Weindling P., Zittel, C. (2008). *Medical Science in the Light of a Flawed Study of the Holocaust: A Comment on Eva Hedfors' Paper on Ludwik Fleck*. *Social Studies of Science* 38/6, SAGE Publications, 937-944.
- Barreira, A.P. (2009). The Regional Profile of Algarve in Innovation, *Spatial and Organizational Dynamics Discussion Papers*, CIEO-Research Centre for Spatial and Organizational Dynamics, University of Algarve, 0: 58-75.
- Bercovitz, J. e Feldman, M. (2005). Entrepreneurial Universities and Technology Transfer: A Conceptual Framework for Understanding Knowledge-Based Economic Development. *Journal of Technology Transfer*, 31: 175-188.
- Bergman, E. (2010). Knowledge links between European universities and firms: A review. *Papers in Regional Science*, 89(2): 311-334.
- Berman, E.P. (2008). Why Did Universities Start Patenting? Institution-Building and the Road to the Bayh-Dole Act. *Social Studies of Science*, 38(6): 835-871.
- Bok, D. (2003). *Universities in the Marketplace – The commercialization of Higher Education*. EUA, Princeton University Press.
- Bozeman, B. (2000). Technology transfer and public policy: a review of research and theory. *Research Policy*, 29(4-5): 627-655.
- Callon, M. (1999). Some Elements of a Sociology of Translation, in Biagioli, Mario (eds.) *The Science Studies Reader*. New York and London, Routledge, 67-83.
- CCDR Algarve (2006). *Estratégia de Desenvolvimento Regional 2007-13 Algarve*. Comissão de Coordenação de Desenvolvimento Regional, Faro.
- Colyvas, J. and Powell, W. (2006). Roads to Institutionalization: The Remaking of Boundaries between Public and Private Science. *Research in Organizational Behaviour*, 27: 305-353.

- Cooke, P. (1998). Introduction: Origins of the Concept In H-J. Braczyc, P. Cooke and M. Heideinrech (Ed.), *Regional Innovation Systems*. London: UCL Press, 2-27.
- Corcuff, P. (2001). *As Novas Sociologias*, 2ª edição, Sintra, Editora Vral.
- Cruz, A. R. (2006). *Redes de Investigação: A Relação da Universidade do Algarve com Organismos Nacionais, Europeus e Internacionais*, Universidade do Algarve, Faro.
- Debackere, K. and Veugelers, R. (2005). The role of academic transfer organizations in improving industry science links. *Research Policy*, 34: 321-342.
- D'Este, P. and Patel, P. (2007). University-industry linkages in the UK: What are the factors underlying the variety of interactions with industry?, *Research Policy*, 36: 1295-1313.
- Estanque, E. and Nunes, J.A. (2003). Dilemas e desafios da Universidade: recomposição social e expectativas dos estudantes na Universidade de Coimbra. *Revista Crítica de Ciências Sociais*, 66: 5-44.
- Etzkowitz, H. and Leydesdorff, L. (1997). *Universities and the Global Knowledge Economy – A Triple Helix of University-Industry-Government Relations*. Continuum, Londres.
- Fernández-Esquinas, M. (2006). La sociologia aplicada. *Revista Española de Investigaciones Sociológicas*, 115: 11-40.
- Fleck, L. (1979[1935]). *Genesis and Development of a Scientific Fact*. Chicago University Press, Chicago.
- Fleck, L. (1986b[1936]). The Problem of Epistemology. In Cohen, R. S. and Schnelle, T. (eds.). *Cognition and Fact*. Dordrecht, Reitel Publishing Company, 79-112.
- Galison, P. and Stump, D. J. (1996). *The Disunity of Science: Boundaries, Contexts, and Power*. Stanford University Press, Stanford.
- Gibbons, M., Limoges, C., Nowotny, H., Schwartzman, S., Scott, P., and Trow, M. (1994). *The New Production of Knowledge: The Dynamics of Science and Research in Contemporary Societies*. Sage, Londres.
- Guerreiro, J. (2008). *Caracterização da Estrutura Económica do Algarve*. NERA, Loulé.
- Guston, D. H. (1999). Stabilizing the Boundary Between US Politics and Science: The Rôle of the Office of Technology Transfer as a Boundary Organization. *Social Studies of Science*, 29(1): 87-111.
- Hedfors, E. (2006). *Reading Fleck: Questions on Philosophy and Science*. PhD Dissertation, KTH, Stockholm.
- Hedfors, E. (2007). *Fleck in Context, Perspectives on Sciences*, 15, number 1, MIT.
- Hedfors, E. (2008). Medical Science in the Light of Holocaust: Departing from a Postwar Paper by Ludwik Fleck. *Social Studies of Science*, 38(2): 259–83.
- IAPMEI (2009). *1ª Sessão de Trabalho entre a Universidade do Algarve e as Empresas da Região*, Relatório, on the Web site: www.cria.pt. Instituto de Apoio às Pequenas e Médias Empresas e à Inovação, Faro.
- Kuhn, T. S. (1970 [1962]). *The Structure of Scientific Revolutions*. The University of Chicago Press, Chicago.
- Lam, A. (2010). From 'Ivory Tower Traditionalists' to 'entrepreneurial Scientists'? Academic Scientists in Fuzzy University-Industry Boundaries. *Social Studies of Science*. 40(2): 307-340.
- Larsen, M. T. (2011). The implications of academic enterprise for public science: An overview of the empirical evidence. *Research Policy*, 40(1): 6-19.

- Latour, B. (2005). *Reassembling the Social: An Introduction to Actor-Network-Theory*. Oxford University Press, New York.
- Latour, B. (1986). Visualization and Cognition: Thinking with Eyes and Hands. *Knowledge and Society*, 6: 1-40.
- Latour, B. and Woolgar, S. (1979). *Laboratory Life: the Social Construction of Scientific Facts*. Sage, Los Angeles, EUA.
- Löwy, I. (1994). Ludwik Fleck e a Presente História das Ciências. *Manguinhos*, 1(1): 7-18.
- McMaster, T., Vidgen, R. T. and Wastell, D. G. (1997). Technology Transfer: Diffusion or Translation?, In McMaster, T., *et al.* (eds.). *Facilitating Technology Transfer through Partnership*, Chapman & Hall, London.
- Merton, R. K. (1987). Three Fragments from a Sociologist's Notebook: Establishing the Phenomenon, Specified Ignorance and Strategic Research Materials. *Annual Review of Sociology*, 13: 1-28.
- Molas-Gallart, J., Salter, A., Patel, P., Scott, A. and Duran, X. (2002). *Measuring Third Stream Activities: Final Report to the Russell Group of Universities*. Science and Technology Policy Research Unit, University of Sussex.
- Nelson, R. (2004). The market economy, and the scientific commons. *Research Policy*, 33: 455-471.
- Nunes, J. A. (2007). Discurso(s) sobre as Ciência(s) e as Tecnologia(s). Apresentação no âmbito do Programa de Doutoramento em Governança, Conhecimento e Inovação. Centro de Estudos Sociais, Faculdade de Economia da Universidade de Coimbra.
- Oliveira, L. (2008). *Sociologia da Inovação – A Construção Social das Técnicas e dos Mercados*. Oeiras, Celta Editora.
- Packer, K. and Webster, A. (1996). Patenting Culture in Science: Reinventing the Scientific Wheel of Credibility. *Science Technology Human Values*, 21: 427-453.
- Pavitt, K. (2001). Public Policies to Support Basic Research: What Can the Rest of the World Learn from US Theory and Practice? (And What They Should Not Learn). *Industrial and Corporate Change*, 10(3): 761-779.
- Pfuetzenreiter, M.R. (2003). *Epistemologia de Ludwik Fleck como Referencial para a Pesquisa nas Ciências Aplicadas*, Episteme, Porto Alegre, 111-135.
- Pinto, H. (2009). Challenges for Innovation in the Algarve: contributions to understand the regional innovation system, Spatial and Organizational Dynamics Discussion 2009-00. CIEO-Research Centre for Spatial and Organizational Dynamics, University of Algarve.
- Pinto, H. (2012) Transferência do conhecimento em Portugal. Mudança e institucionalização das relações universidade-empresa. Tese de doutoramento, Faculdade de Economia da Universidade de Coimbra.
- Pinto, H. and Guerreiro, J. (2010). Innovation regional planning and latent dimensions: the case of the Algarve region. *The Annals of Regional Science*, 44(2): 315-329.
- Pinto, H., Cruz, A. R. and Gonçalves, A. (2011). Hard Working Ant: An Eco-Tourism Spin-Off Creation Tale. *Spatial and Organizational Dynamics Discussion Papers*. CIEO-Research Centre for Spatial and Organizational Dynamics, University of Algarve, 8: 49-68.
- Pinto, H, Guerreiro, J. and Uyarra, E. (2012). Diversidades de Sistemas de Inovação e Implicações nas Políticas Regionais: Comparação das Regiões do Algarve e da Andaluzia. *Revista Portuguesa de Estudos Regionais*, 29: 3-14.

- Rochel de Camargo, K. J. (2002). The Thought Style of Physicians: Strategies for Keeping up with Medical Knowledge. *Social Studies of Science*, 32(5-6): 827-855.
- Santos, B. S. (2008). *A universidade no século XXI: Para uma universidade nova*. Coimbra, Edições Almedina.
- Schnelle, T. (1986). *Cognition and Fact*. Dordrecht, Reitel Publishing Company.
- Shapin, S. (2008). *The Scientific Life: A Moral History of a Late Modern Vocation*. The University of Chicago Press, Chicago and London.
- Siegel, D. S., Waldman, D., Link, A. (2003). Assessing the impact of organizational practices on the relative productivity of university technology transfer offices: an exploratory study. *Research Policy*, 32: 27-48.
- Sousa Lobo, L. (2005). Publicações Internacionais. Ranking das Universidades Portuguesas.
- Star, S. L. (1989). The structure of ill-structured solutions: boundary objects and heterogeneous distributed problem solving, In Gasser, L. and Huhns, M. (eds.). *Distributed artificial intelligence*, Pitman, London, II: 37-54.
- UAlg (2007a). Plano Regional de Inovação do Algarve. Universidade do Algarve, Faro.
- UAlg (2007b). Horizonte 2010, Princípios Estratégicos para a Universidade do Algarve. Universidade do Algarve, Faro.

ALIGNING TECHNOLOGY WITH BUSINESS: A CONTINUOUS EFFORT

ALINHANDO TECNOLOGIA COM NEGÓCIO: UM ESFORÇO CONTÍNUO

Sílvia Fernandes

ABSTRACT

The information systems and technologies (IS/IT) are a decisive platform in the response capacity of organizations to the new management imperatives through new solutions that permit improvement in their competitive position. As information management is a highly differentiated area, the present study compares several enterprises of different sectors, located (head office or branch) in the Algarve region, with the aim of systematising the main differentiating issues related with adoption, restructuring and implementation of information systems and supportive technologies. Every organization should define an accurate and timely plan which, in case of adopting and implementing information systems, has to analyse results within the same plan on a yearly basis of the system's activity, ensuring that it is always aligned with the business strategy. Given the potential of the powerful tools that guide customer-oriented understanding, greater attention is required to their performance on sustainable business dynamics.

Keywords: Technology, Performance, Alignment, Knowledge-base

RESUMO

Os sistemas e tecnologias de informação (SI/TI) são uma plataforma decisiva na capacidade de resposta das organizações aos novos imperativos de gestão através de novas soluções que permitam melhorar a sua posição competitiva. Como a gestão da informação é uma área altamente diferenciadora, o presente estudo compara várias empresas de diferentes setores, localizadas (sede ou filial) na região do Algarve, com o objetivo de sistematizar os principais aspetos diferenciadores relacionados com a adoção, reestruturação e implementação de sistemas de informação e tecnologias de suporte. As organizações devem definir um plano preciso e oportuno que, em caso de adoção e implementação de sistemas de informação, tem de analisar os resultados dentro desse plano, em base anual, da atividade do sistema sempre alinhada com a estratégia de negócio. Dado o potencial das poderosas ferramentas orientadas ao entendimento do cliente, maior atenção é necessária quanto à sua performance na dinâmica sustentável de negócios.

Palavras-chave: Tecnologia, Performance, Alinhamento, Base-de-conhecimento

JEL Classification: O33

1. INTRODUCTION

Modern drivers of change have led to new features for sustaining business competitiveness: virtual enterprises, creative design, interactivity, mobile platforms, etc. These responses require IT-based tools, the increase of information content and creative teams. Any enterprise that wants to optimise its success in the information society must have a basic awareness and a strategy for dealing with this new environment. With the shortening of the life cycle and time to market this has to evolve with a pace that approaches a need for its real time creation (Philipson, 2008). For example, the internet brings critical new functionalities to enterprises by real time business dynamics and relations. If they do not constantly improve the process of managing this, they would quickly become paralysed. Building custom software systems to accomplish it can become so complex that the software requires an 'army' of engineers and consultants to manage it. Small to medium businesses need a way to organise their data on a smaller scale and without the expense of hiring costly consultants or paying for maintenance contracts. The approach of building and managing a custom software solution is financially out of reach for small to medium sized companies. Therefore, companies are moving to web-based software as it can eliminate the need to purchase and manage computer servers, firewalls and software servers just to run the application. A broadband connection to the internet is recommended for sustaining a design in a very modular way, which allows for tremendous flexibility in building intranets that meet the needs of a particular activity. The applications built in a modular way can be combined to form an application suite which is best used as a company intranet. Modules can be mixed and matched to meet a particular need as they keep the intranet free from clutter because firms configure just the features they wish in their intranets.

Many firms are investing in the implementation of IT-based tools to enhance their service, interactivity and tracking. The present paper emphasises the business potential of ERP (Enterprise Resource Planning) systems together with new functionalities more oriented to link front-end management with the ERP system (back-end). These can include CRM (Customer Relationship Management) and CMS (Content Management) functions as an integrated approach to identifying, acquiring and retaining customers. Among several tools that firms apply on their websites and intranets are CRM and CMS. The first enables organizations to manage customer interactivity across multiple channels or business lines and maximize the value of every customer interaction. CRM is a strategy used to learn more about customers' needs and behaviours in order to develop stronger relationships with them. CRM features range from advanced applications, such as database-driven product customization tools, to simple ones, such as a line of contact information on a web page. Combined with CRM, the CMS features enable the building of powerful applications with a very high level of content organization, so that many competitive aspects including efficiency and flexibility are achieved. Company-wide content management is necessary to channel the flood of information and process it in a goal-oriented manner.

Company data can include billing data, project folders and files, web content, computer file servers for storing important documents and email programs for storing messages and contact lists. With the sheer volume of this data increasing exponentially, the need for every person in an organization to have some level of access to the data also increases. Juggling all of this electronic data and paper can lead to lost information, missed communication and a lack of good customer service. CRM can effectively provide better service, make call centres more efficient, cross sell products more effectively, help sales staff negotiate faster, simplify marketing and sales processes, increase customer revenues, and discover and retain customers. CMS contributes to enhance the potential of personalization that these features can entail as their focus is on content management, which combines technology and

business processes to effectively deliver large amounts of diverse information to different media (Forsyth, 2004). This kind of functionality has revolutionized front-end effective management and its integrative link with back-end business processes. This involves a holistic approach in order to match businesses to what partners and customers want by providing the dynamic creation, distribution and publishing of information.

2. PLAN THE OPPORTUNITY

For many entrepreneurs and managers, seeing an opportunity is the easy part. The real challenge lies in seizing it (Basadur, 2009). Those who have identified a gap in the market often stumble because they cannot scale their organization to meet booming customer demand before competitors encroach. The rapid growth required to seize an opportunity places enormous strains on a company's resources, organization and management. Basadur (2009), founder of the enterprise *Basadur Applied Creativity*, defends that a common mistake among both start-ups and established companies is to overcommit resources before a business plan has been nailed down.

This entrepreneur drives attention to the strengths of the individual's thinking style and to a problem solving system to create measurable and successful solutions. He believes that key ingredients of quality results must include the right people with the right knowledge, in a process using knowledgeable skills and tools. The keys are adaptability, constant re-invention and maintaining a proactive stance with an inspired and loyal workforce. Other creativity consultants, such as L. Weygman, an internationally experienced facilitator specialized in innovation and collaborative teams, says that in today's global economies, facing rather tough times, the value of acting creatively and decisively - for the long term while making specific plans in the short term - can result in growth and an edge on the competition. Extraordinary times demand extraordinary measures. Innovation is critical for long term success. An enterprise should then look at its business plan and ask if it can be reinvented. This will require collaboration and a problem solving process, as some people are more creative than others. Some excel at generating new ideas and finding alternatives; others excel at working out the details or implementing a well designed new concept, process or product.

Features now designed to improve businesses are related to customer service and content management such as: response time, customization, and interactive and personalizing tools. Customer management systems are crucial as the responsiveness of customer services is among the most important attributes valued by consumers. A study of Ayanso et al. (2008), based on real data from a large number of top performing web retailers, gives empirical evidence that the effort to improve customer relationship and content management systems is positively related to both customer loyalty and business performance. An important step in building more dynamic and creative businesses is to employ innovative strategies based on the use of modern information and communication technologies. The presence of IT-enabled services and content management functions especially creates a dynamic business environment.

Having solved their back-end problems through ERP systems and data warehouses, many companies are now focusing on solving their front-end problems with CRM. Chandra and Strickland (2004) recognise CRM as a new generation of information system's tools with advances that, linked to an ERP, definitely improve business performance such as:

- single integrated service and view of each customer across all touch-points (e-mail, fax, sms, phone, web, etc.);

- effectively 'know customers' to effectively satisfy and respond to their current and future needs;
- make effective business decisions or intelligent recommendations to further enhance customer-centric decisions;
- efficiently gauge the ideal timing for new service introduction, drive increased customer satisfaction in the service centre and generate incremental revenue with intelligent service cross-sell and up-sell at the point of service;
- inspire greater brand, service and corporate awareness;
- low cost of ownership through a flexible open architecture and productive implementation tools.

CRM can combine features of the company intranet with sales force automated mobility, project management, relationship marketing, document management, messaging, news and calendars all in one easy to use interface. The consistent use of open standards and open-source web technologies make these solutions more scalable and ensure a more effective communication with applications vital for the company, such as its ERP system. This is an increasing requirement as CRM integrates customer information collected at every customer touch-point in the context of multi-channel businesses (web, mobile, call centres, sales force, point of sales at the physical store, digital interactive TV, etc). A solution based on CRM may have great potential for enterprises in modern dynamic businesses: instead of 'pushing' products, it can support long-term customer relationships, as it allows firms to leverage their resources by applying them disproportionately to the most profitable customers. A focus on profitable customers is not new; what is new is that these information systems allow firms to identify high-value customers and respond with customized offers in real time. A focus on acquiring new customers, which is more expensive, gives place to retaining and building businesses with fewer loyal, high-value customers.

According to Vrechopoulos (2007), CRM could be the 5th 'P' of marketing mix (besides price, place, product, promotion) because of its emphasis on long-term relationships and one-to-one interactions through communication channels. The main added values that justify this aspect are:

- increased order size through more effectively targeted cross-sell promotions;
- expanded wallet share by the variety of products and categories customers buy;
- better tracking and tracing of products;
- moved overstocks by knowing which customers buy them at the least price to avoid deep discounting;
- enabled multi-channel coordination of field sales, inside sales, e-commerce and direct mail through relevant product recommendations for each customer interaction.

Today's business activity is very high volume with increasingly rapid and global distribution channels. Companies launch a wider variety of often more complex products resulting in shorter product life cycles. These trends are increasing the potential impact on economic stability as well as the threat to product brand value. Entrepreneurs are deploying new, higher functionality business systems that can provide a 'single system of record'. More highly automated tracking and tracing integrated to this single system will give it accuracy and robustness to pass the corporate risk-mitigating due to today's diligence of businesses. This system should have the ability to monitor the functioning of all online platforms and include tested interfaces to other systems such as control, production, data warehouse and ERP management. It should also be capable of automatically generating product and shipping reports. In addition, it must support high data collection and real-time operations.

Additionally, the system requires facilities to support client-specific data customization and regulation. Finally, the system should have fully automated, enterprise-wide customer service and product change management through CRM processes.

3. STRATEGY TO IMPLEMENTATION

There are some aspects to consider that slow ERP and CRM adoption and explain the existing differences among countries. One is related with several features of the information system's quality (response time, trust, security, usability, etc.). Even if the adoption of these tools is increasing throughout Europe, their effective implementation still evolves slowly in some countries. The increasing demand for modern management systems like ERP, CRM and CMS go far beyond simple information management. Nowadays, the integration of applications and processes in a personalized environment is state of the art. One of the most important requirements is to integrate business processes, which potentially streamlines and boosts the efficiency of the enterprise.

There are several ways in which business processes can be integrated. One of them is the automatic linking of different processes, information systems or business functions of the enterprise. In order to measure internal integration of business processes (business processes within the enterprise, as opposed to external integration where several enterprises are involved), the Eurostat community survey measures automatic linking between computer systems to manage orders and three other internal systems: re-ordering of replacement supplies; invoicing and payment; and management of production, logistics or service operations. Around one third of enterprises in the EU automatically link their computer system to manage orders with at least one of those three systems. However, there are marked differences between enterprises of different sizes: 68% of large enterprises in the EU integrate internally, while less than half of small firms are doing so (Eurostat, 2007). This is one of the factors that explain the slow pace of ERP/CRM effective implementation, such as the case of Portugal where most of the enterprises are small and medium sized.

Today's competition is tough and global, and that especially holds true for information systems and technology offerings. Meeting and mastering this challenge is essential to maintaining a long-term competitive edge. Customer relationship management (CRM) and content management systems (CMS) put enterprises in a position to develop simple but comprehensive solutions to ensure customer loyalty and help realize synergies between their systems for greater efficiency and effectiveness. A hosted CRM service eliminates much of the start-up, maintenance and upgrade fees of its on-premise counterparts. Rather, it offers a cheaper, faster and easier means of tracking consumers. It is a profound challenge to attract, serve and retain the consumers profitably today. Essentially, CRM helps in enabling a customer-oriented organization to deliver an extended infrastructure to customers and partners in new ways: to proactively learn customer needs, design new added values, gain new economies in scale/time/costs, reach new customers, and deploy innovative retention strategies.

Technology has not diminished the importance of maintaining a personal relationship with every customer. Meaningfulness differs among customers; however, by recording, analysing and retrieving important data, ERP and CRM applications offer communication and information on the right topic, in the right amount and at the right time to fit specific needs. Overall business goals must be kept in mind when choosing ERP and CRM modules. The application's compatibility with people and processes that support these goals is of utmost importance. Choosing an ERP and a CRM application is not a simple task, but there are several yardsticks with which to measure their productiveness. Within a company,

tracking information on individual customers and making it accessible through various levels is crucial to building customer loyalty. Automating customer interaction can help companies to handle customer requests and complaints effectively and efficiently. The system should be able to systematize these processes to ensure consistently high service levels, quick response times, full accountability and prompt problem resolution.

Another aspect to consider is related with what Coltman and Dolnicar (2007) have analysed regarding the heterogeneity of CRM performances at the individual firm level. For instance, they verified that it differs between organizations that operate within the same line of business and have access to the same information and technology. Given the potential of CRM, as a powerful tool to guide customer-oriented thinking, greater empirical attention is required. Without sufficient evidence, managers are prone to making investment decisions that are neither efficient nor effective. One of the problems with measuring CRM is that the concept often means different things to different people. Another problem is that these investments have items that are quite different from other assets or resource investments. As CRM systems provide techniques to customize relationships, the operational goal of treating customers differently is achieved as they know their different levels of relationship development. This enables the firm to pitch marketing programs at target customer markets. In many cases, however, related technology investments have proven to be a source of intense frustration to managers. Many organizations simply do not have the capabilities to implement sophisticated marketing programs. Their information systems, customer databases and the software to manipulate customer data are not designed to support widely-accessible customer data. Even the culture and power structure can also create barriers to the organizational change required to support ERP and CRM strategies.

The results obtained in the study by Coltman and Dolnicar (2007) confirm the importance of implementation constraints and organizational assets to financial and operational performance. They also highlight differences in the type of relationship exchange that appear to explain why managers in a certain segment have strong reservations about the strategic potential in CRM. This indicates that managerial judgement is an important competence that is underemphasized in the literature. If an organization does not have the skills and mind-set to execute a CRM strategy, then it is better to choose another option. This analysis is consistent with other works, such as the study of Nohria et al. (2003), about the role of strategy against implementation. These authors have tested and noted that which strategy is picked by a firm is less important compared to the success obtained in the implementation of the chosen strategy. Indeed, in environments like ERP and CRM, where the linkages between actions and outcomes are often uncertain, the research framework must be increasingly explicit. Marketing researchers have access to a set of measurement techniques (discrete choice modelling, structural equations for measuring consumer behaviour, etc.) that can be used to model and better understand the role of managerial judgement and organizational culture. This will shed new light on a source of relevant data about the potential of information systems for more dynamic businesses and how firms can effectively succeed in aligning them with business performance.

3.1. Aligning people, technology and business

Several entrepreneurs were interviewed in a previous study (Fernandes, 2010) from several firms in the Algarve region (some of them having national or international dimensions). They recognize the importance of aligning people, technology and business. Facing the rhythm of change, they may have to reinvent their enterprises and businesses in order to lead their markets. In Portugal, the enterprises (most of them small or medium sized) invest little in information systems' departments due to their limited capacity (financial and organizational). A form of innovation in which they could invest consists of building an

entrepreneurial culture supported by a good information structure. There are new information systems that can easily contribute to that, based on technologies such as CRM (Customer Relationship Management), CMS (Content Management Systems) and ERP (Enterprise Resource Planning). These tools, integrated in well-planned platforms, have accelerated the implementation of new business ideas, new products or services, new business processes or the improvement of existent products/processes. Given their enormous potential, which in some cases can lead to a reconfiguration of the whole organization or its procedures, entrepreneurs should not only know these kinds of platforms very well but should also be involved at the very beginning of their strategic planning (Kearns & Sabherwal, 2006).

Managers make most of their decisions based on a considerable number of documents and amount of data to know what products they should offer, in what quantity and from which supplier, while being aware of the best way of distribution, the best location for stores and how to organize transport. Today, facing the huge wave of data as the internet plays an increasing role in conducting business, firms are using more analytical tools for data warehouse management. These tools are especially used in systems designed for data and process integration. ERP systems do the work of building business models based on simulation principles. However, there is some resistance to adopting them which is related with the time of adaptation and a change of the existing databases and systems. This process can be lengthy, and firms generally avoid interrupting their normal activities to start those changes (Vasilev & Georgiev, 2003). However, many are implementing these systems and benefiting from the whole integration they create, giving a global view of management. This helps firms to virtually manipulate all aspects of product life cycle according to that view.

Firms in technological sectors are then introducing new modules in their ERP systems tailored to business specificities in different sectors (health, industry, etc.) or new features to render modules more flexible and complementary. In contrast to departmentalized solutions, the ERP system is multifunctional as it crosses several levels and functions in the organization. An ERP, being integrated, causes information to flow in a simpler way through different departments to be shareable across their multiple processes. This happens as the information is gathered in a huge, unique database, accessible to all levels and business units in the firm, allowing managers to easily acquire more accurate data. Operations are better coordinated on a daily basis, since the system provides a global view of business processes and information flows (Laudon & Laudon, 2004). These types of systems can respond to several issues such as: allowing customers to immediately know if a product they order exists in stock and know the whole tracking of that order; allowing production to easily communicate with finance for planning new production; etc. In departmentalized systems, on the contrary, there is much data fragmentation which causes a proliferation of complex and expensive relations between systems, as information systems are separated by functions/areas. As an ERP consolidates all the data, it eliminates these complex relations having a positive impact on process efficiency and business performance.

Integrating CRM function in the ERP, which consists of analytical procedures for customer relationship management, makes it possible to consolidate information from different sources or communication channels, answering questions such as: What value does a certain customer add to the enterprise? Who are the most loyal customers? Who are the most profitable ones? Firms can use the answers to these questions to acquire new clients, improve their products and services, better personalize their offers to customers' preferences, etc. CRM techniques allow the joining and selection of key information from different points of view, helping to create unique services and critical success innovations. Since CRM processes can capture unperceived profiles, customers' attitudes and behaviours through highly analytical techniques (data mining), they can become so effective in involving the customer that the customer begins to expect personalised delineation of the products

and services. However, problems may arise with the integration of the CRM function if the employees who use these tools are not generally familiar with the criteria inherent to CRM algorithms and simulations, which require more specific training (Vasilev & Georgiev, 2003).

The enterprises should consider the adoption and diffusion of ERP and CRM systems from a strategic point of view and evaluate them as any other investment. For instance, many firms are not aware of the applications of a data warehouse that is used to consolidate several databases to extract information from different functions into management decision reports (sales, marketing, purchases, stocks, integrated accounting, etc). Instead, they depend on external outsourcing or consulting services, which generally increase their costs. To know all the benefits and costs, including the indirect or hidden ones, the enterprise should define a business plan over time; when aligning it with information systems, they should also evaluate its results within that plan on a yearly basis. A comparison between some firms from different sectors, especially in commerce and services, located (head office or branch) in the Algarve region, reveals some differentiating issues that should be considered within the ambit of aligning information systems and technologies (IS/IT) with business performance.

Most of the enterprises interviewed on their threats and opportunities (Swot Analysis) do not align their vision of business with the potential of information systems or people competences in managing threats through the opportunities and strengths identified. In other words, when analysing the way opportunities can solve weaknesses (or certain threats could become opportunities through related strengths), they do not explore how their information systems could be incorporated to mobilize those strategies more fully. The main factors disturbing this alignment issue are the lack of an enterprise-wide business view and the rapid rate of technological change. Some authors also acknowledged these aspects in their studies, such as Rathnam (2004).

3.2. Knowledge-base: the missing link

Those differentiating issues (described above) will have impacts on business creativity and performance, as recognized by the fact that some interviewed firms actively align their vision of business with the potential of information systems in managing threats through the opportunities and strengths identified. Namely, those from the technological sector and the commerce chains, which perceive the alignment between IS/IT and business strategy, have been enhancing their level of innovation and performance in terms of process integration, management efficiency, time and completeness of response to customers (see the resume in Table 1). These outcomes will contribute to consolidate the knowledge-base of an organization.

Table 1. Resume of the sectors, their adopted IS/IT and main outcomes

Main sector	Main type of IS/IT	Business processes	Management efficiency	Response to customers
Construction (either large or small firms)	Separated databases/ systems; and outsourcing	Repeated information and tasks; more personnel than necessary	Inefficiencies and complex/expensive links between functions	Slower response, misinformation or repeated information
Systems and technologies (either large or medium firms)	Develop and use their own ERP and CRM modules; have their own IS/IT specialists	More integration from a unique database, uniformity of data, better integration of modules	Efficient links between functions, more knowledge about them and better tracking and decision support	Quicker response; more innovative and effective products, services and modules
Services (larger firms)	They tend to adopt ERP systems and recognize their great potential	Better process tracking and more tailored to sector's specificities	Higher management support; better route management (combining GIS); better decision path	More personalized, informed services; either new services or more suitable ones (even locally)

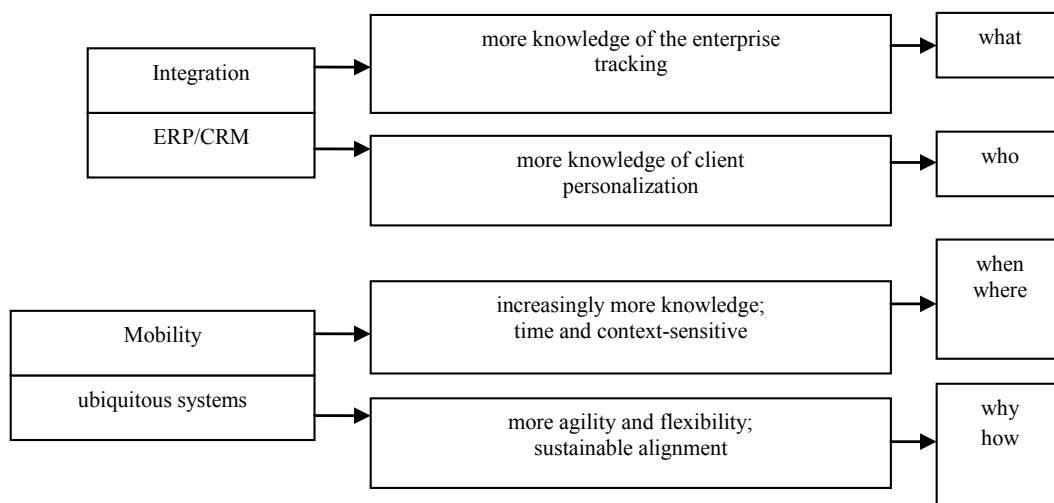
Commerce Chains	They adopted ERP systems/tools but do not have their own IS/IT specialists	More flexibility of operations/logistics and efficient continuity of the business processes	Better chain and internal management, team support management	Better stock-sales' tracking, more directed marketing campaign/promotions
Small firms	Separated databases/systems; and outsourcing	Lack integration, some logistical problems; higher transport costs	Inefficiencies in management and decision; also lack concurrence/market awareness	logistical problems and transport costs reflect on the price and quality of their products/services

Source: own elaboration

Two main reasons are related with this achievement: the nature of their business processes and having the right capacity for it. This mainly happened with the firms in technological sectors, for their specialized know-how, and in commerce chains, for their organizational and financial capacity (Fernandes, 2010). Another reason is that, especially in the technological firms which have been restructuring their systems to engage in ERP, they usually have a department with IS/IT specialists. They prefer to have their own professionals instead of applying to outsourcing, due to the dependence on these contracts and the eventual loss of core-business information. The proximity between IS/IT professionals and managers is fundamental for the strategic alignment described earlier, requiring from the IS/IT professionals a profile that catches the emergent trends and adjusts them to the right pace (Setti & Fernandes, 2007).

Another implication assessed by the case comparison study is that the sectors with more mobile activities (such as INEM-medical emergency, CTT-post offices and ALGAR-residues/eco-points) as well as the banking sector, which increasingly depend on knowledge about financial markets in real time, recognize the growing potential of mobile platforms. For example, easy mobility is achieved (through the new PDA and cell phones) away from their location, by accessing the company's own central system and receiving updated information from its intranet in the mobile gadget. Keeping this aspect in mind and considering the additional potential of integration, the alignment issue, can really be a key for knowledge-based support in addition to business performance. The next figure illustrates this point through the two referred lines of information systems' development and supporting IT and the resulting enterprise, knowledge-based enhancement (second and third blocks):

Figure 1. Main lines of information systems' development and supporting IT for advances in enterprise knowledge-base



Source: own elaboration

That statement is not surprising since information analysts and CIOs (Chief Information Officers) strongly recognize the increasing support of enterprise architecture and engineering (through ontological approaches) for process alignment issues and knowledge-base improvement for more real-time decision making (Zachman, 1987; Spewak & Hill, 1992). A knowledge structure is then derived to support matching the business needs with innovations (Rosset et al., 2009). According to Gudas (2008), knowledge management is the layer to incorporate in enterprise management for knowledge-based enterprises.

4. CHANGING CULTURE

Most companies have been overwhelmed with the flood of data created by their information systems. Much of that data arrives when they install a new ERP (enterprise resource planning system). Suddenly, billions of bits of information are generated about their operations, customers and suppliers, and most of it just gets stored and never used or looked at again. That includes click-stream data, detailed email data and the information that is thrown off by the enterprise planning systems' transition (Brynjolfsson and Saunders, 2009). It is interesting that, by studying this information carefully, employees can have better knowledge of the company's customers, its business processes, and products' quality of its supply chains.

The field of business intelligence has been tapping into this explosion of data which is important in dealing with the alignment challenge. Brynjolfsson and Saunders (2009) argue that a new kind of culture is desirable, where employees regularly organize business experiments and carefully measure their results through their enterprise information systems. Their successful findings should be shared with business managers at other locations and then scaled up to become part of corporate policy going forward. For example, in a hotel, they can experiment whether different kinds of discounts can entice people that normally come for two days to come for three or more days. The experimentation in a café can serve to figure out what work practices can get its waiters to serve customers more effectively and get higher customer satisfaction. This is a mentality that every employee can bring to every aspect of business. Another example is the creation of a wiki to share information between employees, such as knowing how to network with a printer more quickly, among other tasks.

These examples show how smaller innovations, in addition to big ones, can be easily shared. Equally important, or perhaps more important, are the thousand small innovations that regular business managers and line workers can do every day at their jobs. Companies have to nurture this culture of experimentation, through an expertise in how to run those kinds of business experiments and an infrastructure that makes it possible to replicate and scale up the resulting successful innovations. This is a little hard to do in retail or manufacturing companies, but it can be done through the aid of enterprise information systems as many business processes can be embedded in these systems. This regular experimental culture is different than the old mentality of figuring out all the possibilities and then locking in on one. Instead, it is an approach of rapidly prototyping many different options, seeing which ones pan out and using the information technology infrastructure to get the feedback quickly (Brynjolfsson & Saunders, 2009).

Changing culture is, however, a very difficult challenge, as it requires a tolerance for failure and a desire to have employees trying new things. A greater frequency in the exchange of ideas and their joint debate, involving everyone in the company, results in a wider knowledge-base and the faster generation of the resulting intelligence. In addition, more time is freed for other activities or new discoveries. Once people perceive the value they bring to the organization's performance, their level of commitment also rises.

5. CONCLUSION

The relevance of aligning information systems with people and their activities continues to intensify and is normally the core of discussions on performance, especially related with trends in the support provided by technological platforms. For example, one relevant trend to continue researching is the widespread use of mobile platforms due to their ubiquity (i.e. the concept of being everywhere at the same time, related with pervasive equipment). This is an attribute that has to do with the critical role that time plays in modern communications. Facing the increasing geographical scope and time-sensitiveness of services, their application is making the difference. Under the provision of services, one potential of mobile systems is the controlled execution of activities by creating processes that will resolve many problems related to the on-time delivery in the requested local. They ensure that packets of information are delivered correctly, so that the recipients of the communication, although physically distant, are properly synchronized.

Ubiquitous systems provide mechanisms for the selection and alignment of processes that meet the aspects of a context and accurately reflect its constant changes. This pervasive nature, related with the capacity of different, integrated equipment functioning together and context-sensitive in the same environment, has changed the method of conducting activities and interacting with workers at various locations using different systems. When it penetrates all activities and institutions, many aspects of management and organizational structure will change radically. The speed and extent of connectivity it allows enable the creation of new processes and their alignment with the existing ones.

Bearing in mind all these existing and evolving challenges, a company should be able to correctly evaluate benefits and costs, many of which are intangible in the IS/IT area. It is then fundamental to define a plan in due course and assess the results obtained from it, on a yearly basis, by the information system's activity in being strategically aligned with business goals. This involves the planning and attribution of personnel, competences, training, evaluation of opportunities and their adequacy to the goals and competences of the organization (for example, not every company needs CRM or ERP systems). There are also open-software packages available on the internet, free of licences and with frequent and costless updates, which enable the development of many useful and efficient tools, such as QGIS/Grass for geographic information systems, Weka for data-mining, Joomla for CMS (content management) and others. The companies that have made the most of it incur less expense and less time spent on the development of systems, thus gaining several benefits (Fernandes, 2008), such as directing 'saved' time and resources towards effective knowledge creation.

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REFERENCES

- Ayanso, A., Lertwachara, K. and Thongpapanl, N. (2008). The effect of customer service and content management on retail sales performance: The mediating role of customer satisfaction. Paper presented at the International Conference on Advances in Management, Boston, USA.

- Basadur, M. (2009). Creativity and problem solving in recessionary times. Paper presented at the Conference of the European Year of Creativity and Innovation, Albufeira, Portugal.
- Brynjolfsson, E. and Saunders, A. (2009). *Wired for innovation*. Boston, USA: MIT Press.
- Chandra, S. and Strickland, T. (2004). Technological differences between CRM and e-CRM. *Issues in Information Systems*, 2: 408-413.
- Coltman, T. and Dolnicar, S. (2007). E-CRM and managerial discretion. *International Journal of E-Business Research*, 3(2): 41-56.
- Eurostat (2007). *Internet use in Europe: Security and trust* (Community survey on ICT usage and e-commerce in enterprises). Brussels: European Commission.
- Fernandes, S. (2008). *Open document format*. Paper presented online at the Conference of the ODF Alliance on the Future of Digital Documents, Lisbon, Portugal.
- Fernandes, S. (2010). Critical information as a success factor in organizations: objective and methodological approach. *Spatial and Organizational Dynamics Discussion Papers*, 2: 69-82.
- Forsyth, K. (2004). Content management: A prerequisite to marketing and sales effectiveness. *International Journal of Medical Marketing*, 4(3): 228-234.
- Gudas, S. (2008). Enterprise knowledge management aspects and layers. Paper presented at the 12th World Multi-Conference on Systemics, Cybernetics and Informatics, Florida, USA.
- Kearns, G. and Sabherwal, R. (2006). Strategic alignment between business and information technology: A knowledge-based view of behaviours, outcome and consequences. *Journal of Management Information Systems*, 23(3): 129-162.
- Laudon, C. and Laudon, J. (2004). *Management information systems: Managing the digital firm*. New Jersey, USA: Prentice Hall.
- Nohria, N., Joyce, W. and Roberson, B. (2003). What really works. *Harvard Business Review*, 81(7): 42-50.
- Philipson, S. (2008). A specification of an environment for modern product development. Paper presented at the International Conference on Advances in Management, Boston, USA.
- Rathnam, R. (2004). Alignment of business strategy and IT strategy: A case study of a fortune 500 financial services company. *The Journal of Computer Information Systems*, 45(2): 1-8.
- Rosselet, U., Joliet, Y. and Wentland, M. (2009). Knowledge management for IT project portfolio. Paper presented at the 10th European Conference on Knowledge Management, Vicenza, Italy.
- Setti, A. and Fernandes, S. (2007). The role of the information system's manager in the organization. *Interscienceplace*, 1(3): 1-10.
- Spewak, S. and Hill, S. (1992). *Enterprise architecture planning: Developing a blueprint for data, applications and technology*. USA: John Wiley & Sons.
- Vasilev, J. and Georgiev, G. (2003). Tendencies in the development of ERP systems. Paper presented at the International Conference on Computer Systems and Technologies, Varna, Bulgaria.
- Vrechopoulos, A. (2007). Digital marketing and e-CRM. Paper presented at the meeting of the Eltrun Research Centre, Athens, Greece.
- Zachman, J. (1987). The Zachman framework: The official concise definition. Accessed in 24th November 2009, on the Web site: <http://www.zachmaninternational.com/index.php/home-article/13%20#maincol>

LOCALISED ASSETS AND SMALL-FIRMS' TECHNOLOGICAL CAPABILITIES

RECURSOS LOCAIS E AS CAPACIDADES TECNOLÓGICAS DAS PEQUENAS EMPRESAS

Marisa Cesário and Maria Teresa de Noronha Vaz

ABSTRACT

The main objective of the present work is to empirically show how a set of environmental variables affects the adoption of new technologies by small firms. We report the results of the application of a common questionnaire to a sample of 167 small and medium sized firms from clothes, textile and leather sectors (TCL) belonging to the following southern European areas: North (Portugal), Valencia (Spain), Macedonia (Greece) and South Italy (Italy). The following variables were considered as possible predictors: employees, type of ownership and management, supply/distribution/customers' networks and institutional links. A binary logistic regression was computed allowing the characterisation of the process of adoption of new technologies such as: developed internally, supplier dominated and motivated by the international market.

Keywords: Technological Change, Localised Assets, Labour-intensive Sectors.

RESUMO

O principal objetivo do presente trabalho é mostrar empiricamente de que forma um conjunto de variáveis relacionadas com o ambiente envolvente afeta a adoção de novas tecnologias pelas pequenas empresas. São apresentados os resultados da aplicação de um inquérito comum a uma amostra de 167 pequenas e médias empresas dos sectores dos têxteis, vestuário e calçado, localizadas nas seguintes regiões sul Europeias: Norte (Portugal), Valência (Espanha), Macedónia (Grécia) e Sul de Itália (Itália). As seguintes variáveis explicativas foram consideradas: características dos empregados, tipo de propriedade e de gestão, redes de fornecedores/distribuidores/clientes e relações institucionais. Foi determinada uma regressão logística binária que permitiu caracterizar o processo de adoção de novas tecnologias como um processo: desenvolvido internamente, influenciado pelas relações com fornecedores e motivado pelo mercado internacional.

Palavras-chave: mudança tecnológica, Ativos locais, sectores de trabalho-intensivo

JEL Classification: O300, L670

1. INTRODUCTION: TIME AND PLACE MATTERS

Economic globalisation is leading firms to face an increasing openness to rival producers, regardless of the original location of production. In addition to firms, industries and regions are now much more vulnerable to price and quality competition (hyper-competition, in the words of D'Aveni, 1994). The increased sense of risk stimulates regions to search for new paths to resilience (Hudson, 2010). We assume the evolutionary approach to gain an understanding of regional change. Human action and social relations are determinants of regional competitiveness; territories compete with one another, and both attractiveness and local competitiveness depend on similar, common factors which go beyond physical conditions and refer to relational capital and the learning capacity expressed by the territory (Camagni, 2002). The path- and place-dependent nature of these assets stresses the importance of geographic proximity for the strategic positioning of firms.

Despite the increasing global flow of ideas, capital, goods, and labour, the role of proximity in the creation of economically useful knowledge appears to be even more important than before (Scott, 2000; Scott, Agnew and Storper, 2001; Scott and Storper, 2003; Sonn and Storper, 2008; Storper, 2009). Indeed, the 'dead of geography' thesis cannot be sustained, because it wrongly assumes that the rapid diffusion of information and codified knowledge means the rapid diffusion of understanding, and that is not correct (Morgan, 2004). Even in the presence of the 'ubiquitification' phenomena¹, direct face-to-face communication is still an important aspect because some types of knowledge travel more easily than others. While analytical knowledge, which results from the application of scientific laws, has a relatively constant meaning by location, the same is not true for synthetic or symbolic knowledge², the meaning of which is substantially variable (Gertler, 2008).

Agglomeration is important because it facilitates transactional interactions and increases opportunities for matching needs and capabilities; for instance, it eases the dynamics of the backward and forward inter-linkage of firms, allows the formation of dense, local labour markets around multiple workplaces, and facilitates the emergence of localised, relational assets promoting learning and innovation effects (Storper and Harrison, 1991; Scott and Storper, 1992). Although we do not intend to measure the three marshallian forces, as in Ellison and Glaeser (2010), we use their findings to confirm that the advantages of location proximity go beyond transactional efficiencies and include various kinds of externalities, such as knowledge spillovers and dependence on human relations, rules, and customs that enable firms to coordinate under conditions of uncertainty³.

This nexus of untraded interdependencies (as labelled by Storper, 1995) corresponds to that of regionalised relationships that extend beyond traditional customer/supplier links and embrace collaborative and information networks that are both formal and informal. Inspired by evolutionary economics, this argument states that technological change is path dependent because it involves interdependencies between choices made over time. These choices have a spatial dimension; although direct input-output relations may play a role, when organisations travel along a technological trajectory they have interdependencies that are untraded and include labour markets, conventions, common languages, and rules. We

¹ Although technological trajectories are largely territorially path dependent, there is a growing list of territorial inputs being transformed into ubiquities as an outcome of the ongoing globalisation process. Maskell and Malmberg (1999) and Maskell, et al. (1998) use the term 'ubiquitification' to describe the process whereby former, tacit knowledge gradually becomes codified, so that firms in low-cost areas become more competitive in open markets and when knowledge of new technologies and new organisational designs becomes globally available.

² By 'synthetic knowledge' the authors mean the application or combination of existing knowledge, mainly through interactive learning with customers and suppliers; 'symbolic knowledge' means creating meaning through highly, context-specific, learning-by-doing processes.

³ When considering innovative activities, for instance, the importance of geographic proximity promoting interaction has been defended by authors such as Gambardella and Malerba (1999), Arndt and Sternberg (2000), and Cassiman and Veugelers (2002). Inter-firm linkages, in the form of regional networks, are proven to be important prerequisites for successful innovation activities in firms. Similar approaches can also be found in Malmberg and Maskell (1997), Kirat and Lung (1999), Hudson (1999), and Porath (2012).

believe that those links are the bases of regional economic resilience and contribute to the ability of regions to react to the challenges of globalisation and economic integration.

The argument on path-dependency is even truer when considering the specific case of small firms. Unlike big firms, SMEs interact intensely with the territory in which they locate, as a sign of their embeddedness. The particularly tight links they develop with the external environment also reduce uncertainty risks. In general, SMEs do not only locate near the residence of their owners, but they also have geographical and sociological proximities as their main sources of assets and information (Julien 1995; Vaz 2006, 2012). This fact constrains the perspectives and strategic choices of the firms, because most of the market perception arises from the inputs supplied by the territorial institutional context. Small firms learn from close interaction with suppliers, customers, and competitors; additionally, knowledge processes are deeply influenced by local resources, institutions, and social and cultural structures (what we call localised capabilities⁴). Most SMEs and the respective entrepreneurs are generated, to a large extent, by the local context; to face changing and uncertain economic conditions, their decision-making process is firmly based on socialised practices, thereby stressing the importance of geographic proximity as a mediating factor (Camagni, 2002).

When referring to technological trajectories, Dosi *et al.* (1988) mention the importance of both the public elements of knowledge, constructed upon the interdependencies between sectors, technologies, and firms that represent a structured set of technological externalities for individual companies, and the firm-specific technological competences. Cohen and Levinthal (1990) labelled those competences as the firm's absorptive capacity. The authors argue that the ability of a firm to recognise the value of new, external information, assimilate it, and apply it to commercial ends is critical to its innovative capabilities. A similar idea is given by Julien *et al.* (1999), who argue that the main factors distinguishing SMEs using new technologies from those continuing to use traditional equipment are management quality and the organisation's ability to obtain and process technological information. The authors define *technological scanning* as the activity through which the external information needed for technological change is gathered, analysed, and disseminated in the firm.

2. CONCEPTUAL FRAMEWORK AND RESEARCH HYPOTHESES

In accordance, we argue that firms may decide differently about their employees (their origin and type of upgrading of skills provided), ownership and management, as well as the way they relate with suppliers, customers, universities or trade associations. Firms may also have different geographical scales in terms of their supply, distribution and customers' networks. All these decisions are believed to be influenced by the different territorial attributes. We label this set of public and firm-specific elements of knowledge as a firm's networking aptitudes and human capital endowment (Cesário and Vaz 2008; Vaz *et al.*, 2006; Vaz and Cesário, 2008).

Assuming the importance of localised assets for the technological capabilities of small firms, the main question addressed in this paper is: How do firms' networking aptitudes and human capital endowment affect their technological adjustment strategies?

More than just proving such cause-effect relations, we expect to identify the most significant effects produced by localised assets upon the technological capabilities of European labour-intensive firms.

⁴ Porfírio (2011) calls it 'strategic capabilities'.

The following variables are considered as indicators of a) human capital and b) networking aptitudes:

- i. Source of employees, type of ownership/management, upgrading of skills;
- ii. Supply/distribution/customers' networks and institutional links.

These variables will be used as predictors of technological behaviours. We rely on Hall (1987), who distinguishes between general environments and specific (or task) environments. The general environments of firms include technological, legal, economic, demographic, and cultural conditions. The specific (or task) environments include customers, suppliers, competitors, industry associations, universities, and so on. While firms can hardly influence the general environment, task environments correspond to the firms' decisional space, allowing different strategic options, particularly those that concern technology.

The literature review suggests that regional settings can provide an essential level of economic coordination and can be a major source of region-specific material and non-material assets (network collaborations, untraded interdependencies, and associational behaviours are concepts supporting this idea). As mentioned by Pavitt (quoted in Dosi, 1988), the TCL sectors belong to what he called the supplier-dominated group of sectors, where *'...innovations are mainly process innovation: innovative opportunities are generally embodied in new varieties of capital equipment and intermediate inputs, originated by firms whose principal activity is outside these sectors themselves. Thus the process of innovation is primarily a process of diffusion of best-practice capital-goods and of innovative intermediate inputs...The knowledge base of innovation in these sectors mainly relates to incremental improvements in the equipment produced elsewhere, to its efficient use and to organisational innovations.'*

In this argument we highlight two major ideas: the importance of the contacts developed among firms along the productive chain as important sources of technological knowledge, and the importance of efficiency and organisational innovations, in which employees and managers play an essential role.

Malecki and Poehling (1999) suggest that the 'personality' of the small firm reflects the personality of its owner/manager. With regard to the search for external information, the authors classify this personality as an extrovert or introvert type, distinguishing between different abilities to obtain technical and engineering information.

In agreement with these considerations, the following research hypotheses regarding firms' human capital endowment are proposed:

H1: The origin of the firms' employees is a significant predictor of the adoption of new technologies.

H2: The upgrading of the skills of employees is a significant predictor of the adoption of new technologies.

H3: The type of ownership is a significant predictor of the adoption of new technologies.

H4: The type of management is a significant predictor of the adoption of new technologies.

The review of the literature also suggests the importance of supply, distribution, and customer links, recognising that small firms frequently form component parts of extended networks with different possible geographies (local, regional, national, EU, and international). By accessing other markets, assets, and technologies, the firms release themselves from the limits of local and internal competences and gain control over the technological trajectories of their competitors (Camagni, 1991, 1995).

Additionally, the informal contacts that occur inside firms, or between them and other surrounding agents, are also seen in the literature as important sources of technological knowledge. Storper (1995) uses the term 'untraded interdependencies'; with a similar view but a different conceptualisation, Cooke and Morgan (1998) refer to a collective social order that induces firms to collaborate and display 'associational behaviours'. The interactive learning among business networks is argued to be the most effective and credible way for

knowledge acquisition (Morgan, 1996). In agreement, the following research regarding hypotheses for firms' networking aptitudes are proposed:

H5: The scope and geography of firms' networks are significant predictors of the adoption of new technologies.

H6: The nature of institutional links is a significant predictor of the adoption of new technologies.

3. METHOD

3.1. Sampling

Empirically, the analysis is based on the application of a common questionnaire to a sample of 167 SMEs from the TCL sectors belonging to the following southern European areas: North (Portugal), Valencia (Spain), Macedonia (Greece), and South Italy (Italy) (table one). Appendix one gives the design of the questionnaire and sampling procedures.

These areas are composed of one or more Nomenclature of Units for Territorial Statistics (NUTS) II regions and were selected because of their economic vulnerability, established in three common features: a) these areas are lagging behind the EU-27 average in terms of gross domestic product (GDP) per capita; b) their heavy industrial issues are mainly composed of labour-intensive activities, the ones most affected by low-wage competition; and c) their peripheral geographic location constitutes an economic restraint (table two). Considering the NUTS II regions forming the focus areas, all of them were eligible under the EU objective 1 status in the 2000-2006 period. Only the Italian regions of Abruzzo and Molise were not; nevertheless, these regions registered, in 2005, a GDP per head as a percentage of EU-27 of 88 percent and 79 percent, respectively, which are values relatively close to the upper limit of the criterion. Moreover, the entire group presented high levels of dependence on the labour-intensive industries under analysis (quotients of product specialisation above one mean that the proportion of employment in sectors from NACE 17, 18, and 19 is more relevant in that region than it is in the EU-27).

Table 1: Sample Distribution by Focus Area and Sector

	Footwear and Leather Products	Textiles and Clothes	Total
North, Portugal (PT)	14	52	66
Macedonia, Greece (GR)	14	36	50
South Italy (IT)	-	24	24
Valencia, Spain (SP)	15	12	27
Total	43	124	167

Source: Own elaboration

Table 2: GDP per capita and QPS values

Focus Area	Nuts II Regions Forming the Focus Area	GDP per Capita		Quotient of Production Specialisation (NACE 17, 18, 19)
		2000	2005	2005
	EU (27)	100	100	1.00
Macedonia, GR	Eastern Macedonia and Thrace	49	57	1.10
	Central Macedonia	61	70	1.63
	Western Macedonia	60	73	4.35
Valencia, SP	Valencia	79	86	1.96
South, IT	Abruzzo	94	88	2.71
	Molise	80	79	1.65
	Campania	68	69	1.35
	Puglia	72	70	1.98
North, PT	North	53	51	6.15

Source: Eurostat

3.2. Statistical Data and Methodology

3.2.1. The Predictors

The following variables (listed in table three) are used as predictors of the probability of firms adopting new technologies: employment sources (EMPLS); type of ownership (OWNE); type of management (MANG); supply, distribution, and customer networks (NETS, NETD, NTEC); institutional links (LINK); and skills' upgrading of employees (SKILL).

Table 3: Description of Database Variables

Variable	Description	Codification
<i>Predictor variables</i>		
EMPLS	Employment Sources	
EMPLSa)	Family members	1=yes; 0=no
EMPLSb)	Local community	1=yes; 0=no
EMPLSc)	People from outside the region	1=yes; 0=no
EMPLSd)	Parent firm	1=yes; 0=no
OWNE	Type of Ownership	1 = Owned by one person; 2 = A partnership; 3 = Family Owned; 4 = A limited company (reference category)
MANG	Type of Management	1 = The owner-manager; 2 = Other family personnel; 3 = External manager (reference category)
NET	Supply, distribution and customers' networks	
NETSa)	Suppliers: associated local firms	1=yes; 0=no
NETSb)	Suppliers: other local/regional firms	1=yes; 0=no
NETSc)	Suppliers: national firms	1=yes; 0=no
NETSd)	Suppliers: EU firms	1=yes; 0=no
NETSe)	Suppliers: international firms	1=yes; 0=no
NETDa)	Distributors: associated local firms	1=yes; 0=no
NETDb)	Distributors: other local/regional firms	1=yes; 0=no
NETDc)	Distributors: national firms	1=yes; 0=no
NETDd)	Distributors: EU firms	1=yes; 0=no
NETDe)	Distributors: international	1=yes; 0=no
NETCa)	Customers: local/regional market	1=yes; 0=no
NETCb)	Customers: national market	1=yes; 0=no
NETCc)	Customers: EU market	1=yes; 0=no
NETCd)	Customers: international market	1=yes; 0=no
LINK	Institutional links	
LINKa)	Internal personnel	1=yes; 0=no
LINKb)	Customers	1=yes; 0=no
LINKc)	Suppliers	1=yes; 0=no
LINKd)	Industry associations	1=yes; 0=no
LINKe)	Universities and/or colleges	1=yes; 0=no
SKILL	Skills' upgrading of employees	1=yes; 0=no
<i>Dependent variable</i>		
TECH	Adoption of technological changes	1=yes; 0=no

Source: Own elaboration

The variable EMPLS distinguishes among four different sources of employment: family members, local community, people from outside the region, and parent firm (four different, binary variables are considered). Regarding the type of ownership (OWNE), firms may be owned by one person, a partnership, a family, or a limited company. According to the type of ownership, different management situations are possible. The variable MANG aggregates the following options regarding the firm's manager: owner-manager, other family personnel, or external manager.

The variable NET includes supply (NETS), distribution (NETD), and customer (NETC) links. The first two distinguish among five different, network geographies that are possible: associated local firms, other local/regional firms, national firms, EU firms, and international

firms. The destination of firms' sales may be local/regional markets, national markets, EU markets, or international markets.

The variable LINK is used to identify the contacts (mostly informal) used as sources of technological knowledge by the sample firms, and it differentiates among internal personnel, customers, suppliers, industry associations, and universities/colleges.

Finally, the sample firms were examined with respect to the upgrading of their employees' skills. The variable SKILL is measured by a binary scale (1 = yes; 0 = no).

3.2.2. The Dependent Variable

The adoption of new technologies by the sample firms, TECH, was also measured by a binary scale (1 = yes; 0 = no) and used as a dependent variable. To obtain observable measures of technology, Chennells and Van Reenen (2002) distinguish between three types of measures: inputs into the knowledge production function, outputs from the knowledge production function, and subsequent diffusion of these outputs around the economy. Inputs are generally measured by research and development (R&D) activities. Although R&D expenditure has the advantage of being measured in a reasonably standard way, it has a disadvantage related to spillovers. A firm might invest significantly in R&D without receiving any benefit from it, either in the form of innovation for the firm or in the form of the ability to learn from other firms' innovations. Patents, on the other hand, are a widely available and standard way of measuring the outputs of knowledge. However, a large number of patents appear to be of very low value, and there is no obvious method of measuring them when this factor is taken into account.

According to Chennells and Van Reenen (2002), diffusion measures seem to be closely related to what is usually considered technology. Examples of diffusion measures proposed by these authors are the use of computers in a firm (word processors, mainframes), production-based technologies (lasers, robots, CAD, CAM), and the weight of usage (the proportion of people using the computer). Based on these ideas, and considering that the sample is composed of SMEs from low-tech sectors and located in vulnerable European regions (where R&D departments and patents are remote realities), the following technology measures were considered in the present survey:

- (a) inventory control (e.g., PC, software)
- (b) production process technology (e.g., CAM)
- (c) product design technology (e.g., CAD)
- (d) marketing technology (e.g., internet, websites)
- (e) e-mail/website/internet
- (f) business-to-business electronic networks

The firm was considered to have adopted new technologies if at least two of the previous technologies were adopted in the past three years. This criterion was considered as common sense, taking into account the possible combinations of answers given by the firms.

3.2.3. The Model

The quantitative contribution of each of the previous predictors was compared using a binomial logistic regression model constructed by iterative maximum likelihood estimation (MLE), as given by the following equation:

$$\text{logit}(\text{TECH}) = \alpha + \beta_r \text{EMPLS}_r + \gamma \text{SKILL} + \delta \text{OWNE} + \varepsilon \text{MANG} + \zeta_r \text{NET}_r + \eta_r \text{LINK}_r \quad (1)$$
 where r stands for the option of the corresponding question, when variables are subdivided in different yes/no options, each one corresponding to a binary variable itself (see table three).

For the binomial logistic regression, the predicted dependent variable is a function of the probability that a particular subject will be in one of two categories—in this case, the

probability that sample firms adopted new technologies in the past three years (TECH=1). The logistic regression will predict the logit, that is, the natural log of the odds, given by $\ln\{P(\text{TECH} = 1)/[1 - P(\text{TECH} = 1)]\}$. Section five presents the results for the set of recommended procedures and statistical tests developed to assure the adequacy of the model.

4. RESULTS

4.1. Adequacy of the Model

According to Menard (1995), the first and most important assumption in logistic regression is that the model is correctly specified. One crucial component of correct specification is the correct functional form of the model. Logistic regression does not require linear relationships between the independent factors or covariates and the dependent – as does OLS regression – but it does assume a linear relationship between the independents and the log odds (logit) of the dependent. When the assumption of linearity in the logit is violated, then logistic regression will underestimate the degree of relationship of the independents to the dependent and will lack power (generating type II errors, assuming that there is no relationship when there actually is). To assess linearity, as suggested by Menard (1995), the proposed model was compared with a larger model, including the square and cubic values of the original independent variables⁵. The coefficients associated with these variables are jointly non-statistically significant ($p=0.531$), that is, there is no evidence of nonlinearity between the logit of the dependent variable and the set of independent variables.

Another issue to avoid is multicollinearity among variables. High multicollinearity is a problem as it affects the reliability of the coefficients. In this case, the highest correlation registered between two independent variables was 0.633, which does not represent a problem.

4.2. Results of the Estimation of a Logistic Regression Model

Following these procedures, the logistic regression results for equation (1) are presented. These results include statistics for: the goodness-of-fit of the model (chi-square statistics), the estimated parameters, and the predictive capacity of the model (annex 4.1 provides detailed information). The model's goodness-of-fit was assessed using the Omnibus test of model coefficients – the null hypothesis that the coefficients of the variables are all jointly equal to zero was rejected ($p = 0.000$) – and the Hosmer and Lemeshow test – the null hypothesis that the model adjusts well to the data is not rejected ($p = 0.574$).

Table four lists the b coefficients, the Wald statistic and its significance, and the odds ratio for the final independent variables in the model. The Nagelkerke R -square is also presented. Logit coefficients (logits), also called unstandardized logistic regression coefficients, are interpreted as the expected change in the propensity (log odds) to adopt new technologies for a unit change in the associated explanatory variable, holding all the other variables constant. Logit coefficients are easier to interpret when converted to an odds ratio using the exponential function. The odds ratios are simply measures of effect size and will be used to comment on their relative sizes when comparing independent variables effects.

The Wald statistic is used to test the significance of individual logistic regression coefficients for each independent variable (that is, to test the null hypothesis in the logistic regression that a particular logit [effect] coefficient is zero). Of the list of independents initially considered, the following ones are statistically significant: type of ownership (OWNE), suppliers – international firms (NETSe), customers – international market (NETCd), sources of technological knowledge – internal personnel (LINKa), sources of

⁵ Only for the categorical variables, as the square and cubic value of a dummy variable is the dummy variable itself.

technological knowledge – suppliers (LINKc), and employees' skills upgrading (SKILL). All the others are not statistically significant.

Table 4: Results of the Estimation of a Logistic Regression Model with the Final Independent Variables

Predictors	B	S.E.	Wald χ^2	p-value	EXP(B)
OWNE - Type of Ownership			16.902	.001	
OWNE(1) – owned by one person (dummy)	-1.338	1.352	.980	.322	.262
OWNE(2) – a partnership (dummy)	.335	1.182	.080	.777	1.398
OWNE(3) – family owned (dummy)	-2.270	1.202	3.565	.059	.103
NET - Supply, distribution and customers' networks					
NETSe) – suppliers: international firms	1.883	.693	7.393	.007	6.573
NETCd) – customers: international market	1.687	.610	7.646	.006	5.402
LINK - Institutional links					
LINKa) – internal personnel	1.081	.499	4.692	.030	2.947
LINKc) – suppliers	1.926	.573	11.303	.001	6.860
SKILL - Skills' upgrading of employees					
SKILL	2.751	.616	19.923	.000	15.663
Constant	-3.201	1.359	5.552	.018	.041

Source: Own elaboration

Nagelkerke $R^2=0.601$

As indicated earlier, the analysis of the odds ratios allows comparing the effect size of each one of the independents to the odds of the dependent. In other words, among the significant predictors earlier identified, it is possible to identify which ones produce greater positive (odds ratios > 1) or negative (odds ratios < 1) effects on the odds of adoption of new technologies.

For instance, the odds that a firm in a partnership will adopt new technologies are 1.398 times the odds of a limited company⁶ doing so, while the odds that a firm owned by one person or a family owned firm will adopt new technologies are 0.262 and 0.103 times, respectively, the odds of a limited company doing so. The odds of a firm using international firms as suppliers and customers, respectively, are 6.573 and 5.402 times the odds of a firm not using these networks. On the other hand, the odds of firms using internal personnel and suppliers as sources of technological knowledge are, respectively, 2.947 and 6.860 times the odds of firms not using these sources. Finally, the odds of adopting new technologies by firms upgrading employees' skills are 15.663 times the odds of firms not doing it.

From the 84 firms that adopted new technologies, 90.5 percent were correctly predicted (sensitivity), while from the 63 firms that did not adopt new technologies, 77.8 percent were

⁶ When the independent variable is categorical, the odds ratios need to be interpreted in terms of the left-out reference category, which in this case is the option: limited company.

correctly predicted (specificity)⁷. The overall percentage of correctly predicted cases is 85 percent, which is very reasonable.

In order to test research hypotheses H1, H2, H3, H4, H5, and H6, the likelihood of the model with all the independent variables was compared with the likelihood of the model without the variables implicated in each research hypothesis. In testing the first research hypothesis, H1, that the origin of firms' employees is a significant predictor of technological behaviour, the null hypothesis is $H_{01} : \beta_1 = \beta_2 = \beta_3 = \beta_4 = 0$. In this case, H_{01} was not rejected ($p=0.899$), meaning that the origin of employees (family members, local community or outsiders) is not a significant predictor.

With respect to the second hypothesis, H2, that the employees' skills upgrading is a significant predictor, the null hypothesis ($H_{02} : \gamma = 0$) was rejected ($p=0.000$), indicating the importance of employment qualification as one basic condition for the industry capacity to survive in the present, competitive environment.

In the third research hypothesis (H3), which states that the type of ownership is a significant predictor, the null hypothesis ($H_{03} : \delta = 0$) was rejected ($p = 0.002$), meaning statistical evidence was in favour of H3. The individual parameter results (in table four) demonstrate that the category 'a partnership' produces the higher positive effect on the probability of adoption of new technologies when compared with the other categories, indicating that the responsibility towards the partners (not necessarily family members) increases the pressure for better results and necessary changes.

Regarding the fourth research hypothesis, H4, that the type of management is a significant predictor, there is statistical evidence in favour of $H_{04} : \epsilon = 0$ ($p=0.472$), leading to the rejection of H4.

Concerning the fifth research hypothesis, H5, that the scope and geography of the firms' networks are significant predictors, the test was performed for the three network scopes considered – supply, distribution, and customer networks – thereby separately testing three null hypotheses: $H_{05S}, H_{05D}, H_{05C}$. For the first case, H_{05S} , the likelihood of the model with all the independent variables was compared with the likelihood of the model without the variables NETr, considering $r=1...5$, that is, variables NETSa, NETSb, NETSc, NETSd, and NETSe. For the second case, H_{05D} , the variables dropped were NETr, with $r=6...10$, that is, the variables NETDa, NETDb, NETDc, NETDd, and NETDe. Finally, for the last case, H_{05C} , the restricted model dropped the variables NETr, with $r=10...14$, that is, the variables NETCa, NETCb, NETCc, and NETCd. The null hypothesis, $H_{05S} : \zeta_1 = \zeta_2 = \zeta_3 = \zeta_4 = \zeta_5 = 0$, was rejected ($p=0.016$), confirming the importance of the relationships with suppliers as a way of creating critical mass and exploiting standardisation opportunities in the TCL sectors. The null hypothesis, $H_{05D} : \zeta_6 = \zeta_7 = \zeta_8 = \zeta_9 = \zeta_{10} = 0$, was not rejected ($p=0.454$), meaning that the use of different geographically located distributors is not a significant predictor. Regarding the null hypothesis, $H_{05C} : \zeta_{11} = \zeta_{12} = \zeta_{13} = \zeta_{14} = 0$, the result for the qui-square statistic with 4 degrees of freedom just barely means the rejection of this null hypothesis ($p=0.062$), indicating that the variables related with different geographically located customers are jointly nonstatistically significant. Nevertheless, considering such a small p-value, and taking into account the individual parameter result (table four) for the use of international customers ($p=0.006$), this variable should not be ignored when drawing conclusions.

Indeed, the individual parameter results demonstrate that, in both the situations of suppliers and customers' networks, the contacts with international firms (networks' geography) were the ones with statistical significance, producing positive effects on the odds

⁷ Sensitivity and specificity are statistical measures of the performance of a binary classification test. Sensitivity measures the proportion of actual positives which are correctly identified as such, and Specificity measures the proportion of negatives which are correctly identified.

of the adoption of new technologies by the sample firms. The importance of exploring international and quality conscious markets is corroborated by these results.

Finally, considering the sixth research hypothesis, H6, that the nature of institutional links is a significant predictor, the null hypothesis $H_{06} : \eta_1 = \eta_2 = \eta_3 = \eta_4 = \eta_5 = 0$ was rejected ($p=0.000$). Individual parameter results confirm the importance of the use of internal personnel ($p=0.030$) and suppliers ($p=0.001$) as sources of technological knowledge. These results validate again the importance of employment qualification and skills, but they also suggest that the technological adjustment process in TCL sectors is substantially driven by supplier-demanding mechanisms. An easier reading of the results is given in table five.

Table 5: Summary of the results

Question Addressed	Research Hypothesis	Results	Reading
Q: How do firms' networking aptitudes and human capital endowment affect their technological adjustment strategies?	H1: The origin of the firms' employees is a significant predictor.	H01 is not rejected ($p=0.899$)	The origin of employees is not a significant predictor.
	H2: The upgrading of skills of employees is a significant predictor.	H02 is rejected ($p=0.000$)	Employment qualification determines the adoption of new technologies.
	H3: The type of ownership is a significant predictor.	H03 is rejected ($p=0.002$)	The type of ownership is a significant predictor: the category "a partnership" produces the higher positive effects.
	H4: The type of management is a significant predictor.	H04 is not rejected ($p=0.472$)	The type of management is not a significant predictor.
	H5: The scope and geography of firms' networks are significant predictors.	H05S is rejected ($p=0.016$) H05D is not rejected ($p=0.454$) H05C is rejected ($p=0.062$)	The use of international suppliers and customers is a significant predictor.
	H6: The nature of institutional links is a significant predictor.	H06 is rejected ($p=0.000$)	The use of internal personnel and suppliers as sources of technological knowledge is a significant predictor.

Source: Own elaboration

Considering the different effect sizes produced by each one of the significant predictors (given by the individual parameter estimates, correspondent Wald statistics, and odds ratios – table four), it may be concluded that the adoption of new technologies in labour-intensive industries from Southern Europe is a process:

- Developed internally, depending largely on the skills of the workforce;
- Supplier dominated, in the sense that the ideas, suggestions, and/or impositions of suppliers (even more strongly, if international) play an important role in the technological process;
- Motivated by the international market, given the importance of international customers for firms engaged in technological changes.

5. FINAL REMARKS

The process of economic globalisation has brought peripheral regions into the centre of rapid technological and economic change. A great deal of research has focused on the factors behind the technological change in central European regions. In this work, however, the concern was limited to those geographical environments that are not "...blessed by clusters, special factors, or new growth industries. Rather our focus has been on provincial regions with labour-intensive industries vulnerable to low-wage competition from within and without Europe." (RASTEI, 2002).

The main goal was to identify the factors affecting the adoption of new technologies by such industries, considering technological adjustments as the needed way for the promotion of productivity and local development in vulnerable areas.

We conclude that the learning and technological capacity of TCL firms from southern regions is largely influenced by the relationship patterns that producers develop with their suppliers and customers. Those patterns are essential to information exchange in sectors where the process of technological adjustment is primarily a process of diffusion of best-practice along the value-chain. In addition to being a supplier-dominated process, the technological advances in these sectors are largely dependent on the qualifications of the workforce as well as strongly motivated by the appeal of the international market. These two characteristics are interdependent, as firms committed to export production recognise the need to offer specialised and differentiated products, which is not compatible with low-cost production that indicates the use of unskilled labour and firm inadequacy to absorb and diffuse knowledge.

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REFERENCES

- Arndt, O., and R. Sternberg (2000). Do Manufacturing Firms Profit from Interregional Innovation Linkages? An Empirical Based Answer. *European Planning Studies*, 8 (4): 465 - 485.
- D'Aveni, R. (1994). *Hypercompetition: Managing the dynamic strategic maneuvering*. Aru Press. New York.
- Camagni, R. (1991). Local Milieu, Uncertainty and Innovation Networks: Towards a New Theory of Economic Space. In R. Camagni (ed.). *Innovation networks: spatial perspectives*. London and New York: Belhaven Press, 121 - 144.
- Camagni, R. (1995). Global Network and Local Milieu: Towards a Theory of Economic Space. In S. Conti, E. Malecki and P. Oinas (eds.). *The Industrial Enterprise and its environment: Spatial Perspectives*. England: Avebury, 195 - 213.
- Camagni, R. (2002). On the Concept of Territorial Competitiveness: Sound or Misleading? *Urban Studies*, 39(13): 2395 - 2411.

- Cassiman, B. and R. Veugelers (2002). R&D Cooperation and Spillovers: Some Empirical Evidence From Belgium. *The American Economic Review*, 92 (4): 1169 - 1184.
- Cesário, M. and M. T. N. Vaz (2008). How do Small Firms from European Rural Regions Learn and Innovate? *WSEAS Transactions on Environment and Development*, 4 (10): 835 - 845.
- Chennells, L. and J. Van Reenen (2002). Technical Change and The Structure of Employment and Wages: A Survey of the Microeconomic Evidence. In *Source Productivity, inequality and the digital economy: a transatlantic perspective*, MIT Press, 175 - 223.
- Cohen, W. and D. A. Levinthal (1990). Absorptive Capacity: A New Perspective on Learning and Innovation. *Administrative Science Quarterly*, 35: 128 - 152.
- Cooke, P. and K. Morgan (1998). *The Associational Economy: Firms, Regions and Innovation*. Oxford University Press. Oxford.
- Dosi, G., C. Freeman, R. Nelson, G. Silverberg and L. Soete (1988). *Technical Change and Economic Theory*. Pinter Publishers. London.
- Ellison, G., L. Glaeser and W. Kerr (2010). What causes industry agglomeration? Evidence from coagglomerative patterns. *American Economic Review*, 100: 1195-1213.
- Gambardella, A. and F. Malerba (1999). *The Organisation of Economic Innovation in Europe*. Cambridge University Press. Cambridge.
- Gertler, M. S. (2008). Buzz Without Being There? Communities of Practice in Context, *Community, Economic Creativity and Organisation*. Oxford Scholarship Online Monographs, 203 - 227.
- Hall, R. H. (1987). *Organizations: Structures, Processes and Outcomes*. Englewood Cliffs: N.J. Prentice-Hall.
- Julien P. A. (1995). Economic Theory, Entrepreneurship and New Economic Dynamics. In S. Conti, E. Malecki and P. Oinas (eds.) *The Industrial Enterprise and its Environment: Spatial Perspectives*. England: Avebury, 123 - 142.
- Julien P.A., L. Raymond, R. Jacob and C. Ramangalahy (1999). Types of Technological Scanning in Manufacturing Smes: An Empirical Analysis of Patterns and Determinants. *Entrepreneurship and Regional Development*, 11: 281 - 300.
- Hudson, R. (1999). The Learning Economy, The Learning Firm And The Learning Region. *European Urban and Regional Studies*, 6 (1): 59 - 72.
- Hudson, R. (2010). Resilient Regions in an Uncertain World: Wishful Thinking or a Practical Reality? *Cambridge Journal of Regions, Economy and Society*, 3: 11 - 25.
- Kirat, T., and Y. Lung. (1999). Innovation and Proximity: Territories as Loci of Collective Learning Processes, *European Urban and Regional Studies*, 6 (1): 27 - 38.
- Malecki, E. and R. Poehling (1999). Extroverts and Introverts: Small Manufacturers and their Information Sources. *Entrepreneurship and Regional Development*, 11: 247 - 268.
- Malmberg, A. and P. Maskell (1997). Towards an Explanation of Regional Specialization and Industry Agglomeration. *European Planning Studies*, 5 (1): 25 - 42.
- Maskell, P. and A. Malmberg (1999). The Competitiveness of Firms and Regions: 'Ubiquitification' and the Importance of Localized Learning. *European Urban and Regional Studies*, 6 (1): 9 - 25.
- Maskell, P., H. Eskelinen, I. Hannibalsson, A. Malmberg and E. Vatne (1998). *Competitiveness, Localised Learning and Regional Development. Specialisation and Prosperity in Small Open Economies*. Routledge. London.

- Menard, S. (1995). *Applied Logistic Regression Analysis*. Thousand Oaks: Sage Publications.
- Morgan, K. (1996). L'apprentissage par L'interaction : Réseaux D'entreprises et Services D'appui aux Entreprises, In *Réseaux D'entreprises et Développement*. Ed. OCDE.
- Morgan, K. (2004). The Exaggerated Death of Geography: Learning, Proximity and Territorial Innovation Systems. *Journal of Economic Geography*, 4: 3 - 21.
- Porath, A. (2012). Collaborative Research as a Source of Innovation. *Spatial and Organizational Dynamics Discussion Papers*, CIEO-Research Centre for Spatial and Organizational Dynamics, University of Algarve, 11: 6-12.
- Porfírio, J. (2011). The Portuguese Economic Divergence with European Union: A Call for Corporate Strategy in Light of New Economic Geography Principles. *Spatial and Organizational Dynamics Discussion Papers*, CIEO-Research Centre for Spatial and Organizational Dynamics, University of Algarve, 6: 7-22.
- RASTEI (2002). Regional Adjustment Strategies to Technological Change in the Context of European Integration. Final Report, HPSE-1999-00035.
- Scott, A. (2000). *Regions and the World Economy - The Coming Shape of Global Production, Competition, and Political Order*. Oxford University Press. Oxford.
- Scott, A., J. Agnew and M. Storper (2001). Global City-Regions: an Overview. In A. Scott (ed.), *Global City-Regions: Trends, Theory, Policies*. Oxford: Oxford University Press, 11-30.
- Scott, A. and M. Storper (1992). Industrialisation and Regional Development. In M. Storper and A. Scott (eds.) *Pathways to industrialisation and Regional Development*, London: Routledge, 3-17.
- Scott, A. and M. Storper (2003). Regions, Globalization, Development. *Regional Studies*, 37 (6-7): 579-593.
- Storper, M. (1995). The Resurgence of Regional Economies, Ten Years Later: The Region as a Nexus of Untraded Interdependencies. *European Urban and Regional Studies*, 2: 191 - 221.
- Storper (2009). Roepke Lecture in Economic Geography—Regional Context and Global Trade. *Economic Geography*, 85 (1): 1 - 21.
- Storper, M. and B. Harrison (1991). Flexibility, Hierarchy and Regional Development: The Changing Structure of Industrial Production Systems and Their Forms of Governance in the 1990s. *Research Policy*, 20: 407 - 422.
- Sonn, J.W. and M. Storper (2008). The Increasing Importance of Geographical Proximity in Knowledge Production: An Analysis of US Patent Citations, 1975- 1997. *Environment and Planning A*, 40 (5): 1020 - 1039.
- Vaz, M.T.N. (2006). Entrepreneurship in Small Firms and Local Development. In M.T.N. Vaz, E. Morgan, and P. Nijkamp (eds.) *The New European Rurality: Strategies for Small Business*. London: Ashgate, 13-25.
- Vaz, M.T.N. (2012). KIBS in Peripheral Regions: Major Outlines, *Spatial and Organizational Dynamics Discussion Papers*, CIEO-Research Centre for Spatial and Organizational Dynamics, University of Algarve, 11: 44-61.
- Vaz, M. T. N., and M. Cesário (2008). Driving Forces for Innovation: Are They Measurable? *International Journal of Foresight and Innovation Policy*, 4 (1-2): 30 – 50.
- Vaz, M. T. N., M. Cesário and S. Fernandes (2006). Interaction Between Innovation in Small Firms and Their Environments: An Exploratory Study. *European Planning Studies*, 14 (1): 95 - 117.

APPENDIX 1 – DESIGN OF QUESTIONNAIRE AND SAMPLING PROCEDURES

The questionnaire used in the present research was designed, tested, and applied in the scope of the EU FP5 Project RASTEI - Regional Adjustment Strategies to Technological Change in the Context of European Integration - HPSE-1999-00035.

This project aimed to study how local adjustment strategies, designed to enhance productivity utilising technological change in labour-intensive industries, has affected, and will affect in the future, European non-metropolitan regions in terms of their employment potential.

The results for the Greek, Italian and Spanish firms were generously provided by the project coordinator for the present research. The same questionnaire was applied to the Portuguese sample firms during 2005.

Using common questions and an agreed coding system, the data set allows for the pooling of data by question across a group of European southern regions.

The questionnaire has eight separate sections that can be summarised as follows:

- I. Background:** The questionnaire begins with the responsibility of the respondent, as well as the size of the firm as indicated by sales and employees.
- II. Ownership:** In the next section, the questionnaire seeks information about the formal ownership structure of the SME, recognising that these types of organisations vary in form and in practice between jurisdictions and in relation to related firms.
- III. Supply and distribution links:** In this section, the questionnaire sought to elicit information about the geographical and functional origin and destination of inputs to production and outputs of production.
- IV. Competitive strategies:** In this section, firms were asked about the pattern of total sales over the past three years, as well as the nature of the SME response to changes in total sales.
- V. Investment strategies:** Here, the questionnaire asks for information on the nature of investment, the sources of funds used to finance investment, the effect of investment on employment, and the desired results of investment for the firm.
- VI. Technology adoption:** This section explicitly links to the adoption of technology (broadly defined).
- VII. Labour and technological change:** The effect of technology change on employment is explicitly tackled here.
- VIII. Policy and policy institutions:** Finally, the connection is created between decisions made and identified in previous sections and the relevance and usefulness of existing regional, national, and EU policy instruments.

USE OF SOCIAL NETWORKS IN SMALL AND MEDIUM ENTERPRISES: THE CASE OF ALGARVE

USO DE REDES SOCIAIS NAS PEQUENAS E MÉDIAS EMPRESAS: O CASO DO ALGARVE

Ana Belo, Guilherme Castela and Sílvia Fernandes

ABSTRACT

The present work aims at analyzing the use of social networks for the performance of SME (small and medium enterprises) in Algarve, having completed a questionnaire. The empirical study reveals that the collected data (from 70 firms) have good psychometric qualities. It validated that some firms already have an integrated business strategy with social networks, as well as a group of individuals within the enterprise responsible for its involvement in these networks. The data show that the most performed activities are: communicating with customers, being closer to potential customers, and marketing. However, these firms also use social networks for other activities such as: analyzing their competitors and behavioral patterns, knowing trends, cooperation, fidelization, internationalization, new products' launching, new brands and businesses, opinion searching, new ideas, and recruitment. Data also showed that few SME are using social networks for promotions and technical assistance. Most entrepreneurs/managers consider that social networks enhance the performance of their firms, but few really measure the results obtained. The firms that most frequently accede to social networks are those whose entrepreneur/manager has a higher level of qualifications. In addition, the SME that most use these networks are from services and hotel/restaurant/bar sectors.

Keywords: Social Networks, SME, Performance, Involvement

RESUMO

O presente trabalho pretende analisar o uso de redes sociais na performance das PME (pequenas e médias empresas) no Algarve, tendo concretizado um inquérito. O estudo empírico revela que os dados recolhidos (de 70 firmas) possuem boas qualidades psicométricas. Validou que algumas firmas já têm uma estratégia de negócio integrada com as redes sociais, assim como um grupo de indivíduos dentro da firma responsável pelo seu envolvimento nestas redes. Os dados mostram que as atividades mais desenvolvidas são: comunicar com clientes, estar próximo de potenciais clientes e marketing. Contudo, estas firmas também usam as redes sociais para outras atividades tais como: analisar a concorrência e padrões de comportamento, conhecer tendências, cooperação, fidelização, internacionalização, lançamento de novos produtos, novas marcas e negócios, pesquisa de opinião, novas ideias e recrutamento. Os dados mostraram que poucas PME estão usando as redes sociais para promoções e assistência técnica. A maioria dos empreendedores/gestores considera que as redes sociais melhoram a performance de suas empresas, mas poucos efetivamente medem os resultados obtidos. As firmas que mais frequentemente acedem às redes sociais são aquelas cujo empreendedor/gestor tem maior nível de qualificações. E as PME que mais usam estas redes são dos setores de serviços e hotel/restauração.

Palavras-chave: Redes Sociais, PME, Performance, Envolvimento

JEL Classification: O33

1. INTRODUCTION

New communication technologies allow a global interaction like never imagined. Internet evolution and, especially, Web 2.0 (O'Reilly, 2005) opened new opportunities and benefits for SME, given its ease of communication and information dissemination (Brandão and Marques, 2010; Fernandes and Almeida, 2009). One of the greatest opportunities was the opening of new online applications of network environments known as social networks (Tredinnick, 2006; Boyd and Ellison, 2007; Constantinides *et al.*, 2008). Today, the internet presents itself as the platform of greater access, in which millions of individuals enter daily at any place or time (Tapscott and Williams, 2007). In this context, new environments appeared (Evans, 2009) such as the social networking sites like *Facebook*, *YouTube*, *LinkedIn*, *Twitter*, *Hi5*, *Bebo*, and *MySpace*, among others, in which users either communicate or share content (Pei *et al.* 2011; Boyd and Ellison, 2007).

On these platforms, people create their profiles, communicate, exchange pictures and movies, or group on a particular interest, creating communities. Participation in these communities, influencing them for their benefit, can add value to any business. These networked individuals can actively participate in innovation, wealth creation and social-economic development in a way never before considered (Qualman, 2009). According to the study "Internet use in Portugal 2010" (Taborda, 2010) more than 60% of social networks' users in Portugal consider it important that companies have a profile on these networks. The continuous entry of firms in these applications can completely change the way of doing business. Some authors have suggested that, after the knowledge economy and digital economy, a new economy happens now, naming it "Socialnomics" (Qualman, 2009) or "Economy of relations" (Robison and Ritchie, 2010) or "Economy of integrity" (Bernasek, 2010). According to the authors, this new economy is based on inter-relations and built upon trust and integrity. The key features of business and innovation, which in past decades were tangible (such as coal, oil and others), are now replaced by intangible assets such as knowledge, confidence and relations. Companies need to adapt to this revolution in order to be competitive.

Studies on social networking sites have expanded, receiving increased attention from the scientific community (Boyd and Ellison, 2007). These sites are currently a major research focus in several areas. One example is the *Facebook* application, which has been studied by Dwyer *et al.* (2007), Acquisti and Gross (2006), Lampe *et al.* (2007) and Stutzman (2006). Thus, it is essential to explore the potential of social networks in enhancing the performance of SME. These are generally the firms most affected by strong global competitiveness. This work aims at characterizing the representation of Portuguese SME, especially of the Algarve region, in these networks and analyzing the activities most potentiated. Some companies use these networks for marketing activities; however, they should not view social networks as just a strategic, online marketing tool (Evans, 2009). They need to look deeper and analyze these new environments with multiple perspectives because social networks allow communication that covers millions of different features and potential customers (Vasconcelos and Campos, 2010; Tapscott and Williams, 2007; Brandão and Marques, 2010; Constantinides *et al.*, 2008). The company's adaptation to this new reality implies the innovation of its strategy and organization (Magalhães, 2011).

2. OBJECTIVES

The main objective of this work is to analyze the potential of social networks as tools for SME's development and then indicate a methodological approach for general application. Other works from Amo *et al.* (2010), Carr *et al.* (2010) and Silver (2009) have also analyzed factors and gains related to the use of social networks by SME. It then intends to verify which activities of SME in the Algarve region are already being enhanced by these platforms. For this purpose, an online questionnaire was activated and answered by 70 firms from the region. Other related objectives are: if the firms already integrate their strategy with social networks; if there is a group of people within the company involved in this representation/participation; if there is a relationship between who manages this representation and a significant use of social networks, as well as if qualifications have some influence; and if employees' access to social networks at work affects their productivity. In order to achieve the purposed objectives, the following research questions were considered:

Q1: Is there an influence of social networks, where the company is represented, on its economic performance?

Q2: Does the company's business strategy incorporate social networking sites?

Q3: From which business sector(s) are the firms that most use social networks?

Q4: Is there a relation between the SME that most use social networks and the qualifications of those who manage it?

Q5: Are the gains of the representation of SME in social networks being measured?

Q6: Is there a relation between the duration of social networks' use by employees and company's performance?

Q7: Does who manages company's representation in social networks influence their increasing use?

3. COMPARATIVE STUDIES

The innovative social networking sites introduced fundamental changes in the users' behavior. Some companies have recognized this change, taking advantage of being the first to expand their activities to social networks, building communities and selling their products online (Evans, 2009). This can bring great benefits to business, once technology is one of the main tools used by companies to innovate. Several empirical studies demonstrate links between information technologies, innovation and competitive success of SME (Edquist and Henrekson, 2006). The participation in social platforms also creates innovation inside the company. These applications have the advantage of cheap communication, leading to a very large membership and causing the network to grow fast and connect users around the world (Hempel, 2009). This process is also led by the fact that users share common interests (Weber, 2009) without physical contact, without having to meet in the same physical space or belong to the same ethnic group (Kardaras et al., 2003). These online communities, developed around the same interests, can suddenly join a crowd of individuals (Golder et al., 2007; Shirky, 2010).

In fact there are several companies who are profiting from social networks. A forecast made by Wilson (2009) indicates that 50% of internet users in the UK will visit social networks at least once a month until 2013, and office workers will spend at least 30 minutes per day on social networks (Yap and Robben, 2010). SME cannot ignore this time spent on social networks and thus should analyze these communities. They are already getting benefits in launching innovative products and services (Evans, 2009); research and technical support (Wilson, 2009); cooperation, fidelization, market opinion, business creation and recruitment (Pei et al., 2011); internationalization (Zhou et al., 2007); and creation and distribution of informal information systems for innovation (Vasconcelos and Campos, 2010). A work of Arima (2010) points to “social media” as an opportunity for organizations to build brands, demonstrate leadership behaviors, expand resources, reach new audiences and find new sources of ideas. The study of Ingelbrecht et al. (2010), using a sample of 4000 consumers in 10 markets worldwide (including USA, France, Germany and China), gives to social networks, such as Facebook and LinkedIn, the role of being the emergent places for retailing and shopping activities. The same study indicates that companies can use mass collaboration as a link between business value and social networking technologies. For example, they can examine a target community of a particular product and interact with it in order to rethink ways of selling or innovating the product, adding value to their business. In a way, they are taking advantage of the “collective intelligence” of the community to increase business efficiency (Levy, 1990).

A review of Falcão (2010) on a study from IGMMarketing concluded that social networks are a set of tools that benefits the company as much as it invests in them. It must know how to participate, invest time, create content, increment the network, talk to the community, observe and examine. This results in skills and competencies for the team and the individual worker's activity. The same study identifies two factors behind the non-representation of firms in social networks: the lack of time and the idea that social networks are for young people. According to Falcão (2010), these assumptions are indeed barriers because the more they invest in social networks, the more benefits they can get in the long run. Currently, social networking sites are being invaded by companies seeking for a presence or with products to promote. Some companies are even breaking down the barriers between the virtual and physical, hiring their professionals online (E.life, 2010). Companies are migrating to social networks, keeping their first internet sites on a secondary strategic line.

Social networks help to further intensify networking activities, ideas' exchange and knowledge integration. They can also increase the cooperation among stakeholders (Cross and Thomas, 2010). The most visible issue of these relations between enterprise and social networks is the engagement with the community. The company can be near its customers and share benefits with them, which is a possibility that is really important today. The benefits of this representation/participation only exist if the companies manage to understand the power of collective behavior in the impulse of positive changes in business (Bradley, 2011). For companies, it is important to find their *social momentum*, which is the social dynamics that, using the internet specificities and interactivity, provide not only an increment to the economic value of the business model but also a return maximization (Hummel and Lechner, 2002).

4. AN EMPIRICAL STUDY

4.1. Introduction and Methodology

The methodological path began with an observation of facts related with the subject, through a comparison of social networking *sites* and the representation/participation of SME in these, as well as how companies benefit from such involvement. For example, several available videos, presentations and discussion groups were compared on social networks. Then, we analyzed several other, completed empirical studies, which are mentioned in the previous section. This was followed by a selection of techniques for gathering information for data analysis. Firstly, a questionnaire was prepared to collect the data from a sample of SME in the Algarve region. The data were then analyzed through quantitative techniques which include preliminary descriptive statistics. Generally, the questionnaire directed to the SME in Algarve (QSME) aims, on one hand, to test the research questions initially proposed and, on the other, to characterize the types of SME according to their representation/participation in social networking sites. The questionnaire was built using a specialized online tool - *SurveyMonkey* (www.surveymonkey.com) - which allows the design of a *website* where the questionnaire stays available. The use of this tool in research allows quick access to questionnaires, facilitating faster responses. It also has the advantage of representing the answers graphically and analyzing them for descriptive statistics.

4.2. Sample and Questionnaire

As a sample, we considered the 70 SME of the Algarve region which completed the questionnaire and answered it on time. Expecting more cases would take much more time as companies often do not have time to respond to free questionnaires. Some institutions helped in contacting these firms such as CRIA (regional centre for innovation in Algarve); NERA (enterprise nucleus of the Algarve region); CIEO (research centre for spatial and organizational dynamics) and the Business directory “Sulempresas.com”. These institutions usually deal with the SME of the region. After closing the process of the online questionnaire, the data were collected to be analyzed. The analysis started within the *SurveyMonkey* tool and was then complemented in a later discussion with arguments from statistical analyses.

Table 1 shows the questions used in the questionnaire (QSME) and their possible options or attributes. These questions were based on the observation of social networks’ use and comparison with other studies in the area.

Table 1. Characterization of the questionnaire (QSME)

Question	Options
QSME1: Is your company represented on the Internet with a website?	Yes / No
QSME2: In which social networking sites is your company represented?	Blog; Facebook; Hi5; LinkedIn; MySpace; Orkut; Twitter; Wikis; Youtube
QSME3: Does your company usually use social networks for performing its activities?	Yes / No
QSME4: Have your company implemented an integrated strategy with social networking sites?	Yes / No
QSME5: Do you consider that the representation/participation of your company in social networks favours its business performance?	Yes / No
QSME6: Which activities are more benefited by the representation/participation of your company in social networking sites?	Analyze competition; analyze patterns of behavior; technical assistance; communicate with customers; trust; knowing trends; cooperation with other companies; being closer to potential clients; loyalty; internationalization; launch new products; marketing; brands; new businesses; opinion search; find new ideas; research; recruitment; promotions
QSME7: Are you measuring the gains of your company's representation/participation in social networks?	Yes / No
QSME8: If you answered yes to the previous question, tell how they are measured?	Open answer
QSME9: Who manages in your company this representation/participation in social networks?	Person outside the company (freelancer); company's employee; director/manager; subcontractor (outsourcing)
QSME10: Is there in your company a group of people involved in its representation in social networks (for content creation, response to customer feedbacks, etc.)?	Yes / No
QSME11: How often do you use social networks for a better performance of your business?	Once in a year; monthly; once in a week; 3 times a week; 5 times a week; every day; several times a day
QSME12: Do your company's employees, in general, access to social networks?	Yes / No
QSME13: Is there some kind of control in your company for limiting the use of social networks?	Yes / No
QSME14: Do you consider there may be a decrease of employee's productivity due to social networks access?	Yes / No
QSME15: Do you find your company's employees more motivated since they use social networks?	Yes / No
QSME16: Which is your company's main sector of activity?	Entertainment; industry; traditional commerce; hotels/restaurants/bars; transports; communications; services; construction, health/ biotechnology; other
QSME17: What is the level of qualification of your company's entrepreneur/director/manager?	Master; PhD; graduate; post-graduate or technical course; 12 ^o year; secondary school; primary school
QSME18: E-mail address of your company:	Open answer
QSME19: Name of your company:	Open answer

Source: Own elaboration

The issues raised in this questionnaire aim to derive and analyze different corresponding variables and the relationships between them.

4.2.1. Operational Variables

Table 2 describes the variables created and their associated questions in the QSME. Note that in this table there are three variables (VESRS, VEGR and VEACT) subdivided into variable items. These result from the multiple-choice questions (multiple answers) which are the QSME2, QSME9 and QSME6 respectively (Table 1). According to the statistical rules in constructing the database in SPSS, such questions provide as many variable items as the options (choices) associated.

Table 2. Operational variables and questions associated in the QSME

Variable	Description	Associated question	Variable items
VESRS	social networks in which the company participates	QSME2	VECTOR (<i>Orkut</i>); VERSBL (<i>blog</i>); VERSWI (<i>Wiki</i>); VERSFA (<i>Facebook</i>); VERSTW (<i>Twitter</i>); VERSLI (<i>LinkedIn</i>); VERSYO (<i>Youtube</i>); VERSMY (<i>MySpace</i>); VERSHI (<i>Hi5</i>)
VEHABG	qualification level of the entrepreneur/director/manager	QSME18	
VEGR	person who manages company's representation in social networks	QSME9	VEGRDR (manager/director); VEGRCB (employee); VEGROT (outsourcing); VEGRFL (freelancer)
VEACT	benefited activities	QSME6	VEACTMK (marketing); VEACTNP (new products); VEACTCF (trust); VEACTCP (cooperation); VEACTPM (promotions); VEACTPQ (research); VEACTAT (technical assistance); VEACTRH (recruitment); VEACTOP (search for opinion); VEACTFD (loyalty); VEACTCM (communicate with clients); VEACTED (knowing trends); VEACTNN (new businesses); VEACTAC (competition analysis); VEACTIN (internationalization); VEACTPC (potential customers); VEACTCO (behavioral patterns); VEACTID (find ideas); VEACTMC (brands)
VERSRS	use of social networks	QSME3	
VEIE	strategy integrated with social networks	QSME4	
VEODA	opinion on favouring the company's performance	QSME5	
VEGP	group involved in representing company in social networks	QSME10	
VEQURS	how often company uses social networks	QSME11	
VESA	company's sector of activity	QSME16	
VEMR	measuring gains with social networks' representation	QSME7	
VECRD	control to limit the use of social networks by employees	QSME13	
VECRS	employees' access to social networks	QSME12	
VEMRD	employees' motivation with social networks	QSME15	
VEDP	employees' productivity decrease	QSME14	

Source: Own elaboration

The questions launched online through the questionnaire QSME, and their correspondent variables, aim to address quick and accessible information for discussing the research questions initially proposed in this study.

5. PRELIMINARY ANALYSIS

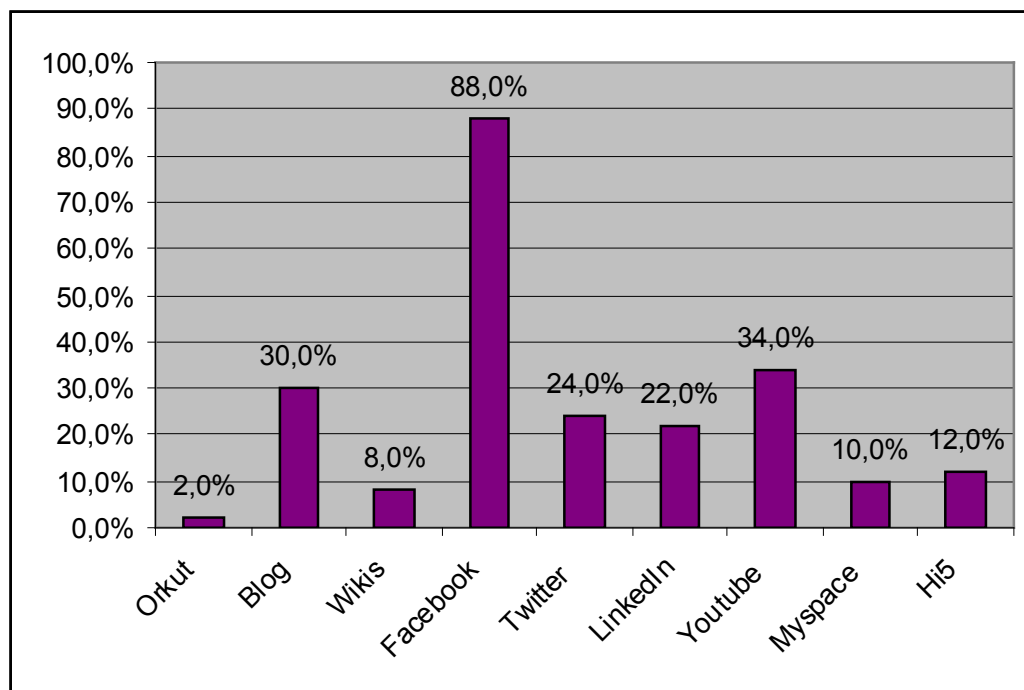
We began to descriptively analyze the data under the research questions proposed - Q1 to Q7 - taking into account the questions in the QSME most related with them.

1) - Analysis of the questions most related with the research question Q1:

- In which social networking sites is your company represented? (QSME2)

From the data obtained, as illustrated in Figure 1, *Facebook* is the social network with the greatest representation of SME (88%). Not all the firms responded positively to this question (20 companies), which means that 28.5% do not use social networks. *Youtube* is the second most used (34%), followed by *Blogs* (30%), *Twitter* (24%), *LinkedIn* (22%), *Hi5* (12%), *MySpace* (10%), *Wikis* (8%) and *Orkut* (2%).

Figure 1. Social networks most commonly used for the representation/participation of the SME in Algarve



Source: Own elaboration

- Does your company usually use social networks for performing its activities? (QSME3)

The proportion of SME that use social networks from the performance point of view was 50% (35 companies). In this regard, several enterprises have omitted this aspect because they consider it as a competitive advantage to their businesses.

- Do you consider that the representation/participation of your company in social networks favours its business performance? (QSME5)

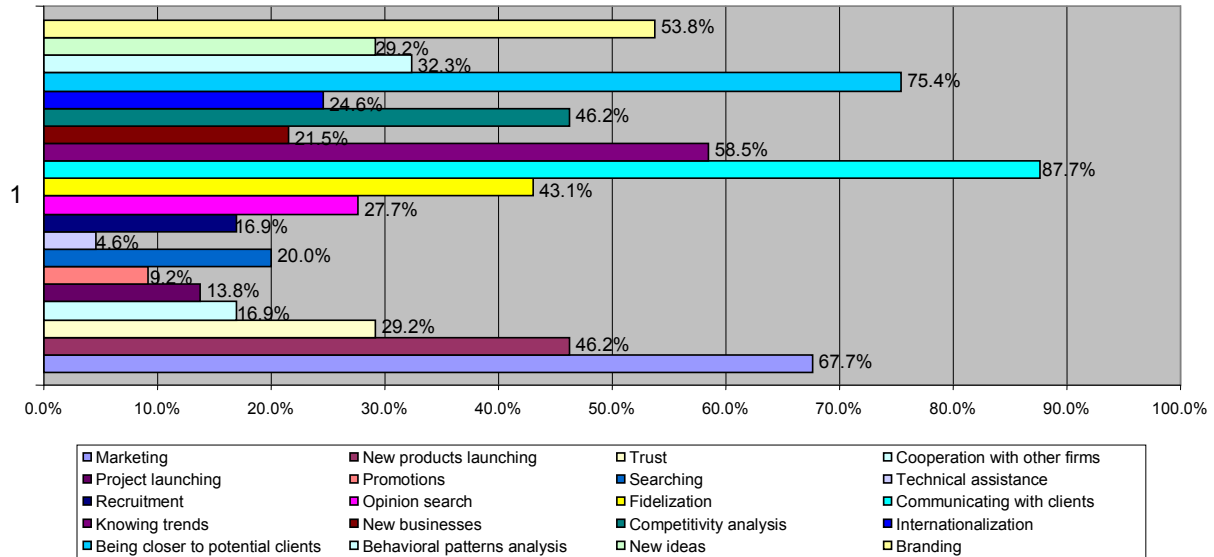
The SME in the Algarve region are sensitive to social networks' use, among which 88% of the sample agree that they favor the performance of their businesses. Only 12% of them considered the opposite.

- Which activities are more benefited by the representation/participation of your company in social networking sites? (QSME6)

Indeed, there are already several activities in SME that are taking advantage of social platforms. Figure 2 shows that the most favored activities are: "communicating with clients" (87.7%), followed by "being closer to potential clients" (75.4%) and "marketing" (67.7%).

Surprisingly, few companies are using these platforms for “promotions” (9.2%) and “technical assistance” (4.6%).

Figure 2. Activities that most benefit from the representation/participation of these SME in social networks



Source: Own elaboration

On this issue, there was an open question in the QSME where companies could mention other activities. However, none mentioned anything; this may indicate that social networks in Algarve are mainly being used to enhance those selected activities.

2) - Analysis of the question most related with the research question Q2:

- Have your company implemented an integrated strategy with social networking sites? (QSME4)

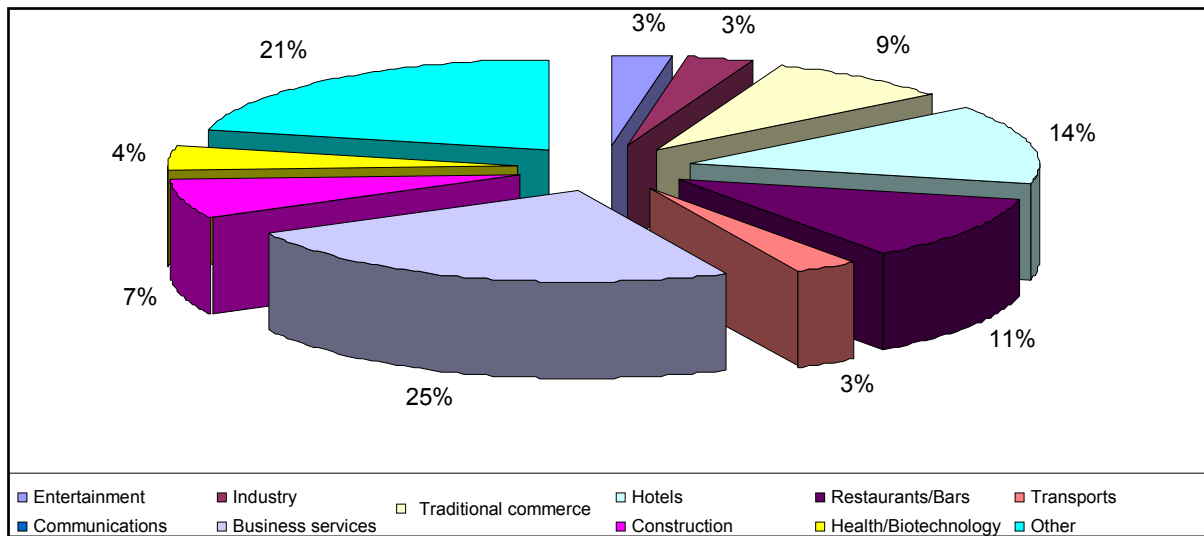
The data show that about 31% of the SME have implemented an integrated strategy with social networks, are present in several of these platforms and have a group of people involved in this participation according to their business goals and branches.

3) - Analysis of the question most related with the research question Q3:

- Which is your company's main sector of activity? (QSME16)

The largest segment (25%) was found in the “business services” sector, followed by 14% in “hotels”, 11% in “restaurants/bars”, 9% in “traditional commerce”, 7% in “construction”, 4% in “health/biotechnology”, 3% in “transports”, 3% in “entertainment” and also 3% in “industry”, as illustrated in Figure 3.

Figure 3. Sectors of the SME that responded to the questionnaire



Source: Own elaboration

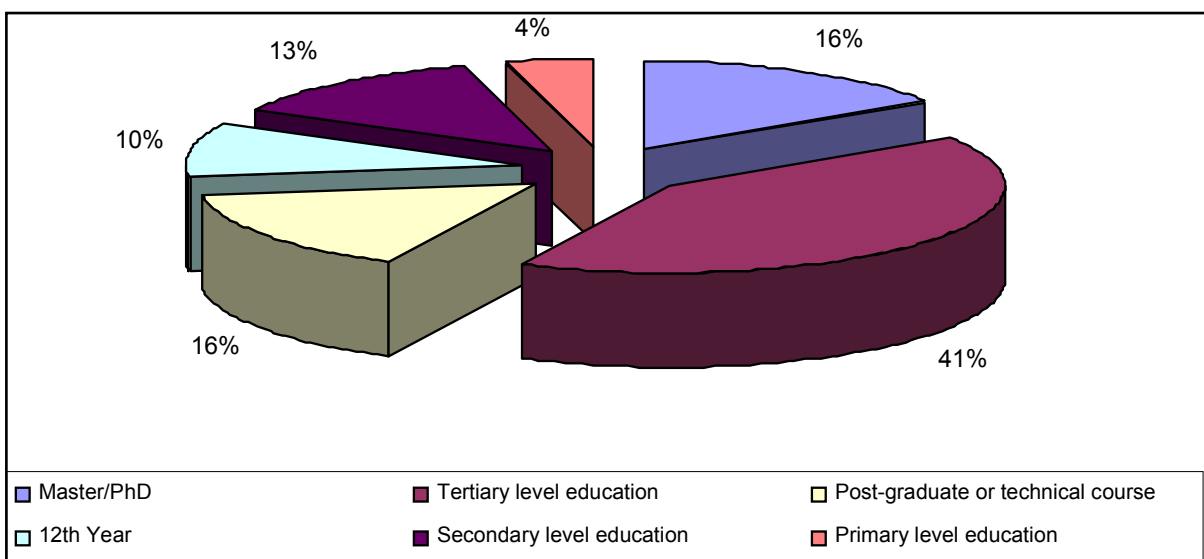
Note that the option “other” among the sector options included 21% of the SME, which belong to major groups having a diversification of their activities throughout several sectors.

4) - Analysis of the question most related with the research question Q4:

- Is there a relation between the SME that most use social networks and the qualifications of those who manage it? (QSME17)

The data show that for the majority of SME in the sample (41%), aware of the potential of social networks, their director/manager has a high degree, followed by either post-graduate with “Master/PhD” degree (16%) or “technical course” (16%). Only 4% of the cases have “primary level education”, and 13% have “secondary level education” as shown in Figure 4.

Figure 4. Skills of the director/manager of the SME that responded to the questionnaire



Source: Own elaboration

5) - Analysis of the question most related with the research question Q5:

- Are you measuring the gains of your company's representation/participation in social networks? And if so, how they are measured? (QSME7 and QSME8)

Analyzing the data obtained, we detect that few SME really measure the gains from using social networks (15%). To the open question that asked to these cases which methods they use for this measurement, they answered: segmentation; number of visits to the *blog*; number of requests for information and reservations through *Facebook*; sales and number of visits; number of *clicks* on ads (or other online publications); *Google* analytics; number of budgets asked through *Facebook* and number of these that were performed. For example, with the creation of events it is easy to get an idea of how many people adhere to them.

6) - Analysis of the questions most related with the research question Q6:

- Do your company's employees, in general, access to social networks? (QSME12)

In this issue, the majority of SME in the sample (68%) allow their employees to access social networks within the company.

- Is there some kind of control in your company for limiting the use of social networks? (QSME13)

The greatest part of the sample (74%) revealed there is no such control. Thus, if a considerable number of SME (68%) allow internal access to social networks, it means that many of their employees access social networks without control, which raises the question of an eventual decrease in productivity.

- Do you consider there may be a decrease of employee's productivity due to social networks access? (QSME14)

About 52% of the SME in the sample believe that there may be a loss of productivity; 25% don't know and 23% believe that this situation does not occur.

- Do you find your company's employees more motivated since they use social networks? (QSME15)

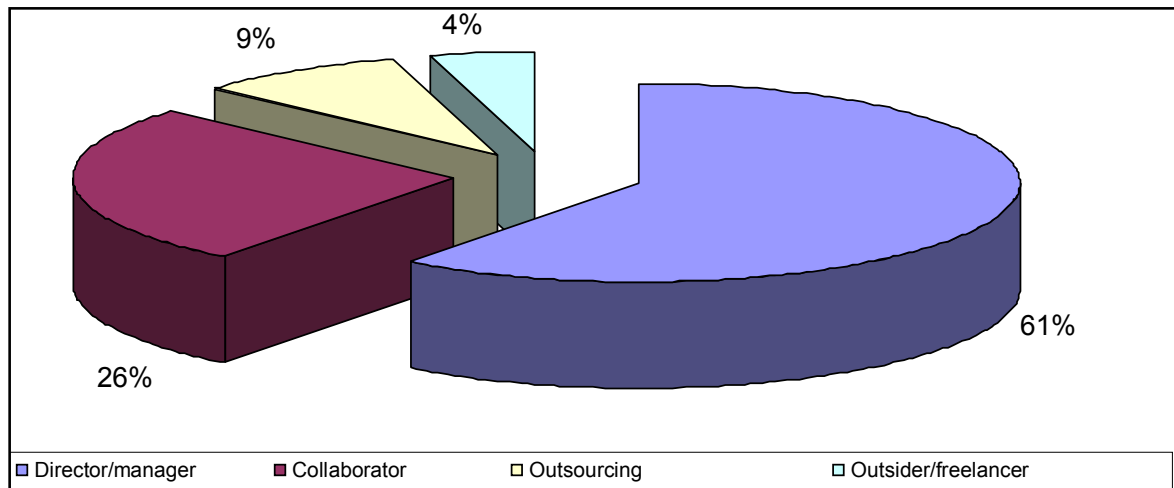
Only 20% of the SME consider this relationship positive; however, 44% of them don't know and 36% believe that this relationship does not occur.

7) - Analysis of the questions most related with the research question Q7:

- Who manages in your company this representation/participation in social networks? (QSME9)

The percentage of management of social networks in SME by their own "director/manager" is considerable (61%), followed by "collaborator" of the company (26%), "outsourcing" (9%) and technician "outsider/freelancer" (4%), as illustrated in Figure 5.

Figure 5. Management of the representation/participation of SME in social networks



Source: Own elaboration

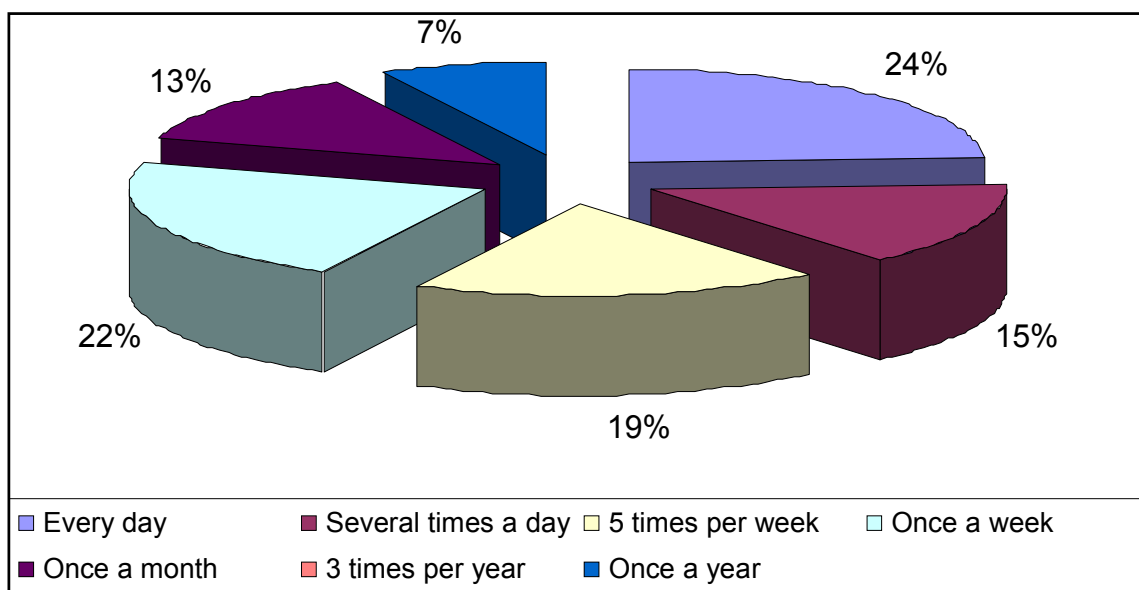
- Is there in your company a group of people involved in its representation in social networks (for content creation, response to customer feedbacks, etc.)? (QSME10)

For this aspect, we verified that the majority of SME (67%) still do not have a structured management group responsible for their representation in social networks, creating content, twitter messages, presentations, answering customer comments, etc.

- How often do you use social networks for a better performance of your business? (QSME11)

It was found that about 24% of SME in the sample have access to social networks “every day” for carrying out some of their activities. Then, 22% “once a week”, followed by “5 times per week” (19%), “several times a day” (15%), “once a month” (13%), and “once a year” (7%), as shown in Figure 6.

Figure 6. Frequency of access to social networks by the respondent SME



Source: Own elaboration

6. CONCLUSION

Currently, social networks are the subject of much discussion, due to their massive adoption by individuals and businesses. This study, focused on SME, aims at bringing together two approaches to investigate whether the SME in Algarve already use these networks in performing their activities and analyze the characteristics and potential from it. This required a questionnaire adjusted to these goals and to the SME of the region. The empirical study found that these firms use social networks for several *online* activities such as: communicating with customers, being closer to potential customers, analyzing the competition and behavioral patterns, knowing trends, cooperating with other companies, internationalization, launching new products, marketing, branding, new businesses, opinion searching, and recruitment. Curiously, few SME are using social networks for activities like promotions, sales and technical assistance, which could be highly beneficial due to the proximity to consumers allowed by these kinds of platforms. The results showed that SME with a greater presence on social networks are from hotel/bar/restaurant and services' sectors. However, some firms of these sectors are not using these tools in the same way, losing some opportunities. The majority of SME recognize that their presence on social networks will favor their economic performance, but only half from the sample effectively use them for performing their business activities. Less than half have already implemented an integrated strategy with social networks, as few have prepared a team/group involved in social networking strategies and in measuring the gains from it. The SME where the owner/director/manager has more qualifications are those which more frequently access social networks and measure the resulting gains/benefits.

On the issue of productivity and motivation of workers/employees, this study found that most companies allow them to access social media, but mostly without the appropriate control. More than half of SME in the sample consider that there may be a loss of productivity, and few consider their employees more motivated since they use social networks. As most users' access varies during the day, we can reflect on whether this whole scenario leads to productivity losses. Therefore, such access is very important for SME but through better education and control of their employees. Social networks should be seen as work facilitators, and entrepreneurs need to better understand how to take advantage of their use and provide results for the companies. Some advantages to be emphasized are: 'constant' (24 hours a day); 'global' (internet as support) and 'in real time' (direct/immediate). These are critical attributes for creating flexible and distinctive outcomes. However, some studies (Inesting, 2011; Brandão, 2011) note that it is not sufficient to be present in large social networks (the famous ones) or in several of them; rather, it is necessary to define a 'social media' strategy. Thus, entrepreneurs must be familiar with the existing types of social networks, including their characteristics and potential, in order to determine in which to be present and take full advantage.

A limitation of this study is the narrow literature support in this area in Portugal, such as empirical studies that clearly sustain the two dimensions of social networks obtained and their connection with the objectives described. There are discussion groups where these issues are debated by professionals who usually work in the area, but they lack strong empirical evidence. Another limitation has to do with the size of the sample used, which could be larger to include more sectors. However, a factor to consider here is that some managers are not really present in social networks as they mix them with regular websites.

These results allow us to indicate some recommendations for future research, not only in this area but also in other related ones. For example, in economics, there is a need for further studies on companies' behaviors towards social networks. One idea could be to explore workers' productivity in using these platforms during their working period and, in

this context, analyze the impact of productivity losses on the region/country. Another issue could be to study the contribution of social media, such as *LinkedIn*, for people recruitment. Also, the analysis of activities such as direct sales and orders is so important that today there are already companies having direct sales' channels on *Twitter* and *Facebook* (E.life, 2010). It would still be a useful study to examine which policies could help SME in Portugal to implement their businesses online, in view of the number of users on social networks.

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REFERENCES

- Acquisti, A. and Gross, R. (2006). Imagined communities: Awareness, information sharing, and privacy on the Facebook. Accessed in 3 February 2011, on the Web site: <http://www.heinz.cmu.edu/~acquisti/papers/acquisti-gross-facebook-privacy-PET-final.pdf>.
- Amo, M., Constantinides, E. and Romero, C. (2010). Profiles of social networking sites users in the Netherlands. University of Twente Publications. Accessed in 10th March 2011, on the Web site: <http://doc.utwente.nl/73399/>.
- Arima, K. (2010). Dicas sobre o uso de redes sociais na empresa. Accessed in 2 April 2011, on the Web site: <http://info.abril.com.br/noticias/corporate/gartner/dicas-sobre-uso-de-redes-sociais-na-empresa-28062010-13.shl>.
- Bernasek, A. (2010). The economics of integrity. Editora Harperstudio.
- Boyd, D. and Ellison, N. (2007). Social network sites: Definition, history, and scholarship. *Journal of Computer-Mediated Communication*, 13(1), article 11. Accessed in 20th February 2011, on the Web site: <http://jcmc.indiana.edu/vol13/issue1/boyd.ellison.html>.
- Bradley, A. (2011). Employing social media for business impact: Key collective behavior patterns. Accessed in 12th March 2011, on the Web site: <http://www.gartner.com/DisplayDocument?ref=clientFriendlyUrl&id=1538316>.
- Brandão, R. and Marques, B. (2010). The impact of web 2.0 in the informal learning of the Portuguese SME. AIP-CE, CEPCEP. Universidade Católica Portuguesa.
- Brandão, M. (2011). O que são redes sociais verticais e horizontais. Accessed in 12th February 2011, on the Web site: <http://www.maiswebmarketing.com/o-que-sao-redes-sociais-verticais-e-horizontais/>.
- Carr, R., Castleman, T., Mason, C. and Parker, C. (2010). Factors affecting SME's willingness to share knowledge on-line: A path model. Proceedings of the 23rd Bled eConference eTrust on Implications for the individual, enterprises and society. University of Maribor. Bled, Slovenia.
- Constantinides, E., Lorenzo, C. and Gómez-Borja, M. (2008). Social media: A new frontier for retailers? *European Retail Research*. 22: 1-27.
- Cross, R. and Thomas, R. (2010). Conduzir o desempenho através das redes sociais. Editora Vida Económica.
- Dwyer, C., Hiltz, C. and Passerini, K. (2007). Trust and privacy concern within social networking sites: A comparison of Facebook and MySpace. America's Conference on Information Systems (AMCIS). USA.

- Edquist, H. and Henrekson, M. (2006). Technological breakthroughs and productivity growth. Accessed in 22th February 2011, on the Web site: <http://www.ifn.se/Wfiles/wp/wp665.pdf>.
- E.life (2010). O Futuro das redes sociais: Fim das barreiras offline. Accessed in 7th March 2011, on the Web site: <http://www.itweb.com.br/noticias/index.asp?cod=74536>.
- Evans, D. (2009). Marketing de media social, uma hora por dia. Editora AltaBooks.
- Falcão, H. (2010). Social technology. Accessed in 15th February 2011, on the Web site: <http://pt.scribd.com/collections/2545330/Social-Technology-Tecnologia-Social>.
- Fernandes, S. and Almeida, H. (2009). Critical information as a success factor in organizations: Objective and methodological approach. *Journal of Spatial and Organizational Dynamics -Discussion Papers*. 2: 69-82.
- Golder, S., Wilkinson, D and Huberman, B. (2007). *Rhythms of social interaction: Messaging within a massive on-line network. Proceedings of the 3rd International Conference on Communities and Technologies*. London, UK.
- Hempel, J. (2009). *How facebook is taking over our lives*. Accessed in 16th March 2011, on the Web site: http://money.cnn.com/2009/02/16/technology/hempel_facebook.fortune/index.htm.
- Hummel, J. and Lechner, U. (2002). *Social profile of virtual communities. Proceedings of the 35th Hawaii International Conference on Systems Sciences*. Hawaii.
- Inesting (2011). Social media marketing. Accessed in 12th February 2011, on the Web site: <http://www.inesting-search.com/SMM/social-media-estrategia.html>.
- Ingelbrecht, N., Patrick, C. and Foong, K. (2010). User survey analysis: Consumer marketing using social network analysis. Accessed in 20th March 2011, on the Web site: <http://www.gartner.com/resId=1381514>.
- Kardaras, D, Karakostas, B and Papathanassiou, E. (2003). The potential of virtual communities in the insurance industry in the UK and Greece. *International Journal of Information Management*. 23 (1): 41-53.
- Lampe, C., Ellison, N. and Steinfeld, C. (2007). Profile elements as signals in an on-line social network. *Conference on human factors in computing systems*. San Jose, CA. USA.
- Levy, P. (1990). *Les technologies de l'intelligence*. Editora la Découverte. Paris.
- Magalhães, R. (2011). Infrastructure and infrastructuring as a bridge between information systems design and organization design. *Journal of Spatial and Organizational Dynamics -Discussion Papers*. 7: 32-44.
- O'Reilly, T. (2005). What is web 2.0: Design patterns and business models for the next generation of software. Accessed in 9th April 2011, on the Web site: <http://www.elisanet.fi/aariset/Multimedia/Web2.0/What%20Is%20Web%202.doc>.
- Pei, M., Ramayah, T. and Suki, N. (2011). Factors enhancing employed job seekers intentions to use social networking sites as a job search tool. **International Journal of Technology and Human Interaction**. 7(2): 38-54.
- Qualman, E. (2009). *Socialnomics - como os media sociais estão a mudar o mundo como vivemos e como fazemos negócios*. Editorial Presença.
- Robison, L. and Ritchie, B. (2010). *Relationship economics: The social capital paradigm and its application to business, politics and other transactions*. Editora Gower.
- Shirky, C. (2010). *Eles vêm aí - O poder de organizar sem organizações*. Actual Editora.

- Silver, D. (2009). *The Social network business plan: 18 strategies that will create great wealth*. John Wiley & Sons. New Jersey.
- Stutzman, F. (2006). Student life on the facebook. Accessed in 20th February 2011, on the Web site: http://ibiblio.org/fred/facebook/stutzman_fbook.pdf.
- Taborda, M. (2010). A utilização da internet em Portugal 2010. LINI - Lisbon Internet and Networks International Research Programme. Lisboa.
- Tapscott, D. and Williams, A. (2007). *Wikinomics, a nova economia de multidões inteligentes*. Editora Quidnovi.
- Tredinnick, L. (2006). Web 2.0 and business: A pointer to the intranets of the future. *Business Information Review*. 23(4): 228-234.
- Vasconcelos, V. and Campos, P. (2010). Distributed informal information systems for innovation: An empirical study of the role of social networks. In: J. Varajão et al. (eds.), *Enterprise information systems. Part II CCIS 110*. Springer-Verlag.
- Weber, L. (2009). *Marketing to the social web: How digital customer communities build your business*. John Wiley & Sons. New Jersey.
- Wilson, J. (2009). Social networking: The business case. *Engineering and Technology*. 4(10): 54-56.
- Yap, R and Robben, J. (2010). A model for leveraging social learning technologies in corporate environments. *Proceedings of the 7th International Conference on Networked Learning*. ISBN: 978-1-86220-225-2.
- Zhou, L., Wu, W. and Luo, X. (2007). Internationalization and the performance of born-global SMEs: The mediating role of social networks. *Journal of International Business Studies*. 38: 673-690.

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