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RESUMO/ABSTRACT

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Knowledge management, competitive intelligence, data mining are all buzzwords in a more digital and complex world. Nowadays, digital information and IT-based knowledge creation and application are present in most successful business initiatives. Unveil the surrounding factors of these successes is critical and therefore, this article discusses the relationship of digital patterns to knowledge management creation and application. It argues that some of the enablers and inhibitors come from firms' regional and/or local environment. Understanding the factors that determine technology and knowledge management adoption is thus a highly relevant topic from the policy point of view. Considering the growing impact of e-business on regions, this research sets the background for the assessment of the relationship among ICT, knowledge management, and e-business practices.

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ABSTRACT

Knowledge management, competitive intelligence, data mining are all buzzwords in a more digital and complex world. Nowadays, digital information and IT-based knowledge creation and application are present in most successful business initiatives. Unveil the surrounding factors of these successes is critical and therefore, this article discusses the relationship of digital patterns to knowledge management creation and application. It argues that some of the enablers and inhibitors come from firms' regional and/or local environment. Understanding the factors that determine technology and knowledge management adoption is thus a highly relevant topic from the policy point of view. Considering the growing impact of e-business on regions, this research sets the background for the assessment of the relationship among ICT, knowledge management, and e-business practices.

INTRODUCTION

Since the 1990s, especially in developed countries, there has been a rapid diffusion of information and communication technology and Internet use. The Internet has introduced a wave of changes, not only on how to trade and do business (Barnes & Cumby, 2002; Brännback, 1997; M.T.B. Tiago, Couto, Tiago, & Cabral Vieira, 2007) but also to firms' internal and external characteristics (Pires & Aisbett, 2001).

Several research organizations and academic researchers have attempted to quantify the extent of national investment in information and communication technology, henceforth ICT, by deriving generalized indexes of IT or "e-readiness" (e.g. Colecchia & Schreyer, 2001).

Three effects on economic growth and productivity driven from ICT are common to most of these studies. The first is the investment made in ICT and its contribution to

capital deepening, thereby helping to increase labour productivity. Secondly, the rapid technological evolution in the production of ICT goods and services may also leverage the efficiency of capital and labour, or multifactor productivity (MFP), in the ICT-producing sector. The third aspect considers the greater adoption of ICT in all the economy domains which helps firms to increase their overall efficiency.

These impacts can be analysed at several levels, based on macroeconomic data (Colecchia & Schreyer, 2002; Jorgenson, Ho, & Stiroh, 2005; Van Ark, Inklaar, & McGuckin, 2003), industry data (Eid, Trueman, & Ahmed, 2002; Pae, Kim, Han, & Yip, 2002; M T B Tiago, Couto, Tiago, & Vieira, 2007) or even individual firms' data (Eder & Igarria, 2001; Pae, et al., 2002; M T B Tiago, et al., 2007).

However, despite the growth of the ICT, research in this area still has some gaps, especially when the emphasis is on small regions (Huizingh, 2002). Thus, the objectives of this paper are to present the bases for the assessment of the relationship between information and communication technology and knowledge management practices and their impact on e-business based on firms' performance. This paper discusses the results of an exploratory survey conducted among a large sample of European and North American companies. A structural equation model was used to examine these relationship paths.

Without fully covering the history of ICT concepts and applications, a brief acknowledgement of its relevance is presented in section 2, with its connection to knowledge management and e-business performance. The last sections present the conceptual framework and describe the hypotheses, the results obtained and the avenues for future research.

BACKGROUND

In today's competitive global context, information and communication technologies are imperative for reducing the uncertainties relating to production and administrative processes (Dewett & Jones, 2001) and subsequently the achievement of a sustainable competitive advantage. A review of the literature that investigates the impact of information and communication technologies and IS on organizational performance may enable a more effective implementation of these tools and permit organizations to take advantage of its application (Eder & Igarria, 2001). However, despite considerable interest in the relationship, the body of work that focuses on the contributions of

technology on organizational performance could be enlarged (Eder & Igarria, 2001; Pae, et al., 2002; M T B Tiago, et al., 2007).

In accordance with Bayo-Moriones and Lera-López (2007), empirical evidence underlines the importance of information and communication technologies in business performance. The positive impacts identified are not limited to the increase of productivity and the reduction of costs, covering intermediate performance measures such as process efficiency, service quality, organizational improvements, processes optimization, and customer and supplier satisfaction.

More recently, the debate over the use of ICT has sought to determine the characteristics that enhance firms' adoption of ICT and augment their impact on organizational performance (Dewett & Jones, 2001; J. Liao, Welsch, & Stoica, 2003; S.-h. Liao, Fei, & Liu, 2008). In this sense, the literature suggests as adoption enablers firms' characteristics, strategy commitment and external environment, emphasizing regional systems as specific conditioners of firms' adoption processes.

Regardless of the ICT adoption process, Gottschalk (2007) suggests an integration of ICT and knowledge management that has increased over the past few years and that predicts a greater combination in the future, which reveals the interest in analyzing this subject. Modern technology facilitates the integration of dispersed knowledge, accelerates the replication of best practices, eliminates time and geographical constraints, and facilitates use and access by multiple users. However, controversy persists about the role that information technology should play in knowledge management (Wild & Griggs, 2008).

Knowledge management is not easy to define, since it covers a wide range of concepts that pass through the pooling of resources, technologies and organizational practices, and are scattered across several major areas of research. A wide range of knowledge systems has been presented. Boisot and Canals (2004) advocate the partition of knowledge in itself, public, staff and common sense. Choo, Detlor, and Turnbull (2000), based on the early work of Boisot, suggest a distinction among tacit knowledge, explicit and cultural turn. Blackler (1995, page) underlines the knowledge "embodied, embedded, embrained, encultured, and encoded," each of which considers the content and processes as launching platforms.

In virtual environments, the integration of technology into knowledge management processes has emerged as a determinant of success. According to Anderson, Hansen, Lowry, and Summers (2005), many firms that have adopted e-business, leveraged

critical business processes, explored the Internet as a medium for transaction management, and allowed access to a wide range information, services and even remote access payment. However, the relation between the investments made in IT systems and organizational performance is not entirely clear. Some authors, such as the IT economist Paul Strassmann, suggest that no correlation can be found between computer expenditures and company performance. Others conclude that the investments made in IS can generate different competitive advantages. More recently, Valacich and Schneider (2010) considered that e-business and other ITC can enhance four components: (i) inputs of the business, whether they take on characteristics of raw materials or other information, (ii) human and capital resources, (iii) practices of e-commerce, and (iv) the use of management and analysis of processes taking to support customer feedback.

This revolution is confirmed by the growing number of resources that can be searched, managed, created and/or consumed in the virtual environments of the Internet, Intranets and Extranets. According to Valacich and Schneider (2010), there is a wealth of opportunities and methods for exploiting the potential of ICT and it is up to each company to evaluate its own suitability for e-business.

Evaluation Framework and Hypotheses

Information and communication technologies have spread rapidly in the last three decades, bringing a considerable economic impact as consequence of gains of capital and labor, or of multifactor productivity. For this reason the buzz surrounding it has created an interest among researchers to unearth the factors behind this phenomenon. The country seems to be one of the factors that may affect the adoption of ICT. Associated to this contextual variable, a set of dimensions can be considered: (i) the culture of the country (Erumban & de Jong, 2006); the level of income and the country's openness to investment (Pohjola, 2003); and the IT skills of the human capital (Martin & Matlay, 2001).

Several of these elements were combined by the International Telecommunication Union in its ICT Development Index (IDI). The index is based on the assumption that ICTs can be a development enabler if applied and used appropriately. A set of indicators was selected to create three subcomponents (i) ICT infrastructure and access; (ii) ICT use (primarily by individuals, but also households, businesses, others as data become

available) and the intensity of use; and (iii) ICT skills (or capacity necessary to use ICTs effectively). This Index classifies countries according to their path of ICT development. Thus, a country can be in one of three levels:

Stage 1: ICT readiness, reflecting the level of networked infrastructure and access to ICT;

Stage 2: ICT intensity, reflecting the level of use of ICTs in the society; and

Stage 3: ICT impact, reflecting the result of efficient and effective ICT use.

But, how much do local firms suffer from their country's stage of ICT evolution? Is ICT a true enabler or inhibitor? How much does it affect the acceptance and adoption of ICT and the use of KM?

The literature review showed that organizations tend to adopt ICT in order to meet the increasing competitiveness of global markets and overlapping regional settings (Strauss, El-Ansary, & Frost, 2003; Wu, Ong, & Hsu, 2008).

Therefore, despite the undeniable impact of ICT diffusion on the organization, its location and outcomes have been the subject of an important debate in the economic literature, but several questions are either still unanswered or need clarification. The effect of the organizational and spatial structures and behaviors of firms on ICT adoption process and its connection to knowledge management is one of the less analyzed structures. Thus, this work attempts to establish the nature of these relationships, using the IDI has country ICT profile dimension and firms' characteristics as the other dimensions which greatly influence the adoption of ICT.

The digital era presents enormous challenges, especially if firms consider the gathering of information about customers, suppliers, markets, and supply. It also tests the processing of information about company processes, products, and services. Therefore, the impact of ICT on knowledge management is crucial to the understanding of ICT's effect on firms' performance.

The literature acknowledges the impact of ICT and KM on e-business performance. For this matter, seems proper to discuss this relationship, especially since we are living in both the "knowledge era" and the "digital era".

Table 1 summarizes a set of hypotheses that can be formulated, considering the theoretical bases found in the literature in management and information systems.

Table 1 – Hypotheses

Hypothesis	Literature Support
<p>H1: Firms surrounding elements have a positive impact on information technology and communication adoption.</p> <p>H1a) IDI have a positive impact on ICT adoption;</p> <p>H2b) Firms e-readiness has a positive impact on ICT adoption.</p>	<p>(Eid, et al., 2002; Erumban & de Jong, 2006; Fichman, 2000; Jorgenson, et al., 2005; Martin & Matlay, 2001; Natário, Couto, Tiago, & Braga, 2010; Pae, et al., 2002; Peansupap & Walker, 2005)</p>
<p>H2: The adoption of information communication technology has a positive impact on knowledge management.</p>	<p>(Giraldo, 2005; Metaxiotis, Ergazakis, & Psarras, 2005) (Gottschalk, 2007)</p>
<p>H3: Knowledge management has a positive impact on the development of e-business activities.</p>	<p>(Gottschalk, 2007; Singh, Iyer, & Salam, 2009) (Holsapple & Singh, 2000)</p>
<p>H4: The adoption of ICT has a positive impact on the development of e-business activities.</p>	<p>(F. G. Tiago, Tiago, & Couto, 2010; M T B Tiago, et al., 2007)</p>

The first hypothesis sought to identify a positive impact of firms' internal and external factors, as driving-agents of the adoption and use of ICTs. The second hypothesis seeks to confirm the inference that there is a positive impact of ICTs on knowledge management practices.

The third hypothesis attempts to validate the existence of a positive impact of knowledge management in the development of e-business organizations

The last hypothesis reflects the main research question of this work and empathise the impact of ICT, considering IDI and firms' e-readiness, in e-business and it's perspective a positive impact, following the results found by other researchers.

The model is validated by using a structure equation model to test the hypotheses. The measurement model is done by using Confirmatory Factor Analysis (CFA). We will see later that the observable variables (indicators) we selected are measures of latent variables (factors). We assume that innovation and ICT features have a direct effect on knowledge management and e-business activities. Therefore, we assume that the online firm activities are explained not only by the knowledge management strategy, but also by integrated ICT.

Methodology and Results

To validate these assumptions, data was collected from a sample of 2.248 European and American firms from two services industries and covering seven dimensions of analysis: (1) ICT infrastructure and e-business software systems; (2) automated data exchange; (3) e-standards and interoperability issues; (4) Innovation activity of the company; (5) ICT skills requirements and ICT costs; (6) ICT impacts, drivers and inhibitors; and (7) background information about the company. The dataset was enlarged with the inclusion of IDI metrics for each country. The ICT Development Index (IDI) was firstly presented in the 2009 edition of *Measuring the Information Society* (ITU, 2009) and it reflects ICT access, use and skills of each country. The decision to adopt Europe and North America as a field of study came from the limited amount of comparative research on knowledge management on the internet (Zhu, et al., 2004). The data employed in the empirical research comes from e-Business W@tch annual survey (2007), covering eight countries: the USA, Poland, France, Germany, Spain, Sweden, the UK and Italy.

Initially we used a set of descriptive statistics that allowed for a greater sensitivity to the data (Sekaran, 2006). Such descriptive statistics also acted as guide for the multivariate statistics (Hair, Anderson, Tatham, & Black, 1998). Some notes about the sample used. Around 54.4% of the firms were small or micro-sized. Some authors have noted that the size of the company constrains online activities (Dewett & Jones, 2001). In contrast, some studies have reported that, in terms of digital environments, the differences in the size of organizations do not make sense. This lead to questioning firms about their perception of firm' size influence on e-business activities. Only the Polish respondents consider firms' size as a relevant restraining factor of e-business activities.

As it seeks to share and disseminate information and knowledge, digital security emerges as a relevant aspect to consider in knowledge management in virtual environments. For that reason, it has drawn attention from both businesses and academic researchers. Thus, respondents were asked about the importance of security and privacy in the development of e-business activities. USA firms expressed the most concerns with security and privacy, closely followed by German and French firms.

One of the points made in the valuation model of technological sophistication (Colecchia & Schreyer, 2002) is the way it handles the transmission of information within and between firms. The results suggest that recourse to the use of electronic

transmission as the main medium has its greatest expression in Sweden and the UK, When measuring combine electronic and paper source transmission of information greater expression was found in the United States of America and Germany firms. These two countries are those in which the use of traditional media (verbal and paper) does not correspond to more than 50% of the processes of information transmission.

The model was estimated by the maximum likelihood method in the AMOS package. The model goodness of fit may be considered acceptable according to the values of some goodness-of-fit indexes, although the chi-square test statistic ($\chi^2 = 825,7$; p-value = 0,000) is significant, implying a bad fit. However, this test is known to have serious limitations — namely its dependence on the sample size and on the number of indicators. In general, for large sample sizes the chi-square statistic is significant, and in the present case the sample size is very large. Several goodness-of-fit tests were conducted to access whether the empirical model could explain the observed data. The measures for global model fit (below) suggest that our model fits the underlying data quite well and that the hypothesis paths were all statistically significant.

After global model fit has been assessed, the numerical results were evaluated to test their support of the research question. The numerical results can be obtained directly from the path coefficients of the structural model.

Our findings support the conceptual framework regarding to hypotheses two and three. Thus, these findings lend empirical support to the concept that e-business activities can be improved by exploring the information knowledge management and are enablers of ICT adoption. Looking closer to the results we can notice that e-business contributes 82% to ICT construct and ICT impacts 98% knowledge management construct. The significant relationship achieved between firms e-readiness and ICT adoption and use (0,78) supports the idea internal firms conditions can leverage the ICT adoption process. Nevertheless, the results suggested the IDI does not have a significant impact on ICT adoption and use, since it's impact on ICT construct is of 0,04.

A split structural equation model was also performed to analyze the possible differences among regions, especially Europe and North America. Nevertheless, the model achieved was not reliable and for that reason no remarks can be presented.

LIMITATION OF THE STUDY AND FUTURE STUDIES

As Jorgenson (2005) and Hanafizadeh, Saghae and Hanafizadeh (2009) have suggested, empirical evidence supports the direct correlation among national and regional ICT infrastructures, background, firms' ICT adoption, and e-business performance. However, the success of organizations depends on and can be optimized by several factors, such as the way in which employees use knowledge to create value. As Gottschalk (2007) noted, this function is more complicated in e-business, because the technological components of the Internet turn a firm into an ICT-driven global player with daily challenges and large knowledge flows. Thus, how are organizations influenced by internal and external factors? How do they take advantage of ICT and knowledge management to improve their e-business activities?

The literature review shows that only a few works have taken a corporate perspective to examine the contributions of knowledge management to e-business performance; hardly any have mentioned the regional impact on digital practices. More, most of these works were confined to specific industries or countries. Therefore, the goals of this study were therefore: (1) to determine whether the implementation of ICT and knowledge management is positively linked to e-business; (2) to determine which of the external

and internal components can be enabler or inhibitors of ICT adoption; and (3) to identify the relationship between e-business activities and ICT adoption.

The main results suggest a strong positive relationship between knowledge management and e-business as well as a positive impact of e-business in ICT. The analysis also reveals that in digital environments the internal factors have a greater impact on ICT activities than regional settings do. The analysis also reveals that no relationship can be established between a firm's practices on the Internet and its country of origin.

Previous works have already examined the impact of ICT at the macroeconomic level (Colecchia & Schreyer, 2002; Van Ark, et al., 2003) and show that ICT investment contributed to capital deepening and growth in most OECD countries in the 1990s (Yates, Gulati, & Tawileh, 1999). Nowadays, and taken the results from the model presented, questions can be post regarding regional and national investments in ICT and their impact on local firms performance.

Thus, this work contributes to the theory of regional and national ICT policiy, revealing that IDI elements have a short impact on firms' ICT adoption, applied to the European and American realities. Simultaneously, it adds to the knowledge of assessment of ICT adoption and connection to knowledge management as well as expands the research into the field of e-business.

Further work is clearly needed to examine the empirical results of this model. Aside from these considerations, it would be interesting to compare the results of online to those of brick-and-mortar firms. Certainly, there is ample scope for further research in this area.

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