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What are the competences in information system required by managers? Curriculum development for management and public administration degrees

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Abstract

This paper analyzes the competences required by executives to manage information system, and consequently, the competences that must define the information system subjects in non-technical degrees, degrees, such as Public Administration or Business Management. This work reviews the literature about business managers' competences on Information Technologies (IT) and compares the theory with the traditional body of knowledge about information systems taught at business schools. By analyzing the executives' function, their role in the information system management, and, above, all the importance of their decisions in the effective integration of IT in business processes, this work proposes specific development in seven knowledge areas that facilitate the acquisition of these types of executive competences.

Keywords: Information systems, Competences, Managers, Management degree, Public administration studies

Background

The Bologna process requires the definition of the objectives to be achieved in a subject in terms of knowledge, skills, and competences. This requires in-depth thought about the competences, described in terms of knowledge, skills, attitudes, and abilities, in which the graduates must acquire to successfully handle their work, both in their daily tasks as well as their professional development throughout their career. To develop these competences is the final object of an educational program (European Commission 2015).

According to the European Commission (2015), competence can be defined as the proven ability to use knowledge, skills and personal, social and/or methodological abilities, in work or study situations, and in professional and personal development.

Competences are subject specific or generic. This paper aims to explore the subject-specific competences, regarding the information system subjects which are taught in management degrees. These degrees include Business Management and Public Administration. The objective of these degrees is to train managers (executives) capable of assuming responsibility within the organizations for which they work. Consequently, this paper begins by defining the concept of executive competence in a generic way,

subsequently, developing these executive competences in detail in relation to information systems.

Executive competences

From a business perspective, competence is the ability to sustain the coordinated deployment of assets in ways that help a firm to achieve its goals (Sanchez et al. 1996).

Executive competences are essential, since they allow to interpret the environment and to create a unique vision based on which it is effectively possible in business. This vision or mental model (Senge 1990) of the organization and the environment makes possible to detect opportunities and threats, establishing the organization's strategic approach to exploit asymmetries in markets with strategic factors (Lado and Wilson 1994; Hambrick and Mason 1984). Executives are the persons in charge of setting the mission and objectives that guide the creation and implementation of strategy, and the development of organizational skills and capabilities (Lado et al. 1992).

The executive competences originate from both explicit and tacit knowledge, based on the executives' experience. The executive competences usually include both the abilities and know-how of the executives on an individual basis, as well as the skills and capacities derived from the interaction with other staff members.

Leadership is also considered as a determining success factor for managers. Leadership allows to communicate the mission and to obtain the commitment from the entire organization, thus allowing its members to act in a collective rather than isolated way (Lado and Wilson 1994; Lado et al. 1992; Westley and Mintzberg 1989). Osbaldeston and Barham (1992) insist on this point, indicating the link of the company's competitiveness with the management competence to develop and completely use the experience and talent of all the members of the organization, integrating and encouraging the efforts of a complex team of persons. Thus, management competences cover aspects as diverse as general and specialized knowledge, individual abilities as well as social ones, organization and planning skills, capacity to innovate, and cope with non-routine activities.

These types of competences decisively determine the acquisition, development and deployment of the firm's resources and capacities, their conversion into valuable products, and the creation of value. Thus, Penrose (1959), Hambrick and Brandon (1988), and Castanias and Helfat (1991) emphasize the value of executive talent and its heterogeneity to improve the company's competitive rank. More recently, Bettiol et al. (2012) confirm the value of the managers' unique vision to interpret the environment, and the importance of this vision to exploit the firm's resources (Yang and Li 2011; Siegel and Renko 2012).

Researchers differ in relation to the dimensions that comprise the executive competences. For example, Lado and Wilson (1994: 703) solely distinguish two dimensions: the outline of a strategic vision and the establishment of a beneficial link with the environment. Lado et al. (1992), however, identify a third dimension, leadership, independently of the dimension of the strategic vision. Camisón (2002) integrates these models, proposing five dimensions in the executive competences: (1) Strategic approach. The strategic approach is the executive capability to outline a strategic vision that supports the development of the organizational resources and establish a beneficial organization-environment link. (2) Qualification of the executives: This includes their talent, technical

and management knowledge, their ability to solve problems, and make decisions and their experience. (3) Personality of the executives. This dimension alludes to the executives' knowledge about themselves, their capability to control their own behavior and emotions, and the values and standards that motivate them, which condition their social model and conduct. (4) Executive mentality. Orientation of the managers in relation to achievement, time use, change and innovation, as well as risk (revealing their perspective when facing risk). (5) Effective leadership. This alludes to the management style and leadership ability to communicate the strategic vision (a clear vision of the organization's future) to the members of the organization and to delegate power to the employees to carry it out, achieving their enthusiastic commitment.

In our study, we are interested in the direct effects of the executive competences in information systems (IS). For this purpose, we focused on the specific aspects of the executive competences in relation to the information management in organizations, limiting our study to the executive competences in IS which are described below.

Executive competences in information systems

Within the MIS (Management Information Systems) literature, there are numerous works that study the role of top managers in the efficiency of the IS in organizations. This study is mainly based on the exceptional paper of Bassellier et al. (2001) on the subject, and tries to update the proposal of these authors and apply it to the development of business schools' curricula.

Since the outset of IS, the importance of the executives' support has been recognized to obtain all the benefits which IT systems can offer. One of the first studies about the matter (Swanson 1974) showed that the managers who participate in the development of IS achieve a greater appreciation of the system. This means that the participation has an influence on the appreciation. Swanson describes the "appreciation" concept as the executive's belief about the relative value of IS in a particular business activities.

It is in the mid-eighties when IT ceased to be confined to the specific aspects of the business activity and was used on a generalized basis in the organization, affecting the way of doing business in a substantial way. Here, the strategic vision became necessary to guide their development and the general managers' participation was mandatory. This led certain authors to state that IS are too important to be abandoned in the hands of the technicians (Doll and Torkzadeh 1987; Rockart 1988). Then, since the outset of the extensive IT use in organizations, the involvement of executives in IS has been considered as necessary to exploit the advantages, which these technologies offer. A reference work of this period is that of Jarvenpaa and Ives (1991). These authors analyzed the important role managers play in the decisions of how, when, and where to use the IT resources. The results found a positive correlation between the involvement, participation, age, and professional training of the executives on IT, on the one hand, and the progressive use of IT in the company, on the other hand. This same study showed that the involvement of the executives in the activities linked to the IS area is positively correlated to the participation of executives in the organizational planning of IS, and yet, weakly associated with the executive's functional training on IT.

Other studies show that the executives' perceptions are essential to understand how IT can affect the organizational performance. Dent-Micallef and Powell (1998) consider

that the CEO's commitment and integration of IT in the company's general strategy are crucial to take advantage of the IT potential. In a similar way, Jarvenpaa and Ives (1991) define the executives' participation as the degree, in which management considers the IT as instrumental to accomplish the organizational goals. Busch et al. (1991) have found that the executives' perceptions and attitudes toward the IT are associated with the progressive use of IT in the organization. In a similar way, manager's IT knowledge and attitude are valuable indicators of how IT is used to support the business strategy (Boynton et al. 1994). The work by Broadbent and Weill (1993) demonstrates a positive relation between the executives' perceptions of the role of the IT and the IT investment.

The managers' IT vision is basic in the success of IT projects. Researchers advocate the executives' participation in the IS planning (Broadbent and Weill 1993) or the creation of a shared vision between business and IT managers and a mutual recognition of the business objectives as a way to improve the benefits provided by IS (Reich and Benbasat 1996; 2000). On the other hand, if the business and IS managers maintain divergent objectives for the IT; there is a little hope that the IT investments can benefit the organization. The MIS literature confirm that to ensure that IT deliver the value which is expected, top managers must participate in the business integration process of IT. In turn, acknowledgement of the IT value and the management's degree of participation in the IT decisions are solidly related. More recently, Devece (2013) shows the importance of the managers' IT competence on organizational performance. When the executives are involved in the evaluation of IS, the determination of objectives, and they establish a fluent relation with the IS department, their perception of the IT is more favorable and adds more value to the firm. Consequently, the executive's personal participation in the IT management can lead to a positive increase in the IS benefits. This means, the managers who invest a significant amount of time to make decisions related to IS tend to appreciate them better and consider that they have a critical importance for the organizations. Having reached this point, it is necessary to clarify what is understood by the executive's participation in the IT management to determine the competences involved in this activity.

The executive's participation in the IS management is linked to the importance which this person grants to IT. The participation refers to the perception and attitudes of the executive in relation to IT, namely the degree in which the executive observes the IT is critical for the organization's success. Considering this point of view, several authors propose that the manager is not required to be an expert in the "how" mechanics of technology, but simply be familiar with what the technology is capable of doing in the organization and what is doing in the industry. Managers must communicate with the IT team (Lederer and Mendelow 1988; Cegarra-Navarro et al. 2011), keep informed about the company's IT activities and be well informed about the IT skills and capacities of the organization and their initiatives. There is little literature about how the interchange between the managers and the IT team takes place and how managers learn about the IT possibilities. There are several proposals which range from informal communication to the manager's chairmanship of an IT management committee (Torkzadeh and Xia 1992). These committees outline the organization strategies from both corporate as well as business units' perspective and specify how IT can support business activities. In turn, this support from top managers generates commitment and enthusiasm by the

remaining executives and employees. Accordingly, the proper business integration and implementation of IS depend largely on the degree of commitment of managers. Linking the literature in the MIS field with the classification of manager's competences presented in the heading above, we highlight two specific fundamental dimensions of IT manager's competences which directly affect the development of the organization's information systems: (1) the executives' strategic vision of IT and (2) the executives' qualifications in IT. These two dimensions are closely related with each other (Bassellier et al. 2001).

This concept of IS competences, understood as IT knowledge and as strategic vision of IT applied to business, has also been adopted by Bassellier et al. (2001). These authors define the IT competences of the CEOs as the set of explicit and tacit knowledge in relation to IT that an executive possesses and which permits him/her to display IT leadership in the business sector. Likewise, the authors consider that leadership is characterized by the manager's knowledge. Subsequently, Bassellier et al. (2003) define the IT competence of the managers as the set of IT knowledge and experience which the manager possesses.

Next, we describe the two dimensions, in which we have divided the manager's IT competence.

Managers' IT knowledge

Boyatzis (1982) defines the managers' IT knowledge as specialized knowledge, a useful body of facts and relevant concepts for a specific job. Based on the Boyatzis' definition, Bassellier et al. (2001) consider three major knowledge areas that managers must possess to exploit IT in the organization: (1) Keep up-to-date with the information assets and the information opportunities. (2) Understand the value and potential of IT. (3) Know the potential as well as current and future limitations of IT and determine how rival companies use them.

Another classification of the required IT know-how is provided by Brown and Magill (1994). In this case, the authors suggest a division between the management of the technology specifically and the management of its application in the information systems: (1) Technology management (including computer operations, communication/connectivity, emerging technologies, and technological planning). (2) Technology use management (including system development, computer support to end user, and application planning).

Other works consider that the main purpose of managers IT knowledge is to permit the executives to communicate with the IT personnel. This knowledge facilitates the "link" or the connection between the business system, and the IS Department. Reich and Benbasat (1996) define "linkage" as the degree, in which the IT mission, objectives, and plans support the business mission, objectives, and plans through their mutual reinforcement. These two authors state that the "linkage" concept has two dimensions: an intellectual dimension, considered as the internal consistency and external validity of the contents of the IT and business plans; and the social dimension, considered as the mutual understanding of the plans and objectives between top managers and the managers of the IS Department.

Bassellier et al. (2001) classify the explicit IT knowledge of managers into five groups:

- *Technology* managers should know about hardware (basic components) and software (programming languages) in different areas (processing, data storage and communication). This will let them to evaluate the current IT infrastructure, understand the description of the system features, and visualize the requirements for the future.
- *Applications* this refers to the knowledge of common IS used in the industry (vertical applications) and the applications common in different organizational functions, and how these applications can help to achieve the business objectives. This involves knowledge of the portfolio of current applications, the information architecture, and the emerging applications.
- *System development* it is necessary to possess knowledge about the practices in project management, time programming, budget calculation, etc. Likewise, one must be accustomed to different development methodologies, the life cycle of systems, work with the end user, software purchase, and *outsourcing*.
- *Management of IT* the managers must know the activities related to the IT administration, although they do not actively participate in them, because this permits them to integrate the strategic IT planning with the rest of the company.
- *Access to IT knowledge* since it cannot be expected that a manager has comprehensive IT knowledge, this person must know the reliable knowledge sources, both inside and outside the organization, who can provide him/her with expert advice about IT.

To these five groups, we propose to add two more areas of knowledge. These areas are present in most of the up-to-date manuals of IS management:

- *e-Commerce* the importance of the effect of the Internet on a business can differ depending on the industry, but the capacity to change the rules and success factors of a business of the e-commerce (Crowston and Myers 2004; Stare et al. 2006), the mobile technologies, and the new marketing tools offered by the web 2.0 (Riegner 2007) cannot be neglected.
- *Legal aspects* all countries have data protection rules, and managers must take punctilious care when dealing with customers rights. Personal data should be gathered only under strict conditions. Legal aspects of e-commerce are also basic. The growth of a global electronic market has affected numerous legal issues, including network security and transactions, protection of property rights, intellectual and copyright material in the digital environment, management of payment systems, the legality of electronic contracts, and different aspects of the jurisdiction in cyberspace.

Strategic IT vision

First, it is necessary to make the distinction, as suggested by Sabherwal and Chan (2001), between the IT strategy, the IS strategy, and the information management strategy. The IS strategy is focused on the IT business systems or applications, whose main objective is their alignment with the business requirements and their use to achieve strategic benefits. The IT strategies are focused on the technology policies, including such aspects as the architecture, technical standards, security levels, and risk attitudes. Finally, the

information management strategies are concerned with the structures and functions for the IS and IT administration, focusing on issues, such as the relations between experts and users, the managers' responsibilities, the management controls, and the performance measurement processes (Earl 1996). In this study, when we refer to the IT strategy, we include the applications administration, and hence, we also encompass the IS strategies.

The importance that the literature in the MIS field places on IT strategy is reflected in the numerous works that deal with the strategic alignment concept. The IT alignment with the company strategy has been consistently considered as one of the most important aspects for both CEOs and IS departments. This persistent interest in strategic alignment is due to the fact that researchers consider its lack as one of the factors which hinder the achievement of the expected value of the IT investments (Chan and Reich 2007; Oh and Pinsonneault 2007; Chan et al. 2006; Croteau and Bergeron 2001). To achieve this strategic alignment, the literature identifies a key concept: The knowledge shared in a domain (Bassellier and Benbasat 2004, Bassellier et al. 2001). Since the innovative applications based on IT are derived from the fluent and prosperous dialogues between business managers and IT managers, this requires a knowledge overlap between both types of executives. Hence, an in-depth understanding by the managers of how IT can support the company strategy is a determining factor to take full advantage of these technologies. In this sense, the managers' judgement about how IT can contribute to the organization's performance is closely related with the IT role in the organization. However, the manager's strategic vision transcends the strategic alignment between business and IT objectives. Not only can IT be adapted to the business strategies, but also IT specifically create new business options to explore. This strategic IT vision can only be achieved when a strategic business vision is combined with in-depth IT knowledge. Organizations are capable of creating innovations based on IT solely through the suitable union of business and IT knowledge. A high-level knowledge of IS and the business have been considered as a determining factor in the integration of IT in organizations (Hotho and Champion 2011). The strategic IT vision required to be able to create these innovations can only be constructed through apprenticeship and experiences accumulated in the form of tacit knowledge.

Conclusions

This study analyzes the competences that a manager should acquire about information systems. This paper clearly shows the need for middle or top managers to achieve these competences to achieve the competitive edge in the organizations they work for. One of the most important functions of these competences is the possibility to create a vision of IT and how these technologies can be applied to organizations. Always bearing this strategic vision in mind, the information system courses for managers must develop seven essential competences. The first is knowledge in information technologies. The second competence is linked to the knowledge of the existing applications in the market and which programs exist for each of the specific functions of the organization and how they can provide support to the activities and to the decision-making processes, as well as the information systems as the basic coordination component among activities. Third, it is necessary to create competences in the development and analysis of

information systems, linked to IS creation or upgrade projects in the organizations. The fourth competence involves the acquisition of abilities in IS administration and all the aspects linked to security and audits. Fifth, e-commerce, web 2.0, and the new tendencies in mobile technologies and applications should be included in the curricula of the IS subjects. Sixth, managers must know about the legal aspect of data protection, e-commerce, and e-government. Finally, although with a less academic nature, it is necessary to encourage students about the importance of knowing reliable IT experts and consultants who are vitally important for SME. This basic framework of competences with the proposed strategic approach should appear in the subjects of information management in non-technical degrees with a management profile.

Authors' contributions

The work was jointly developed by all authors. All authors read and approved the final manuscript.

Competing interests

The authors declare that they have no competing interests.

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