A system architecture based on open source enterprise content management systems for supporting educational institutions

Catalin Maican*, Radu Lixandroiu

Transilvania University of Brasov, Department of Management and Business Information Systems, Romania

ARTICLE INFO

ABSTRACT

As academic institutions produce large amounts of information in their teaching/research and administrative activities and this information should flow smoothly between departments, there appears the need to organize and manage this information thoroughly. In order to avoid information overlapping, this should happen considering the other internal existing systems. Nevertheless, because not all institutions afford to spend a lot on various systems, open source software is an appropriate solution for both educational and administrative services. Our aim is to prove the utility of Enterprise Content Management (ECM) in context of academic organizations. The first part makes an introduction to the concepts of ECM and open source software, as means to enhance process management. The second part regards the components of ECM systems and makes an analysis of their potential use in academic institutions. A system architecture based on ECM, by means of which ECM is usefully connected to other systems operating in educational establishments is proposed. A case study, discussing the implementation of an open source ECM in a large Romanian university, showing its efficacy and focusing on features related to document workflow, is analyzed.

1. Introduction

It is a fact beyond doubt that organizations nowadays have to cope with increasingly numerous new sources of content, which entail the increase in the amount of information underlying decision-making for the effective operation of businesses. Over the past three decades, by introducing office-suites and user-friendly operating systems, software developers have created tools that have not only allowed users to overcome the physical boundaries of paper-based systems, but also to make decisions based on structured and unstructured "big" data within organizations and outside them. One of the consequences was that it became possible for the information produced in any kind of organization to have an exponential increase.

The category of organizations includes, among many others, academic institutions, which can be simultaneously regarded as teaching establishments, scientific communities, research organizations, or even corporations (Brown & Cloke, 2009). All these facets, involving academic and scientific goals and performances,

human resources, infrastructure and cash flow, coexist in a natural balance within universities, which does not mean that they spare the management certain problems. The management's aim is to harmonize structures so as to obtain efficiency and to accomplish the mission of the organization and reach its objectives (Hedman & Kalling, 2003). Consequently, there is a strong demand for improvement, which presses higher education to identify the underlying principles of management and concentrate on management resources. Accordingly, the management has to harmonize routine activities and to combine the organizational elements in a manner that ensures the efficient and effective performance and quality of the university.

Typically, at university level, the issues connected to information flows may be regarded from two distinctive perspectives: incoming and outgoing documents, and internal documents. From the point of view of the stakeholders, information may relate to students, teachers, researchers, administrative staff, and may be required and conveyed either horizontally or vertically at university level (Fig. 1). Let us provide a few specific examples (based on the Romanian context): for students—enquiries and submissions for approval regarding accommodation, scholarships, internships, tuition fees, diploma supplements, participation in various teaching and research programs etc., for teachers—enquiries and submissions for approval regarding the involvement in research,

* Corresponding author at: Colina Universitatii nr. 1, Corpul A, etajul III, Brasov, Romania. Tel./fax: +40 268 473538.
E-mail addresses: maican@unitbv.ro (C. Maican), lixi.radu@unitbv.ro (R. Lixandroiu).

the participation in and organization of scientific events, course syllabi, teaching materials etc., operational documents—purchasing of goods and services, payment of invoices and salaries, the liaison with the economic and social community and with authorities, collecting fees etc.

All this are part of an organization-wide information system in which all these inputs can be both paper-based and electronic.

From the point of view of teaching and research, higher education is increasingly dependent on primary (laws, regulations, reports) and secondary data sources (books, journals, manuscripts) that are available in other than traditional paper-based forms. To reflect the diversity of materials, especially in digital form and their importance to academic pursuits, it is increasingly common to refer collectively to these sources as "assets" of a college or university, or of the academy in general (Conway, 2008). According to (Kim et al., 2013), these assets take various forms: text materials, such as journal papers, theses, performances from performing arts departments, recordings of native speakers of indigenous languages or videos demonstrating various practical procedures. No matter the context of use, these digital assets need to be managed effectively, with a view to meeting the core mission of HEIs—research, teaching, learning and community service.

Among the possible tools which can assist various levels of management, in various organization types, including academic organizations, in accomplishing the aim and objectives of the organization, we identify:

- Management information systems (MIS) for producing reports based on data extracted and summarized from the organization's information systems, (Blau & Presser, 2013), (Rushby, 2013),
- Decision Support Systems (DSS) used by middle and higher management to compile information from a wide range of sources to support problem solving and decision making (Cavus, 2011),
- Executive Information Systems (EIS) as reporting tools that provides quick access to summarized reports coming from all company levels,
- Enterprise Resource Planning (ERP) systems that facilitate the flow of information between all business functions inside the boundaries of the organization,
- Knowledge Management Systems (KMS) for managing unstructured content, on vertical and horizontal industries, as it is analyzed in (Rosu, Dragoi, & Guran, 2009).
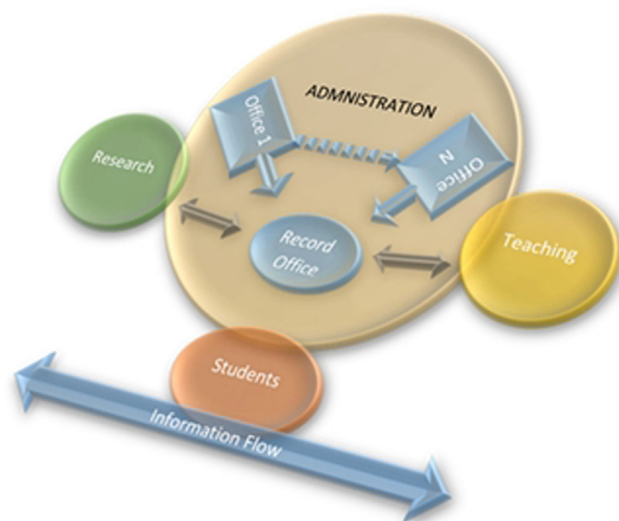

Fig. 1. Information flow inside a university, with the Records Office playing the main role.

At the level of academic institutions, other complex systems exist, such as Student Information Systems (SIS), which manage all the information connected to students (financial (Melchor-Ferrer & Buendía-Carrillo, 2014), academic etc.), often including teaching and learning materials (Ermalai, Dragulescu, Ternauciuc, & Vasiu, 2013). Lets note that any of the above systems may be used in academics, at various decision-making levels (e.g., a faculty dean may use the data from a MIS combined with information from SIS together with external data for developing new study programs if the labor market requires, while the top management may use information from university-wide EIS and ERP systems for governing the university in the desired direction for education/research).

For an efficient management, organizations need to use such tools, as they make work easier, contribute to faster decision-making, based on accurate data. Thus, organizations, irrespective of their type, can answer to the market requests sooner. Nevertheless, an important problem arises: complex systems, which can manage all the flows within an organization, can have extremely high initial costs, which not all organizations can afford. This problem can be solved by means of free/libre/open source software (FLOSS).

Open source is an approach to coding and creating software, the resulted software being free to use and, as the name suggests, denoting a code that is open to anyone to be used, adapted and distributed. This approach can offer important cost savings, but the most important part is users' ability to play with the software.

Open solutions have been developed to the point where they are seen as a viable alternative to commercial, closed source products (e.g., Open/Libre Office vs. Microsoft Office, Linux vs. Windows/MacOS, MySQL vs. commercial databases, NoSQL databases like Cassandra, Couchbase, HBase, data mining with Hadoop, R and many, many other open source solutions) The larger benefits of adopting open technologies may be seen at individual level, but also at local community level. At academic level, by using open source software, students may use at home, free of the fear of piracy, the same tools they use in schools, while the organizations using this kind of software find some relief on budgets. At administrative level, the greatest benefit is provided by cost-saving in initial license fees. Using open source in education allows:

- freedom in education,
- increases the quality of teaching and learning and
- may produce a state-of-the-art learning and teaching environment.

Given that the open source software is developed and managed by a community, being also regarded as a movement (Ljungberg, 2000), the premise behind this community-provided and maintained software is that community-source approaches result in better quality, better fitted, more sustainable and mission-critical software for higher education (Fuchs, 2010), while the output should be software that is cheaper (Wu, Gerlach, & Young, 2007) to install and customize and also far cheaper over time to maintain and enhance. In 2013, 50% of higher education institutions were running open source systems like Moodle and CourseSites by Blackboard.

It has been noted that, as regards the administrative (ERP) software and library systems used in academic institutions, there are open-source applications available (e.g., Odoo, Kuali, ERPNext), but the vast majority of institutions do not plan to adopt open source (Van Rooij, 2007). However, there are systems that have a number of applications rolled together, such as student services, which can benefit from open source, because they can be customized for the institution's particular needs based on access to the source code. We are of the opinion, supported by other researchers as well, that universities which have to deal with legacy systems or which have