



CENTERIS 2012 - Conference on ENTERprise Information Systems / HCIST 2012 - International Conference on Health and Social Care Information Systems and Technologies

Establishing a business process reference model for Universities

Carsten Svensson^a, Hans-Henrik Hvolby^{b,*}

^a King Abdullah University of Science and Technology, Information Technology, Thuwal, Saudi Arabia

^bAalborg University, Centre for Logistics, DMEM, Fibigerstrede 16, DK-9220 Aalborg, Denmark

Abstract

Modern universities are by any standard complex organizations that, from an IT perspective, present a number of unique challenges. This paper will propose establishing a business process reference framework. The benefit to the users would be a better understanding of the system landscape, business process enablement, collection of performance data and systematic reuse of existing community experience and knowledge. For these reasons reference models such as the SCOR (Supply Chain Operations Reference), DCOR (Design Chain Operations Reference) and ITIL (Information Technology Infrastructure Library) have gained popularity among organizations in both the private and public sectors. We speculate that this success can be replicated in a university setting. Furthermore the paper will outline how the research group suggests moving ahead with the research which will lead to a reference model.

© 2012 Published by Elsevier Ltd. Selection and/or peer-review under responsibility of CENTERIS/HCIST.

Keywords: Reference Models; Business Process Management; BPM; Enterprise Systems

1. Business Process Reference Models

A business process reference model is a collection of business processes documented using a standardized method. Business processes being defined as a "specific ordering of work activities across time and place,

* Corresponding author. Tel.: +966-544-70-1048;
E-mail address: Carsten.svensson@kaust.edu.sa

including clearly identified inputs and outputs" [1]. The typical purposes of documenting business processes are:

- To document the relationship between business processes and IT
- To have a common reference for change and process improvement
- To ensure consistent quality in process execution

A reference model is defined as a predefined model used for the construction of other process models [2]. The purpose of a reference model is not to implement an exact replication of the reference model, but to provide a solid starting point that reuses community knowledge obtained from addressing similar requirements in comparable organizations. Over time, numerous reference models have been created. A 2005 survey identifies 30 business process reference frameworks [3].

Some notable reference models include the Y-CIM Model created by Prof. Scheer [4], the application orientated SCOR reference model for supply chains (supply-chain.org) [5], the commercial reference model for SAP and the successful Information Technology Infrastructure Library (ITIL) [6, 7]. In addition to the generic concepts, some very industry-specific models such as the supply chain reference model for the fruit industry [8] have been created in response to the specific conditions in a given industry.

The most granular models are typically the software specific implementation reference models which include the individual transaction level. The software models are limited to the scope of the particular software application whereas industry models are an identification of functions and services provided in "end-to-end" processes.

The benefits derived from using business process reference models have been documented in numerous areas. However a literature review has shown that no such models exist for university specific business processes. While commercial models can be leveraged for parts of a university process landscape, there are a number of business processes that are unique to higher education institutions, such as admissions, research grants management, student lifecycle management etc.. In this paper it is suggested that constructing such a reference model, with associated performance benchmarks, will improve the effectiveness of administrative business processes across universities, thereby freeing resources for research and improving the customer perceived quality.

1.1. Overlap between reference models

Like other organizations, universities have adapted best practices. Hence there is going to be overlap between industry models and the proposed university reference models, e.g. university IT processes have been covered by ITIL, universities have implemented PMP in their program management offices etc. While these areas are well documented elsewhere the authors will focus on business processes where there are no widely known reference models.

In some industries software vendors can provide adequate end to end support, however no software vendor has attempted to describe end to end university business process or provide complete enterprise solutions. The proposed university specific reference model provides an end to end perspective as a supplement to the software or area specific models. Hence an industry specific reference model will support the organization in defining services and benchmark performance and is not in conflict with functional or software specific models.

2. Business Process Reference models Applied

The use of reference models have enabled the industrialization of software implementations, moving from a customized paradigm where the software was developed for the individual customer, to a scenario where the

customer adapted business practices to the software implemented. Modern ERP systems, which are used by the majority of larger enterprises, are typically based on a process reference model at the operational level. The level of detail in the software models includes thousands of predefined business processes and inter-organizational scenarios [7].

The reference models that the software companies offer are typically based on industry solutions such as aerospace, manufacturing, health care, education, banking etc. For the customer this accelerates the implementation because there is a baseline process which is adapted to the specifics of the business rather than having to establish completely new processes.

The solutions will provide the typical functionalities that are commonly used within the industry. While the solutions will not provide any competitive advantages - as they are often used by the competitors - the solutions do provide a cost efficient means to support the business. Similar for the business processes that are captured in reference models, while they do not provide any competitive advantages, they significantly reduce the cost and risk associated with exploring business areas and can ensure that a best practice service level is provided, because the initial effort of others is reused. While adhering completely to a reference model might not be suitable for all, having a model to discuss can prove to be a catalyst of establishing a specific solution.

The use of reference models have also led to conformity in ERP systems which have moved ERP solutions for giving organizations a competitive edge to utility software.

3. Reference models in a University context

Universities are complex organizations, hence their technical infrastructure often becomes very complex, consisting of a mix of native applications, COTS systems, cloud applications and specific academic applications. From a process perspective, seamless process integration between systems is a prerequisite to efficient process execution. Process integration is a continuum between full accessibility to all data pertaining to a process and crude manual batch loading of data.

Gulledge [8] categorizes integration using the terms little I and big I for process integrations, little I being point to point integration and big I being consolidation of all data in one system. While big I is desirable it might not always be feasible in complex organizations, as the agility that comes with Big I has to be weighed against the cost of infrastructure consolidation and the trade-offs compared to best of breed (breed ?) applications. In scenarios where Big I is not possible the organization has a strong interest in keeping close track of the system interfaces, using business process mapping, as practical experience indicates that the interfaces tend to be the weakest link of a cross platform business processes. For a university some systems need to be closely linked, such as grading and booking systems, due to the large number of transactions whereas other systems such as the alumni CRM system requires less integration due to the more static nature of data. A reference model will create a communal repository of available integration points and the degree of integration.

Process architectures are used in defining the scope of process enablement through IT solutions. A generic reference model will be useful in placing and comparing the services provided by systems. The mapping of business processes and enabling systems will highlight if there are redundancies in functional support and will highlight the interfaces required in support of end to end processes. This paper is a proposal for a reference model which will be developed in a collaborative effort. The work in the following should by no means be considered complete. It is merely a suggestion for a significant collaborative effort that should lead to the establishment of a reference model. The model will go through a lifecycle of continuous reviews and changes.

3.1. Reference model benchmark and reporting

In response to ever increasing demand for performance reporting, a recent trend in universities is an increased interest in enterprise wide business intelligence. Business intelligence can be defined as “an umbrella term that includes the applications, infrastructure and tools, and best practices that enable access to and analysis of information to improve and optimize decisions and performance.” [9].

The application of business intelligence tools will improve analytical capabilities, however the pursuit of business intelligence is further complicated by the decentralization, autonomy of departments and the complex system landscapes of universities. Often in-depth analysis will reveal that significant amounts of organizational data are stored locally in excel files or in hardcopy format. A strategy of enabling access to this data has to be devised. Fortunately the ability to access this data has increased significantly with Microsoft SharePoint, Google Docs and similar user-friendly document management tools despite raising another issue regarding the maintenance of the data. While most organizations understand the importance of maintaining good data practices in transactional enterprise systems, locally managed content management systems are considered more informal and hence there is less commitment to maintenance. Tying performance objectives into the process reference model as seen in SCOR and other models will allow for early consideration of which performance data to collect and report on.

Navarro et al. [11] identifies a set of generic performance indicators in universities shown below, translated via Maria da Conceição da Costa Marques, Key performance indicators in Portuguese public universities (2001) (appendixA)

More extensively Tavenas [12] reviews across countries and identifies universities in Quebec as leading in terms of establishing objectives and monitoring performance. Shun et al. [13] identifies 18 measurement dimensions, and 78 Performance measure indicators. These performance indicators should be linked to the reference model ensuring that the relevant processes and performance is linked. Additionally each organization will carefully have to balance key performance indicators which can be opposing.

4. Presentation of the Reference Model

The purpose of the business process reference model for universities is to:

1. To provide access to a reference framework of university business process.
2. To link generic university business process to universal university performance indicators.
3. To link business functions to enabling IT systems.
4. To identify data elements required for execution of generic business functions.
5. To provide a reference for common departmental functions performed at a university.

The reference model will be modeled using the ARIS software from Software AG. ARIS was selected because it has already been used for several reference models such as SCOR and DCOR and is also the tool of choice at the author’s institutions. However the choice of tool is irrelevant for the purpose of evaluating the model. The model is proposed to be a four layer hierarchical model. Level one and level two will be value added chain diagrams which will identify business areas and functions, while the lower three levels will be Event Driven Process Chains which will be used to document the business processes. While the Implementer layer is not included in the SCOR model [10], it is proposed for the generic university model because it is at this level that decisions about system scope and interfaces are made.

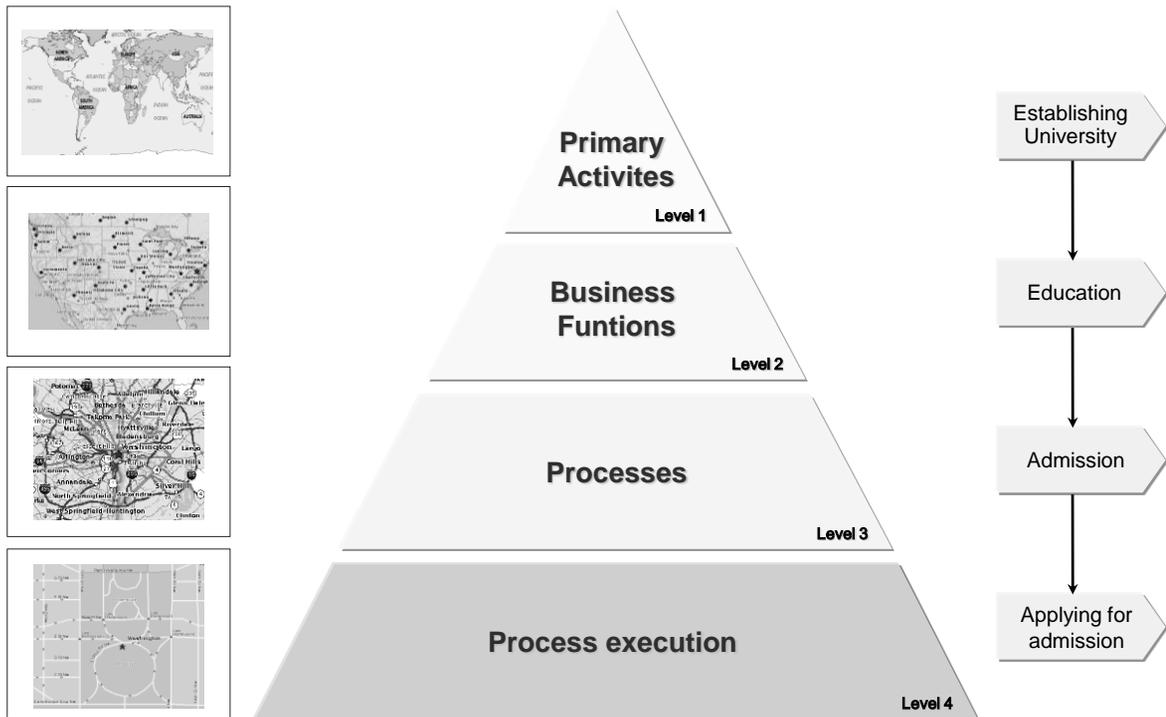


Fig. 1: The primary activities get broken down in to business functions and two levels of processes.

Based on existing organizational specific models it is estimated that a reference model would need approximately 500 individual level four business process models.

In the lifecycle of a reference model the first several iterations are likely merely to be documentation of end to end processes which will collect, distribute and process the data elements required to complete the process. In the evolution of business processes this can be seen as the intermediate level between documenting processes and actually improving processes. To reach the next level we must start to systematically change the standardized processes so that we can uncover opportunities for improvements.

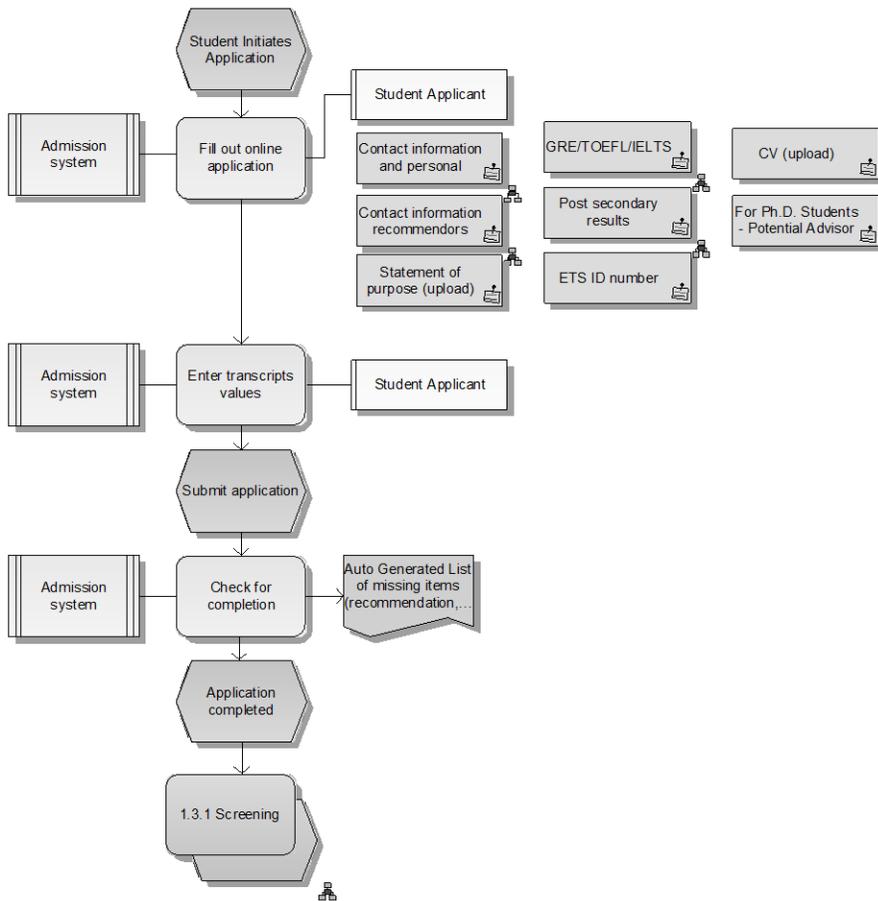


Fig. 2: Example of a level four process, which is the example of the student applying for admission using a web-based admission system.

5. Next steps

In conclusion, the reference model should be considered an enabler for the discussion of a solution, rather than a turn-key solution. No matter the level of detail captured in a reference model, the university will have to match processes and business needs. Some requirements will be driven by local regulation or cultural preference.

A key point is that reference models are not mutually exclusive but can be seen more as supplements. For example, a process reference model for specific helpdesk software is a supplement to the overarching ITIL model which fits within a framework for the specific industry.

The next steps are to pursue funding and partners to develop the reference model and establish policies and procedures for maintaining and developing the reference model. To do this, consideration to a reference model management system (RMMS) as suggested by Thomas et al. 2006 will be given. Additionally it is speculated

that specific attention should be given to the mobility aspects of business process execution and reporting. As these start to become more integrated business scenarios, a reference model should support these.

The objectives of establishing a reference model for universities is to improve process quality and reduce the administrative burden already put on university budgets. For other industries we have learned that reference models can accelerate the roll-out of process enablement via IT, and provide an overview of the relations between systems, processes, customers and organizations. Additionally a reference model can also support universities being established in helping to build the infrastructure needed to run a modern university.

References

- [1]Davenport, T., 1993. *Process Innovation: Reengineering Work through Information Technology*, Harvard Business School Press, Boston, Massachusetts.
- [2]Thomas, O., Horiuchi, M. and Tanaka M., 2006. Towards a Reference Model Management System for Business Engineering. Proceedings of the 2006 ACM symposium on Applied computing.
- [3]Fettke, P., Loos, P., and Zwicker, J., 2005. Business Process Reference Models: Survey and Classification, Proceedings of the Workshop on Business Process Reference Models.
- [4]Scheer, A., 1996. *Wirtschaftsinformatik - Referenzmodelle für industrielle Geschäftsprozesse*, 7. Auflage, Berlin u.a., Springer.
- [5]<http://supply-chain.org/SCOR-Overview-Web.pdf> (last accessed may 15th 2012).
- [6]<http://www.itil-officialsite.com/> (last accessed may 15th 2012).
- [7]Dongen, B.F., Jansen-Vullers, M.H. and Verbeek H.M.W., 2007. Verification of the SAP reference models using EPC reduction, state-space analysis, and invariants, *Computers in Industry*, 58, pp. 578–601.
- [8]Gulledge T., 2006. What is integration?, *Industrial Management & Data Systems*, Vol. 106 pp.5-20
- [9]Gartner IT Glossary (<http://www.gartner.com/it-glossary/business-intelligence-bi/>) (last accessed may 15th 2012)
- [10]Siegl, M., 2008, Understanding the Supply Chain Operations Reference Model, *Army Logistician*, 40,
- [11]Navarro Galera, 2000. Los Indicadores de Gestión en Universidades Públicas. Jornadas Luso Espanholas de Gestión Científica. Vilamoura, Algarve.
- [12]Tavenas, F., 2004. Quality assurance A reference system for indicators and evaluation procedures. U8Report published for European University Association, Belgium, pp. 1–53.
- [13]Shun-Hsing C., Wang, H. King-Jang Y., 2009. Establishment and application of performance measure indicators for universities, *The TQM Journal*, Vol. 21 Iss: 3, pp.220 - 235

Appendix A. Key performance indicators in Portuguese public universities [11]

Education	Research	Administration
<ul style="list-style-type: none"> • Candidates (per academic course or degree) • Number of students enrolled in doctorate courses / Number of graduates (per academic course and degrees) • Number of students enrolled / Total number of teaching staff (per graduate and academic courses). • Students enrolled / Square metres for the teaching activity and their complementary services (per degree). • Number of hours for practical training in enterprises and institutions / Total number of 	<ul style="list-style-type: none"> • Number of doctors' theses with a favourable award / total number of doctorates • Number of articles in magazines such as referee / Total number of researchers (per knowledge area). • Number of books published / total number of researchers (per knowledge area). • Number of papers presented at seminars and scientific meetings / Total number of researchers (by areas of knowledge). • Number of projects and research contracts sponsored / Total number of researchers (by areas of knowledge). • Number of registered patents / 	<ul style="list-style-type: none"> • Average time spent in the management of an expense process • Number of expense processes handled / Total number of staff in administration and services in admin management services. • Number of hours for professional training of staff / Total number of staff in administration and services • Students enrolled / Total number of administrative staff and services (per degree). • Average time spent in the acquisition of investments

<p>students enrolled (per degree)</p> <ul style="list-style-type: none"> • Number of students who failed / Total number of students enrolled (per degree). • Number of students that complete their courses in the period set / Total number of students enrolled (per degree) • Number of Masters and Post-graduate courses / Number of graduates (per academic course and degrees). • Number of hours spent in enrolments / Total number of students enrolled (per degree). • Number of complaints made by the students. 	<p>Number research projects (by areas of knowledge).</p> <ul style="list-style-type: none"> • Number of research groups subsidized / Total number of researchers (by areas of knowledge). • Budget resources used in research activities / Total number of researchers (by areas of knowledge). • Number of seminars carried out outside of the university scope / Total number of teach and research staff. 	
---	---	--