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An Agile Business Process and Practice Meta-model

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Abstract

Business Process Management (BPM) encompasses the discovery, modelling, monitoring, analysis and improvement of business processes. Limitations of traditional BPM approaches in addressing changes in business requirements have resulted in a number of agile BPM approaches that seek to accelerate the redesign of business process models. Meta-models are a key BPM feature that reduce the ambiguity of business process models. This paper describes a meta-model supporting the agile version of the Business Process and Practice Alignment Methodology (BPPAM) for business process improvement, which captures process information from actual work practices. The ability of the meta-model to achieve business process agility is discussed and compared with other agile meta-models, based on definitions of business process flexibility and agility found in the literature.

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1. Introduction

Business Process Management (BPM) encompasses the discovery, modelling, monitoring, analysis and improvement of business processes. Traditionally, business processes are developed by creating a detailed model of such business processes, acquiring an IT-system to support them, and then implementing the system in the organizational practice [5]. One essential aspect of BPM is to guide the design of business process models through a well-defined-language, providing a syntax (rules to build model) and underlying semantics (concepts, and relationships among them). Properly defined languages allow to easily communicate and share models among stakeholders. Such languages are commonly known as meta-models. In a previous work, we proposed the Business Process and Practice Alignment Methodology BPPAM [19]. Rather than using traditional data collection techniques such as interviews and workshops, BPPAM provides a way to build business process models from daily actions in order to assure their alignment with actual work practices. A description of the supporting meta-model of the methodology can be found in [10].

In order to cope with increasingly dynamic business environments, BPM research is looking into the notions of process agility and Agile BPM, where a number of principles, methods and tools have been proposed to adopt an agile approach to BPM [2,4,5,7,16,17]. Our own experience in the application of the methodology on small organizations points to the need of incorporating agility principles in the methodology and adjusting the supporting meta-model. The changes introduced in the agile version of BPPAM are discussed in [11]. The goal is to harness changes in business process improvement needs through business process agility. Business process agility is defined as “the ability to dynamically modify, reconfigure, deploy and control a business process (and its various components) to accommodate required and potential needs of the firm” [14]. BPPAM stresses the need of achieving business process agility by accelerating business process model (re)design within both design and execution phases. The scope BPPAM is the process level i.e. on improvements of individual business process, and its target are small enterprises or organizations.

This paper describes the meta-model that supports the agile version of the methodology. The meta-model is adjusted to accommodate agility concepts and principles, including notions from dynamic control systems fundamentals [3]. The remainder of this paper is organized as follows: section 2 presents a brief discussion of the definitions of agility, business process agility and agile BPM, as well as an overview of traditional and agile BPM meta-models. It also discusses how agile approaches achieve agility, based on the definitions of the literature. Section 3 describes the proposed meta-model and compares it with the other agile meta-models. Section 4 summarizes our conclusions.

2. Related Work

2.1. Agility, Business Process Agility and Agile BPM

The definition of a meta-model for agile BPM entails a discussion of the meaning of the concepts of agility, business process agility, agile BPM. Several agile BPM approaches are based on the agility principles and agile methodologies from the software development field. Agile methods in software engineering emerged from the need of overcoming the limitations of traditional software development approaches to address constantly evolving business needs. The principles and motivation for agile software development (ASD) are expressed in the well-known Manifesto for Agile Software Development [7]. Agile software development cope with change by delivering early and frequent working software products through a continuous planning, execution and feedback loops, performed together by business people and developers. In spite of its extensive application, a thorough discussion around the meaning of agility and no complete agreement on the meaning of agility and ASD is still lacking [5].

In BPM research literature, various authors have addressed the refinement of the concept of agility and business process agility [7,13]. From a business perspective, agility as a concept is built upon the notion of flexibility in economics [6], where flexibility is defined as the ability to respond effectively to *changing* circumstances. The concept of agility also entails effective responses to *change* but it stresses that responses must also be *quick*. Hence, whereas both concepts entail responsiveness to changes, agility has associated a time factor. Sambamurthy et al [14] identify three types of agility; customer, partnership and operational agility. BPM focuses on operational agility,

referred by the author as the ability to rapidly redesign existing processes. Furthermore, operational agility has been defined at the firm and process levels. At the firm level, “management can add new processes and redesign processes across the organization to take advantage or exploit the conditions of the dynamic environment” [13]. Agility at the process level, entails “the ability to redesign and reconfigure *individual* business process components, combining individual tasks and capabilities in response to the environment” [13]. The author further refines the concept of business process agility as construct encompassing four components; (1) reconfigurability, (2) responsiveness, (3) employee adaptability, and (4) a process-centric view. *Reconfigurability* is related to the ability to adapt to changes. More specifically, it refers to the ability to add or change capabilities to new or improved business processes” [13]. *Responsiveness* is related to the time factor and it refers to the ability to react to changes in a proper and timely fashion. *Employee adaptability* stems from acknowledging that the agility assumption of continuous change requires knowledgeable people able of responding to such dynamic conditions. The latter component is related to the management perspective on the business process. Since business processes cross the boundaries of functional departments, managers with a *process-centric view* will be more capable of understanding the business process from end to end than managers with a functional view. Thereafter, an organization with a process-centric view is better prepared for process agility since it is more able to adapt to changes at the process level than organization with a functional view.

The overlap existing between the concepts of flexibility and agility, requires distinguishing between approaches seeking business process flexibility and business process agility. The former deals with how much can business process execution deviate from business process models. Flexibility in BPM means designing processes where the participants have more degrees of freedom when performing a business process i.e. in deciding who performs an activity, when to perform it, the resources used, etc. Bider and Jalali [5] summarize four categories to achieve process flexibility; (1) *Flexibility by design* which means to contemplate all possible scenarios at design time, (2) *Flexibility by under-specification*, which separates the definition of flexible points from the process models by defining a placeholder for those points, (3) *Flexibility by deviation*, which allows the process to deviate from the normal path at runtime at any point, and (4) *Flexibility by change* proposes to adapt processes to change at runtime. A more radical flexibility is achieved by using a declarative way of defining business processes. An example is to use as few as possible constraints specifying what is forbidden through rules. The latter form of flexibility is well suited for processes where people can decide the order of activities on the fly i.e. at runtime.

Regarding agility, Bider and Jalali [5] define agile BPM as the capability of adjusting to changes in business needs or discovering opportunities in dynamic business environments. According to the authors, “becoming agile requires setting a structure that allows discovering changes and opportunities as soon as possible and react on them appropriately”. Hence, agile BPM distinguishes from managing flexible processes not only in introducing a time factor (*Responsiveness*), but also in the origin and degree of change that both aim at addressing. Flexible business process address variable degrees of deviation from designed process, but all aforementioned approaches assume that the process remains essentially the same. Changes addressed by flexible processes are mostly due to unexpected situations or lack of information. Agile BPM aims to harness changes in the business environment that could lead to require radically different, or even totally new processes. This goal is consistent with the *Reconfigurability* component of business process agility.

2.2. BPM Meta-models

As a result of several standardization efforts, BPM research and practice provides various BPM meta-models that capture functional, informational and behavioral aspects of business processes. Table 1 summarizes the main concepts used in specifying three BPM meta-models, that are relevant for our work. These concepts are grouped in process components, connectors, resources and attributes specific to each meta-model. The Business Process Modelling and Notation (BPMN) is the de facto standard for the graphical specification of business processes and services [6]. In a BPMN Process meta-model, a Process is composed by several *FlowNodes* (*Activity*, *Event*, *Gateway*) connected by *SequenceFlows*. A *SequenceFlow* shows the order in which activities are performed in a process, and relates activities, gateways and events to each other. A *Process* has several resources that will perform or will be responsible for that Process which are designed by *ResourceRole*. As depicted in Table 1, the Quality-Oriented Business Process Meta-Model (QOBPM) [8] uses similar business process components, connectors and

resources but includes various quality attributes such as *reliability*, *performance*, *efficiency*, and *availability*. These attributes represent dimensions that group together single quality factors, which are related to the process as a whole or to its components. The Transactional Meta-Model for Business Process (TMBP) [18] has the following distinctive features; it includes an Organizational layer that shows organizational concepts (*OrganizationalUnit*, *OrganizationalRole*, *FunctionalRole*, *Actor*) and its relation with business processes, it enables reusing *BusinessProcessPatterns* from a catalogue drawn from best practices to model certain business processes, and it allows decomposing business processes in *subProcesses* (when the responsible is an *OrganizationalUnit*) or in *BusinessTransactions* (when the responsible is a specific *Actor*). *BusinessTransactions* are decomposed in *Tasks*, which require specific *FunctionalRoles* (skills or competencies).

Table 1. Relevant business process concepts of three BPM meta-models

Meta-model	Process Components	Process Connectors	Process Resources	Organizational Features	Specific Features
BPMN	<i>Flownodes</i> { <i>Activity</i> , <i>Event</i> , <i>Gateway</i> }	<i>SequenceFlows</i>	<i>ResourceRole</i>		
QOBPM	<i>ElementObject</i> { <i>Activity</i> , <i>Event</i> , <i>Gateway</i> }	<i>Connectors</i> { <i>SequenceFlows</i> , <i>MessageFlows</i> , <i>Associations</i> }	<i>InputSet</i> , <i>OutputSet</i>		<i>Quality</i> { <i>Reliability</i> , <i>Performance</i> , <i>Efficiency</i> , <i>Security</i> , <i>Availability</i> }
TMBP	<i>SubProcess</i> <i>BusinessTransaction</i> <i>Tasks</i>	<i>Routing</i> { <i>Previous</i> , <i>Next</i> }	<i>Tool</i> , <i>Item type</i>	<i>OrganizationalUnit</i> , <i>OrganizationalRole</i> <i>Actor</i>	<i>Functional</i> { <i>Skill</i> , <i>Competence</i> } <i>Catalogue</i> { <i>BusinessProcessPattern</i> }
BPPAM	<i>Activity</i> <i>Behavior</i>		<i>Product</i> <i>Business Role</i>	<i>Actor</i> <i>BusinessArea</i>	<i>Service</i> { <i>Value</i> , <i>Business Product</i> , <i>Business Service</i> , <i>Business Collaboration</i> , <i>Business Interface</i> } <i>Actions</i> { <i>Action type</i> , <i>Resource Item</i> , <i>Agent</i> , <i>Contexts</i> }

As aforementioned, the previous BPPAM version has the distinctive feature of providing guidance about how to gather patterns regarding work practices and knowledge, to contribute to business process improvement. As a result, the BPPAM meta-model is composed by 3 layers; (1) Service, (2) Structure and (3) Action Layer. The *Service Layer* describes the *Business Products* and *Business Services* offering some *Value* for external costumers, which involves some *Business Collaboration*. The *Business Process* layer describes the *Business Processes* used in providing a *Business Service*. *Business Processes* are composed by *Business Activities*, which can also be available as *Business Service* through a *Business Interface*. Each *Business Activity* consumes and produces a *Product*, and are performed by *Actors* playing a specific *Business Role*. Both *Business Activities* and *Business Processes* define a *Behavior* representing the best practices that guide the organization. A *Business Area* is an organizational unit responsible for one or more *Business Activities*. Hence, a *Business Process* encompasses several *Business Areas*. The *Action Layer* complements the *Business Process* and *Service Layers* by providing the concepts required to model work practices. Work Practices distinguish from business processes in that they do not represent standardized, normative behaviours. Rather, they reflect behaviour of particular individuals in particular circumstances. Work practices involve people engaged in activities over time, using specific tools (machines, documents, etc.). The main concepts used in our methodology to model work practices are *Agents*, *Resource Items*, *Action Types* and *Contexts*. The meta-

model adjustments for the agile version of BPPAM were concentrated in this layer. Hence, the meaning of these concepts, as well as their relationships among them and with concepts of other layers is described in section 3.

2.3. Agile BPM Meta-models

Alexopolou et al [2] address the problem of business process that fail to satisfy changing organizational needs by introducing agility in business processes through an event-centric BPM approach that identifies meaningful events that drive action execution. For the authors, business process agility means the capability of adjusting and modifying business processes upon unexpected contingencies even during their execution. This capability entails a BPM approach where business process design and execution take place in parallel and there is a continuous interaction among both phases. The supporting meta-model defined encompasses the following concepts: *Event*, *Action*, *Unit*, *Actor* and *Data Folder*. *Events* represent meaningful facts that take place and cause another *Event* or an *Action*. *Complex Events* are combinations of events through causal or logical relations (and, or). *Actions* are primitive units of functionality. Logically related actions are grouped together and form higher-order functionality *units*. The interaction among units is represented with *Boundary Events*, which can be incoming or outgoing. Hence, *units* A and B interact when *unit* A has an outgoing event that is an incoming event of unit B, or vice-versa. This meta-model regards actions as autonomous units only aware of their triggering and triggered events, in order to eliminate predefined business processes sequences. The authors posit that this autonomy foster agility as it increases a modular enterprise functionality modelling. However, according to the definitions given section 2.1, this work actually aims at business process flexibility rather than business process agility. In particular, the approach corresponds to the latter form of flexibility, which uses a declarative business process specification.

Table 2. Agile BPM Meta-Model [17]

Scope	Process Roles	Planning Level	Project Roles	Meetings	Artefacts	Tools-Techniques
Process	Process Owner Process Manager Process Participant	Project Sprint Release	Stakeholder Team { Agile BPM Master, Agile BPM Proc. owner, Team Member }	Sprint planning Daily meeting Sprint Review Sprint Retrospective Backlog grooming	Project artfs. Sprint artfs. Sprint backlog Process backlog Backlog item { Epic, User Story, Tasks,...} BPM artfs. { Process model, Process status, User Task, Org. Chart, KPI, }	Story Mapping Team maturity Team Weather

To address the problem of changing requirements, Thiemich and Puhlmann [17] combine a traditional BPM methodology with agile software development and define a supporting meta-model (depicted in Table 2) that puts together BPM process-related concepts with project concepts following agile principles and methodologies. The concepts are grouped in the following categories; *Scope*, *Process Roles*, *Planning Level*, *Project Roles*, *Meetings*, *Artefacts* and *Techniques and Tools*. The category *Scope* contains a single concept; *Process*, which represents the process to be improved. The methodology defines three *Process Roles*; *Process Manager*, *Process Owner* and *Process Participant*. *Planning Level*, *Project Roles*, and *Meetings* encompass project-related concepts that are based on the Scrum Methodology [14]. *Planning Level* and uses the concepts *Project*, *Sprint* and *Release* to define the project structure in terms of sprints, and associate each sprint with a specific version of the process within the scope of the project. The *Project Roles* defined are *Stakeholder* and *Team*, where the team is composed by an *Agile BPM Master*, *Process Owner* and *Team Member*. The *Meetings* categories groups together the type of meetings that take place during a sprint and include the same type of meetings the defined in the Scrum methodology. The *Artefacts* category groups a set of project, sprint, process and BPM artefacts. *Project* and *Sprint* artefacts use the same artefacts used in Scrum. This methodology defines two types of backlogs (set of tasks to be completed), one for each

sprint and one for the Process. Both encompass a list of *Backlog Items*. Backlog items are described as *User Stories*, which can be grouped in *Epics*. Each *User Story* has a theme, an acceptance criteria and one or several *Tasks*. BPM artefacts encompass typical BPM artefacts that document the process to be improved such as its model, tasks, status, and key performance indexes (KPI). It is noteworthy that *User Story Tasks* are related and thus, are also part of BPM artefacts. The latter category groups a set of tools and techniques mostly drawn from Scrum used in producing the aforementioned artefacts. In summary, the Agile BPM meta-model indicates that methodology introduces business process changes through projects. The wide application of Scrum concepts, as well the definition of specific process and project roles, foster *Reconfigurability*, *Employee Adaptability* and *Process-centric view* components of business process agility (section 2.1). Nonetheless, the effort of putting in place a project are only justified when the number of required changes are deemed sufficient by the organization, and thus several changes would have to wait for a project to be initiated. Hence, the methodology is not *Responsive* enough to be well suited for continuous process improvement ends.

3. Proposed Meta-model

The revised version of our methodology combines traditional and agile BPM approaches to enable truly continuous process improvements. Whereas modelling the service and structure layers described in section 2.1 follow a traditional BPM, agility is infused in modelling work practices, which are captured through action layer concepts. Hence, the adaptations were concentrated in this layer. The main concepts of the updated meta-model are depicted in figure 1. **Agents** are specific individuals or groups. **Goals** are defined as an agent's aims or desired results. In order to be captured, goals must be observable and measurable. Due to the multi-tasking nature of work, agents play different business roles, which define specific patterns of behavior composed by several **actions**. It is important to note that agents typically interleave among several roles. At any given moment, agents execute actions and interactions according to patterns of behavior defined by the particular role(s) played at that moment.

Actions are units of behavior executed by **agents** that change the state and produce an *observable* and *measurable* outcome or result on a given **resource item**. Actions may also require to use resources. **Resources items** are material or abstract entities (information, knowledge, etc.) relevant for the operation of the organization. Actions can be **communicative** or **non-communicative**. **Non-communicative** actions change the state and produce an *observable* and *measurable* outcome or result of a **material** or **abstract** resources. **Communicative actions** are essential for coordination and collaboration ends. They involve two or more agents: a *sender* and a *receiver*. A communicative action produces an observable and measurable result on the *receiver*. Hence in this case, the receiver is also a (human) resource. **Communicative actions** typically trigger other actions. **Interactions** are pairs of communicative actions where the first initiates a communication from a sender to a receiver and the second is a reply to that communication. **Conversations** are a sequence of interactions around a given business *subject*. Conversations create **interaction contexts** that tell a *story* of that particular *subject*. Conversations are constrained and supported by **interaction patterns & rules**. **Interaction patterns** are recurrent sequences of actions and interaction. Sometimes these patterns emerge from explicit or tacit **interaction rules** shared among agents participating in a given interaction context, other times they simply reflect habits or preferences of those agents. Finally, interaction patterns and rules represent agents' **work practices**.

In order to infuse agility by rapidly identify and reacting to changes in work practices, we draw on the idea of using dynamic control systems to address enterprise transformations [1]. Thus, work practices are managed through feedback loops comprising *defining*, *executing*, *evaluating*, and *redefining* work practices. This feedback loop is distributed among all agents. Regardless of the business role played, *all agents* evaluate the results of their actions and interactions. Upon changes on business needs, and depending on the frequency, dimension and degree of unpredictability of the change, agents may redefine their goals, change their pattern of behaviour or even defining a totally new behavioural pattern. In the former case, agents apply control measures and thus, play the role of a **controller**. When they change their patterns of behaviour or create new ones, they play the role of a **modeller**.

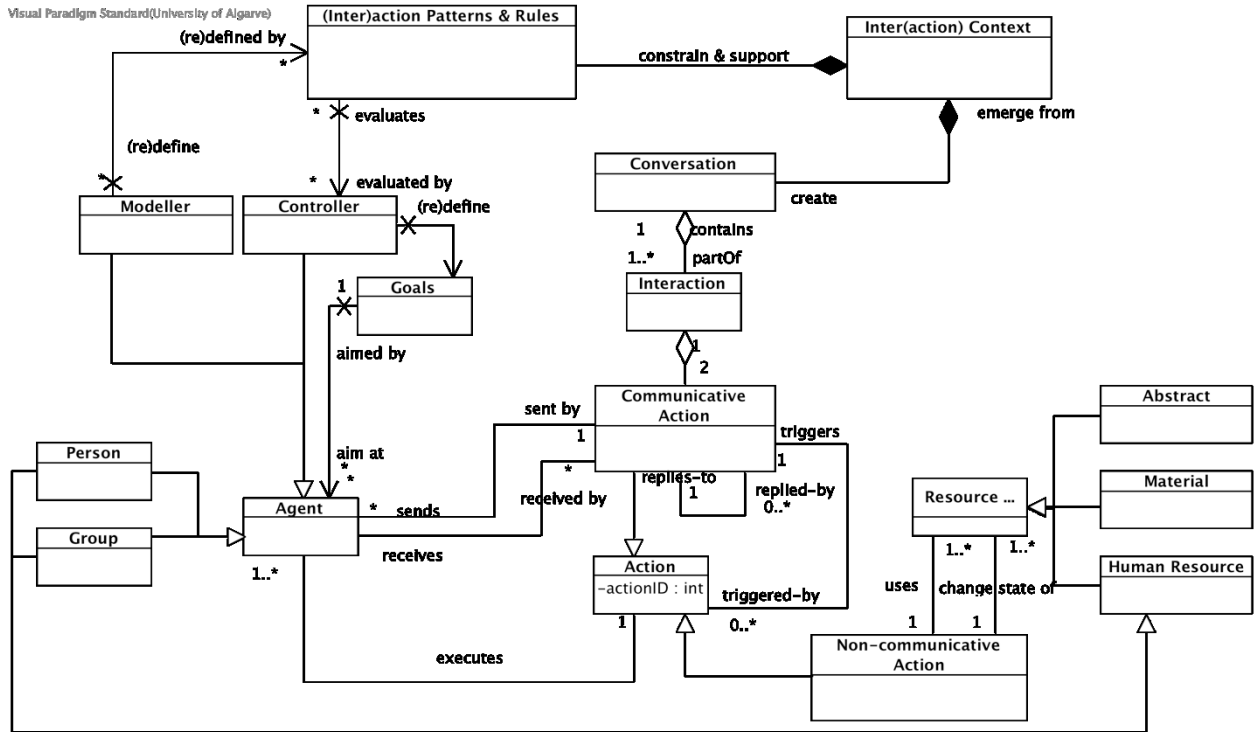


Figure 1. Revised meta-model for the action layer

Changes in work practices may produce negative outcomes i.e. deviations or positive outcomes i.e. innovations. Hence, changes per-se should not be discouraged. Rather, mechanisms for their detection, analysis and eventual integration in current business models need to be devised. That is the main goal of our methodology. Figure 2 depicts the concepts involved in such integration. The analysis of work practices i.e. action an interaction patterns that emerge within interaction contexts allows identifying changes related to **business activities, roles and products**. It is noteworthy that a work practice may be related to several business activities and a business activities may encompass several work practices. Thereafter, a proper integration cannot be fully automated since it requires discussion, negotiation and agreements among all participants.

4. Conclusions

This paper summarizes a set of traditional and agile BPM meta-models focusing on different concerns of business processes. Two BPM meta-models claiming to be agile are described and their suitability regarding their agility is discussed, based on definitions of business process flexibility and agility from the literature. As a result, we conclude that the event-centric approach presented in [2] aims at business process flexibility rather than agility. The Agile BPM meta-model [5] reflects the combination of traditional and agile BPM using a layered meta-model composed of project and process layers that show how the methodology feeds business process changes through projects. The meta-model of the agile version of our methodology also reflects a combination of traditional and agile BPM through layers where business process changes are fed through daily work practices, captured and modeled in the action layer. We posit that while both approaches satisfy to some extent all business process agility components, the agile BPM meta-model hinders the *Responsiveness* required for continuous process improvement, since changes are implemented only within the scope of a project. With the implementation of dynamic control of work practices through feedback loops and enabling all participant agents to play controller and modeler roles, our methodology and supporting meta-model seek to foster responsiveness in business process improvements with any frequency deemed appropriate by the organization. The meta-model proposed in this paper will be validated through case

studies in conjunction with the agile version of BPPAM through case studies. In this sense, it is noteworthy that BPPAM does not propose a blind application of its agile version for all situations. Rather, it specifies criteria that defines the circumstances where its application is appropriate. Thereafter, the case studies will be directed to situations where such circumstances are present.

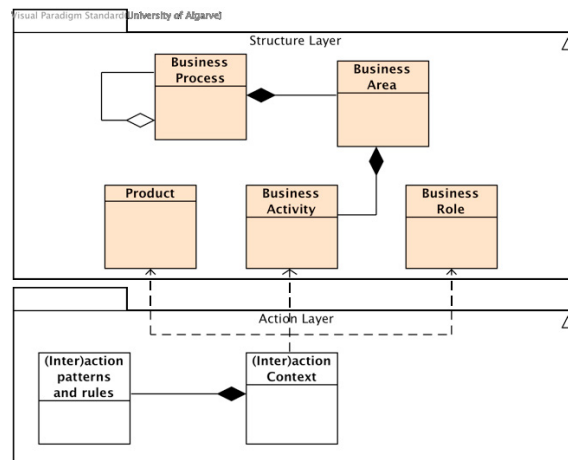


Figure 2. Concepts involved in work practice integration into business processes

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