A Call to Include Workflow Management Systems in MIS Curriculum

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Abstract— **Despite being identified as an emerging topic, Work Flow Management Systems (WMS) has not been included in the Management Information Systems (MIS) curriculum of most US universities. Workflow system combines business and technology and requires the integration of management policies and IT systems. MIS students can benefit from the knowledge of WMS and be able to explore job opportunities. We argue for the inclusion of WMS as an independent course and develop the framework for a full-fledged workflow management module in MIS. We explore the WMS components and the influential factors that are important for pedagogy and we conclude with the outline of a model curriculum.**

Keywords- Workflow Management Systems, MIS curriculum, workflow, curriculum development

I. Introduction

Management Information Systems (MIS) discipline stands at the crossroads of management and technology. A Workflow system is one such MIS artifact that imbibes characteristics of both business and technology. Workflow management requires the integration of management policies and IT systems. The intertwining of people, policies and systems has the potential of creating competitive advantage (Barney 1991). Upon graduation, IT students would be working in such situations where they can apply their skills to create IT initiatives that can generate value for their company. However, the work management systems are embedded deep in the IT systems of organizations that are inaccessible to students. Students may not have access to the internal (real world) operations that would give them an opportunity to learn and understand work management systems. Hence it will be desirable to create a simulated environment using a combination of technologies from available open-source software so that students can gain familiarity with work management systems. One only needs to look at popular job sites for workflow jobs and one will find numerous positions that are available all around. Workflow related jobs fall under the categories of system analyst, customer representative, sales representative and managers. This indicates that there is a need in the area of workflow management. A cursory search for "work flow" as keyword on Monster.com brings up 1000+ results. Despite being identified as an emerging topic, Work Flow Management Systems (Gorgone et al. 2006) has not been included in the MIS curriculum. In this paper, we propose a system that uses a combination of technologies that are representative of the real world technologies.

In recent times, more than ever, specialization has increased and therefore, IT departments of the universities need to look at electives such as work flow systems to cater to the job market requirements. MIS students need to be equipped with a good combination of business and IT skills and be well prepared for working with modern technological business systems. Regrettably, Work Flow systems do not even appear in the curriculum guidelines for undergraduates for 2010 (Topi et al., 2010). It is a relatively new area in the area of information technology (Hadidi, 2011). Still, only few institutions and universities that offer education in Business Process Management (BPM) in a systematic and in-depth manner (Bandara et al., 2010)

With our proposed comprehensive curriculum on workflow management systems, the students should be able to grasp basic terminology, concepts, and understand the driving forces, current industry, and behavioral aspects as related to the Business Process Management and Workflow management systems. Towards the completion of the course, they should be able to build simple programs as well as be able to develop small code snippets and install a basic configuration of WMS. At the end of the paper we point out some resources, such as case studies, books and seminal papers that can provide guidance towards building a model WMS focused curriculum.

II. IS 2010 Curriculum

The latest model of MIS Curriculum is known as IS 2010 which has been revised upon previous models of IS 1997 and IS 2002. The IS 2010, developed by the joint task force of Association of Computing Machinery (ACM) and Association of Information Systems (AIS), is a model curriculum that has been designed to help IS programs offered by US universities

to prepare their students for a career in the field of Information Systems. The faculty can utilize this curriculum as broad guidelines to prepare their own courses customized to the specific needs of their students. The IS 2010 curriculum consists of seven IS core courses and eleven IS course electives which are offered to be taken by students as per their needs and as per their academic program goals (Topi et al, 2010). The seven core courses are: Foundations of Information Systems, Data and Information Management, Enterprise Architecture, IT Infrastructure, IS Project Management, Systems Analysis and Design, and IS Strategy, Management and Acquisition. The elective courses are as follows: Application Development, Business Process Management, Collaborative Computing, Data Mining/ Business Intelligence, Enterprise Systems, Human-Computer Interaction, Information Search and Retrieval, IT Audit and Controls, IT Security and Risk Management, Knowledge Management, and Social Informatics. In addition to these electives, Workflow Management Systems can also serve as an important elective for IS students as discussed previously. In the next section, we present how can a Workflow Management System designed. We begin with outlining the learning objectives and in the later sections build the actual contents of a Workflow Management Systems curriculum.

III. Workflow management systems

A. Learning Objectives

At the end of the semester:

- Students will be able to define the workflow concepts and terminology.
- Students will be able to describe the process of workflow management analysis and implementation.
- Students will be able to explain the role of workflow in Business Process Management.
- Students will be able to analyze and customize existing workflows.
- Students will be able to analyze a business scenario, model, design and implement a process.
- Students will be able to develop knowledge and skills in using workflow design tools
- Students will be able to customize a workflow system based on given requirements in a business organization.
- Students will be able to discuss behavioral/management issues in workflow management

The list of learning objectives provided above could be used as a guidance and the faculty depending upon other constraints might tailor it to their needs. Once we have the learning objectives in place, let us explore what could be the actual contents of the course. We will first begin with building the terminology.

B. Developing basic terminology

A workflow management system is a computer system that manages and defines a series of tasks within an organization to produce a final outcome or outcomes. Workflow Management Systems allows us to define different workflows for different types of jobs or processes. Table 1 provides basic concepts of work flow management. Table 2 outlines the fundamental process development concepts. Table 3 provides the fundamental concepts in Enterprise Content Management (ECM). Table 4 describes the typical roles in ECM and Business Process Management (BPM).

TABLE 1. BASIC CONCEPTS IN BPM

Concepts	Details
Auditing	Availability of collecting and evaluating evidence
Annotation	Unstructured information (such as notes, comments, or messages) about a folder or document.
Analysis of workflows	Average and total time spent by workflow and work items in a workflow, Work throughput in a given time period Current status, Queues, Work item processing by queue dimensional hierarchy, Current status, Work item processing by step dimensional hierarchy, Work item processing by user dimension
Containment	The ability of a document to be virtually saved in different folders
Inheritable depth	The maximum number of levels through which permission can be inherited. There are three possible settings: "This object only," "This object and immediate children," and "This object and all children."
Life Cycle Management	For example, a loan application's lifecycle is likely to have states that occur in the following order: 1. Application 2. Approval 3.Funding 4. Servicing 5.Closed
Milestones	Applicants can list the status of their document
Publishing	A rendition engine can automatically convert records into publishable content.
Process Tracker	Process Tracker provides at-a-glance status of a workflow that is currently in progress. With Process Tracker, you can tell what steps have been completed, when they were completed, and which steps are currently active
Process Administrator	With Process Administrator, you can search for and view workflows, edit workflow data and properties, and manage workflows. Process Administrator provides a wide variety of options so you can focus your search very precisely.
Rules Engine integration	Inculcating domain knowledge
Reminders	Managers can automate reminders to employees as the deadline to process units of work come closer
Task Reassignment	A task can be escalated to a manager
Tracker	A participant who is designated to monitor the progress of a workflow. If necessary, the tracker can modify various step and workflow property
Versions	Two-level Versioning on documents Major (1, 2, 3...), Minor (1.1, 1.2…) Each version of a document has a version status property - this property has 4 values: In-

	Process, Reservation, Released, Superseded
XSL script	A script written in Extensible Style sheet Language. XML property mapping script objects contain XSL scripts to perform automatic document classification

TABLE 2. FUNDAMENTAL PROCESS DEVELOPMENT CONCEPTS

Concepts	Details
AND-join	A step in the workflow that acts as a collector for an AND-split step. An AND-split step results in the workflow simultaneously following multiple routes; the AND-join step subsequently brings the workflow back into a single path. An AND-join is also referred to as (and designated in the Process Designer UI as) a collector step.
AND-split	A step in the workflow where there are multiple outgoing routes that the workflow can take simultaneously. In the Process Designer UI, the outgoing routing for an AND-split step is set to "all true conditions." An AND-split step must have a corresponding AND-join step (collector step).
Child work item	Within a running Process Designer-based workflow, a child work item is created for each participant in a multi-participant step and for each route taken simultaneously from an AND-split step. Within a running Composer-based workflow, a child work item is created via a StaticSplit system instruction.
Deadlines	Managers can enforce deadlines to employees to process units of work within a process.
Event Based workflow launching	A workflow is triggered by an event.
Isolated regions	A logical subdivision of the workflow database. Work cannot be shared across or moved between isolated regions. Use isolated regions to separate groups of users as appropriate for the organization.
Branch	A set of parallel steps in a workflow. You can add branches to an existing branch and merge branches. A workflow step is a node in a branch.
Steps	Component step – Program General step - Human System step - SubMap step - group of steps (reusable)

TABLE 3. FUNDAMENTAL CONCEPTS IN ECM

Concepts	Details
Document Classification	Document Separation, Classification, Batch Preparation
Document Processing	OCR, ICR, blank page detection, Assembly, Indexing
Document Release	Save to Repository

TABLE 4. TYPICAL ROLES IN ECM/BPM

Roles in ECM/BPM	Details
Developer:	The developer typically has programming capabilities, helps the administrator in tweaking the software to the needs of the client.
Administrator:	The administrator possesses installing and deployment knowledge along with Domain knowledge. Typically the administrator gets feedback from the users.
Super User:	The super user is one with good "content management skills" and will use the content management tool from the backend. Within the Super User group, you may have Process Managers; ECM Specialists etc. who make sure that the company policies are being conformed to. This may include company rules, any process changes in business, any change in document retention policy, etc. Then based on the application being used in the ECM/BPM environment, you may have ECM/BPM Supervisors, etc. who ensure smooth and maximum usage of the ECM/BPM system (The distance education staff at the university). Examples**:** Professors using blackboard/WebCT.
User:	Upfront user. Basic computer skills required. Examples**:** Students

Business students should have the opportunity to learn WMS not just for their technological and business relevance, but including WMS in the curriculum is also important because of many other factors that we discuss next as driving forces. Integrating these driving forces would provide a comprehensive perspective of the students and the students will be able to learn the context in which WMS artifacts are embedded.

C. Understanding the driving forces

The importance of WMS has increased due to several driving forces such as compliance, e-discovery, regulations, fear of litigations, and best practice.

Government Regulation (Compliance): After the Enron case, US Congress reinforced laws by passing the Sarbanes-Oxley Act (SOX 2002), compliance of which was made mandatory for publicly listed companies. This new law demands that C-suite executives confirm their confidence in the quality and integrity of information generated by information systems by signing off on the figures. Under SOX 404, the Securities and Exchange Commission holds executives accountable for reliable internal controls, record retention, and fraud detection. In turn, executives are looking up to the reports generated by the information systems and the audits conducted by the IS auditors to help them meet their regulatory responsibilities (Volonino et al. 2004).

Producing Documents on Demand (E-Discovery): Preserving the documentation related to business decisions and processes are important from the legal perspective. Electronically stored information (ESI) can be used as part of evidence as per the amendments to the federal rules of civil procedures (Withers, 2006). State laws are modeled after the framework laid out by the federal laws and hence it becomes incumbent on organizations that documentations are preserved in such a way that allows for quick, accurate and efficient retrieval or e-discovery whenever such a need arises.

Industry Regulation: Industries have implemented ISO 9000 in order to either be compliant or competitive advantage (Wise et al. 1993). The AACSB in the field of education stands out as an illustration. In addressing the requirements of AACSB, various universities have deployed software like Digital-measures related to managing the research of their faculty.

Fear of litigation: In a lawsuit, the related documents must be produced on demand making document management a high management priority (Shukla 2004). WMS is provided to be able to collate relevant documents.

Best Practice – quest for competitive advantage: Just like the implementation of ERP, Balanced score card, TQM, JIT

etc., software related to ECM/BPM are being implemented to be more efficient with the ultimate purpose of being competitive in the market. With BPM, employees second in line get the document from the moment the first is done with it. Using such technologies, the manager can provide an employee a specific time schedule to complete a job, send him a reminder before a certain time and send the task automatically to the next person. A system adhering to effective management processes can be a source of sustained competitive advantage (Barney 1991; Simons 1990). There are best practices in workflow management that serve as guidelines for companies to contribute to the achievement of better quality and to help in the implementation, support and operations. The principles for best practice of workflow management are as follows: establish a clear ownership for workflow management; use standard terminology to standardize communications between stakeholders; strive to centralize all workflow related data and information; provide transparency of workflow related data and information; provide good enough solutions, if not perfect, in workflow management; follow industry standards.

In response to the above-mentioned drivers, organizations have implemented ECM/BPM software. With ECM/BPM, an organization can see and analyze what was changed, who changed it, when was the change made, how much time was utilized to do it, and whether it was done on time. Organizations have the version before and after each stage of change for prompt review and comparison.

Hence, based on the previous discussion, inclusion of ECM/BPM in the MIS curriculum will be a timely and significant step towards improving the quality of business education. Next, we will discuss if ECM/BPM is to be included in the business curriculum, and what should be the fundamental components of ECM/BPM focused syllabus.

D. Understand current industry software

- Available open source and commercial software

Software	**Comments**
IBM- Filenet	Proprietary
EMC –Documentum	Proprietary
Open Text	Proprietary
Microsoft	Proprietary
Oracle	Proprietary
JackRabbit (Apache)	Open source
Alfresco	Open source
Plone	Open source
Nuxeo	Open source
Jahia software	Open source

E. Technology Requirements

While the software choices are many, the setup for such a course will be just like database courses where the database resides in a server and students receive login rights. Students can then log in, create and modify workflows.

F. Seminal papers

Georgakopoulos, Diimitrios, "An Overview Of Workflow Management: From Process Modeling To Workflow Automation Infrastructure", Distributed And Parallel Databases: An International Journal, Volume: 3, Issue: 2, Page:119
Barney, J. "Firm Resources And Sustained Competitive Advantage," Journal Of Management (17:1) 1991, P 99.
Shukla, R. "The Case For Electronic Records Management," Financial Executive (20:7) 2004, Pp 50-52.
Noteboom, Remko, "Capturing Workflow In The Digital Age" Journal Of Digital Asset Management, Aug2010, Vol. 6 Issue 4, P210-215, 6p
Kumar, Akhil, Van Der Aalst, Wil M.P, Verbeek, Eric M. W "Dynamic Work Distribution In Workflow Management Systems: How To Balance Quality And Performance".
Modeling And Analysis Techniques For Cross-Organizational Workflow Systems. By: Lida Xu; Huimin Liu; Song Wang; Kanliang Wang. Systems Research & Behavioral Science
Dynamic Routing and Operational Controls in Workflow Management Systems. Full Text Available By: Kumar, Akhil; Zhao, J. Leon. Management Science, Feb99, Vol. 45 Issue 2, p253-272
Juliane; Van Der Aalst, Wil M. P Bridging: The Gap Between Business Models And Workflow Specifications". Dehnert International Journal of Cooperative Information Systems, Sep2004, Vol. 13 Issue 3, p289-332

G. Books

Workflow management: models, methods, and systems By Wil van der Aalst, Kees Max van Hee
Production workflow: concepts & techniques Leymann Frank, Roller Dieter Workflow Management: Modeling Concepts, Architecture and Implementation by: Stefan Jablonski, Christoph Bussler

IV. Conclusion

MIS students work at the crossroads of management and technology in their career. Therefore studying about Workflow systems may provide additional opportunities for them in the job market. Workflow management requires the integration of management policies and IT systems. We proposed a curriculum that will be useful for MIS students to learn about workflow systems. This course will definitely help MIS students help find jobs in additional areas. Among all departments, the IT department is unique in terms of adapting to a fast changing industry needs. Unlike other departments like accounting, finance etc., which have had almost unchanged courses, the IT departments' success partly lies in catering to the fast changing needs of the industry. We have to be flexible to the current needs of the industry. In order to do so, we need to be aware of current trends, such as content management, and cloud computing etc. WMS is one of the latest trends that need to be urgently included in the MIS curriculum of the business students. We conclude our discussion with a flow chart illustrating the demarcation between the undergraduate and graduate level curriculum of WMS as shown in Appendix A.

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APPENDIX A

A Flow chart for Undergraduate & Graduate Course Design