From Information Systems to e-Learning 3.0 Systems's Critical Success Factors: A Framework Proposal

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Abstract. This paper seeks to identity and provides Critical Success Factors (CSFs) that affect the decision of adoption of e-Learning 3.0 systems. The study begins with a literature review related to the CSFs for information systems, followed by a literature review for e-Learning systems CSFs. The paper introduces an initial framework for understanding of which factors can influence successfully the adoption of an e-Learning 3.0 system. The framework is composed of five main dimensions, such as: technology, content, students, professors and educational institutions, as well of its influencing factors, and characterizes the factors in each dimension. This study can assist the stakeholders, i.e. students, professors and organization, in their intension to adopt an e-Learning 3.0 system

Keywords: Information Systems, e-Learning, Web 3.0, e-Learning 3.0, Critical Success Factors (CSFs), higher education.

1 Introduction

The exponential deployment of information technology, along with new developments in education, launched excellent opportunities for new learning methods. In the last decade, the e-Learning concept had a growing recognition and is currently one of the most prominent developments in the information systems industry.Today, e-learning has evolved into a model widely adopted in academic institutions [1].The first version of e-Learning, e-Learning 1.0, was pioneer in the online distribution of educational contents. Learning materials transposed the walls of the classroom. However, as the internet was in its early stage of development, these

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contents were read only. The information was available, but it was static, and could not be edited. With e-Learning 1.0, students had freedom in terms of space and time, allowing them to organize their learning processes and at their own rhythm. However, the learning process remained pre-established.The content was organized into units and modules. Learning Management Systems (LMS) were introduced to assist the process of administration content and didactic tools to enhance learning [2]. With the evolution of the Web and the great popularity of Web 2.0, e-Learning took the technology behind "read/write web" and addressed itself more to the student and to the collaborative environment. Collaboration, information exchange, social learning, content generation, are the pillars of e-Learning 2.0 [3].Education faces many challenges such as budget constraints, rising costs and increasing demand for e-learning platforms [4]. The response to these challenges, by educational institutions, has led those to reassess how the teaching is being carried out. In this perspective, the added value that Web 3.0 brings to e-Learning has been questioned as well. As with other technologies and pedagogical tools [69] [70], the first step to implement Web 3.0 on e-Learning is to decide whether, in fact, it is a valuable resource. It is believed that Web 3.0 can be a powerful pedagogical tool that has the potential to improve the construction of knowledge and personalize the learning experience of students. At the same time, it is expected that it facilitates some aspects from the teachers' responsibilities (i.e. support the development, assessment and student support) [5].Web 3.0, called Semantic Web or Web of data, is the new generation of the Web, with features and technologies such as collaborative filtering, cloud computing, big data repositories, mobility, etc.. If Web 2.0 is a social network where predominates the collaboration between creator and user, then Web 3.0 is the intelligent Web applications. If we want a more intelligent Web, with tools that enable us to find the information we need and when we need it, it is necessary to give more meaning to the information found therein. The information must be structured in such a way that the devices can read and understand as humans do, without ambiguity. Despite many uncertainties, educational institutions have followed this whole evolution of e-Learning. However, it is necessary to focus on what is really essential for the success of e-learning programs. Nowadays it is necessary a total understanding of the critical factors that contribute to the success of an e-Learning system. Institutions need to identify which factors actually contribute to that success. However, there are no studies that identify these critical factors for e-Learning 3.0. Thus proven the gap, it is intended with this study propose a framework for the critical success factors in e-Learning 3.0 adoption. With the integration of e-learning in most educational institutions, there are several factors that should be considered when it is decided to adopt an e-Learning 3.0 system, so that its application can succeed in institutions currently very demanding.

2 Critical Success Factors

It is recognized the importance of identifying the critical success factors for the organizations when there is an intention in adopt a new system.Being the focus of this

research to identify the CSF that affect the decision of the adoption of e-Learning 3.0, the study began with a literature review on critical success factors of information systems in general and in e-learning systems in particular. These literature review, and the study of Web 3.0 and e-Learning 3.0, supported the development of an initial framework of critical success factors of e-Learning 3.0.The critical success factors are seen as activities and constituents that must be addressed to ensure the success of your compliance. They can also be seen as what should be done if an organization wants to succeed. The critical success factors should be few in number, measurable and controllable [6].

2.1 Critical Success Factors for Information Systems

The critical success factors for the implementation of information systems are addressed by several authors. In reviewing the literature we can find researchers that

Table 1. Critical success factors for information systems implementation

Dimensions	Critical Success Factors	Authors
Organisational	- Top management support and commitment - Culture (collaborative, innovative) - Communication (involvement of all in sharing information and opportunity for expression) - Clear strategic goals - Interdepartmental collaboration - Motivation	[8], [9], [10], [11], [12], [13], [14], [15], [16], [66]
Technology	. New technologies - Equipment conditions - System complexity and lack of interoperability - Hardware, Software	[8], [9], [10], [13]
Education and training	- Continuous monitoring - Training	[8], [10], [12], [13], [14], [15], [66]
Evaluation	- Impact of the new system - Monitoring and evaluating performance	[10], [12], [13], [15]
People	- Team capacity (high competence and expertise of the team) - Specialization - Project Manager	[9], [10], [11], [13]
Data accuracy	- Reliable data from both internal and external sources - Maintenance and integrity - Confidence in the information provided by the system	[7], [9], [13]

discuss about the importance of commitment from the management in order to invest time and effort guiding the project, clear link to the strategic goals, management of organisational resistance to challenges, appropriate technology, the quality of the staff with technical knowledge, reliable data from both internal and external sources [7].Table 1 summarizes the critical success factors for information systems implementation, grouped in six dimensions, according to their similarities. The organisational dimension includes factors related to leadership, management support, communication, strategy, culture, motivation. Other dimension, technology, focuses on issues related to the technological challenges and equipment conditions. Education and training (training of users and staff), evaluation, people (enough management and technical skills) and data are the others dimensions considered in this study.

2.2 Critical Success Factors for e-Learning

The critical success factors for e-Learning emerge from the existing literature. A literature review was performed to collect the CSFs identified by several authors.

Table 2. Critical success factors for e-Learning

Dimensions	Critical Success Factors	Authors
Technology (infrastructure)	- Broadband (internet speed) - Equipment quality - Network security - System backup - Equipment availability - Appropriate equipment	[17], [18], [19], [20], [21], [22], [24]
Environment (Learning)	- Accessibility - Interface design - Interaction among participats - Usability - Being according to the objectives	[17], [18], [19], [20], [21], [22], [23], [24], [26]
Professor	- Learning facilitator - Technical competence - Interaction with the class - Clarification of objectives - Attitude toward the students	[17], [18], [19], [20] , [24], [26]
Student	- Motivation - Commitment and responsibility - Student content interaction - Student-student interaction - Confidence - Knowledge technology	[17], [18], [19], [20], [23], [24], [26]
Institutional support	- Training - Help desk - Technical support	[17], [19], [22], [24], [25]
Leadership	- Being an expert	[21]

These CSFs can be considered critical to the success of an e-Learning system. The most prominent are mentioned in the next table. According to the research study, six dimensions were considered: technology, learning environment, professor, student, institutional support and leadership. Each dimension included several factors.

2.3 Critical Success Factors for e-Learning 3.0

2.3.1 Expectations and Challenges

The notion of e-Learning 3.0 emerged from the increasing popularity of Web 3.0 as an educational asset. E-learning has been taking advantage of Web 3.0's innovations. In general terms, Web 3.0 has become an appealing tool for education due to its promise of increased personalisation, effective knowledge management and improved interactive and collaborative instruments. The use of the Semantic Web is expected to maximise the resources that are already in place and to address its main challenges.

There are three main components in Web 3.0's definition: Semantic, Mobile and Immersive [67]. The semantic aspect relates to the precept of a personalised Internet, using each user's profile to customise their experience online. This is supported by software that has the ability of "utilizing natural language searches" and of "understanding the meaning of data". In terms of mobility, Web 3.0 offers the opportunity of using several devices with increasingly advanced features that enable a richer internet navigation, regardless of the device that users employ. The notion of an immersive internet concerns virtual and augmented reality and 3D settings. Web 3.0 "encompasses efforts to build a new WWW architecture that enhances content with formal semantics, which enables better possibilities for navigating through the cyberspace and accessing its contents" [58]. Also, Web 3.0 can be classified as a variety "of Internet-based services and technologies that include components such as natural language search, forms of artificial intelligence, software agents that make recommendations to users and the application of context to content" [67]. Web 3.0 envisions the internet as a database, it seeks to transform it into an organised data source. It uses Web 2.0 tools as enablers. This stage of the web unites both We1.0 and Web 2.0, but it takes the concept of the Web forward to include semantics, intelligent agents, personalisation, increased mobility and a more focused experience for each user [68].The panoply of benefits emerging from the use of Web 3.0 in e-Learning have been made clearer by the pioneers of its application, but as with any innovation, e-Learning 3.0 needs to be accepted and employed. The majority of the challenges deriving from e-Learning 3.0 are common to its predecessors' versions. Since the beginning of the electronic delivery of learning there have been aspects that concern the education community and impede a wider acceptance of e-Learning. In order to fully comprehend the hazards of e-Learning 3.0 it is paramount to understand that some of these challenges are common to all versions of e-Learning and that others are

specific to the use of Web 3.0.Innovative technologies have several advantages, but while they can be a valuable ally for learning it is overwhelming to accompany the speed at which they are developed and evolve. Institutions and professionals are yet in the process of trying to harness web based learning and research shows that great part of Web 2.0's tools and precepts have not been completely embraced. Hence, when artificial intelligence, mobile interfaces or immersive virtual environments start to appear as potential educational instruments, some scepticism and confusion is expected [67].The fact the e-Learning 3.0 is invested in the development of information as a resource that is accessible without time, space and interface constraints, poses a challenge in terms of interoperability. To achieve this goal, it becomes necessary to enable several types of applications and interfaces to interact to facilitate a more proficient setting for users [27].The challenges of using ontologies relate, namely, to their creation, to the way they are build. While it is possible to find a variety of approaches to create ontologies, none of these approaches is regarded has being a standard method [32]. Additionally, ontologies of superior quality require substantial monetary means and significant time allocation. Financial resources and time are two of the main obstacles for the development of superior quality ontologies [53].Despite the many advantages that cloud computing presents it still has some challenges namely repercussions in terms of performance due to internet connection velocity; a higher cost that the hardware itself, when considering a long term subscription of the data centre; and the key effect that service quality and backups have when considering the security of the data [47].To move forward into a fully functional E-Learning 3.0, the aforementioned challenges must be considered and addressed. Online education can benefit greatly from the pioneering precepts of the Web 3.0 but for its advantages to be truly enjoyed, it is essential that the educational institutions evaluate all these issues.

2.3.2 The Framework

In order to identity the CSFs for e-Learning 3.0 systems it was carried out a literature review on the topics evolution of the Web and evolution of the e-Learning followed by a detailed review of Web 3.0 and e-Learning 3.0. These, combined with the information systems and e-Learning CSFs, contributed to design an initial framework.Based on all this work it was identified a list of potential CSFs to adopt when an institution intend to adopt an e-Learning 3.0 system. During this process some CFSs from the informations systems and e-Learning systems were refined (added or removed), and new dimensions and factors were added.This framework organized the CSFs into five dimensions (table 3).

Table 3. Critical success factors for e-Learning

Dimensions	Critical Success Factors	Authors
Technology	Smart mobile technology	[27]
	Web 3.0	[27], [28]; [29], [30]
	Semantic features	[28], [29], [31], [32]
	Video games	[33]
	High power graphics	[34]
	3D and immersive web	[34]
	Ontology-based tools	[29], [31], [36], [39]
	3D visualization and interaction	[35]
	Intelligent Search Engines	[34]
	Cloud computing	[29], [36], [37]
	Independency from centralized institutional web-sites	[37]
	Service-oriented infrastructures	[41]
	User-friendly interfaces	[30], [38], [40]
	User profiling techniques	[42]
	Artificial intelligence	[43], [45]
	Ontology creation	[30],[44],[46]
	Ontology maintenance	[44], [46]
	Hardware equipment (computers, laptops, mobile phones, etc.)	[47]
	Fast internet connection	[47]
	Semantic interoperability	[31]
	Interoperability of web-based educational systems	[48]
	Easy to use end-user applications	[30]
	Mobile Apps	[49]
Content	Widely spread ontology structure	[41], [50]
	Personalised content	[51], [52]
	Machine-understandable learning material	[47]
	Semantic homogeneity	[39], [50]
	Development of domain ontologies	[31] [53];
	User generated	[54]
	Dynamic	[54]
	Semantic markup	[31], [56]
	Metadata	[41], [52], [57], [58];
	Semantic web ready content	[30], [46], [50], [59]
	Open data	[60]

Table 3. *(continued)*

Students	Collaborative learning	[35]
	Self-organization	[37]
	Real-time learning and real-time collaboration	[35]
	Personalized learning	[43]
	Trust	[55]
	Tagging resources	[61]
	e-Skills	[62]
	Feedback on content	[52]
	Add information to learning systems	[46]
Teachers	Basic understanding of Web 3.0	[63]
	Trust	[55]
	ICT training	[62]
Educational Institutions	Creation of learning value systems	[55]
	Policy-aware infrastructure–Interoperability/Standards	[55]
	Training for e-learning Tutors	[64]
	Inter-connectedness among institutions	[65]
	Development of learning methods based on real experience	[57]
	Data integration platforms	[50]
	Infrastructural semantic tools and services	[50]
	Large repositories of linked data	[50]
	Educational servers	[29]

3 Conclusions and Future Work

There is no doubt related to the integration e-Learning 1.0 systems and its successor, e-Learning 2.0, in the majority of higher education institutions [70]. Therefore, an evaluation to the factors that determine the success of this adoption need to be done.

Several studies were carried out by different researchers on CSFs of information systems and e-learning and also frameworks were proposed [69]. However, no specific study was done for e-Learning 3.0.

This paper, in line with what have been done for the IS and e-Learning systems, illustrates the CSFs which need to be considered when decide to adopt and e-Learning 3.0 system.

The idea of identifying CSFs as a basis for determining the adoption of e-Learning 3.0 follows the sense that the CSFs represents the main issues without which a project stands little chance of success [14].An initial framework for CFS in adoption of e-Learning systems is proposed in this paper. Despite some obstacles (i.e. financial, organizational, people), e-learning seems to be recognized as an important support for education. In order to facilitate the decision to adopt an e-learning 3.0 system, a framework was proposed to support the decision of adoption.Future research should

be conducted to validate this framework by collecting opinions from a group of experts, and the resultant framework will be also assessed by a survey.

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