

## ICT FOR HIGHER EDUCATION: AN OUTLOOK ON THE COST SAVING IT PROJECTS AND INFORMATION SYSTEMS

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### **Abstract:**

This research paper provides a review of the possible and affordable IT projects and information systems (IS) that Universities can implement. The existing literature on IS and ICT for institutions of higher education is deficient. This study contributes in reducing this deficiency by providing analysis of the literature on the benefits and costs that HEIs face and reasons why it is difficult to measure the same. As a result, ten cost-saving projects that can aid HE Institutions to focus on reducing cost while maintaining quality education are numbered, explained and backed up with existing literature. These projects are a direct result of the study conducted in South East European University (SEEU). Moreover, SEEU is taken as a case study to show the utilization of the different information systems to offer high-quality education in its endeavor to create homegrown ERP solution.

*Keywords: information systems, information technology, higher education, ERP, IT projects*

## 1. INTRODUCTION

There is not enough research available on information systems and information and communication technologies for institutions of higher education. This study tries to reduce this gap by providing insight in the benefits and costs that HEIs face and reasons why it is difficult to measure the same. Even more, this study contributes directly by providing all-in-one place, ten cost-saving projects that can aid HE Institutions to focus on reducing cost while maintaining quality education. These projects are numbered, explained and backed up with existing literature. Moreover, a three year study conducted at South East European University (SEEU) that analyzed both what is already in place but not documented, and what can be developed in terms of improving quality of services and minimizing the costs related with the solutions that were proposed, is a direct source for these projects that are explained in this study. Since SEEU is taken as a case study, the different information systems that are used in this university to offer high-quality education are listed and described. The results show that this University has most of the systems already in place, and is taken as evidence that integration of the different information systems in a university setting can prove to bring the institution better decision making and optimal sourcing strategies.

## 2. IS INVESTMENTS AND BENEFITS IN HEI SECTOR

Analyzing the cost and benefits of IS investment in higher education institutions can be very frustrating, and there is not enough evidence in literature regarding the same. Although there have been a lot of debates regarding the benefits and costs of investments in IS or ICT in higher education, it is stated by American Council on Education (ACE) that practically all of the issues in higher education have an IT component “whether in an operational role or as the source of information vital to a good understanding of the institution”. Moreover, it is believed that the most important things in education in the future will be the advances in the technological methods and administrative productivity to deliver education. Presently, 25.6% of ACE survey respondents rank IT as a topic of high interest, which rises to 31.7% when the same individuals look ahead (Parker et al., 2011). That is one of the major reasons that there is increasingly a need for research in the area of information systems strategy formulation and analysis of the potential benefits from IS/ICT investments in educational institutions. There are some really good frameworks in place, as the one developed by a team from University of Strathclyde, together with JISC, which can be used by Universities to analyze and review their information systems and IT management, as well as to assist them to evaluate their approach to these endeavours through benchmarking with the best practices across the sector (JISC, n.d.). However, there is little data available for the use of this framework, and most importantly, this framework does not reflect the current technology issues that Universities face for implementation of information systems.

Since the business value of information systems is increasing exponentially, especially in the last decade, there is a need to bring critical decisions, like the availability and performance of IS, from the level of IT departments within institutions to executive levels of the universities. Studies show that, even though there are investments in information systems, sometimes Universities cannot reach the level they have desired and that the costs associated with these investments are high. This gray area between the benefits and the results sometimes is not seen. Davis et al noted “*There is a belief that the payoffs from investments in information technology (IT) are difficult to recognize, and therefore a sustained competitive advantage from an IT-enabled strategy is difficult to distinguish from a temporary competitive advantage*” (Davis et al., 2003). Analyzing the costs and the benefits that institutions face is becoming demanding. Looking at the normative literature, there are models which seek to assist management in identifying the costs associated with their investments in technology. Nevertheless, the set of social and organizational aspects that interplay makes the assessment of information system investments complex, and the recognition of these aspects becomes of enormous importance in technology management since these costs are difficult to identify, quantify, manage and then control (Irani et al., 2006). The need to attract and keep students, improve the quality of education, and keep costs down is becoming an imperative for many institutions of HE. These are exalted objectives that each university is striving to accomplish, and they are achievable if institutions learn to evaluate their business processes and leverage technology to manage the entire student lifecycle (McLean, 2007). Universities around the world in the process of undertaking projects that are scalable, inexpensive and that will improve the relationship of the students and the instructors, administration and management.

### 3. COST SAVING IT PROJECTS IN UNIVERSITY SETTING

Institutions of HE undergo a series of innovative and cost-saving projects. There are studies that try to analyze the cost structure of the universities, but they fail to give a guide to what in particular can help them reduce costs while maintaining or improving the same quality of teaching. Johnstone (Johnstone, 2004) in his study tries to examine the rationales for cost-sharing, as a way of dealing with the cost burden that institutions face, especially in the 21st century. Oliver (Oliver, 2002), claims that ICT has begun to have a presence but the impact has not been as extensive as in other fields, and asserts that the use and development of ICTs within education will have a strong impact on what is learned, how it is learned, when and where learning takes place; and who is learning and who is teaching. Bates (Bates, 2001), affirms that Web is a low-cost technology for education, and that the cost of the technology needed for online courses is marginal, development of materials is relatively low cost and that through the use of the Internet, there is no direct charge for independent packets of information. A study conducted by Bakia (Bakia, 2000) focuses on the costs of use of Information and Communication Technologies (ICT) for teaching and learning in higher education. Harley (Harley, 2002), in the study where he examines several universities, identifies the potential for cost-saving ICT project within higher education, but alleges that there is lack of evidence, and especially empirical studies to support the same.

Using the grounded theory approach, the analysis of the existing literature, the practice in SEEU, and analysis of the publications by universities and consulting service provides for HEI regarding the new trends for cost-saving endeavors that universities carry out, a list of 10 ICT projects is provided in the table below, together with examples for each of the mentioned. Afterward, for each of the mentioned projects, the evidence in literature is provided.

**Table 1:** List of cost-saving ICT project for Institutions of Higher Education

Type of the Project	Examples
Virtualization	Multiple virtual networks on a common infrastructure; Use of commercial and open source virtualization products (desktop and server virtualization); Virtualization eliminates student hardware-dependent images; Virtual environments; Virtual Computing Lab (VCL)
Cloud computing	Emails (Google apps); Data Centers; Cloud storage (Dropbox)
Software as a service (SaaS)	Google; Amazon; Youtube; Flickr; Hobson's CRM; Digital Measures; ServiceNow IT support
Web-based applications	Electronic textbooks. (ex. InterBook); Web-based course
Open-source software applications	Moodle; Kuali; Sakai for LMS; PSATi
Wikis	Wiki-Systems; Wikipedia; TWiki system; BauWiki
Portals	A variety of electronic information resources: library resources, emails; messages (both public and individualized), services, schedule, exam information etc - into a single Web page.
Shared documents and workspaces	Semantic reference systems; Digital libraries; BSCW and TikiWiki
Web-based tele/videoconferencing	Web based VLE; Videoconference-Based Tele-Education
Integration of CMS/LMS with social networking sites	Using Facebook group as a learning management system

#### 3.1. Virtualization

Virtualization as a concept can be seen from different dimensions. Looking at it from technological perspective we have virtual computers, and desktop or server virtualization. Network virtualization is a cost saving project for institutions of HEI since it enable the existence of multiple virtual networks on a common infrastructure (Zaki et al., 2010) with relatively small costs and quick deployment. This is also an important source of reducing operating costs while meeting capacity demands (Luftman and Ben-Zvi, 2010). However, there is another viewpoint for virtualization products. For instance, VMware virtualizes computing, from the data center to the cloud to mobile devices, to help users be more agile, responsive, and profitable. Virtualization eliminates student hardware-dependent images (Stackpole et al., 2008). Commercial and open source virtualization products are being used by researchers and

educators to create a wide variety of virtual environments (Pollitt et al., 2008). Virtual education found in the literature, and among practitioners, i.e education delivered through the Internet or delivered via some other platform of information and telecommunication technologies (Willoughby, 2004), has increased drastically in the last few years. South East European University is amongst the first and the best in the Balkan region that does server virtualization, storage virtualization, virtual LANs and virtual desktop infrastructure in the computer labs. There are 5 benefits for conducting the same. First, there is cost reduction in maintenance. Instead of many individual servers where only few services can be raised, that would use 20-30% of the servers capacity, SEEU has one blade server, created two clusters, one with 6 hosts and the other with 4 hosts, and in each of the hosts more services are raised. So instead of maintaining many servers now only one is maintained. Second, there is cost reduction in usage of the processor. With server virtualization, it can use 70-80% of the capacity. Third, less electricity is consumed. In SEEU around 70% less electricity compared to earlier. Fourth, there is a need for less cooling of the server's room. SEEU has reached around 60% reduction in the costs associated for cooling the server room. And last, there is a need for less physical space. SEEU has moved from 5 racks to 2 racks.

### **3.2. Cloud computing**

Many institutions aim to garner the anticipated economic benefits of cloud computing models, and such efficiencies are especially welcomed in these extremely difficult economic times (Wheeler and Waggner, 2009). Cloud Computing offers to universities the possibility of concentrating more on teaching and research activities rather than on complex IT configuration and software systems (Mircea and Andreescu, 2010). Cloud computing is being seen by many researchers as a strategy to improve agility in the current difficult financial situation that many universities face. It is essential for an educational and learning organization, with its budget restrictions and sustainability challenges, to use the cloud formation. (Alabbadi, 2011; Mircea and Andreescu, 2010). Examples given above are some of the cloud initiatives many universities have embraced. Dropbox is being used for data storage in many institutions and the benefit is that there is low capital investment for cloud, and operational expenditures may be free or ongoing low cost for institutions of HEI compared to on-premise technology (Reimche, 2013). SEEU has moved some of the services in the cloud, such as the drive, storage, email and google apps from Google. Box.com offers also 50G of storage for staff members of this university as an institution. However, analysis of moving completely to the cloud has proven to be negative and not feasible for SEEU at this point.

### **3.3. Software as a service**

In its basic form, software as a service (SaaS) means that applications are delivered through the medium of the Internet as a service. Instead of installing and maintaining software, it is easily accessed via the Internet, freeing the user from complex software and hardware management (Sultan, 2010). There are a growing number of vendors providing SaaS solutions to help institutions become agile and implement solutions focused on today's problems (Ritchey, 2012). Youtube is being used by instructors to offer a variety of tutorials and help videos, Flickr where students can share and download pictures also from others for different project uses, and Google docs for synchronous and collaborative writing (nuCloud, n.d.). Kellen stresses that higher education has been steadily adopting, and that a software like Hobson's CRM for manage recruitment activities adopted by universities have proven to be very successful (Kellen et al., 2012). SEEU has a so called in house SaaS using Microsofts virtual up whereas the software is used like a desktop app. University management system and the finance system are just examples of virtualized software, and currently there is a development in place that will remove the going, installing and configuring these services to make it desktop independent.

### **3.4. Web based applications**

According to Brusilovsky, web-based education is quite far from achieving its main goal, i.e. reaching a wide distance audience in a cost effective manner (Brusilovsky et al., 1998). Electronic textbook is one of the most prominent varieties of Web-based educational systems. In his research paper, he presents an example of such a tool, namely the InterBook system, which is a tool for authoring and delivering adaptive electronic textbooks on the World Wide Web (Brusilovsky and others, 1999). This tool was developed and is being used for non-commercial purposes even today, and it was built as a result of the cooperation between researchers at the Carnegie Mellon University, University of Trier, and

developers at the University of Karlsruhe and University of Pittsburgh. Benefits of Web-based education are clear: classroom independence and platform independence. Web-based courses and web-based conferences are also being used a lot in today's university setting (Hong, 2002). SEEU has most of the services as web-based applications, starting from i-seeu, myseeu, academic planning, Libri – in house developed LMS etc.

### **3.5. Open source software**

Open Source is presumed to be more flexible and less costly than commercial software. Higher education institutions in many countries view open-source software as the key to balancing pedagogical needs with the need for administrative efficiencies (van Rooij, 2009). The deployment of free and open source software emerges as an option that provides a platform to distribute an educational and research tool, obtainable by anyone around the world, and thus, seamlessly creating a community of users/learners that interact and collaborate with each other (Vanfretti and Milano, 2007). Due to the fact that there is a great deal of freely-downloadable open source software, many institutions can build entire systems cost-free. However, many require prerequisites that are not free or open source, and also other that require technical experience in-house (Chauhan, 2004). Fuchs also argues that the increasing demand for IT services in Universities coupled with declining budgets is the greatest systematic challenge for these institutions, and that CSS (community-source software) and SOA (service oriented architecture) should take the place of strategies to deal with these challenges (Fuchs, 2008). Sakai for LMS and Quali for ERP are just two examples that can save institutions thousands of dollars since they are open source (Dougiamas et al., 2003). SEEU is just utilizing Open-Class plus the api from Pearson as Learning Management system. This university also uses open source for the library system, the PMB system but this is hosted from the university not the provider.

### **3.6. Wikis**

Blogs and wikis are two new content development and management technologies that enable an interactive and intercreative engagement amongst students and between students and teachers. Wikis offer an online space for collaborative authorship and writing. They are available online for all Web users or for members of specific communities, and include version control tools that allow authors to track the history of specific pages, and the history of their personal contribution. Common to all of these technologies is that they are strongly social and community based (Duffy and Bruns, 2006). Because of their ease of use and rapidity of deployment, they offer the opportunity for powerful information sharing and ease of collaboration. If effectively deployed, wikis, blogs and podcasts could offer a way to enhance students learning experiences, and deepen levels of learners' engagement and collaboration within digital learning environments (Boulos et al., 2006). The basic ideas of wiki-systems exactly follow the main idea of universal access. However, the findings of Boulos where he tested the benefits of wikis in a classroom setting are in contrast to a number of previous studies regarding wikis, which most often enthusiastically revealed a great success of wikis utilized for education, but he states that wikis can be a sensible addition in an educational context if usability and motivational aspects are considered. Some examples of effective wiki-systems and case studies for the use of Wikipedia, TWiki system and BauWiki are given by Ebner (Ebner et al., 2008). SEEU has not and does not use wikis. The closest to the idea of wiki in the University is the knowledge base – the Help Desk for support.

### **3.7. Portals**

A Google search on the web in January 2015 revealed about 1,58 trillion entries in 0.23 seconds, compared to the search of Tatnall in December 2003 where it revealed only 35.6 million (Tatnall, 2005). This shows that there is a significant increase over the last decade for the use of the portals. Chang and Wang in their study reveal that portals provide several cost-reduction and service-improvement opportunities to businesses (Chang and Wang, 2011). These opportunities include the abilities to integrate business processes electronically with other supply chain members, provide worldwide customer service, track the system status of third-party service providers, and reduce service costs and response time. University of Buffalo has created its own portal, named MyUB, as a solution to consolidate crucial online services and information. It is a site where the university, instead of sending mass e-mail messages, can publish information for everyone on the campus, or it can post individualized messages that appear when specific users or members of groups log on (Olsen, 2002). MyUB as an institutional portal is just one example of the many portals that universities have built.

Many universities today have created portals for students wanting to change personal details, enrolments, get results, information on fees and exams, handbooks, IT etc; for faculty who teach and conduct research; for management and for administration. SEEU has MySEEU, which resembles much more to a portal than any other. It has all the capabilities of MyUB, and much more. All the services that a student needs, including bursary information, schedule registration, graduation module, downloadable software, program information, directory of academic and administrative staff, etc. are provided in this portal.

### **3.8. Shared documents and workspaces**

The importance of shared documents and workspaces has been documented in literature from the boom of web 2.0 technologies. Collaborative writing, as one of the major success factors for information sharing, knowledge creation and awareness and coordination of information flows has been widely accepted as a factor for improvement of understanding and knowledge (Dourish and Bellotti, 1992). Nicol et al, in their study present two tools, BSCW and TikiWiki, for the shared workspace system for group collaboration in University setting (Nicol et al., 2005). Their results showed that these tools influenced the ways teams structured resources, and that it improved their team collaboration and writing, thus leading to better understanding and learning. These tools help support education, especially since there are available open source solutions that HEI's can utilize. For example, TikiWiki is free open source web application with a lot of built-in features such as knowledge base, collaboration and project management, publishing news feeds, blogs and rss, social networking capabilities, PIM details with calendar, webmail, e-learning capabilities, and most importantly integrated. SEEU institutionally uses Google for shared workspace and Microsoft's SharePoint for collaboration, shared documents and workspaces.

### **3.9. Web based tele/videoconferencing**

The use of web based tele/videoconferencing has been proven to be as effective as face-to-face learning in literature. A study conducted by Chipp et al, show that videoconferencing is proven to be at least equivalent with traditional learning, if not even more effective in terms of increasing knowledge and knowledge integration (Chipps et al., 2012). Studies have shown high participant satisfaction with the use of educational technology, such as videoconferencing, for education. Piccoli et al, in their study compare web-based virtual learning environments to a traditional classroom through a longitudinal experimental design (Piccoli et al., 2001). Their results indicate that there are no significant differences in performance between students enrolled in the two environments. It is important for institutions to acknowledge the importance of web base tele/video conferencing, since there is not a significant difference between traditional learning and virtual learning environments, and that the later has one competitive advantage: Low cost or free Web- based videoconferencing is already available. In SEEU, Google hangout is completely integrated\ to offer such services, although there is technology in place to serve institutional needs in terms of visiting professors, delegates, public speeches and etc.

### **3.10. Integration of CMS/LMS with Social Networking Sites**

One of the main reasons why there are integrations of CMS/LMS with social networking sites is moving the e-learning process beyond traditional LMS's and engaging students in the active use of web. Dalsgaard in his paper looks at this integration as an opportunity to engage the students in the web as recourse for their self-governed, problem based and collaborative activities (Dalsgaard, 2006). OECD report from 2005 indicates that ICT investments have more impact on administrative services rather than classroom. However, with the changing landscape of the universities, more and more will either try to draw information out of social networking sites and into the LMS or provide LMS facilities inside the social networking sites. Many are moving for the second option with Facebook, since it "makes sense" to provide educational facilities to the students in environments at which they are comfortable (Sclater, 2008). Tools that are used to carry e-learning usually cover discussion forums, chat, file sharing, video conferences, shared whiteboards, e-portfolios, weblogs and wikis. Use of personal tools combined with social networks form the basis of an individualization or personalization of the web (Wang et al., 2012). In order to satisfy the needs for participation, interaction, and collaboration of learners and educators in the cognition, construction, and socialization process of learning; Bogdanov et al propose an interactive and collaborative e-learning platform which combine the advantages of LMS and social software by integrating social software with LMS (Bogdanov et al.,

2012). SEEU is using OpenClass for the purpose of integrating the CMS/LMS with social networking sites.

#### **4. INFORMATION SYSTEMS AT SOUTH EAST EUROPEAN UNIVERSITY**

The role of information systems does not only focus in increasing efficacy and efficiency of the organizational processes, but also meeting the need of the students, parents, government as well as society. The integrated campus management systems in higher education, due to the Bologna process, are created as a result of the consideration of the integrated application systems that help improve the administrative processes in education (Schreiter, 2011). Many universities are investing in integrated application systems, ERP's, to integrate all functional areas of the institution. Other universities are using their human capital and IT talent to integrate themselves their existing information systems. In higher education, the major services supported by information systems include one or more of the following: Student Lifecycle Management (SLM), Learning Management Systems (LMS), Human Resources (HR), Finance, Library services, Student Information, Content Management System (CMS).

##### **4.1. Student Lifecycle Management (SLM) Systems**

Student Lifecycle Management Systems or also known as Student Information Systems are information systems that manage student data throughout their lifecycle: recruitment, admission, student, graduation, and alumni. These systems are crucial to universities as Transaction Processing Systems are to companies since these systems generate all the student data such as: student applications, student admissions, course enrolments, course grades, graduation and diploma management, and alumni. South East European University has a home-grown Student Lifecycle Management System called University Management System (UMS), which manages all the data related to students, curricula, and lecturers. This system is a central system and all the other systems revolve around this system.

##### **4.2. Learning Management Systems (LMS)**

Learning Management Systems are an important factor in modern education since they serve as course material repository and an extension of a classroom which is available 24/7 for the students. South East European University has its own home-grown LMS called Libri with features such as course repository, online assignments and quizzes, forums, email, and chat. However, recently in order to save on costs for development and maintenance, South East European University is experimenting with free solutions such as Moodle, Pearson OpenClass and Google Classroom.

##### **4.3. Human Resources (HR) Systems**

Human Resource Management Systems are important for Universities for several reasons. They enable universities to keep up to date administrative and academic staff data which are used for various needs as: defining roles, identity access management, determining salaries and payments, determining staff engagements, keeping teaching history, etc. South East European University has a ERP module from Ultra that is used for keeping staff history as well as their roles. This system is tightly integrated with the financial and accounting module described next.

##### **4.4. Finance System**

The Accounting/Finance System helps organizations to register financial transactions as well as plan organizations' budget and finances. In university setting, accounting/finance systems have the same role. South East European University uses the financial module from the same vendor as the HR system.

##### **4.5. Library services system**

Libraries are an important resource for universities. They are used from academia and from the students at the same time. Library services systems help libraries to manage the book inventory as well as maintain accurate data about the books' availability. South East European University uses an

open source solution for its library where students and staff members can search and reserve books online. They also get notified by email when they need to return a book.

#### **4.6. University portal**

University portals are systems that enable users to view content from one single website. Portals are an important feature for users since they do not need to go to different places in order to perform different tasks. South East European University has a portal called MySEEU which is a one stop page for different tasks for students and staff members. This portal is a home-grown solution of the university and enables students to perform different tasks: read campus news, view and register course schedule, view bursar, check their class attendance, view their transcript, library services, etc.

#### **4.7. Toward integrated information systems at SEEU**

South East European University has done a tremendous effort to integrate all its information systems. Today, around 90% of the information systems at SEEU are integrated in-house to create an ERP. Although the university uses different information systems as was described above in the backend all the data is integrated using web services. For example, the data about SEEU staff resides in HR system which feeds UMS, library services, etc. Data about students resides in UMS and through a web service it feeds library services, Libri, etc. Course data resides in UMS and using web services it feeds other systems. MySEEU on the other hand integrates all the information systems in one place and is fed with data from all the information systems at the SEEU. Apart from the above mentioned benefits, one of the major benefits of the integration of the information systems at SEEU is single point of view of the organization which helps decision making through generation of reports for the management of the university. Indeed, the senior management of the university has dashboard in i-seeu which shows critical information about the achievement of planned activities and goals.

### **5. CONCLUSION AND FURTHER WORK**

This study provides three main contributions:

- Identified ten cost saving IT projects that Universities can implement.
- Through a case study, identified how each of these projects can be implemented by showing examples.
- Through a case study, described the major information systems of a university and how these systems are integrated to provide better decision making.

As depicted earlier, the incentive for this paper comes as a result of the project initiation at South East European University for ERP adoption. Initially, potential cost-saving IT investments were considered and systems for seamless integration of data, information and legacy systems within this institution were analyzed. This paper is a direct result of the list of the IT cost-saving projects and information systems that are used or were considered. SEEU decided to build ERP with a limited budget and IT staff, module by module and integrate the existing systems and data in different databases after performing cleansing and quality check. Documentation of this process, module optimization and results of the chosen are yet to be properly written to support institutions in their projects such as ERP. Further work would be to focus on a creation of a formal framework for the process of ERP creation in a University setting and how the legacy systems can be used to create a fully functional ERP with optimization of the systems and the modules. Another possible further work can be the exploration of data and information activities supporting management and strategic decision making in a University outlook.

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