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IMPROVING INSTITUTIONAL SERVICES THROUGH UNIVERSITY ERP: A STUDY OF THE ACADEMIC PLANNING MODULE DEVELOPMENT AT SEEU

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DOI: 10.1515/seeur-2017-0018

Abstract

Enterprise Resource Planning (ERP) systems are used by universities to handle the academic services and business processes while providing enhanced experience and services to students. This study begins with a background review of ERPs in higher education institutions, the impact on the business processes through optimization and the importance of critical success factors for easier implementation. Secondly, Academic Planning, a core part of the student module of ERPs for higher education,

is analyzed in this paper from the prism of data integration, business process workflow, and process optimization. The issues that arise with development of a module are addressed through a case study at SEE-University. The data and business process workflows are based on an actual study by real implementation at this institution. The findings from this study will serve other universities who are in the process of implementation of an ERP to ease their development process and improve the efficiency of the services provided. Main contribution of this study is that it reduces the gap in literature and practice for issues and solutions that arise with the development of a new system, especially in higher education institutions, which in turn are very scarce in nature.

Keywords: ERP, higher education, process optimization, BPM, academic planning, workflow

Introduction

Looking at the literature there is a gap between theoretical background for ERP adoption in higher education and real examples of what universities have done to achieve integration. The main contribution of this paper is that it does give an overview of the issues, frameworks and processes that South East European University (SEEU) faced, together with a roadmap for developing a module (specifically the academic planning module) in-house as part of the endeavor to create a fully functional enterprise system (ERP).

This study is structured as follows. First, a literature review of ERP systems in higher education institutions is introduced followed with

identification of the critical success factors and business process optimization derived from ERP systems. Next, problem formulation is developed through presentation of the SEEU case study with history of the information systems in this university, existing information systems and process optimization through ERP in-house development attempt. Then, academic planning module in SEEU case study with background, methodology, and results and findings are given. Finally, a theoretical discussion and indications for further research are presented.

Literature review

Technology and innovations have disrupted many industries, and education is not left behind. Since the main assets of the university are the students, faculty and administrative staff (Pollock & Cornford, 2004), and the drastic increase of the number of students over the last decade (OECD, 2014) indicate that there is more administrative burden over the management of the university, many universities have turned to investments in technology and enterprise systems for the integration advantages that these systems provide. In this section the focus is mainly in adoption of ERP systems in higher education, the critical success factors, business process reengineering (BPR), process optimization, and business and technology benefits for the institutions of HE.

ERP in Education

ERPs are one of the most successful systems for resource management in any organization (Luić, Kalpić, Bojović, Milašinović, & Radivojević, 2011) The benefits from these systems are well documented in literature

(Bologa, 2007; Fosser, Leister, Moe, & Newman, 2008; Hossain, Patrick, & Rashid, 2002; Karedla, n.d.; Klaus, Rosemann, & Gable, 2000; Nah, 2001; Rajesh K., 2010; Umble, Haft, & Umble, 2003). In the last two decades Universities have also started to adopt these systems to gain the integration advantages (Ahmad, Francis, & Zairi, 2007) as well as increasing operational efficiency and decreasing costs (Abugabah, 2014; Abugabah & Sanzogni, 2010; Seo, 2013). Despite the fact that have been reported failures in achieving the expected outcomes and results of ERP implementation (Rabaa'i, 2009; Seo, 2013), and that these systems create tension and affect the business processes of the universities (Pollock & Cornford, 2004; Seo, 2013), universities continue to adopt these systems since it facilitates the integration of the administrative functions that in the past have been supported by separate legacy systems (Zornada & Velkavrh, 2005), use modern technology (Seo, 2013), access data in real time (Bologa, 2007), and increase income and decrease expenses (Sabau, Munten, Bologa, Bologa, & Surcel, 2009).

Critical Success Factors in ERP for education

Critical success factors (CSF) can be defined as results in areas, provided that are satisfactory, ensure competitive advantage for the organization (Rockart, 1978). Moreover, they are the factors needed to ensure a successful ERP implementation process (Gibson, Holland, & Light, 1999). In literature, several CSF have been reported as important for institutions of HE. Top management support and commitment is reported as a main CSF not only in HEI but also in the business sector as well (Aldayel, 2011). Change management to shift the university out of

its current state to a future state, as well as project management for coordination of the activities, scheduling and monitoring to achieve project objectives, are also reported to be of immense importance during ERP implementation (Alghathbar, 2008; Al-Shamlan & Al-Mudimigh, 2011; Davis & Comeau, 2004; Rico, 2012). However, many universities fail to understand that there is a change in the work process when ERP is implemented (Aldayel, 2011). BPR and the management of the business processes is one of the most daunting tasks not only for HEI but for any organization undertaking a big project like ERP. Alterations in existing business processes are often needed and recommended as a result of an ERP for HEI (Swartz & Orgill, 2001). One of the reasons for failure of ERP (Allen, Kern, & Havenhand, 2002) is exactly the implications of the BPR, especially in the organizational culture. Ahmad argues that CSF for BPR should be identified when implementing an ERP. Nonetheless, it remains that ERP's are a big project and should follow the success factors to fully accelerate the benefits that come along with these systems.

BPR in HEI

Business process management is defined as "how we study, identify, change, and monitor business processes to ensure they run smoothly and can be improved over time."(Association for Information and Image Management, 2015) While BPM deals with managing the business processes, business process improvement, reengineering and optimization, are actions on business processes and all of them are concerned with improving the business processes. Business Process Reengineering (BPR) is an approach that gained popularity during

1990s. As many other hypes, it was “advertised” as the “savior” of inefficient organizations. BPR is a process of radical changes in business processes of an organization, especially during the implementation of an ERP solution. A lot of research has been conducted for BRP in HEI (Abugabah, 2014; Abugabah & Sanzogni, 2010; Ahmad et al., 2007; Aldayel, 2011; Al-Mashari & Zairi, 1999; Balasubramanian et al., 2009; Bologa, 2007; Swartz & Orgill, 2001; Zornada & Velkavrh, 2005). Most of them suggest that it is an important factor for success rate of ERP solutions, especially in higher education institutions.

Process optimization in HEI

Since there is a lot of documentation in higher education institutions, and most of the documentation is handled paper based, starting from contracts with faculty members, administrative staff, to the ones with suppliers and procurement, and continuing with other administrative burden that Universities face to run academic programs and the institutions itself, an ERP solution looks like godsend for institutions of higher education (Andriole, 2006; Bandara et al., 2010; Floyd, 2013; OECD, 2014). By automating, integrating and streamlining business processes, organizations around the world, and institutions of HE as well, have increased productivity and cut costs and optimized the information systems that support these processes. Process optimization is impossible without a strategy for managing and improving the performance of a business through the continuous optimization of business processes in a closed-loop cycle of modeling, execution, and measurement (Bandara et al., 2010). The scientific approach to determine the best way to design and operate a system is what defined process optimization, so the

abovementioned BPR would be impossible without a great design of the system operation.

Problem Formulation – SEEU Case Study

History of Information Systems at SEEU

South East European University (SEEU) from its foundation has put a big effort in information systems. It all started after the establishment of the University in 2001, when the University foundation based in Switzerland decided to go with commercial-off-the-shelf software in order to manage all the University data. The University took a vanilla approach to implement an already tested solution which has already shown results. The solution was based on Fretwell-Downing Informatics Group system to handle University data. However, this solution had its limits and was not aligned with the business processes at the University. SEEU found that the information systems and the business processes were not the best match and customization of the business processes in the ready solution would harm the University.

Therefore, the University management decided that most of the information systems at SEEU are developed in-house, first as separate isolated applications based on the needs of the university. In this manner, many isolated information systems were formed such as: Student Information Systems, Course Scheduling System, electronic grading system, learning management system, Human Resource Management Systems, facility management system, etc. However, with the number of "isolated islands" growing, the SEEU management realized the need for

integrating those systems on the back-end. Another problem was data quality and redundancy. While redundancy required data to be inserted multiple times in different information systems, on the other hand it had also to be maintained in different systems. This created a problem with data quality as a result of not maintaining data correctly in different systems.

As a result, with the sponsorship of the senior management, project team was formed which aimed to integrate the information systems. The core team consisted of senior management members, IT department, student services office, and academic staff with business and IT background. This team created a broader focus group with the aim of gathering the systems requirements and identifying the current problems. After many meetings it was concluded that the project team should start from identifying and documenting the business processes since most of the business processes were not defined and documented properly.

Existing Information Systems at SEEU

Although, with the project the IT team achieved to integrate more than 90% of the information systems on the back-end, SEEU encountered yet two more important challenges to streamline its information systems:

1. Data Quality issues, and
2. Business Process Optimization

Regarding the data quality issues, the university had challenges as a result of data kept in different formats, as well as data not matching in different legacy systems. For example, staff members had different primary keys in Student Information Systems (called UMS at SEEU),

HRMS and LMS as depicted in Fig. 1. For this reason each department in cooperation with the IT department had a task to match records where it was not possible to integrate those entities on the back-end systematically or in an automated way. This issue was resolved successfully but it was costly in human work hours. Second, the issue of data not matching in different systems was solved in a similar manner. Each record was checked manually whenever there were inconsistencies.

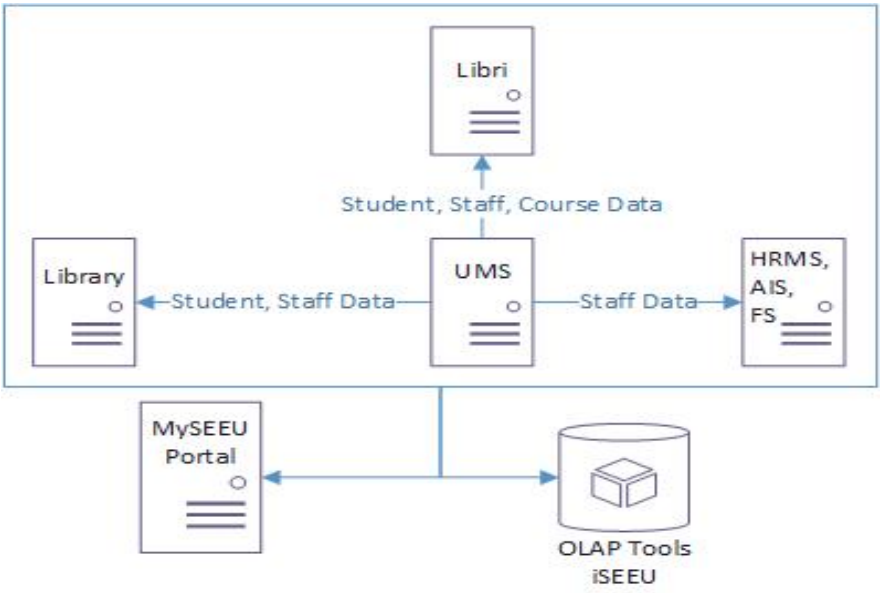

Fig. 1. Integration of information systems at SEEU

There was the issue with data duplication in regard to the quality of the data. Many software applications (the independent ones) when integrated with central database, require that data are duplicated among systems and converted accordingly. The data duplication and conversion by itself is a complex and resource consuming process.

After resolving data quality issues, the second phase was Business Process Optimization. Indeed, the whole project started as a result of the

updating the new system where some business processes which were done using emails or spreadsheets to be integrated in Academic Planning and Course Scheduling. With the beginning of the project, during the requirements gathering, four major issues were identified:

1. There was a lack of documentation of the existing business processes
2. Many business processes were interpreted differently by different individuals who were part of the business processes
3. There was a lack of support by the information systems in performing the "as-is" business processes,
4. There was a need for streamlining these business processes.

Business Process Optimization at SEEU

The next important process in streamlining information systems and achieving single view of organization's reality through integrated information systems and thus business intelligence tools that would be fed with quality and up to date data was the business process optimizations which would become an input for improving existing information systems to the next level.

Business Process Optimization can be achieved through two methods: Business Process Re-engineering, and Business Process Improvement. (Ahmad et al., 2007; Al-Mashari & Zairi, 1999; Anand, Wamba, & Gnanzou, 2013; Arlbjørn, 2010; Bahn & Paper, 1998). While the first method is more radical, the second method is a milder form for achieving business process optimization. The approach chosen at SEEU was BPI. The rationale is that the processes did not need radical changes. Rather,

the major part was documenting the existing business processes, and where issues identified, the business processes needed to be redefined.

Developing the Academic Planning Module for Higher Education – the case of SEEU

The starting point of the initiative was to identify and document the business processes since there was a lack of well defined and properly documented processes. By analyzing the existing systems ("the islands") the core module which is considered to be the common denominator for all the data and processes is the Academic Planning Module. Three major steps were identified:

1. Defining the workflow with all the business processes
2. Preparation of activity diagrams, DFD diagrams, and UML diagrams based on functional requirements
3. Finalization of technical requirement document

During the initiation phase it was requested to integrate the scheduling and academic planning to achieve better resource planning. The scope was also identified for this phase, which is limited only to the process of academic planning starting from curriculum offering, to the staff engagement, and ends with the schedule creation and registration.

Workflow and Process Definition

Identified Issues - General issues with the existing information systems were identified. First, systems were isolated and did not communicate with each other so they couldn't be used by other departments who need

this information. Second, most of the data was kept in Excel sheets. Third, there were conflicting data between different information systems in place. Fourth, ad-hoc solutions to the information systems were not planned from one office. And fifth, the system did not support many existing business processes, rather the processes relied on human factor.

What is done - For the new system seven entities were identified as depicted in the level zero data flow diagram (DFD) illustrated in Fig. 2 below. These entities will provide and receive data from the academic module that will be developed in house in SEEU, namely the Scheduling System. Second, 10 business process were identified for academic planning. Third, functional and nonfunctional specifications were identified using the MOSCOW model. For the purposes of this paper the focus will be on DFD and business process modeling. Due to the DFD 0 diagram illustrated below, it was decided that many information systems of SEEU have to integrate or at least should be able to interchange data using web services. Also, another problem was that some of the data in these isolated information systems were missing or had data quality issues. Moreover, issues with primary keys were identified. Indeed, some of the data had different primary keys in different systems so the integration of such data was identified as problematic. Finally entities described in DFD 0 were also identified as different users and views of the new system to be built.

Results - Clear results from the business process modeling phase were: First, lack of formal documentation was identified for most of the business processes. Second, the existing business processes were not understood the same by different employees. Interviews with staff

members identified that there wasn't a unanimous understanding of the business processes by all the stakeholders. Even more, for some business processes there was no answer by process owners themselves. Third, the information systems were not enforcing and supporting many business processes. Rather, many business processes were enforced by process owners and part of the data was kept outside of the formal information systems such as documents, spreadsheets, and emails. Last, many business processes were not optimized. Thus, there were: business processes that did not have clear process owners defined, business processes with no appropriate segregation of duties, and also lack or overload of business process in some cases. This stage also covered identification of ten business processes. All of them were documented with DFD to show the workflow, main actors, restrictions, and results. A matrix was created which is closely linked with the views in the system.

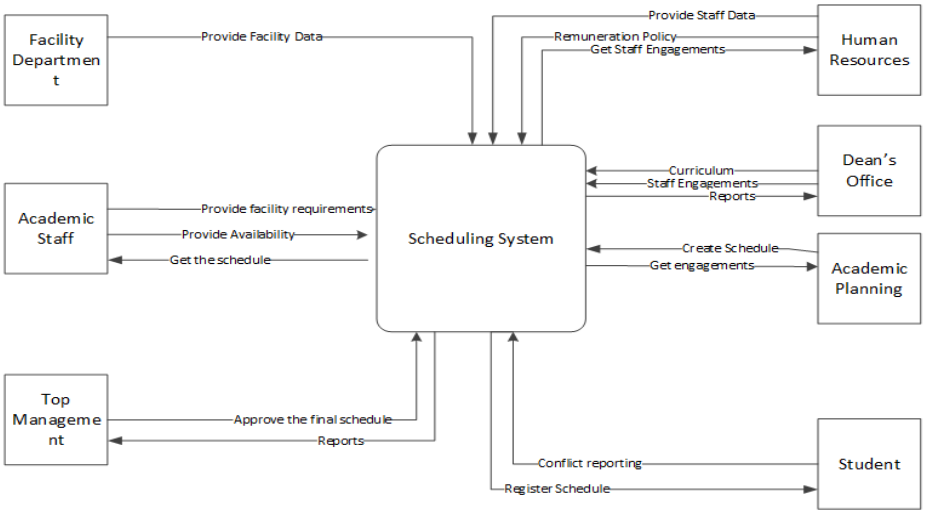

Fig. 2. Level zero data flow diagram – interaction with the academic planning module in SEEU

Functional Requirements Gathering for Activity Diagrams and DFDs

Identified Issues - Once the ten business processes linked with the e-scheduling system were identified and documented, the second phase included creating of the functional requirements for the seven entities described in figure 2, which are named user views in the system. The requirements followed the MoSCoW (must, should, could, would like – to have) method. Also, a matrix requiring the dependencies between the processes, its owner, and the view were its applicable, input and output as well as approval was to be created.

What is done - User views that were created to be fully integrated with the system and appear in MySEEU portal with access permissions were the following:

1. Student View
2. Lecturer (academic staff) View
3. Dean's Office (faculty planning) View
4. Top Management View
5. HR View
6. Facility Management View
7. Academic Planning View

Results - New user interface which is friendlier and more flexible for each of the stakeholders was created. Academic planning view is enhanced to meet the functional requirements. Connection with HR Module was established. Study program offering catalogue is completely up to date and integrated with the system. It is important since it is linked with the dean's office view to create engagements for the next academic

year. Venue catalogue is fully functional. Last but not least, CMIT (Conflict Management Intelligence Tool) is created.

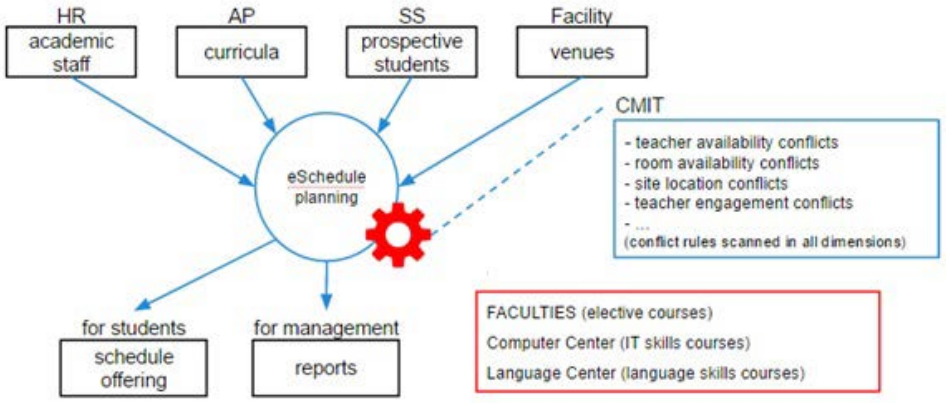

Fig. 3. CMIT in SEEU

Creation of technical requirement documents (TRD)

Identified Issues – The IT department in SEEU is very well familiar with most of the processes for the scheduling system. Nonetheless, in order for them to develop the requirements, the need to create technical requirements (TRD) arose. TRD in general shows how the user will interact with the system, showing each possible communication of the system with the users.

What is done – The IT developers' team was divided into five major groups, one per each team. Other members consisted of other stakeholders in the user view for which the TRD was created, a management level employee, and a member from business or computer sciences faculty. For each of the functional requirements within one specific group a TRD was created.

Result – a fully functional TRD was created by an expert hired from SEEU based on the TRD's created in house. Around 80% of the TRD and the functional requirements are developed at the time this study is being written. Evaluation of the success will commence next academic year.

Conclusions

This paper contributes in five main aspects to existing research about design and implementation of a homegrown solution for ERP implementation. First, this study links the theoretical research to application in the area of software engineering and business process modeling, offering an overview of the literature and how this relates to a real university. Second, this paper serves as a case study on how business process improvement solves issues related to improvement of a higher education institution and information systems. This is linked with the third aspect, which is that this study outline of the problems of higher education institutions and how these problems can be solved by creating a roadmap with requirements, issues, methods of solving these issues and results. Fourth, this study serves as a success story in the area of business process improvement and as a guideline for an organization with similar problems. And last, but not least, this study richens the existing literature in higher education and business process management with a real case of business process management.

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