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A Study Of The Usage Of Information Systems In Higher Education: An Exploratory Review

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Abstract— **Since Information Systems have become an essential requirement in every field it is important to scrutinize the behavior of information system in higher education sectors. Failure rates of Information Systems are being increasing among all sectors than success rates mostly in developing countries when considering the past research of Information System Development. Importance and application of Information Systems in higher education sectors have been taken considerable weight when making decisions to implement or purchase an Information System to academic institutions. This article aims to provide a brief discussion and clear direction regarding practices of information Systems in higher education sectors. Higher education institutions and universities around the world have been developed Information Systems to manage academic, nonacademic and administrative processes according to literature. An in-depth review of the existing literature has been done to meet the objective of this study. A variety of studies across several different countries and academic industries have been taken into account for identifying the effect of Information System in higher education. Hopefully, this article will add some additional information to the decision makers of Information Systems to make the system more viable and also achieve correct decisions to implement in the Information Systems.**

Keywords- *Information System; Higher Education; University Education; Student Information System*

I.   INTRODUCTION AND BACKGROUND

"IT investments are expensive and high risk" (Bartis & Mitev, 2008, p 112) in whatever the field. Technology improvements enable the building of information systems which can be used at any place and any time. "Information System is described as 'any organized combination of people, hardware, software, communications networks and data resources that collects, transforms and disseminates information in an organization" (O'Brien, 2003 cited in Reeva & Johnston, 2007, p 73). Information systems of organizations provide information to someone on something. They are not just self-operating control mechanisms and human involvement is needed. According to some definitions, it is difficult to understand the difference between Information Systems and Computer Systems. "Information Systems are not computer systems but they are

the systems of human activity or micro social systems and consequently the functionalist science or interpretative sociology appear inadequate basis on which to study them in a wider critical social context that seem to be more relevant" (Clarke & Lehaney, 2000, p 555).

Policies issued to implement educational changes for the quality of education often fail because of lack of comprehensive understanding of the complex nature of the quality of education in schools or higher education institutions (Cheng and Tam, 1997). Universities all over the world generate voluminous amounts of data daily because of the nature of their administrative and research activities (Uwadia et al, 2006). Today education system is faced with many problems, including falling behind developments and technology, lacking equipment, personnel and resource, scarcity of scientific researches, personnel having no skills and the quality demanded by the system, education programs under efficiency standards (Dursun, Oskaybas and Gokmen, 2013). Information is required for writing thesis, making assignments, preparing project reports and other academic works. Students are expecting quick response to their information needs and easily accessible information through viable Information System to meet their academic standards. Electronic databases and mobile wireless app have become a popular technique in their academic needs. Global relationship among academics and students is an important facility invented by the electronic information system. Information is a strategic tool to access all the procedures in an organization and it does the same to access knowledge in a higher education institute. It is significant important for all ranks of staff members in a university too. Many higher learning institutions have utilized management information systems to provide productive services to students.

Information System failure has become a problematic situation in the commercial field than education sector. Developing any information system whether it is based in a commercial organization or within a university environment is an activity that is fraught with risk. (Uwadia et al, 2006). Research of Information System failure dates back to 1960s. The early works were concerned with technological or engineering problems where systems were not delivering the required performances. These failures originated in hardware or software deficiencies. In 1970s, the focus turned towards to user resistance and the lack of user involvement was quickly claimed to be a major reason for failure. Later,

discussions included managerial or organizational issues but still direction of IS failure that is moving on different dimensions (Bartis & Mitev, 2008). Information System projects failure rate in higher education sectors is high particularly in developing countries. This is perhaps the planning of such projects required combination of management and IT knowledge and also the knowledge of prevailing education management system of the institution or the country. "Planning of Higher Education Management Information Systems for an institute is difficult and for a country as a whole is still more complex because, every institution has its own distinctive system of management and implementation of such projects" (Ali, 2010, p 13).

"It is a well-known secret in the computer industry that information systems projects are more likely to fail than not" (Stanforth, 2010, p 6). The failures push developing countries on the negative side the global technology. For all these reasons, IS failure is therefore a very real and very practical problem in developing countries that needs to be addressed. Sultan & Wong (2010) have done a research to explore the critical research issues in terms of service quality in higher education. They have critically examined a number of leading studies relating to satisfaction, service quality, and higher education. They have found five critical research agenda in the field of service quality in the higher education sector. The paper has shown the research gaps of service quality in higher education through a review of literature. They have pointed out that future research should empirically address those gaps.

II. Usage of Information Systems in Higher Education Sector

Information technologies leading the reorganization of all institutional procedures have become one of the integral parts of the education sector over the time. Today computers and communication technologies are the factors which provide training the education services unlike in 1990's when they were used as supportive devices in the education service (Dursun, Oskaybas & Gokmen, 2013). Universities have been in the forefront of online services and e-services such as enrolment, course delivery, course support and library lending are rapidly becoming standards within the education sector (Sutarso & Suharmadi, 2011; Kim-Soon, Rahman & Ahmed, 2014). It is important to provide up-to-date information to meet students' needs. Electronic service tools and sources in the university system can include information resources such as an online and off-line database e.g. WebCT, Blackboard as an e-learning tool or a service, such as a virtual help desk, provided via a network like local area network, intranet or the Internet (Kim-Soon, Rahman & Ahmed, 2014). With this situation implementing of Information Systems are rapidly increasing among universities.

Higher education institutions offer students an information infrastructure to assist them on different aspects of university life. According to Cobarsi, Bernardo and Coenders (2008), these infrastructures were traditionally based on two principal elements: paper documents and face-to-face communication. By the end of the twentieth century, the rise of information technology and electronic communication radically altered the potential for exchanging information in universities. A conceptual framework for campus information systems tested in a study of Spanish higher education institutions that has been defined involving university life in a wider sense, including academic, administrative and social aspects. A two-dimensional model based on information resources and information attributes has been proposed by Cobarsi, Bernardo and Coenders (2008).

Table 1. Information resources and attributes proposed by Cobarsi, Bernardo & Coenders(2008).

Type of resource	Name of the resource
Academic	Information about subjects prior to registration Library Subject-specific website for students from the same class Library: catalogue Library: subject bibliographies Library: document acquisition service Library: electronic bulletin of specialized news Library: complaint and suggestion forms Exam archive
Administrative	Financial aid Registration Provisional final grades
Social	Housing information Professional information Directory of professors Directory of students Forums Campus news

New technology has enabled universities to serve students in new and creative ways, such as delivering not only learning materials but also administrative and welfare services using Information Systems. Information System makes student services cheaper, easier, faster, and more accurate than traditional Information System at present. It can be seen a clear positive turning point in the higher education here. It is not limited to learning process but also to administrative services which are more efficient and effective than manually. It helps to reduce university workload and involvement of human and physical resources. Students can access information within few seconds and more effective way to fulfill their academic needs.

New trend of Information System is the mobile-wireless information systems among students. Mobile-wireless information systems can create benefits for academic organizations; e.g. productivity enhancement processes and procedures flexibility, service improvements, lower operation costs and improved processes. According to Gafni (2008) mobile-wireless information systems face new kinds of problems; narrow bands, small devices, tiny screens and diversity of users and devices. Information systems quality cannot be measured only by software faults absence; it must be broader, including characteristics to cover all aspects, life-cycle phases and viewpoints (Gafni, 2008). These problems would intensify when the information system is targeted for a wider audience in the higher education institutions. Because these devices have small memories, they have short battery life and limited calculation and computation capabilities. Low resolution and small keyboards those are difficult to operate because of academics always work on research activities like research articles. Security problems can arise when devices are lost due to possible unauthorized access to sensitive data. The network causes other problems, including: limited bandwidth, inconsistent connection stability, transfer delays and varied standards and protocols, high overhead, decreasing of the performance level. Moreover, when users operate the system during mobility the connection point to the network can change and obstacles could be disturbed causing temporary disconnections, interruptions or disturbances. Besides security, privacy, and confidentiality are very important issues (Gafni, 2008). Research conducted by Gafni (2008) has focused on the mobile-wireless information systems, which are activated through the end devices which include a screen with displays such as cellular phones and Personal Digital Assistance devices. According to Gafni (2008) the research can be expanded to new kinds of mobile-emerging wireless information systems emerging because of the rapid development of the technology and the wireless networks such as wearable information systems and information systems based on RFID (Gafni, 2008). Students like to use mobile devices and it has become a popular tool among them. According to Varshney (2003) Mobile and wireless Information Systems can be described as systems involving: mobile devices, users, wireless and mobile networks, mobile applications, databases. Advances in each one of these areas that influence all mobile and wireless information systems. Voelker and Bershad (1996) have discussed about "Mobisaic" as follows. "Mobisaic is a World Wide Web Information System designed to serve users in a mobile wireless computing environment. Mobisaic extends the Web by allowing documents to refer and react potentially to changing contextual information such as one's current location in the wireless network." (Voelker & Bershad, 1996).

Some can argue that the better technique is the mobile wireless information system than other Information Systems. But it may depend according to organization and country. Students use Information System to fulfill their information needs within a short period effectively and students used to achieve their academic needs using mobile wireless information system. Library mobile wireless information system is a good example for that. It is no doubt that the electronic information system is better than the manual. Although some researchers have argued that mobile information system as the best way to deal with information and it has pros and cons of its own. "The students themselves contribute directly to the quality of service delivered and to his/her own satisfaction or dissatisfaction" (Martinez-Argüelles, Castan & Juan, 2010, 152) and can send their feedback although they are travelling and can be accessed at any time and at any place.

III. ELECTRONIC SERVICE QUALITY IN THE FIELD OF HIGHER EDUCATION

Information Systems can be mainly divided into two parts; manual and electronic. Electronic based services are a win-win situation for universities and students alike (Sutarso and Suharmadi, 2011). The new generation is adapted to use the internet that means this generation will readily take advantage of e-services for their academic activities. The growth of service quality literature started with commercial enterprises and emergence profitable organizations. Later, it expanded in the management and marketing of higher education sectors with the advent of new technology. Measuring and modeling the service quality is yet to be an integral part of the higher education (Sultan & Wong, 2010). Owlia and Aspinwall (1996) have included several factors for software quality that are widely used in software engineering in their research on "A framework for the dimensions of quality in higher education". Dimensions of software quality have been redefined for a higher education environment and summarized as follows (Owlia & Aspinwall 1996).

Table 2 Software quality factors in higher education

Dimensions	Definition in higher education
Correctness	The extent to which a programme/course complies with the specified requirements
Reliability	The degree to which knowledge/skills learnt are correct, accurate and up to date
Efficiency	The extent to which knowledge/skills learnt are applicable to the future career of graduates
Integrity (security	The extent to which personal information is secured from unauthorized access
Usability	The ease of learning and the degree of communicativeness in the classroom
Maintainability	How well an institution handles customers' complaints
Testability	How fair examinations represent a subject of study
Expandability	Flexibility (generality)
Portability	The degree to which knowledge/skills learnt are applicable to other fields

Kim-Soon, Rahman and Ahmed (2014) have developed a single dimension comprising six elements to measure the quality of e-service in higher education namely in the areas of learning, research and communication support. These elements are: e-service is always available, it is very convenient to use, the user interface has a well organized appearance, makes it easy to find what is needed, the e-service has met needs and experience and e-service assures schedule flexibility. Generally, quality of e-service is related to the frequency use of e-services provided by the university (Kim-Soon, Rahman & Ahmed, 2014). Numerous methods are available to measure the service quality of Information Systems in higher education. SERVQUAL(Cronin & Taylor, 1992; Watson & Kavan, 1998; Pitt, Watson & Kavan , 1995; Behdioglu & Sener, 2014) and SERVPERF (Cronin & Taylor, 1992) etc. The purpose of the paper of Brochado (2009) was to examine the performance of five alternative measures for service quality in the higher education sector; service quality (SERVQUAL), importance-weighted SERVQUAL, service performance (SERVPERF), importance-weighted SERVPERF, and higher education performance (HEdPERF). The paper attempted to develop insights into comparative evaluations of five measuring instruments of service quality in higher education setting. In this study, he aimed at comparing the performance of five operationalization of the service quality concepts of SERVQUAL, SERVPERF, importance-weighted SERVPERF and HEdPERF. It has concluded that SERVPERF and HEdPERF presented the best measurement capability, but it was not possible to identify which was the best (Brochado, 2009). However HEdPERF technique is a very important tool in the field of higher education (Kumar & Yang, 2014; Shauchenka et al, 2014; Sultan and Wong, 2011). "It should be noted that due to the importance of service quality in universities and higher education in recent years a model that was developed by Servqual and that is named HEdPERF and its components are designed especially for universities and higher education centers"(Abdullah, 2005; Akbariyeh , 2012, p 62).

IV. PRACTICE OF INFORMATION SYSTEMS IN HIGHER EDUCATION

Higher Education Institutes (HEIs) around the world are developing Higher Education Management Information Systems; HEMIS (Ali, 2010). "An interrelated group of information resources accessible by computer through the campus institutional external and internal web environment that a university places at the disposal of its users to enable them to consult it and/or to provide a selection of significant and relevant data in wider context of their university life in its academic, administrative and social senses and order to improve student's knowledge base" (Cobarsi, Bernardo & Coenders, 2008; Asif & Krogstie, 2011, p 5) According to Kim-Soon, Rahman and Ahmed (2014), there are three main areas of supporting systems in an academic institution and

these are learning, research and communication areas. Service quality is a measure of how well the service level delivered matches with the customer expectations. Delivering quality service means conforming to the customer expectations on a consistent basis. Almost all universities use electronic information systems and the usage of manual system has decreased with the new technology. Traditional face-to-face and paper based campuses are now part of a more rich and complex environment where electronic networked information resources have grown in importance. Universities are traditionally highly decentralized organizations, so corporate information resources management is a challenge in the present context where external pressures due to the rise of the network society pose questions about the role of universities. These questions affect the concept of information systems and their role (Cobarsi, Bernardo and Coenders, 2008). Cobarsi, Bernardo and Coenders (2008) established a conceptual model for information systems for campus/university students, in order to make their comparison possible for strategic management purposes. This conceptual model faced in the fieldwork on Spanish higher education institutions, in order to relate information system's characteristics with other organizational features. The conceptual model was based on socio-technical information systems and knowledge management literature. This user centered information systems conceptual framework was set up to obtain a global vision of new information and learning electronic environments in campuses. Its application in a fieldwork on Spanish universities offers new insights about information and organizational features in higher education (Cobarsi, Bernardo & Coenders, 2008). According to Kim-Soon, Rahman and Ahmed (2014) many task can be conducted using electronic service in academic institutions. The tools and sources of electronic services provided for students include registration service, student webmail, graduation, examination management, student's activities, programmes, clubs and association, e-learning, e-library which provide e-books, online database, e-journals, Web online public access catalogue for books etc.(Kim-Soon, Rahman and Ahmed, 2014).

Governments at all levels have launched electronic government projects aimed at providing electronic information and services to citizens and organization in worldwide. Service quality has become a key tool in enhancing private sector competitiveness. Customers' demand and satisfaction is not limited to private sector but also applies to institution of higher learning particularly the public universities. "In Malaysia, the public universities carry the responsibilities to produce highly competitive graduates in order to enhance graduate employability. To achieve such targets, public universities are often expected to have effective and efficient information management system" (Ghani, Muhammad and Said, 2012, p

245). Higher education institutions will have to be faced many difficulties if they conduct their program without the support of Information Systems. That reason has come to be the major point to depend on Information Systems.

V. Conclusion and Future Research

Higher education institutions and universities around the world are developing Information Systems to manage academic, nonacademic and administrative processes. Usage of Information Systems in higher education sectors are rapidly increasing because the system makes student services cheaper, easier, faster, and more accurate than traditional techniques. New trend of Information System is the mobile-wireless information systems. It can be seen a clear positive turning point in higher education here. Although researchers have argued that mobile information system as the best way to deal with information and it has pros and cons of its own. "It is a well-known secret in the computer industry that information systems projects are more likely to fail than not" (Stanforth, 2010, p 6). Information system failure has become a common issue in many fields and in the higher education sector too and these issues are being discussed. Numerous measurements are available to measure the service quality of information Systems and various dimensions; Servqual, ServePerf and HEdPERT are popular techniques to measure the service quality of Information Systems.

HEdPERT technique takes the priority in the field of higher education among them. Information System failure that would create many problems in higher education industry in near future with limited budget and resources that have allocated to the Information System implementation. Measuring service quality in the higher education has been recognized as a novel concept if much needs to be investigated in future. "It can be identified the research gaps of service quality in higher education through a review of literature and future research should empirically address those gaps" (Sultan & Wong, 2010, p 259). "It is necessary to improve regular evaluations and appraisals of the e-service of Information Systems provided by universities to monitor its performance" (Kim-Soon, Rahman & Ahmed, 2014, p 9). Information System Failures in the field of education is important issue to examine in near future. Techniques of measuring service quality can be tested using different data sets from the higher education field. These results show the clear difference between developing countries and developed countries. The investigation of possibility to improve the service quality of higher education using Information System is a turning point in an academic institution.

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