KMI-IWS: Towards a Framework for a Knowledge Management Initiative Intelligent Work-flow System

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***Abstract*—Knowledge is enriched information which contains framed experience, values, context and expert insight. It has been posited that the survival of the modern organization depends heavily on knowledge, since it has become one of the primary sources of competitive advantage. Given that knowledge exist in people, processes and data, it is necessary for deliberate organizational activities aimed at accessing, explicating and where applicable converting information into knowledge. In addition, technology driven systems are required to support storage, update and the application of knowledge in order to produce the desired benefits. This can be accomplished by implementing knowledge management systems (KMS). However, the process for developing KMS that extends the existing information systems infrastructure remains inadequately addressed in the existing literature. Whilst there are some successes, many knowledge management initiatives (KMIs) are challenged by lack of process visibility, in addition to the difficulties associated with defining system requirements early in the process as it is not known what new knowledge will be discovered and how the new knowledge can be applied or will be integrated at the beginning of these initiatives. Improved process visibility enables better tracking towards completion or transitioning between the activities in the process. In this paper, we advance the argument that a work-flow system can be used to overcome some of these issues associated with KMIs and therefore have positive impacts on the success KMS implementation. Further, we discuss a framework for an intelligent, adaptive work-flow system for supporting activities related to implementing a KMS. We suggest that the integration of adaptive and intelligent techniques will improve outcomes of initiatives geared towards improving knowledge capability of the organization.**

Keywords–Knowledge Management System; Work-flow system; KMI-IWS.

I. INTRODUCTION

Knowledge is a 'fluid mix of framed experience, values, contextual information and expert insight that provide a framework for evaluation and incorporating new experiences and information [1]. This differs significantly from information and data which are lower according to the data-information-knowledge-wisdom (DIKW) hierarchy [2]. Bowman argues that knowledge can be critical to an organization's success as it can improve their capability [3]. Other authors have underscored the importance of knowledge to success and competitive advantage of the modern organization [4][5]. Knowledge has become critical to the survival of the organization since it provides for learning, and supports strategy. Given the importance of knowledge to the organization, it is very important to advance initiatives to manage knowledge in order to support the continued survival of the organization. Important consideration must be given to how information and communications technology can be used to support these KMIs. Given the proliferation of computer-based information systems, consideration must also be given to how these technologies can help and facilitate the knowledge initiatives in the firm. This study defines a KMI as a group of tasks aimed at improving the knowledge capability of an organization. Primarily, a KMI is aimed at exploiting some aspect of the organization or some process to enable the acquisition, storage, application and update of new and existing knowledge. Whilst the it is not always the case, generally, the desired outcome of a KMI is a KMS.

A KMS is a class of information systems applied to managing knowledge in the organizational context. They are IT-based systems developed to support and enhance organizational processes related to knowledge management [6]. KMS extend beyond traditional information systems as they provide a context within which information is coded and presented for use [7], in addition to supporting the four main knowledge management activities of knowledge creation, storage, application and update. KMS within this context should therefore be comprised of a toolset that facilitates proper organization of resources with emphasis on information technologies that will drive the knowledge processes in the organization. KMS should also provide components that will support the acquisition, modeling, representation and use of knowledge [6][8]. It is also important that knowledge is suitably modeled so that it integrates into the organization to enable appropriate use. Knowledge must also be constantly updated to ensure that the most current knowledge is being used. The type of knowledge that exists in the organization also plays a significant role in determining the actions necessary for knowledge management and building KMS. If the knowledge exists in experts, then capturing (knowledge elicitation) should be the focus. If the knowledge is an object then the focus should be collect, store, and share knowledge. If the knowledge is embedded in processes the KMS should provide for improvements in the flow of the knowledge [9].

Most modern organizations today use computer based information systems that are vital to their processes and data management needs. These provide features to effectively manage their data and transform this into information. There is however less evidence of firms effectively implementing and

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using KMS and by extension, leveraging their information resources for knowledge. Several methodologies have been proposed for knowledge management in the organizational context. There is however gap in the current literature related to moving from information management systems to KMS, i.e., transitioning from information management to knowledge management supported by existing information systems. Based on an action research study in a developing country context, a domain specific model CoMIS-KMS was developed and applied to address this problem [10]. The major challenges with the case based application of this model included many of the process based challenges such as lack of process visibility and limited or no room for adaptability and/or flexibility. These challenges have been well addressed in the work-flow systems literature. A work-flow can be defined as a collection of tasks organised to accomplish some business process (e.g., processing purchase orders over the phone, processing insurance claims). One or more software systems, one or a team of humans, or a combination of these can perform a task. Human tasks include interacting with computers closely (e.g., providing input commands) or loosely (e.g., using computers only to indicate task progress) [11].

This study posits that work-flow technologies can be successfully applied to a KMI and in particular in the management of task associated with transitioning an information systems environment into a knowledge management environment driven by computer based KMS, which extends the current information system.

In this paper, we propose a framework for a Knowledge Management Initiative Intelligent Work-flow System (KMI-IWS), which provides tools to support the execution of a KMI that includes the transitioning of a current information system to a KMS. We discuss the framework in relation to a current project in a developing country environment. The rest of this paper presents our work in progress. Section II discusses work-flow systems and techniques applied on other domains. We then present the KMI-IWS framework in Section III followed by a discussion, conclusion and future work.

II. Work-flow Management Systems

A work-flow management system either completely or partially support the processing of work item(s), in order to accomplish the objective of a group of tasks within a process activity. These systems usually include features for routing tasks from person to person in sequence, allowing each person to make a contribution before moving on in the process [12]. Given that work-flow systems allow tracking of tasks from one step to the other and assigns participants in a process, they have the advantage of providing positive benefits to managing processes and enhances visibility of the process it manages. In general, work-flow systems would depend on a well defined process that is then automated by the use of computer software. The rules and process steps are predefined and remains relatively static. Given that the business environment has become increasingly fast paced and dynamic there has been the need to allow static work-flow systems to evolve into adaptive, flexible systems [13][14][15]. The literature provides several reasons and examples of methods for developing adaptive work-flow systems and examples of their use are well established. The key reasons supporting the need for adaptability include new business needs, supporting change after the process has begun, handing exceptions during process execution and providing flexibility while assuring coherence and process quality [14][16][17]. The literature also provides significant focus on the benefits, application and techniques used in work-flow systems and how they can be made more effective in supporting the modern organization. Work-flow systems have undoubtedly provided significant benefits to process management in many domains and is the core of many enterprise resource planning systems.

III. The KMI-IWS Framework

The presented framework illustrated in Figure 1 depicts a combination techniques that may be implemented as an intelligent work-flow system to enhance the success of KMIs. Particularly, the framework develops on the specific domain where activities have been applied to transition an existing MIS to a KMS [10]. The process applied in this domain was successful but several questions about its continued application and generalization remain. One major issue was that given that KMIs are not prevalent, especially in developing country environments, organizations want to be able to track these processes more carefully to enhance the likelihood of success; as such process visibility is desirable. Additionally, given that many of the tools and techniques have never been applied in these organizations, expertise is lacking in their use, selection and application. Therefore if the work-flow system can provide guided assistance and decision support, this may improve outcomes. Finally, as we propose the application of the process to develop the knowledge management capability of the organization by transitioning to a knowledge management environment applying a KMS, the nature of change in the organizational setting, differences between knowledge resources and organizational culture among other things enforces the need for our work-flow system to be flexible, adaptive and robust. Figure 1 illustrates the proposed framework.

A. Components of Framework

The KMI-IWS framework (see Figure 1) specifies two major components: *activity management work-flow* and the *interactive management component*. The interactive management component includes *process improvement tools, analytics engine and a plugin manager.*

In the *activity management work-flow* component, tasks for the KMI are identified and sequenced. The tasks are first listed by the initiative owner who may or may not specify all the task at the planning/beginning of the project. Importantly, the tasks dependencies must be defined. Thereafter, we suggest tasks be plotted on a directed graph to represent the constraints on the order of execution. This approach is useful as once graph representation is used, several techniques such as shortest paths and minimum spanning trees can be applied over the set of tasks plotted as a graph or any subgraph of tasks. This representation will allow for multiple possible arrangements of tasks depending on the dependencies that will be enforced by the directed edges between nodes which represent tasks. Adaptability and flexibility is enabled by this representation as the initiative can have tasks reorganized as more tasks are added or removed or can be re-sequenced to give alternative sequences of execution subject only to the constraints of which tasks must be done before others. This *activity management work-flow* component is the core of the system which supports the other main components in applying tools for process improvement, analytics and the support of

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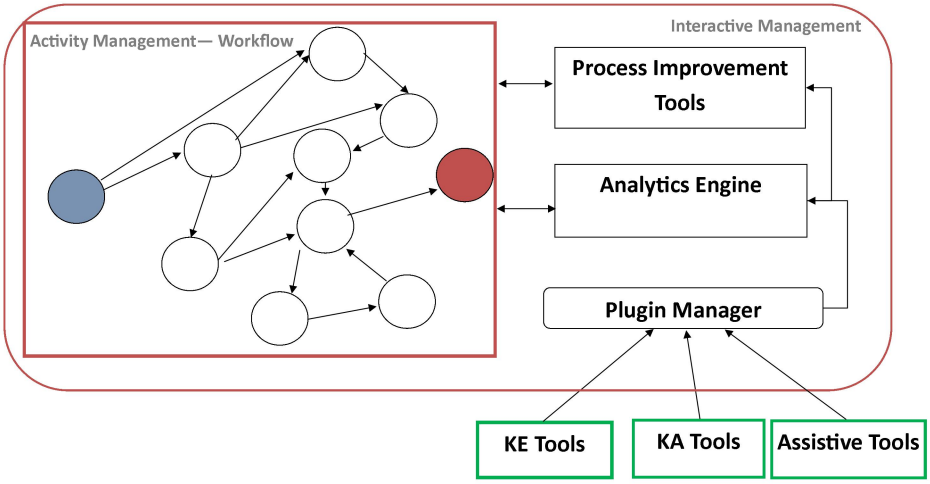

Figure 1. The KMI-IWS Framework

specific tasks within the work-flow. The arrangement of tasks in this component represents the work-flow to be used.

Within the *interactive management component*, the *process improvement tools, analytics engine and plugin manager* will interact with the activity management work-flow to allow several intelligent and assistive tools and agents to better execute the tasks within the work-flow system. A core design requirement is a plugin manager that will allow for the insertion and removal of tools to be used during the execution of the tasks within the KMI. It is established that KMIs differ in what is required to complete them depending on the type of knowledge that exists [9]. Therefore, the tools required to support the execution of specific tasks in one initiative may differ significantly for another. In general, the tools may include knowledge elicitation (KE)/knowledge acquisition (KA) tools, such as questionnaire manager, repertory grid or other artificial tools that are widely used in elicitation/acquisition and coding of knowledge. Built into these tools are relevant intelligent agents that will ensure the proper elicitation of knowledge. One simple example is the use of an expert system to do automated questioning of an expert where subsequent question responses are used to determine next questions in the sequence. Additionally, with the use of artificial methods for knowledge elicitation, the data collected can be interpreted by algorithms or heuristics to produce the knowledge automatically. The primary goal of the tools in this sub-component is to improve on how well tasks are done in relation to the overall work-flow. Thus, any tool that can allow for improving the sequencing of tasks, the completion of specific standard tasks or the reorganization and visualization of the tasks in the work-flow are included. *Process improvement tools* may also include a set of decision support tools that will provide suggestions throughout the execution of the initiative such as suggestions on tasks that may not have been completed and those that are pending as well as prompting and suggesting alternative allowable sequencing of tasks. The insertion and removal of tasks and alternative plotting of execution sequences that the initiative may take to its completion are also included in this sub-component. This provides the flexibility of having multiple sequences for completing the initiative and the adaptability required based on changes in tasks or the need to add and remove tasks as the initiative progresses. In addition, tools to allow the execution of specific tasks are included in *process improvement tools*. One example, based on the tasks in the work-flow, could be, tools to assist the user in identifying and specifying possible knowledge sources, then use heuristics in a decision support system (DSS) to reason and suggest the best method to elicit/acquire the knowledge based on the description of each knowledge source identified. In an organisation that has their data in largely structured ways such as in relational databases, this DSS may be able to guide the user on the best methods and tools to apply based on the task goals. This intelligent agent will add value to, and allow for improvement in the user's ability to successfully complete tasks. The process improvement sub-component should also include document management capabilities which will allow the system to act as the document repository for the initiative. This is useful to ensure that the entire initiative management and tracking is integrated into the designed work-flow system.

The *analytics engine* will provide assessments of task performance within the work-flow. It will log activities and provide analysis of performance with visualizations of tasks progress. This sub-component will also include a set of tools that can perform basic data analysis to support knowledge elicitation and acquisition activities within the execution of the overall KMI. The collated data within the analytics engine focus on how tasks are done, and their progression. This will be capable of eliciting trends based on the performance of tasks within the initiatives and will include tools to allow the user to specify rules for identifying lagging activities, prompting where tasks are overdue and managing the metrics that must be met as performance indicators for the KMI. The *analytics*

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engine collects, collates and assesses performance within the context of the initiative itself such that on-the-fly reports and analysis of the KMI can be done. This should inform the user of how well the initiative is going, patterns of success or failure on execution, changes and any trends that could inform how things should change to meet the objectives of the KMI.

IV. Discussion

The KMS-IWS framework specifies how an intelligent work-flow system may be developed to support a sequence of activities that are associated with a KMI. In this study the focus is on transitioning a current computer-based information processing environment to a knowledge management environment driven by a computer-based KMS. Regardless of the determined tasks, the framework suggests that any work-flow system built according to this design will allow tasks to be defined and their dependencies and constraints will be enforced by using well established techniques from graph theory. The other important components of the system will allow for managing the process to make sure there is increased process visibility and will integrate intelligence based tools to assist in the efficient completion of tasks. The system must allow for plugins to be added and removed as necessary since some of the assistive tools that are required for use in the analytics engine for process improvement may not always be applicable to each KMI. Therefore, the initiative owner should be allowed to check-in and check-out tools as necessary so that the process is managed within the work-flow system without the need to use several fragmented systems.

The primary aim of the framework is to establish a suitable design specification that may be useful when designing a work-flow system for managing KMIs. The resulting work-flow system may be widely used for many different organizations and types of initiatives with many different constraints or unique properties. This design specification incorporates flexibility and robustness given that initiatives for knowledge management depend on the sources, type and the availability of knowledge which may differ in each domain. We posit that this framework is a useful guide that can lead to building adaptive/intelligent work-flow systems generally applicable to different knowledge management context.

V. Conclusion, Current and Future Work

This paper presents a framework for developing an intelligent, adaptive knowledge initiative work-flow system. The framework provides a design guideline and components that are relevant to the development of a work-flow system that will allow an organization to manage their KMI. The basis of this framework was a specific domain in a developing country context where a successful knowledge initiative process was executed following a defined process model, which identified tasks and the sequence for execution. The researchers having completed this initiative observed challenges with managing the tasks in the process. One major challenge was process visibility. Additionally, upon completion of the initiative, the evaluation identified improvements, if integrated could assist the process through better tracking of progress. In addition to the need for process improvement, the initiative could have benefited from other assistive tools that could make the execution of tasks more efficient. This work therefore provides the design specification a work-flow system that would address these problems. We therefore developed the KMI-IWS framework. Our current work includes the development of a prototype system based on this framework after which we will use the system for another initiative and do a comparative analysis of its impact.

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