Conceptual framework for smart university

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Abstract. Determine the potential value of the technology that an organization has, for example, the university, is an issue that is not easy to answer. The only way to look to the future, since there is no data, is to have a very good theory or model. The application of maturity models creates useful benefits. Its application covers a diversity of problem areas related to the development, use and impact of information technology. The human-computer interaction is part of a process of creating technology. Generating a model of intelligent maturity can be seen as an evolutionary approach for a traditional university to progress to several levels of maturity of a smart university.

1. Introduction

To evaluate an organization's capabilities concerning a problematic area, maturity can be considered as the appropriate measure [1]. It can be referred to as organizational resources such as the maturity of processes, objects or technologies [2] and people's capabilities [3,4]. Most maturity models are conceptual models [3], describe the development of an organization over time [4] and are valuable tools for information technology (IT) managers [5]. They have been developed to help organizations obtain and retain competitive advantages [6]. They have been designed to assess the maturity of a selected domain based on a set of more or less exhaustive criteria [1,7].

The five-point Likert scale is the most popular way to assess maturity, where "5" represents the highest level of maturity. The capability maturity model (CMM) has been included in the concept of measuring maturity across a multitude of domains [8]. Some of its properties are as follows: The development of an organization is simplified and described with some maturity levels; they are ordered sequentially and are characterized by certain requirements that the organization must comply with and progress from one level to the next [9]. Maturity models allow: Evaluate the growth status of an organization or business process; That organizations move progressively through maturity levels, ranging from the inconsistency of business processes to the optimal level of continuous improvement of business processes. Cleary outline improvement strategies to achieve the planned objectives [11]; identify the areas or factors where the organization should focus to improve and guide improvement programs. Although the maturity models are numerous and widely applicable, there is little documentation on how to develop a maturity model that is theoretically sound, rigorously tested and widely accepted.

The growing number of maturity models indicates a certain degree of arbitrariness in their development processes. In particular, this is highlighted by the incomplete documentation of the methodologies applied for the development of maturity models [5]. Additionally, they are generally expensive and do not have procedures for their implementation [10]. Three general challenges for the
investigation of the models of maturity are identified: the great scope of conceptual research; the empirical evaluation of the stages, and the practical non-existence of a linear sequence of stages in organizational life.

2. Background

The usefulness of the application of maturity models is varied. In the first place, the aspects that are analyzed generate: their state, importance, potential, requirements and complexity. Secondly, for the implementation of a systematic and well-directed approach to the improvements found can serve as a framework of reference. Third, they can guarantee an approach to quality, avoid mistakes and evaluate their own capabilities on a comparable basis. To achieve their objectives, their development must be validated [1]. There is no consensus so far. Within the scope of maturity models some problem areas can be included, such as the development, use and impact of IT. There are research topics such as the adoption of information technology, a relevant trend for more than one area. [3]. Some inconsistent and contradictory findings have resulted from research into maturity models. For many academics, however, maturity models are still considered useful. They have been and will continue to be widely adopted and their number is growing. However, there is a lack of documentation ready to be used [12]. There is still a lack of input from academics in the detailed guidelines for the practical adoption of the models developed.

The institutions of higher education are complex organizations. Despite being autonomous, they must perform a series of functions and develop a variety of procedures to ensure compliance with their functions, which inevitably poses constant challenges. The number of functions they perform and the variety of procedures they develop under their autonomy to ensure compliance with their functions, pose constant challenges to management and administration at different levels. The difficulties in the systematization of procedures and in the analysis, evaluation and optimization of workflows pose problems not only to management itself, but also to the design of information systems [13,14]. For [15]: “Smart University is a concept that implies a comprehensive modernization of all educational processes. The concept of smart in the field of education involves the emergence of technologies such as smart cards, smart screens and wireless internet access from anywhere”. Thus, to generate an intelligent maturity model would be to generate an evolutionary approach for a traditional university to advance to the various maturity levels of an intelligent university. Therefore, to generate various levels of SU intelligence, SU designers must pay more attention to the maturity of intelligent characteristics such as self-organization, adaptation, anticipation, detection, inference and self-learning [15].

Technology is part of everyday life, it is used for purposes as varied as communication, work, entertainment, teaching, learning, among others. The communication between man and machine, to make possible its purpose, has been a subject of study in recent years, in which the mediation between man and machine increases because of the computational applications that require more and more interaction for achieve an efficient use of its potential [16-18]. The definition of user experience (or UX) and its relationship with human-computer interaction (HCI) is complex [19,20]. UX is a broader set of considerations than HCI. It adds and contextualizes HCI by incorporating the concerns of both end users and organizations. That is, UX consists of all the factors that influence the relationship between the end user and an organization, especially when a product mediates that relationship [21]. Within the usability can be analyzed a set of sub-attributes such as: prevention of errors, ease of learning, efficiency in the task, ease of recall, aesthetics and accessibility. For the creation of technology HCI is a fundamental part. Creating "well" not only requires automating a certain set of tasks, but also inventing tools that introduce new possibilities both for the organization and for the people who use them [19].

Historically, software engineering and the disciplines associated with usability, such as HCI, usability engineering (UE) or user-centered design (UCD) have evolved in parallel and without connection, generating a gap between different disciplines. Most of the process proposals detected in the different documents of revisions or generation of mappings have their conceptual origin within software engineering, also proposals were detected coming from alternative disciplines such as HCI, UE and UCD. This tends to reduce the gap between software engineering and those disciplines. Another
aspect to be highlighted is that within the processes that originate in software engineering there are a similar number of agile and predictive processes. This indicates that the importance and criticality of usability is independent of the development philosophy used in the base process and the integration of usability is sought transversally in both agile processes and predictive processes [21].

3. Methodology

Purely conceptual work is becoming less frequent as the academic world attempts to corroborate maturity models with case studies and surveys. Qualitative research strategies used highlight case studies, fundamental theory, action research and quantitative strategies such as experiments and surveys are used by empirical studies [3]. Survey data and user interviews will be collected from technology managers and decision-makers in higher education to investigate how technology is adopted in education, the obstacles faced by technology users, and how it can be optimized in order to get all the benefits of work. The quantitative part to measure knowledge about the maturity level of technology adoption, while the qualitative part to get a broader idea of how it has been used in education. Quantitative and qualitative data can be obtained from surveys, interviews and literature reviews [22].

As an example, taken from [23,24], the method of data collection could be done as follows: Two different surveys are planned, one of them aimed at the users who are directors of technology and the other aimed at users of technology in the educational environment. The questionnaires could be administered through the internet through some tool. The validation and evaluation of the model will be activities of the last objective of the proposal, becoming an interesting challenge, since the great majority of the models exposed in the literature do not provide validation of their proposed metrics [25]. For the validation process of the model [26], the following processes could be carried out: list the criteria identified during the initial stages of model development; present the results of the validation instrument; select an expert panel; design a validation instrument to test success criteria; relate the results with the success criteria to obtain strengths and weaknesses and discuss how these strengths and weaknesses could affect them.

4. Results

Validation and evaluation of the model will be activities of the last objective of the proposal. It will be done in the Universidad Francisco de Paula Santander (UFPS), Ocaña, Colombia. It is focus on processes, as presented in Figure 1, allows improving customer satisfaction and the management performance of the University, towards the achievement of the development plan and the fulfillment of the requirements and needs in terms of professional training. The institution has implemented technologies as tools that allow effective performance in the management of this, cross-cutting the different administrative processes and academic management. The elaboration of the strategic plan in the UFPS, Ocaña, Colombia, since 2015 [27], became the guidelines of the technological development in the strategic processes (direction and planning), missionaries (academic management, research and extension), support (university welfare management, human management, information systems, telecommunications and technology, administrative and financial management, communication management, general secretariat, infrastructure and maintenance and admissions, registration and control) and evaluation and improvement (internal control, integrated management system). New technologies have changed the way people work, relate and learn; for this reason, it has been integrated into teaching; lately its popularity has grown in the educational context and therefore governments are working to reduce the digital divide [28]. This process of technological evolution has transformed the teaching-learning process through the diffusion of educational hardware and software, generating a dynamic work environment where the teacher and the student have an endless number of educational tools and possibilities.

This process of technological evolution has transformed the teaching-learning process through the diffusion of educational hardware and software, generating a dynamic work environment where the teacher and the student have an endless number of educational tools and possibilities; advise and manage the acquisition and implementation of new information and communication technologies that provide
effective, effective and timely solutions to the needs of the client and interested parties, taking into account the efficient use of technological resources, minimizing the environmental impact and under a favorable work environment for workers [29]. By including technology in the organization, not only connectivity, access to information and response time in processes are improved, but also academic training is framed in a dynamic context, adapted to the changes that globalization brings. Once the needs have been identified and how they can be met, they will be incorporated into the model, particularly in its design. These needs are reflected in the application of the projected model to various organizational structures. The right balance between simplicity and an often complex reality [8,30]. In developing this conceptual framework, a fundamental part of projecting the model, considering the purpose of its application, including whether the resulting maturity assessment is descriptive, prescriptive, or comparative in nature, see Figure 2.

Figure 1. Ocaña UFPS process map.

A value that resides in the ability to measure and evaluate the capabilities of the domain at any given time would be given to the organizations in the projection to apply this model. Similarly, it would provide a better understanding of existing domain capabilities, comparison with a wide range of competitors, greater efficiency in the use of resources to improve domain capabilities and an opportunity to improve success in the domain [31]. A university in search of its continuous improvement defines the strategic objectives that guide the development of the strategic plan through projects, broken down into activities and responsible. The vision is conceived in a horizon of (5) years, and a first moment or space of (3) years is specified, which is considered appropriate to implement and monitor the actions defined, in accordance with the dynamics of the institution [29]. Universities generate top management the institutional development plan, which is your navigation map. Information and communication technologies are incorporated into all institutional, administrative and academic processes. According to Rockart [32], the key success factors (FCE) are defined as the limited number of areas, in which the results, if satisfactory, will ensure a competitive and successful operation for the organization.

The main function of the IT organizational unit is to provide support and technological support to all the processes of the institution [33]. Based on the environment surrounding the institution, its macro policies and nature itself; as well as the continuous improvement of the processes, framed in its policy of quality and services in technology as part of its mission, it is vital for the agency to find the best way to apply its experience, expertise, knowledge, human talent and resources to offer the university its services with quality, exercising control over the needs, requirements and challenges in its business, its clients and final users [34]. At present, the term smart university "smart university" is incorporated. They can be considered intelligent universities, since they profitably use available intelligent
technologies such as cloud computing, the Internet of things, big data and artificial intelligence to improve the performance of their processes, as well as to improve the quality of their graduates [35,36]. However, continuous improvement must take place in order to continue narrowing the gap and become smarter universities [37]. In the end, intelligent technology solutions foster collaboration and cooperation among people [38-41].

![Figure 2. Projection of IT adoption maturity model [42].]

5. Conclusions
From the senior management process, a university model must be defined that includes an IT structure that provides value and generates a response to the needs of that model. This goes hand in hand with the trend identified through the review, which highlights the need for alignment and integration of technology with organizational processes, calling for greater interaction with senior management.

It is necessary to analyze the levels and the relationship with the processes where they are involved, that is to say, how the IT technologies used and each factor within the university can enrich the university community. The IT organizational unit of the universities are in charge of adapting all these "Smart" technologies to the university environment in each of its teaching, research, management or government facets. The complexity is great, there is talk of very diverse environments with very different needs.

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