Critical Features in Business Processes Modeling

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ABSTRACT

There are quite few models in the literature for the analysis and modeling of business processes. However, there is not a model that is general enough to include all practical aspects of business processes for analysis. This is one of the major drawbacks for these models. The goal of this paper is to identify a set of critical features under which real business processes may be adequately represented and addressed. The paper first provides a brief review of definitions of business processes and workflows; next the assumptions contained in major models, and then propose a set of desired features in modeling.

INTRODUCTION

Business process (BP) management has been a very active area both in academia and software industry in the last two decades. Some of the reasons are: (1) value - every organization has the desire to improve the efficiency and effectiveness of BPs, (2) dependency – BPs are highly dependent on technologies, information technologies (IT) in particular, (3) opportunities - the fast paced progress in information technology (IT) over the same period of time creates opportunities for business process improvements, and (4) IT/Business alignment - a competitive business today requires IT to be aligned with core business processes. The BP software industry responses to the needs of businesses; over two hundred BP management software are available in the market place. Recently, business processes extend functions from internal processes to cross organizational processes, such as supply chain process. Further more by taking advantage of the Internet, the software industry is developing "Web services" standards; business process modeling languages (BPML) and business process modeling notation (BPMN) are two important standards for constructing business process over the Internet. However, BP software have not been lived up to its expectations because of limited capabilities and weakness of methods employed. Workflow management - a closely related field of BP - despite much research, it still lacks of conceptual frameworks and theoretical models (Kumar and Zhao, 1999). One critical issue underlying the weaknesses is the absence of a commonly agreed upon framework that more completely characterizes the modeling environment of BP or workflow. This paper represents an attempt to identify the set of important assumptions under which real complex business processes can be analyzed and modeled.

WHAT ARE BP, BPM, AND BPMS?

Interestingly, the phrase "business process" is easy to understand but difficult to define. At this time there does not exist a universally acceptable definition. Part of the reason may be attributable to the ever expanding scope of BP – scope creep as in systems analysis. Mackenzie (2000) describes "processes" consisting of *events*, a *time-dependent sequence of events, entities, elements, relationship between a pair of elements, links to other processes, resources, and outcomes.* Zur Muehlen (2004) describes a (general) *process* as "a discrete, holistic, temporal and logical sequence of those *activities* that are necessary to manipulate an economically relevant object." He views "*business process"* as a specific process and a workflow a specific representation of a process. Hammer and Champy (1994) define BP as a set of partially ordered activities aimed at reaching a well-defined *goal*. So there is a wide spectrum of definitions of BP.

On the phrase "Business Process Management (BPM)"? Aalst, ET al (2003) define it 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*." BPM emphasizes the integration and management of business processes and *resources* across applications and business boundaries. And then there is the phrase "Business Process Management System (BPMS)". Weske, ET al (2004) proposes the following as the definition of BPMS: "A generic *software system* that is driven by explicit process designs to enact and manage *operational* business processes."

WHAT ARE "WORKFLOW SYSTEMS"?

Frequently in reading BP literature it is not uncommon that workflows were treated synonymously with BPs. According to the Workflow Management Coalition (WfMC) the *workflow* is:

"The automation of a business process, in whole or part, during which documents, information or tasks are passed from one participant to another for action, according to a set of procedural rules."

A *Workflow Management System* (WfMS) is defined as: "A system that defines, creates and manages the execution of workflows through the use of software, running on one or more workflow engines, which is able to interpret the process definition, interact with workflow participants and, where required, invoke the use of IT tools and applications."

Thus, a "workflow" defines who is next to performing the action according to a set of rules within a business process; a WfMS is a software system supports enactment of multiple workflows. Clearly there is a considerable similarity between the notion of BP and workflow, so does BPMS and WfMS. From now on workflow is viewed as a specific representation of BP (Muehlen, 2004). Next, we provide a review of the dimensions under which current BP/workflow models assume.

FEATURES IN BP AND WORKFLOW MODELS

1. Features of Business Process and Workflow Models Discussed Above.
   BP and WF discussed above involve such features as: *events*, *entities, elements, relationship between a pair of elements, links to other processes, resources, humans, organizations*, *applications*, *documents*, *information, goals, and outcomes.* A more comprehensive modeling of BP should have all those features although at the expense of higher complexity. Curtis, Kellner and Over (1992), and Kwan and Balasubramanian (!997) describe a framework for process and workflow modeling. They classify majority of these features into four critical dimensions, namely; *functional, behavioral, organizational, and informational.* However, their modeling is carried out by using separate modeling tools as opposed to an integrated setting.
2. Classification of Business Processes and Workflows
   Different categorization of BPs has been proposed. Melao and Pidd (2000) articulate pluralistic and multidisciplinary modeling approaches to BP. They classify BP into four categories; *deterministic machines, complex dynamic systems, interacting feedback loops, and social constructs* (BP is viewed as a subjective construction of the minds of people); not necessarily mutually independent. Other classifications of BP exist, for example; strategic, tactical, and operational processes; and system-to-system, system-to-human (and vice versa) processes. However, work/research has been done mainly on operational processes. Other categories of workflows are: *production workflow, administrative workflow, ad hoc workflow, and collaborative process.*
3. Competing BP Modeling Methods and Languages
   Depending on the purpose of the business process/workflow model, researchers propose different modeling techniques. They range from graphical languages to formal mathematical constructs. Here are major models/languages:
   i. **Petri Net**

The classical Petri net (Petri 1962) is a graphical process modeling language.

Workflow processes can be mapped to Petri nets and it is possible to incorporate resources (Aalst, 1994). However, modeling workflow systems with classical Petri net has many limitations. Three well-known Petri net extensions have appeared: (1) the extension with color to model data, (2) the extension with time, and (3) the extension with hierarchy to structure large models. This belongs to the category of complex dynamic process modeling.

ii. **Pie Calculus**

The founder of the Pi calculus is Robin Milner (1999). Briefly, the Pi calculus is a formal language for defining concurrent, communicating processes, including, but not limited to, business processes. Smith H. and Fingar P. (2003a, b) claim that Pi calculus inspires a breakthrough in the representation and execution of business processes, and is used by the new Business Process Management Systems (BPMS). A written detailed proof of this claim is not available (to the author's knowledge) at this time.

iii. **The Language/Action Perspective**

The language/action perspective (LAP) as originally introduced by Winograd and Flores (1986) has been applied to BP and workflow modeling (Weigand and Moor, 2003; Goldkuhl, 1996). The theme of the perspective is BP and workflow models contain *coordination* activities that use *communication process* that can address at the social level as the central means for achieving it; not simply by using data (viewed as a form of limited communication) analysis as in Petri nets.

iv. **State-Oriented Business Process Modeling**

Bider applies mathematical system theory to model business processes. He envisions business processes as dynamic goal-seeking processes in which process control acts as a mechanism for choosing activities that can move from the current state to the nearest final goal state.

v. **Trigger Model**

The trigger model (Joosten, 1994) is developed to describe a workflow as a dynamic system in terms of triggers. An event "e" *triggers* an activity "a" if the occurrence of "e" causes "a" to be performed. The trigger can be an event, activity and actor. A workflow system consists of *activities, roles* and *triggers* and activities are related to one another by a trigger relation, or triggered by external events. The trigger model can be mapped to a Petri-net.

vi. **Metagraphes**

Basu and Blanning (2000) utilize a graph-theoretic construct called a metagraph to analyze connectivity and interactions issues of activities, information and resources between workflow components. The approach may also model activity procedural constraints.

vii. **Event-Driven Process Chains**

A modeling approach (Scheer, 1998) adopted by SAP as the key component of SAP's enterprise resource planning system. Modeling includes analysis of: responsible entities and their relationships function (activity) flow, output flow, information flow, control flows, resource flows, human output flows, consolidated business process model, and a business process meta-model.

viii. **Business Process Modeling Language (BPML) and Business Process Modeling Notation (BPMN)**

As parts of the Web Services technology, BPML and BPMN provide standards for constructing business processes over the Internet. It has modeling elements: Events, activities, data objects, message flows (the flow of messages between two entities), and associations (to associate information and artifacts with flow objects). The area is new and is predicted to have a huge impact in business, industry and software sectors.

ix. **Unified Modeling Language (UML)**

UML is developed as a computer aided software engineering (CASE) tool, but it can also be used for general business process modeling capable of representing all important features. However, it lacks the theoretical basis.

CRITICAL FEATURES IN SUMMARY

To summarize, critical features for a modeling system should consider the following:

i. Key elements in modeling

Common elements used in modeling are: Procedure, task, information object, role, actor, goal, resource, event, responsibility/authority, state, constraint, rule…

ii. Modeling perspectives

It would be desirable to include multiple perspectives and functionalities in the modeling environment; for example, function, behavior, organization, information, social constructs, coordination, and system dynamics.

iii. Graphics and rigor

Because of the complexity of BP and workflow systems, any modeling approach would be made easier if it is accompanied by a graphical support tool. In addition, it is imperative that a model is created with a sound theatrical basis.

CONCLUSION AND FUTURE RESEARCH

Business process and workflow systems are important and practical. Knowledge of this area has grown significantly and is rather broad for study and research. A critical pre-condition for defining area of study/research is to define the required features of the modeling environment. This paper has come up with a recommendation of a set of features that a modeling environment should provide. Current developments by software industry are in standardizing business process language and notation under the Web services platform. Also, they are expected to impact the design and construction of new BP systems, cross organizational systems in particular.

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