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Distributed Processing for Knowledge Management in cooperative e-Government administration projects

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Abstract: We review multidisciplinary methodological approaches for implementing Knowledge Management (KM) tasks. We mainly examine how Distributed Processing and KM influence the cooperative e-government projects. An integrated approach to examine issues of e-government administration projects has to focus on the four different challenging perspectives: social, economic, organizational, and technological. This paper in particular focuses on social and technological aspects of e-government, and also examines how to apply Business Process Management techniques to model the KM activities in distributed environments. The role of Ontologies is also presented, and we briefly discuss how to develop and apply ontologies for semantically enhanced processing. We also study the ICT-supporting architectures and platforms. Case studies are eventually discussed to provide some evidence of the feasibility and effectiveness of specific phases of various methodologies proposed in the literature.

Keywords: e-government, Knowledge Management, Business Process Modeling, Ontologies.

1. Introduction

Business Process Management (BPM) and Business Process Reengineering (BPR) have been predominant business trends since the mid-eighties. Another very popular trend that was arisen later is Knowledge Management (KM). BPR and KM have similarities, such as: Improving efficiency, Saved Costs, Easy Response to changes, and Innovation.

It is worth of mentioning that Skyme et al (Skyrme et al, 1997) distinguish between leaders and laggards. Leaders are characterized by a “culture of openness and inquisitiveness that stimulates innovation and learning”. Laggards “blindly follow a change process, e.g., business process re-engineering, without understanding the associated knowledge dimension.” (Skyrme et al, 1997) Mainly though, BPR efforts have not focused much on leveraging knowledge (Papavasiliu et al., 2002). Knowledge is a critical factor, empowering the organization with the ability to sustain competitive advantage (Bhatt, 2002). There have been several attempts to integrate these two often treated independently activities concurrently (Papavasiliu et al., 2003), (Papavasiliu et al 2002), (Kalpi and Bernus, 2006).

The application of BPM has brought benefits to many organizations, but the models developed tend to be used for reference during business operation and re-engineering activities; they rarely play an active role in supporting the day-to-day execution of the process. However, there are collaborative projects investigated the use of ontologies, agents and knowledge based techniques to provide support for flexible workflow management e.g. within the chemical industries (Chung et. al., 2003).

Process modeling techniques are not without their criticisms. Green and Rosemann use the Bunge-Wand-Weber models, which are based on ontology, providing a theoretical basis on which to evaluate process modeling. The analysis conducted confirms that process view is not sufficient to model all the real – world constructs required (Green, 2000).

Belsis et al (Belsis et al, 2008) focused on exploiting Organizational Memories characteristics (Abecker et al, 1998a) (Abecker et al, 1998b) towards a more integrative approach, combining business process modeling and information workflow control activities, with KM related tasks, such as exploiting ontology representation capabilities; providing the user with task-oriented knowledge, deconstructing the hidden complexity between the tasks needed to be handled and the related to this specific task knowledge. Furthermore, they enhanced the knowledge exploitation process by integrating multimedia capabilities in a software prototype in order to make possible expert's knowledge reusability.

Batini et al. presented the multidisciplinary methodology GovQual, "a quality driven methodology for E-Government project planning". They propose an approach based on the analysis towards five axes (perspectives): social, juridical, economic, organizational, and technological. They particularly focus on the social and technological aspects of E-Government. (Batini et al., 2009)

2. Knowledge and Knowledge Management

Knowledge is categorized into two types by the philosopher Polanyi: tacit knowledge and explicit knowledge (Polanyi, 1966).Tacit knowledge is "embedded in the human brain and cannot be expressed easily", and explicit knowledge "which can be easily codified" (Nonaka et al., 1995). "Both types of knowledge are important, but Western firms have focused largely on managing explicit knowledge" (Davenport and Volpel, 2001). It is transferred through personal interaction, mental models, technical skills, and experience. Hence, by the term knowledge "firms generally mean codified information with a high proportion of human value-added, including insight, interpretation, context, experience, wisdom, and so forth" (Davenport and Volpel, 2001). Knowledge has always been an important asset for organizations and "Knowledge management is the key success factor of today's business leaders" (Davenport and Volpel, 2001).

Effective knowledge management requires the concurrent exploitation of both tacit and explicit knowledge. The most practical way to define KM is to emphasize that it largely involves new applications based on the existing IT infrastructure (King et al 2002). On the other hand, traditional workflow management systems facilitate the modeling and execution of complex processes but they exhibit major limitations when confronting adaptability issues and support for knowledge related tasks (Papavasiliu et al, 2002).

Kalpi and Bernus discussed "the role and contribution of business process modeling (BPM) in the knowledge management initiative and in the management of

company-specific knowledge". They believe that BPM could be seen as a tool for knowledge management to transform knowledge into codified knowledge and facilitate knowledge externalization, and knowledge sharing. They present a mapping of the BPM concepts into the knowledge life-cycle model, proposed by Nonaka and Takeuchi (Kalpi and Bernus, 2006).

Another approach (Belsis et al., 2007) consisted on enhancing information workflow control with organizational memory techniques, in order to facilitate project management activities by providing context-specific knowledge to the user.

3. A theoretical framework for Knowledge sharing in cooperative e-Government

The GovQual methodology (Batini et al., 2009) could be described as the following phases:

Phase 1.1: Social context (state) reconstruction, which concerns the environment that services will impact ("how social context influences the service planning"), and the related "outcomes for the services"

Phase 1.2: Public administration's (state) reconstruction, "a description of the processes that allow service provision under an information systems perspective". This phase mainly focus on the ICT technologies and the organizational structure

Phase 2: Quality assessment, "to identify and measure the most relevant qualities of the different organizational/technological issues". Qualities have been investigated in the literature and belong to four general categories: Efficiency, Effectiveness, Accessibility, Accountability.

Phase 3: New quality targets' definition, to "fix the target values of quality dimensions to be achieved in the time horizon of the plan".

Phase 4.1: Preliminary planning to define the reference ICT architecture(s) that can be adopted as model E-Government projects.

Phase 4.2: Preliminary operational planning to choose the E-Government projects

Batini et al. stress that the above "activities must be performed cyclically with the final goal of producing the group of projects that guarantee achievement of target qualities with minimal cost".

4. A framework for Monitoring Knowledge Process Workflow

Belsis et al. (Belsis et al., 2007) presented an approach that focuses on implementing knowledge management tasks in distributed environments for e-government administration projects. In order to model the activities, business process management techniques have been applied. Ontologies have been developed and applied for semantically enhanced processing; they also described the IT-supporting platform which has been experimentally applied in the case of an e-government case study. By combining both business modeling techniques and the IDEF5 ontology description language, they proposed a framework, whose main methodological steps are presented in the following phases:

Phase 1: Business Process Identification. At this phase, the most important knowledge dependent activities are identified. The ones of critical value to the organization are selected, in order to be further supported through the framework.

Phase 2: Business Process Deconstruction. At this phase each activity is analyzed in terms of a) tasks consisting the business process, b) roles involved, c) key people and d) documentation related to tasks.

Phase 3: Classification. Certain tasks with strong interdependence are identified and potential sources of knowledge are identified, including both explicit as tacit sources of knowledge.

Phase 4: Business Process Design. Through a business modeling graphical tool the information flow is recorded and a business process model is provided focused on KM activities.

Phase 5: Ontology refinement. By making use of the IDEF5 syntax a mapping from the BPM to an ontology is provided that helps the users identify the knowledge structure of the related to their specific task, identifying both important roles as well as other potential sources of knowledge (e.g. Documents) aiming to assist their task.

Phase 6: Expert's knowledge acquisition. In accordance with phase 5 activities, access is provided to the user to browse a list of experts and in selected cases to communicate directly with them, acquiring further information, through a real time video transmitting application.

4.1. The role of the IDEF5 Ontology

Based on the IDEF5 language lexicon, the basic concepts used are those of kinds, which are mapped to structure units and participating organizational bodies, and relations, which are mapped to links

5. The impact of Business Process Management (BPM) and Knowledge Management (KM) in cooperative e-Government administration projects. Related work and discussion

According to van der Aalst et al. (2003), BPM is defined as "supporting business processes using methods, techniques and software to design, enact, control and analyze operational processes involving humans, organizations, applications, documents and other sources of information".

Ko et al. conducted an extensive literature review of BPM notations, languages and standards. A BPM Standards Classification Framework is proposed, which "lists each standard's distinct features, strengths and weaknesses" (Ko et al., 2009).

Riege consider that "Companies wishing to make their KM strategy and integrated knowledge sharing strategy a success need to pay attention to a large number of potential knowledge-sharing barriers." It is proposed that successful sharing goals and strategies must be related to a knowledge-sharing culture. Successful sharing is depended on three main factors: "1) Motivation, encouragement, and stimulation of individual employees to purposefully capture, disseminate, transfer, and apply existing and newly generated useful knowledge, especially tacit knowledge; 2) flat and open organisational structures that facilitate transparent knowledge flows, processes and resources that provide a continuous learning organisational culture, clear communication of company goals and strategy linking knowledge sharing practices and benefits to them, and leaders who lead by example and provide clear directions and feedback processes; and 3) modern technology that purposefully integrates mechanisms and systems thereby providing a suitable sharing platform accessible to all those in need of knowledge from diverse internal and external sources." (Riege, 2005).

In many KM systems there is no explicit notion of business processes while there is some kind of knowledge-related processes support. On the other hand, in many business process modeling tools or workflow management systems the modeling of

business process is well supported. However, these systems often lack the support for knowledge-related processes. (Papavasiliu et al., 2002)

Knowledge-oriented organization analysis is not new. Business Process Oriented KM BPOKM is also applied in the context of the PROMOTE project that relies on conventional strongly - structured workflow paradigm (Karagiannis et al., 2000). Similar tasks in e-Gov projects have been applied in the DÉCOR project, which establishes a similar methodology and has been applied to a public sector insurance Institution (Abecker et al., 2002).

The objectives of KM can be achieved by various approaches like the following: building a technical infrastructure such as knowledge repositories, videoconferencing tools, intelligent search engines, and so forth, structuring a learning organization, establishing KM processes etc. (Kim et. al., 2003).

Cooperative systems for supporting office work (e.g. Office tasks related to the processing of contracts) are complex. Their functionality is in the triangle of knowledge representation, BPM, and KM. In the case of the EULE tool, a knowledge-based system to support Business Processes in the insurance sector, several views, on the knowledge base, are allowed e.g. access via a terminology browser, and via a window which shows the various pieces of knowledge according to the knowledge source from which they originate (Reimer et.al, 2000).

Different projects demonstrate results of coupling workflow with document analysis and information retrieval (Abecker et. al, 2000). All document oriented solutions need an ontology or taxonomy to classify content. Ontologies that are used for KM in corporations must be capable of reflecting different interests, use cases, rapid changes etc. (Fillies et. al, 2003).

Batini et al. present a case study which provides evidence of the feasibility and effectiveness of the GovQual methodology. (Batini et al., 2009)

Belsis et al. (Belsis, 2007) describe the IT-supporting platform which has been experimentally applied in the case of an e-government case study (the Infosociety case study).

Mahmoodzadeh et al (Mahmoodzadeh, 2009) analyse the impact of business process management (BPM) and knowledge management (KM) on reduction of outsourcing risks and pitfalls, and they consider that a strategic KM approach can reduce such risks. They conclude that BPM and KM could reduce risks of outsourcing. The Business Process Outsourcing (BPO) lifecycle is based on coordinating BPM, and KM lifecycles.

6. Conclusions – Further work

The GovQual methodology (Batini, 2009) includes two main phases: (1) strategic planning to define the objectives, and "express them in terms of the improvement of a set of qualities" and (2) preliminary operational planning, to identify the organization of the projects and the technological solutions.

The establishment of a process oriented IT infrastructure by the use of business process modeling tools (e.g. ADONIS ADO) facilitates all the involved administrators in cooperative e-government administration projects on fulfilling their primary tasks, such as design, control and guidance of all the supervised projects. Main knowledge oriented functions could be supported, such as the detection of: Relative knowledge areas, Related capabilities/skills, Relative knowledge flows, Interrelation between Knowledge and skills

The aforementioned tasks consist of basic tasks essential for any KM function establishment (Belsis et al., 2007).

Using a framework through the described scenario in section 4 (Phases 1-6), we could facilitate the information workflow, and acquire better control over the several procedures that need to be followed, achieving knowledge exploitation and extraction the moment that is needed, especially in critical procedures such as project management, and project funding procedures.

In the future, we shall study how the Information System for e-Government administration projects could be enhanced, with more information process and knowledge management oriented applications. Such applications include the introduction of content and context based knowledge manipulation, integration of skills profiles into knowledge processes. Further exploitation issues will be examined through the activation of network-based applications, directly through ontology graphical representation schemes, where users select the skills profiles that assist them. A user-centered approach will focus on the way users fulfill their task by examining the ontology, and on the background a network based application brings them in contact with the selected profile(s).

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