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Mehdi Khosrow-Pour
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Towards a Multi-Dimensional Model of Digital Competence in Small- and Medium-Sized Enterprises

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Dragos Vieru

Distance Learning University of Quebec (TELUQ), Canada

INTRODUCTION

To be competitive, small and medium-sized enterprises (SMEs) need to develop new business strategies involving the utilization of e-business enabling information technologies (IT) (Ferrari, 2012). It has been shown that the ability of small businesses to innovate will depend heavily on investments made in IT platforms, the success of which, in turn, depends on workers having the appropriate skills (Ifinedo, 2011). Investments in IT are particularly crucial for an SME owner, partly because of their scale and duration but also because of their potentially important impacts on firm competitiveness. It would therefore appear that such competitiveness could help the SMEs to successfully compete against larger firms and raise the potential of e-business.

While some SMEs have effectively engaged in Internet-based business (Dibrell et al., 2008), others have been not that keen to integrate e-business enabling technologies in their organizational structures (Brown & Lockett, 2004; Ashurst et al., 2011). The literature suggests that SMEs in general, have reduced human and financial resources (Bridge et al., 1998; Bengtsson et al., 2007) and are therefore likely to be less ready to change their business strategies. The ability to align business strategies with existing technical skills was found to have a significant impact on the level of IT adoption in a SME environment (Fillis & Wagner, 2005). Effective SME participation in the new digital marketplace will involve ongoing up-skilling and training. On one hand, SMEs need to adopt e-business strategies to keep up with the economy. On the other hand, they lack the human resources with appropriate digital competencies. But, how do SMEs' managers know what digital skills they need for their workers? The lack of a precise understanding of what IT-related

skills are represents a significant challenge in determining if SMEs have the skills and competencies required for the digital economy (Ashurst et al., 2011). This raises questions in regard to:

How to assess digital competence in the SME context? Whether or not there is a framework for digital competence evaluation in an organizational context?

The purpose of this article is three-folded: to identify through a literature review the key dimensions of the concept of *digital competence* (DC) in terms of the knowledge, skills and attitudes needed for firms to be digitally competent; to advance a conceptual model for digital competence assessment in SMEs; and to propose a research agenda for assessing the conceptual model in an SME context.

BACKGROUND

Competence has been conceptualized as an umbrella-type of notion wrapping almost every attribute that might influence performance (Bassellier et al., 2001). In the context of a 21st century digitized society, digital competence represents a “set of knowledge, skills, attitudes (thus including abilities, strategies, values and awareness) that are required when using IT and digital media to perform tasks, solve problems, communicate, manage information, collaborate; create and share content, and build knowledge effectively, efficiently, appropriately, critically, creatively, autonomously, flexibly, ethically, reflectively for work, leisure, participation, learning, socializing, consuming, and empowerment” (Ferrari, 2012, p.3). This long and detailed definition reveals that digital competence

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covers more than the plain know-how and technical skills, by including confidence and a critical way of thinking as well.

Both academic and practitioner literatures on digital competence present three main preoccupations: how to define, how to measure it and how to develop digital competence. Various definitions of digital competence reflect differences based on the context of assessment and the particular concept used, e.g. digital literacy, e-skills, IT skills, IT competence, information literacy, media literacy. This approach has resulted in a 'jargon jungle' (Ferrari, 2012). All these conceptualizations have one commonality: they all portray digital competence as a multi-faceted concept that exists at the convergence of multiple disciplines: media studies, education, information sciences, information systems (IS), and communication studies. Extant conceptual frameworks for the development of digital competence show that while some of these frameworks tend to emphasize the practical and technical aspects of using IT, several others suggest that developing digital necessitates a focus on the acquisition of higher order thinking skills (Ferrari, 2012).

The IS literature suggests that IT skills and the capacity to combine them with business opportunity represents "critical assets and need to be acquired, developed and nurtured appropriately" (Lee, 2001, p.xiv). The IS studies on digital competence focus either on IT competence for business managers (e.g., Bassellier et al., 2001; Bassellier & Benbasat, 2004) or on a general IT user competence (e.g., Marcolin et al., 2000; Jaspersen et al., 2005). In the former approach, Bassellier et al. (2001) suggest that in order to become IT competent, business managers need to develop a knowledge- and experience-based tridimensional IT competence: competence as a skill, competence as a personality trait, and competence as knowledge. In the latter approach, researchers suggest that understanding IT user competence is important for organizations that need to be able to capitalize on the benefits in IT investments (Jaspersen et al., 2005). In this vein, IT user competence has been defined as being "the user's potential to apply technology to its fullest possible extent so as to maximize performance of specific job tasks" (Marcolin et al., 2000, p. 38) or as being able to "correctly exploit the appropriate capabilities of software in the most relevant circumstances" (Boudreau, 2003, p. 236).

Much of the research in IS in the last several decades has focused on identifying the technical skills required for improving the performance of business managers (Bassellier et al., 2001), the knowledge and skill requirements for programmers, systems analysts, and IT managers (Todd et al., 1995) or on assessing IT professionals' personality characteristics such as trustworthiness and credibility (Bashein & Markus, 1997). In the context of SME, the IS literature provides evidence that different levels of IT competence in the organizations studied are related to different levels of accumulated individual IT skills, knowledge and competence in the organization. In particular the development of internal IT skills combined with management's knowledge and attitudes towards IT adoption and use create the competences required to achieve higher levels of success with IT use in SMEs (Dibrell et al., 2008).

In sum, current research and practice in the field of digital competence provides a myriad of different conceptualizations of digital competence and reveals a scattered image that falls short of providing the clarity needed by scholars and managers alike to understand the multi-faced nature of this concept. Considering this gap in the literature, this article aims to propose a more encompassing conceptualization of digital competence in general and in SME context in particular. This conceptualization will be more reflecting the reality of users. More precisely, three key competence domains, i.e. technological, cognitive and social as well as three underlying dimensions, i.e. skill (know-how), knowledge (know-what) and attitude (know-why) will be assembled in a theoretical framework.

DIGITAL COMPETENCE

A Confusing Concept

There is a wide agreement among researchers that different types of literacies related to Information Technology (IT) or Information Systems (IS), all converge to the concept of *digital literacy* (Martin, 2006). This might explain why there is a variety of terms used to refer to this concept (i.e., Computer/IT Literacy, Information Literacy, Media Literacy, just to mention some of the most common used terms).

Any attempt to define Digital Competence implies taking a position in theoretical and semantic terms. While some authors refer to 'Digital Literacy' (Bawden, 2001), others prefer the term 'Digital Competence' (Krumsvik, 2008). According to Calvani et al. (2012), both terms are often used as synonyms because to a greater or lesser extent, overlap one another. In this article the concept of 'Digital competence' was chosen because: 1) the term competence is performance-based and includes knowledge, skills, attitudes, and personal characteristics that can be improved with experience and/or training; 2) in the last decade, the meaning of the concept of literacy has become larger, including elements typically referring to the notion of competence (OCDE, 2012).

The debate on defining digital competence, or literacy, started as early as the 90s, when several authors used it to refer to the ability to read hyperlinked texts and explore multimedia formats (Bawden, 2001). The first definition was given in 1997 by Gilster, who coined the term *digital literacy*, which emphasizes the ability for critical thinking rather than just the possession of IT skills and represents a complex integration of capabilities, skills and knowledge. While Gilster (1997) did not identify specific skills, competences or attitudes, he defined what represents to be digitally literate - an ability to understand and use information from a variety of digital sources. Analyzing Gilster's work, Bawden (2001) identifies a number of characteristics a digital literate person should have: 1) Ability to build reliable information from diverse digital sources; 2) Retrieval skills enhanced by critical thinking for making informed judgments about retrieved information, with wariness about the validity and completeness of Internet sources; 3) Capacity for reading and understanding non-sequential and dynamic material; 4) Awareness of "people networks" as sources of advice and help; 5) Familiarity with filters and agents to manage incoming information; 6) Being comfortable with publishing and communicating information, as well as accessing it. However, the fact that Gilster (1997) did not suggest a set of competences, as well as the fact that digital literacy is considered as being related to other 'literacies' such as computer and information literacy, some academics refer to the ability to use technologies as *computer literacy* (Dominick et al., 2009), others prefer to use the term *information literacy* (Huvila, 2011), or support the prevalence of *media literacy* (Erstad, 2010).

Other terms have been used for what appears to be very much Gilster's (1997) idea of digital literacy. The term *e-literacy*, stemming from *electronic literacy*, has been adopted almost identical by some researchers. Drawing on other types of 'literacies' – information, media, computer/IT – and involving awareness, understanding and reflective evaluation as well as computer skills, Martin (2006) similarly presents *e-literacy* as a central concept and suggests that the concepts of digital literacy and e-literacy are synonymous.

With the increased importance of information technology (IT) in organizations since the dawn of the 21st century, IS scholars are interested in analyzing how organizational members understand and use IT resources effectively. While at the organizational level the extant literature presents several studies in which researchers advance a variety of IT management competencies, at the individual level (e.g., Bassellier et al., 2001; Bassellier & Benbasat, 2004; Torkzadeh & Lee, 2003) with some few exceptions, the authors focus on the IT competence of managers and IS professionals. Based on this literature, IT competence can be defined as the ability of organizational members to effectively use IT functionalities to support IT-enabled activities. IT competence thus describes the ability of individuals to be aware of what IT functionalities have to offer, to understand when to use them, and, when they decide to use them, to do so effectively by taking advantage of their specific IT functionalities (Pavlou & El Sawy, 2006).

In sum, digital competence is a complex and multi-faceted concept, and the extant literature proposes a myriad of variants of the same concept applied in different contexts. However, this generates confusion when one tries to explain in a unified definition what digital competence exactly is and how one should integrate and compare its overlapping dimensions.

Digital Competence and Its Connection to Organizational Competencies

Digital competence is just one of other organizational competencies that involve differential skills, complementary assets, and routines used to create sustainable competitive advantage in line with customer value (Selznick, 1957). These competencies represent the core competencies of a firm defined as "the collective learning in the organi-

zation, especially how to coordinate diverse production skills, and integrate multiple streams of technologies” (Prahalad & Hamel, 1990, p. 80). A skill is defined as the ability of an individual to apply his/her own personal characteristics and knowledge to engage in organizational practices. A core competence should: (1) provide potential access to a wide variety of markets, (2) make a significant contribution to the perceived customer benefits of the end products, and (3) be difficult for competitors to imitate (Prahalad & Hamel, 1990).

IS literature suggests that when digital competencies are hard for rivals to match and hard to replicate or imitate, and difficult to obtain from others, they hold the potential for competitive advantage (Christensen, 1999). Digital competencies have an external focus on the value added to the customer and services that represent the collective learning of an organization. As part of core competencies, digital competence consists of especially hard to coordinate diverse skills, which integrate multiple functions of IT such as, business applications and helpdesk and expose these to the customer. Rather than at the level of a whole organization, or even at that of a small group, digital competence is most easily analyzed at the individual level, as most organizational competencies start with the individual. Beyond individual learning, digital competence in organizations is rooted in the interaction of distinctive IT skills, specific processes and assets, and organizational cultural norms and values (Pavlou & El Sawy, 2006).

DIGITAL COMPETENCE IN ORGANIZATIONS: A CONCEPTUAL MODEL

Definition

As a core competence, digital competence is sensitive to the organizational context and it would not be reasonable to think of a unique model of digital competence acceptable at all times and in all organizational contexts that are usually characterized by idiosyncratic practices, norms, and values. Digital competence stands as an important challenge for the IS research in the SME context. We consider DC as a multidimensional concept illustrated by a set of knowledge, skills and attitudes needed to be functional in an organizational digital environment. Its acquisition in an organizational context

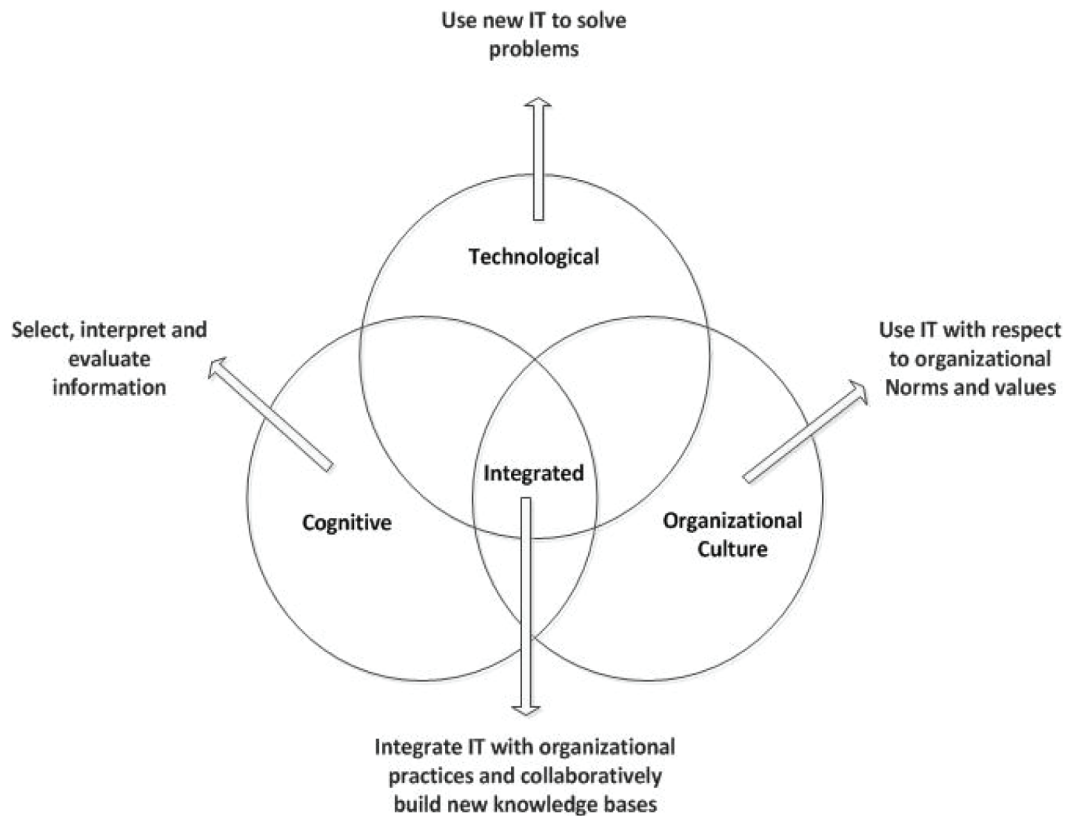
may be defined as a mindset, enabling the individual to adapt to new practices and norms requirements set by the evolving IT (Bassellier et al., 2001; Bassellier & Benbasat, 2004). In addition, being at ease with new IT only happens when the technology is embedded in the organizational practices. These practices entail contextual knowledge and certain beliefs and values about IT and socially interact with them in certain ways (Wagner et al., 2010). In other words, IT needs to be appropriated by users. Appropriation entails a specific way to interact with the materiality of the IT (it requires specific attitudes), of understanding them (holding specific knowledge), and of being able to use them (having specific skills). Based on the above argumentation, we propose the following definition of the digital competence in an organizational context:

Digital competence consists in the ability to adopt and use new or existing information technology to analyze, select and critically evaluate digital information in order to investigate and solve work-related problems and develop a collaborative knowledge body while engaging in organizational practices within a specific organizational context.

The definition emphasizes the co-existence of several conceptual dimensions. Based on Calvani et al.'s (2008) digital competence framework, we propose a theoretical model for assessing digital competence in an organizational context. The model (Figure 1) is based on three dimensions and on their integration (the fourth dimension):

1. Technological dimension: being able to deal with work-related tasks by using new or existing IT in an effective and efficient manner;
2. Cognitive dimension: being able to read, select, interpret and evaluate information taking into account their work-related pertinence and reliability in a specific organizational context;
3. Organizational culture dimension: being able to interact with other individuals collaboratively using available IT along the line of the existing organizational work norms and values;
4. Integration between the three dimensions: illustrates the understanding of the advantages offered by IT, which facilitate organizational members to retain, transfer and share information and collaboratively build new knowledge bases.

Figure 1. Digital competence key dimensions (adapted from Calvani et al., 2008)



Challenges to Assess Digital Competence

There are several challenges associated with the effort to assess DC at the individual and/or organizational levels. First, asking the respondents to present a view on behalf of their organization may be problematic; second, while including different types of e-business it is possible that perceptions for these technologies, such as e-mail or e-ERP acceptance in the sampled SMEs may not be similar. Third, it may happen that views of study participants who would indicate that their business operations are not suitable for Internet transactions might be pooled together with those having more favorable perceptions of e-business technologies. As a consequence, the results of the data analysis might be negatively impacted by the inclusion of such diverse viewpoints.

Finally, individuals responding to a questionnaire will have varying levels of digital competence levels. Levels of computer access and computer penetration

differ between countries. Citizens of some countries may not be provided with the opportunity to use computers in the workplace or have access to IT in their daily lives. Knowledge and skills related to the Internet-based technologies will also vary since its use is primarily concentrated in North America, Western Europe and Japan. This is due in part to less IT penetration in other countries as well as cultural differences. Any evaluation instrument (survey questionnaire or interview) must ensure that respondents are able to indicate their own culturally linked experiences with IT within a pre-established personal and/or organizational context.

Therefore, the concept of digital competence cannot be reduced to a single dimension, nor can it be assessed using only survey methodology. The adoption of a mix of quantitative and qualitative (semi-structured interviews) methodological approach is therefore needed, without forgetting to define criteria that allow comparing data gathered from different industries and/or countries.

Digital Competence in SMEs

To compete in global markets, many manufacturing small and medium-sized enterprises (SMEs) need to employ new information technologies. However, historically it has been showed that SMEs have poor human and financial resources (Welsh & White, 1981; Bridge et al., 1998) and therefore are prone to be less ready and able to change. A better understanding of the ways in which SMEs implement and more importantly, use new IT, is necessary because previous research in the area is limited and rapidly out of date due to the ever changing economics and social aspects of using IT (Brown & Lockett, 2004).

Despite the evidence that the Internet has provided opportunities for SMEs to create value through e-business utilization (Levy & Powell, 2000), attaining value from e-business has proved to be tricky (Daniel & Wilson, 2002). For the purpose of this document, we consider *e-business* as encompassing any business transaction or service conducted over the Internet including the use of specific applications such as ERP (enterprise resource planning) and technologies such as intranets to exchange information either within the firm itself or with external stakeholders (Daniel & Wilson, 2002).

The literature on SME suggests that an important way that e-business practices can create value for organizations is through IS innovation. IS innovation represents the firm's ability to be creative and capture the value-creating opportunities presented by the growth of Internet technology and its usage. It is also the mobilization of "knowledge, technological skills and experience to create novelty in their offerings and the way in which they create and deliver those offerings" (Tidd et al., 2005: p.5). The Internet and its intra- and inter-firm applications have present "a plethora of latent opportunities for small firms and/or entrepreneurs to creatively engage in new value creating activities" (Jones et al., 2003, p. 287). Chircu & Kauffman (2000) find that lack of ability to acquire skill and expertise in new technologies combined with a lack of training and education form significant barriers to the adoption of e-business technologies. In the context of SMEs, the organizations that possess digital competence are more likely to accept innovations as they have a better understanding of the benefits of such innovations than if such competences were lacking (Caldeira & Ward,

2002). Indeed, Caldeira & Ward (2002) conclude that for SMEs to successfully adopt IEBT, their executives and employees must have a reasonable knowledge of the relevance of IS in business operations.

Researchers have started to use different theoretical lenses (with a preference for the resource-based theory view of the firm) to identify sets of digital competencies that may be required for organizations to successfully adopt and use of new IT. However, most of this research has been conducted in large firm environments with only a small number of studies of SMEs, which provide a very different IT environment due to their typical lack of IT resources, especially of human IT resources. However, results of these studies indicate that some of the findings from large firms may be generalized to SMEs. These results notwithstanding, studies of SMEs have yet to offer a unified view on what is digital competence, how can it be assessed in this particular context, and what its role is in the process of gaining value from IT-based business or e-business.

In their empirical study Caldeira & Ward (2003) suggest that digital competence is particularly important to SMEs. The study's outcomes show that IT knowledge and skills are needed to configure software to reflect local idiosyncratic practices and negotiate with IT suppliers. Therefore three IT-related skills are identified: technical IT skills, managerial IT skills, and business and general management skills. The same authors argue that SMEs need all three types of competence in order to identify and realize emerging IT opportunities in the organization. Feeny & Willcocks (1998) develop, albeit not in a SME context, a list of nine core IT capabilities. Although the authors label them as IT capabilities, they meet the definition of "competence" as defined by Lambert & Bytheway (1998, p.3) as being "the ability to develop, manage and deploy resources in support of a capability or capabilities." Feeny & Willcocks' (1998) research does not aim to provide a complete set of digital competences. Instead, the authors advance nine dimensions of the digital competence that reflect the core abilities that organizations need to have in order to take advantage of IT in an environment where many IT services are outsourced. Thus, these nine dimensions focus on supplier relationships in a context similar to the SMEs where IS services are provided by external firms. In another study, Scupola (2008) focuses on IT competencies and e-business within an SME environment.

At the individual level, three types of competence are found to be important: technical skills, interpersonal skills, and conceptual skills.

FUTURE RESEARCH DIRECTIONS

In an organizational context digital competence is developed and continuously evolves over time through a process of learning. We adhere to the view that sees structural organizational dynamics as continuous processes. The evaluation of a multi-faceted and evolving concept such as digital competence in an organizational context entails considering a number of activities and events, including their sequence. Hence, we consider that a processual approach (Van de Ven & Poole, 1995) is better suited to understand and assess DC than a variance-based approach.

By providing a conceptual model, based on a multi-dimensional concept, we believe that it is possible to explain how the three dimensions in combination cause the requisite skill sets to be developed in a SME context. These in turn cause appropriate organizational competences and processes to come into being, which enable effective adoption of technology and its successful exploitation in use. The conceptual model will provide the theoretical lens to theorize about and empirically test how specific dimensions of the digital competence are related to creativity, innovativeness and willingness to accept and use technology in the SME context. More specifically, it would be interesting to develop a typology theory of key digital competence profiles related to various industry sectors.

We theorized about how specific dimensions of the digital competence might be related to the SME context in this article. We recommend that these dimensions be assessed in specific SME sectors (i.e., aerospace) by applying an exploratory case study method and identifying a typology of digital competences in SME based on different strategic attributes such as innovation creation propensity and information technology acceptance.

CONCLUSION

The need for a conceptual model to assess digital competence in a SME environment was based on recent

literature on SME that suggests that: small businesses need to adopt e-business strategies to keep up with the new economy; there is no theoretical framework to operationalize the concept of digital competence in SME context; and successful innovation in SMEs depends heavily on investments made in IT platforms, the success of which, in turn, depends on employees having the appropriate IT skills (Ifinedo, 2011). In this article we addressed the lack of a clear understanding of what digital competence is and we proposed a framework of how to evaluate it in an SME environment.

This analysis with its focus on the multi-dimensional nature of digital competence is welcoming and timely. Policy makers and industry leaders wishing to understand some of the reasons why certain SMEs lag in the adoption of e-business and related technologies can benefit from the information provided in this study. In the near future, IT local vendors and financial institutions in areas where efforts are made to strengthen SMEs' e-business aspirations may benefit from the results of future studies that will empirically test our proposed research model.

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KEY TERMS AND DEFINITIONS

Competence: A set of related knowledge, skills and attitudes that correlates with one's performance on the job.

Core Competence: A combination of pooled knowledge and technological capacities that allows a company to leverage its resources in order to be competitive in the marketplace. It should also be hard for competitors to replicate.

Digital Competence: The ability to efficiently and critically use information technology for employment, learning, self-development and participation in society.

Digital literacy: The ability to understand and use information in multiple formats from a wide range of information technology to locate, evaluate, use, and create pertinent information.

E-Business: The application of information technology in support of all organizational activities and processes.

IT Competence: The capacity to effectively use information technology functionalities to enable and sustain specific IT-enabled organizational practices.

IT Skills: The ability to use the software and hardware of an information technology-based device such as a personal computer, laptop, or a tablet.