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## Higher Education Success and ICT

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### Abstract

This study proposes that the quality of the teaching and learning process plays a significant role in determining the impact of information and communication technologies (ICT) competence on university success. Drawing from resource theory and educational literature, the authors develop the notion of the quality of the educational operation process as a construct of five variables: ICT satisfaction, ICT attitude, ICT use, ICT culture and ICT directions and routines. Considering the quality of the educational operation process as a mediating variable between ICT competence and university success they present their conceptual model in order to achieve a better understanding of the problem. We also propose a set of three propositions to test in future research.

### Keywords

Higher education, ICT competence, educational operation process quality, university success, conceptual model.

### 1. Introduction

Since the nineties there has been an increase in the number of universities implementing Web technologies in order to complete or improve their services (Alavi & Leidner, 2001). Nowadays most higher education centres offer some kind of virtual learning, although the extension and reach of these practices vary. Institutions use the Internet for educational purposes in different ways including development of virtual teams (Knoll & Jarvenpaa, 1995), improvement of group work by means of technological tools (Alavi, 1994; Alavi & Leidner, 2001), optimization of the interaction in classes by using computers (Leidner & Fuller, 1997), promoting sending and receiving pedagogical material (Leidner & Jarvenpaa, 1993).

More and more, academics are being encouraged to learn to use the technology and develop appropriate pedagogical approaches. Thus, development opportunities should concentrate on changing perceptions of learning and learners, and then demonstrate how actors could use technology to promote the learning and teaching process (Taylor, López, & Quadrelli, 1996).

While universities have begun to realize that the adoption and integration of information and communication technologies (ICT) has become a competitive necessity, they have also begun to realize that there is still much to learn about how to strategically position ICT to ensure the greatest positive effect on university success. Benzie (1999) stresses the importance and the need to create models that are able to help researchers to explain ICT role in universities; determining how ICT impacts on the teaching and learning process in order to achieve university success is an important aim of universities.

## 2. Objectives

Although recent studies have examined the relationship between the success of higher education institutions and ICT, they do not reach clear conclusions and are not seen from a resource-based perspective. Thus, the main objective of the article is to develop a better understanding of how ICT competence influences the success of higher education institutions. Even though prior research as reported in the literature has attempted to explain technology-based organizational success by focusing on various forms of ICT, many researchers tend to conceptualize ICT as a useful tool that may facilitate organizational success but only when combined with existing firm capabilities. Recent literature suggests that the quality of the teaching and learning process plays an important role in enhancing organizational capabilities and organizational success, and that it may benefit from the application of ICT. Therefore the second aim of this paper is to develop a notion of quality in a teaching and learning context, which not only embraces rational aspects of quality but emotional aspects as well.

We adopt a resource-based perspective to explore the complementarities between ICT competence and the quality of the educational operation process and its impacts on success. In the next section, we begin with an overview of the resource-based approach that forms the theoretical basis for our work. We then present the concept of ICT in the university context. After this, we develop the concept of the quality of the educational operation process as the main tool in our model to evaluate the studied relationship; finally we propose a set of propositions to test in future research.

## 3. Conceptual Background

### 3.1 The Resource-based View

Grounded in evolutionary economics and the work of Penrose (1959), the resource-based view (RBV) has gained considerable attention during the last decade (Barney, 2001). In RBV, the firm is seen as a bundle of tangible and intangible resources and tacit know-how that must be identified, selected, developed, and deployed to generate superior success (Penrose, 1959; Wernerfelt, 1984). The theory has been demonstrated to be a powerful and useful tool to analyze the strategic position of a firm in the way to achieve success. Despite the fact that it is not common to apply an RBV perspective in educational contexts we think that RBV adequately informs the clarification of the importance of ICT. Under RBV we analyze the ICT as a resource of the university and we study its relationship with another important resource that

is the quality of the operation process in generating competitive advantage.

Competitive advantage originates from firm heterogeneity in resources and capabilities through barriers to imitation by investing in inimitable idiosyncratic capabilities (Lippman & Rumelt, 1982) and leveraging these firm-core-specific assets for competitive advantage. Firms can achieve sustained competitive advantage by accumulating resources which produce economic value, are relatively scarce, and can sustain attempts at imitation, acquisition, or substitution (Barney, 1991).

According to RBV, ICT per se may not generate a sustainable advantage, because it can be commoditized through competitive imitation and acquisition (Clemons & Row, 1991). However, the advantages of ICT can be protected by embedding it in an organization through complementarity. Complementarity is said to exist when the value of one resource is enhanced by the presence of another. For example, the complementary use of information technology and human resources lead to superior firm performance (Powell & Dent-Micallef, 1997). Resources rarely act alone in creating or sustaining competitive advantage (Wade & Hulland, 2004). They play an interdependent role with other firm resources (Keen, 1993). This is particularly true in ICT resources that act with other firm resources to provide strategic benefits. Thus in university environments, while ICT may be essential for them to compete, it in itself conveys no particular sustainable advantage to one university over its rivals. The value of ICT is enhanced when universities use it to develop the quality of the teaching and learning process. Literature has recognized the role of quality in higher education as an important intangible resource for the organization to achieve a sustainable competitive advantage. ICT is not only a tool for knowledge acquisition but a very important resource for developing student skills, both cognitive and transferable. It allows students to develop communication and collaborative skills as well as to enhance their ICT skills (Hanson, 2003). Moreover, technologies provide the impetus to re-consider how teaching and learning are organized within the university strategy, and to encourage the staff to use technology in new and innovative ways, thus stimulating innovation (Kenny, 2001). Consequently, in this paper we focus on the role that quality of teaching and learning plays in enhancing the value of ICT.

In the next section, we describe the concept of ICT competence, which consists of three resources: ICT components, human ICT infrastructure, and shared ICT services. We then develop the concept of the quality of the operation process in which we include the most relevant variables considered important by the literature: ICT satisfaction, ICT attitude, ICT use, ICT directions and rules, and ICT culture. We link ICT competence and the quality of the operation process in order to determine how they interact to enhance university success.

### **3.2 Information and Communication Technology Competence**

Although popular literature has attempted to explain technology-based organizational success by focusing specifically on various forms of ICT (e.g. laptops, the Internet), on measurements of ICT, and on levels of analysis (Tippins & Sohi, 2003), there is no consensus as to the definition of ICT competence. As there is a lack of a widely accepted conceptualization of ICT, our first aim is to describe the notion of ICT competence in a teaching-learning process context, which consists of a construct with three dimensions: (i) ICT components, (ii) Human ICT infrastructure, and (iii) Shared ICT services.

The previous notion is an adaptation of ICT competence developed in a

business context by Weill and Vitale (2002). These authors added another dimension to their notion ("shared and standard applications" ) that we consider to be outside of the focus of our analysis centered on the teaching-learning process. Moreover despite that applications provide support to the process they are as invisible to students and professors as much as electricity is. We chose not to include shared and standard applications in the definition of ICT competence as we focus only on the concept of ICT competence in the operation process of universities, i.e. which is the teaching and learning process. Thus, processes such as human resource management, budgeting and accounting are beyond the scope of our notion of ICT competence. We conceptualize ICT competence as the extent to which a university is knowledgeable about and effectively uses ICT to manage the teaching and learning process.

### **3.2.1 ICT components**

ICT components embrace commodities such as computers, printers, database software packages, operating systems, and scanners.

### **3.2.2 Human ICT infrastructure**

Human ICT Infrastructure embraces knowledge, skills, standards, and experience in order to facilitate the use of ICT components. Most literature examining ICT personnel knowledge and skills focuses on the types of knowledge and skills that are required for these workers. The major debate in the literature during the 90s was whether ICT personnel required technical skills, managerial skills or both. Nevertheless nowadays there seems to be a consensus forming that ICT professionals should possess managerial, business, and interpersonal capabilities, as well as technical skills, to be effective in today's marketplace (Byrd, Lewis, & Turner, 2004).

### **3.2.3 Shared ICT services**

Shared ICT services are a set of services that users can understand, draw up and share in order to improve the operation process of teaching and learning. They refer to services, which are stable over time, such as management of shared databases, PC/LAN access, intranet and virtual campus.

## **3.3 The Quality of the Educational Operation Process**

Extensive educational literature suggests that learning and teaching are: (i) Processes in which quality plays a very important role in enhancing university capabilities and competitive advantage, and (ii) Processes which may benefit from the application of ICT (Biggs, 1999; Cope, Staehr & Horan, 2002).

When we began searching for the meaning of quality in higher education, the source most often recommended by fellow faculty was Robert Pirsig's "Zen and the Art of Motorcycle Maintenance" (1974). He begins by defining two seemingly "conflicting realities, one of immediate artistic appearance (romantic) and one of underlying scientific explanation (classic)" (Shields, 1999). According to Pirsig (1974, p. 61) "romantic reality is primarily creative, imaginative, inspirational and intuitive". There is a clear predominance of feelings in this view of reality. The classic view of reality relies on reason and evidence. Evidence is often collected as quantitative data. It is associated with using the scientific method to answer questions and address problems (Shields, 1999). Pirsig finds a connection between the romantic notion of quality and the classic one. This is because the concept of quality relies on the relationship between subject and object rather than in the subject or the object itself. Quality is found in the teaching and learning process that connects student and knowledge, and lecturer and knowledge. Thus, quality

relies on the relationship between actors and knowledge during the educational operation process of university. In other words romantic quality and classic quality can be seen as "two different time aspects of Quality, short and long" (Pirsig 1974, p.223). The romantic quality contains the "present, and here and now of things". The classic quality "is always concerned with more than just the present" (Pirsig, p. 253). The quality of the operation process in higher education is dynamic, its purpose is derived from the romantic vision of quality deeply connected with caring, and a sense of what is good.

In order to capture both sides of quality we propose the notion of quality of the operation process in an ICT enabled university as a construct of five dimensions: (i) ICT satisfaction, (ii) ICT attitude, (iii) ICT use, (iv) ICT culture, and (v) ICT directions and routines. This notion of quality focuses on lecturers and students as the most important actors in the operation process of universities. We are considering two different levels of analysis, an individual level that includes ICT satisfaction, ICT attitude, ICT use, and an organizational level that includes ICT culture and ICT directions and routines. Both levels are important when an institution is incorporating ICT and from both we are trying to capture the romantic and the classic quality throughout the teaching and learning process.

The ways in which lecturers may be encouraged, and supported, in the use of technologies is a key priority for senior managers at universities. There is a need to change strategies to encourage greater use of technology. We have tried to capture the ICT related feelings and behaviours of lecturers and students through the following variables: ICT satisfaction, ICT use and ICT attitude. In accordance with Pirsig we understand that imagination, creativity, intuition and caring are the zest of the teaching and learning process. In the next section we summarize the five variables which comprise the notion of the quality of the operation process.

### **3.3.1 ICT satisfaction**

ICT satisfaction represents the perceptions of the students about receiving a quality educational service, and represents the perception of the lecturers about receiving not only technological support but pedagogical as well in order to facilitate their activities.

In their paper, Shrum and Hong (2002) suggested that awareness of the profile of ICT online users was a key element in achieving a high degree of satisfaction. The authors included the two implicit actors (students and lecturers) in their analysis and emphasized the need to obtain first knowledge about the characteristics of student users of Web technologies so that the lecturers could develop appropriate strategies to meet the needs suggested by these characteristics.

### **3.3.2 ICT attitude**

ICT attitude represents the degree of affection actors feel about ICT, according to the Theory of the Reasoned Action (Fishbein & Ajzenis, 1975). This variable allows us to gather information about caring which is deeply embedded in quality choices. For example, one of the most consistent findings has been that student approaches to learning can be broadly categorized as either surface or deep (Cope, 2000). According to Cope a student adopting a surface learning approach only considers isolated aspects of the content they are learning. There is no attempt to seek any relationship between concepts. Deep learning approaches include an attempt to understand through trying to seek and relate the meaning inherent in different perspectives of the content. This intention implies an awareness of the learning experience, both a

developing understanding and the processes to develop that understanding. Consequently, a deep learning approach requires an active learner.

### **3.3.3 ICT use**

ICT use represents the degree of ICT usage and allows to gather information about creative use of ICT in teaching and learning activities. ICT use requires not only training and specialized skills, but communication and interactive abilities as well. Incorporating ICT in universities is a great opportunity to use the new technology as a means of encouraging a re-thinking of teaching and learning practices, not simply transferring established practice to an online environment. In this case, the technology becomes a medium to promote professional growth (Kenny & McNaught, 2000).

### **3.3.4 ICT culture**

ICT culture relates to the values, traditions and social norms of an organization which may encourage positive behaviour towards ICT. Success in persuading staff to use new technology will depend on engendering and nurturing cultural change within the faculties, with emphasis on their need to re-think pedagogical approaches and curriculum design to take into account the new technology, rather than on their capacity to generate a product (Kenny, 2001). In order to accomplish the goal the complex influence of the decentralised nature of academic culture should be also taken into account (Bottomley, Spratt, & Rice, 1999; Coaldrake & Stedman, 1999; Taylor, 1999). For instance, the degree of adoption and integration of ICT in the teaching-learning process of Spanish universities varies on the knowledge domain and on the commitment of the authorities of each institution to such integration.

### **3.3.5 ICT directives and routines**

ICT directives and routines represents mechanisms for integrating knowledge and skills, i.e. specialized ICT knowledge is first transferred and hence integrated by means of rules and directives. Organizational routines are regular and predictable patterns of activity made up of a sequence of coordinated actions by individuals. Institutions demonstrate their commitment to quality by formulating effective policy, directions and practice, and developing instructional and researcher environments that promote the concept of quality among lecturers and students in order to achieve better learning and researching development. Russell and Bradley (1997) analyze how the lack of rules for information technology use in educational centers may increase the teacher's computer anxiety and decrease the possibility of making the best of ICT.

## **3.4 Conceptual Model**

Based on the discussion in the preceding sections, we propose the conceptual model shown in Figure 1.

In this model, we conceptualize ICT competence as a construct of three dimensions as represented by ICT components, ICT human infrastructure and Shared ICT services. Similarly, quality of the operation process is a construct composed of five dimensions: ICT satisfaction, ICT attitude, ICT use, ICT culture, and ICT directions and routines. The model suggests that effect of ICT competence on university success is mediated by the quality of the operation process

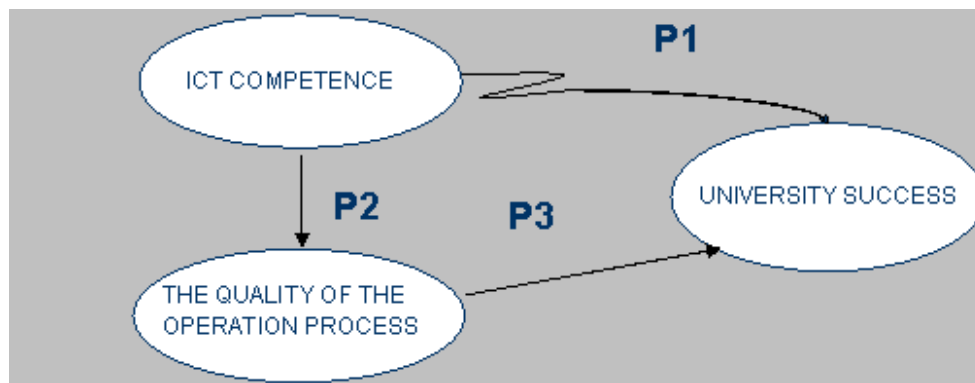


Figure 1. Conceptual Model

## 4. Proposition Development

Applying the model we develop three propositions representing: (i) The relationship between ICT competence and university success, (ii) The relationship between ICT competence and the quality of the operation process, and (iii) The relationship between the quality of the operation process and university success.

### 4.1 ICT Competence and University Success

An important aim of this paper is to develop a better understanding of how ICT competence impacts on university success. In the literature, there is no consensus as to how ICT impacts upon the specific organizational processes that contribute to improve firm success (Bharadwaj, 2000). Nevertheless, many researchers have tended to conceptualize ICT as an important resource to achieve competitive advantage when combined with existing firm capabilities (Tippins & Sohi, 2003). Leidner and Jarvenpaa (1993) noted that information technology may generate competitive value only if deployed so that it leveraged pre-existing business and human resources in the firm via co-presence or complementarities. In a higher education context, the value of ICT is enhanced when universities use it to improve the quality of the educational operation process.

We expect that the impact of ICT on university success cannot be measured directly, but can only be quantified by examining the indirect effect on an important process: the teaching and learning process.

Thus, in order to explore how ICT can be used to gain competitive advantage, we adopt a resource-based approach to examine the mediating role of the quality of the operation process in the relationship between ICT competence and university success.

Therefore, the following proposition is set forth:

*Proposition 1: The relationship between ICT competence and university success is mediated by the quality of the operation process.*

### 4.2 ICT competence and the Quality of the Operation Process

The quality of the operation process may benefit from the application of ICT (Biggs, 1999; Cope, Staehr & Horan, 2002). New technologies provide the impetus to re-consider how teaching and learning processes are organized within universities and serve as a catalyst for the renewal of programmes and

courses as well as student administrative systems to make them more responsive to student needs (Kenny, 2001).

Haywood et al. (2000) surveyed a sample of senior managers, academic staff and "experts" from all Scottish higher education institutes to collect their opinions on the use of learning technologies. The participants in the survey perceived learning technologies as tools that helped improve the quality of the teaching process and recognized that learning technologies had the potential to improve students learning as well. For example, it is suggested that student motivation to learn increases when using an Internet site with multimedia educational tools (Gilliver, Randall, & Pok, 1998). The use of learning technologies changes the teaching-learning process (Lewis, 2002); however simply investing in ICT is not enough. In the university context, investment in learning technologies can only be justified if these are used by teachers to encourage students to use deep learning approaches, and students in turn, to integrate the learning technologies into these approaches (Cope, 2003).

Given the potential impact that ICT competence has on the teaching and learning process the following proposition is set forth:

*Proposition 2: ICT competence is positively related to the quality of the operation process.*

### **4.3 Quality of the Operation Process and Success**

The success of higher education institutions is related to students achievement during their time at university and should be assessed by taking this issue into account. Gibbs (1992, p.1) describes the general aims of a programme of study in higher education:

*"... the development of students' intellectual and imaginative powers; their understanding and judgment; their problem-solving skills, their ability to communicate; their ability to see relationships within what they have learned and to perceive their field of study in a broader perspective. The programme must aim to stimulate an enquiring, analytical and creative approach, encouraging independent judgment and critical self-awareness".*

We see that it is not only important for students to improve their cognitive skills but non-cognitive skills as well. This is especially pertinent as during their university years students experience many changes. These changes are mainly non-cognitive and include a movement toward liberalism, autonomy, self-confidence, independence and self-understanding (Tam, 2002).

Looking into quality in higher education or university success, Astin (1985) says that institutional excellence is about by the institution's ability to bring about a positive change in students, and thereby should be measured in terms of student growth and improvement over time. Given the potential relationship between quality in higher education and success the following proposition is set forth:

*Proposition 3: There is a positive relationship between the quality of the operation process and university success.*

## **5. Conclusion**

The possibility that ICT can provide universities with a basis for competitive advantage has received a great deal of attention in recent years. But while ICT can improve efficiencies, it may not in itself provide a competitive

advantage, because the same technology could be adopted by competing universities. In our context, ICT-related benefits can only be realized when a university develops ICT capabilities and uses them to leverage other complementary resources.

In this article, we have created a conceptual model that may help researchers in future work to measure the relationship between ICT and university success in relation to expectations from deploying ICT. Similarly to the authors in the reviewed prior literature we believe that there is a group of intermediate variables which are strong enough to emphasize the impact of ICT on university success. We have selected and grouped the most representative ones in our model under the denomination of the quality of the operation process. We have also presented three propositions which can be investigated in future research.

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