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Business Process and Practice Alignment Meta-model

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Abstract

Business Process Modelling (BPM) is one of the most important phases of information system design. Business Process meta-models allow capturing informational and behavioural aspects of business processes. Unfortunately, standard business process meta-modelling approaches, such as the Business Process Model and Notation (BPMN) Meta-model, Quality-Oriented Business Process Meta-Model (QOBPM) and Transactional Meta-Model for Business Process (TMBP) focus just on process description, providing different business process models. According to these meta-modelling approaches, it is not possible to compare and identify related daily practices in order to improve business process models. This lack of information recognizes that further research in Business Process (BP) meta-model is needed to reflect the evolution/change on software processes. Considering this limitation in BP meta-modelling, this paper presents a comparative study of the most recognized business process meta-models approaches and introduces a new BP meta-model designed by Business Process and Practice Alignment Meta-model (BPPAMeta-model). Our intention is to present observed problems in existing approaches and propose a business process meta-model that addresses features related to the alignment between daily work practices and business process descriptions.

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1. Introduction

Business process modelling (BPM) specializes on describing how activities interact and relate with each other, and how activities interact with other business concepts such as goals and resources, where resources may be material and informational entities, as well as human or automated actors. BPM emphasizes process notions (workflow, decision, information, activities) as the dominant dimension [4]. However, BPM would benefit from a better understanding of other elements that contribute to process execution such as people and human interactions, products or tools used, specific vocabularies, preferences, habits and rules. Moreover, it has been argued that existing BPM languages don't offer support in keeping up-to-date the continuously evolving knowledge coming from business process execution [5]. Business processes are executed through human and automated activities. Whereas many business processes are fairly static only at a high level, at finer-grained levels such as activities, are more agile and unpredictable. Indeed, many organizations do not know their end-to-end processes accurately or in detail, since the knowledge required for its execution is tacit and decentralized [6]. Recent research in BPM is aiming to address the unpredictability of business processes [7, 8] but there is yet little help in addressing the problem of tacit knowledge and business process model maintenance.

From our point of view, what appears to be unpredictable behaviour does not mean chaos. Indeed, it follows certain rules. The rules followed in the execution of activities and tasks can be uncovered by capturing work practices. Work practice is a concept that originates in socio-technical systems, business anthropology, work systems design, and management science [9]. Work practices are behaviours of specific individuals, performing specific activities, in specific circumstances, exhibited as action patterns. Work practices involve people engaging in activities over time, not only with each other, but also with machines, tools, documents, and other artefacts. The importance of work practice modelling is essential in (1) providing a deeper understanding of the human activities composing business processes, and (2) assessing the alignment between process models and actual execution [10].

Considering the aspects described previously, the authors proposed a Business Process and Practice Alignment Methodology (BPPAM) [11] for business process improvement, which set out principles and strategies for improving quality of business processes. This methodology provides guidance about how organizational practices and knowledge are gathered to contribute for business process improvement against recognized approaches that may not suit for these specific circumstances. A key driver of BPPAM, concerning business process improvement, is the ability to facilitate the alignment of business processes improvement activities and daily work practices. In this regard, this paper focuses on a meta-model to integrate daily work information into coherent and sound process definitions.

The remainder of this paper is organized as follows: section 2 presents a brief analysis about business process meta-models and work practice modeling. In section 3 we present the proposed Business Process and Practice Meta-model (BPPAM). Finally, section 4 concludes and discusses future trends.

2. Related Work

This section describes several business process meta-models, a subject of several standardization efforts. These meta-models are a basis to the BPPAM methodology, briefly described in the introduction. These meta-models comprise a set of concepts to capture several aspects of business processes. In particular, the business process meta-model allows capturing functional, informational and behavioural aspects of business processes. The following present an outline of three meta-models with the strengths and weakness of each approach to justify the creation of our meta-model proposal, we do not represent each meta-model in full detail.

The Business Process Model and Notation (BPMN) Meta-model [1] was defined by the Object Management Group as a de facto standard that holds all definitions common to process oriented models. The BPMN is structured in several layers, the most important is the Core layer that contains 3 sub-packages: *Foundation*, a package with fundamental constructors for modelling; *Service*, a package that includes constructors for services and interfaces modelling; *Common*, a package with the classes that are common to the layers of *Process*, *Choreography* and *Collaboration*. Since our focus is business process meta-modelling approaches, we only describe the Process meta-model and ignore the others because they are out of scope of this study.

The meta-classes of the Process Meta-model are depicted in Fig. 1, the illustration shows the term *Collaboration* used to model interactions between processes. A *Process* contains 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*.

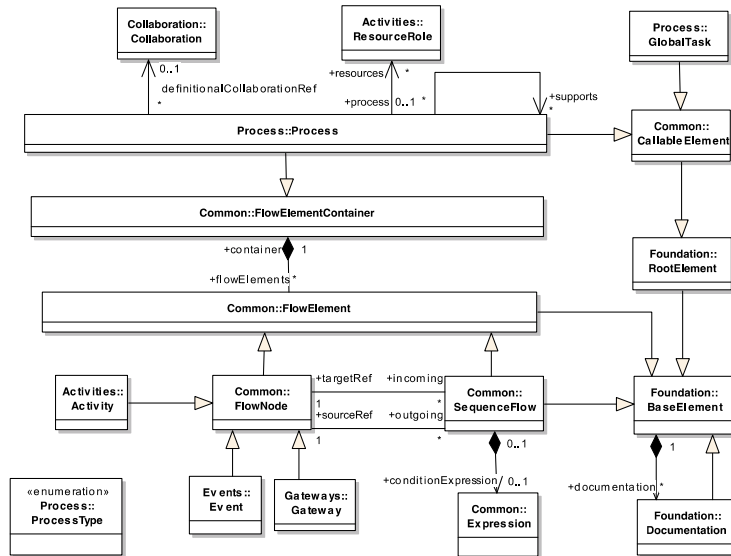


Fig. 1 BPMN Meta-model [1]

The Quality-Oriented Business Process Meta-Model (QOBPM) [3] besides providing a unified view of all business process constructs and related quality dimensions also serves as a basis for business process quality evaluation. The main contribution of this approach was the assignment of quality information meta-classes to the corresponding business process constructs, which are grey-colored in Fig. 2. The different types of elements of a business process are: Activity, Event, Gateway and Connectors. This meta-model has been designed integrating the concepts existing in seven different business process modelling techniques (BPMN, IFED0, IFED3, RAD, UML-AS, SADT and EPC).

The Transactional Meta-Model for Business Process (TMBP) [2] is composed of five packages: *Business Process*, *Organizational*, *Resource*, *Routing* and *Catalogue*. The *Organizational* package differentiates between functional and organizational roles (Fig. 3). The *Resource* package identifies different types of resources. The *Routing* package determines the order of tasks execution. The *Catalogue* package allows the selection of the best design pattern from a catalogue of business (sub-)process patterns to model certain business process. The *Business Process* package describes a business process can involve several business transactions that can be decomposed into tasks. The relationship between the package meta-classes and the *actor*, *resource*, *organizational unit*, *skill* and *routing* meta-classes of the other packages are also included in the diagram.

Some research efforts in work practice modeling include a context model and representation language developed by Pomerol and Brézillon [12]. A premise of this work is that the main distinction between operational practices is the *context* where these practices apply. Their model of context relates the notion of context and knowledge. Sierhuis and Clancey [13] propose an activity-based multi-agent modeling environment to model work practices. The authors develop a notion of situatedness supported by the following concepts; (1) *people* and *knowledge*, (2) *situated action*, (3) *situated cognition*, (4) *situated learning* and (5) *autopoiesis*. As a result, the representation language BRAHMS (Business Redesign Agent-based Holistic Modeling System) was developed to model knowledge in situated actions and learning in human activities.

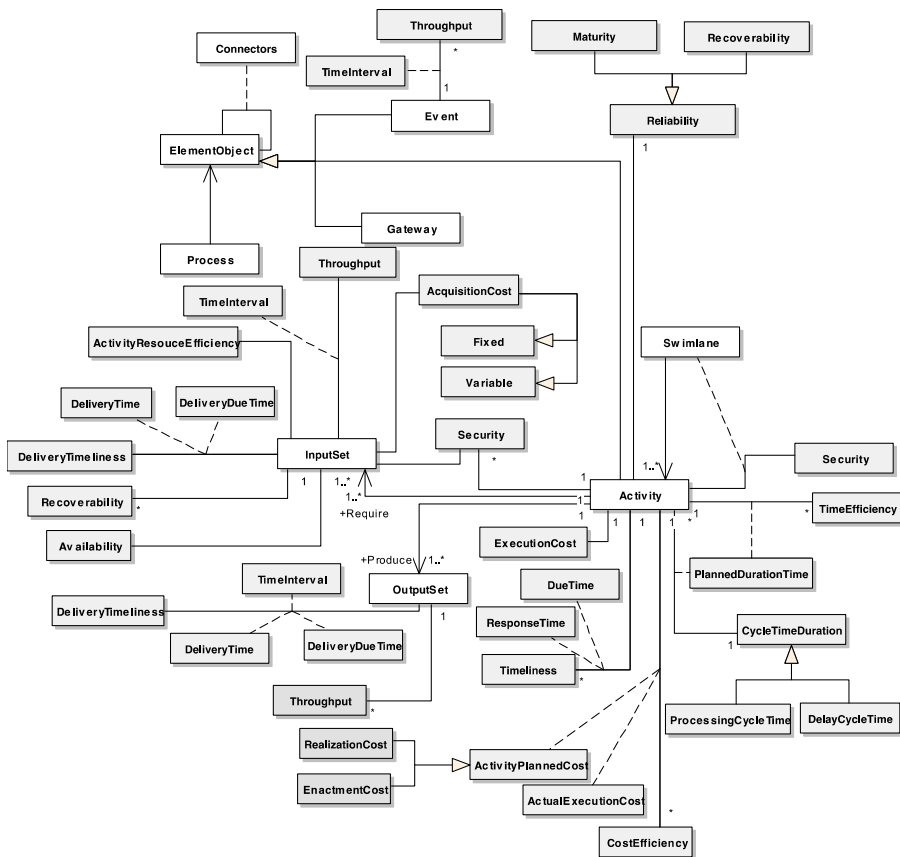


Fig. 2 Quality-Oriented Business Process Meta-model [3]

Work practices are modeled using the concepts of the deliberation layer, where personal and inter-personal activation rules refer here to *scheduling rules*. Since scheduling rules show how people manage themselves, they do not focus on the particular tasks or resources enabled upon context activation. Rather, they simply indicate when personal contexts are activated. It is important to emphasize that these proposals allow capturing *context switches*, rather than task switches. Summarizing, multitasking behaviour is captured identifying (1) the different action contexts handled by individuals during particular time periods, (2) the context switches performed and (3) recurrent switches and the actions or commitments triggering those switches.

Although, there is no current standard core business process meta-model, all the three meta-models presented use more or less the same concepts and don't support work practice modeling. As final conclusion, BPMN also integrates orchestration and choreography. The QOBPM considers all possible constructs of a business process but enriched with quality information to effectively assess the quality of business processes. Finally, the TMBP links organizational structure aspects with business (sub)process and makes it feasible the reuse of business (sub)process patterns to create business (sub)process. Concerning the research related to work practices modeling, existing approaches don't address task switches and ignore the alignment with business process. However, these proposals don't address the alignment between work practices and business process. These meta-models present some limitations, such as the relation with work practices constructs that are not considered in business process meta-models.

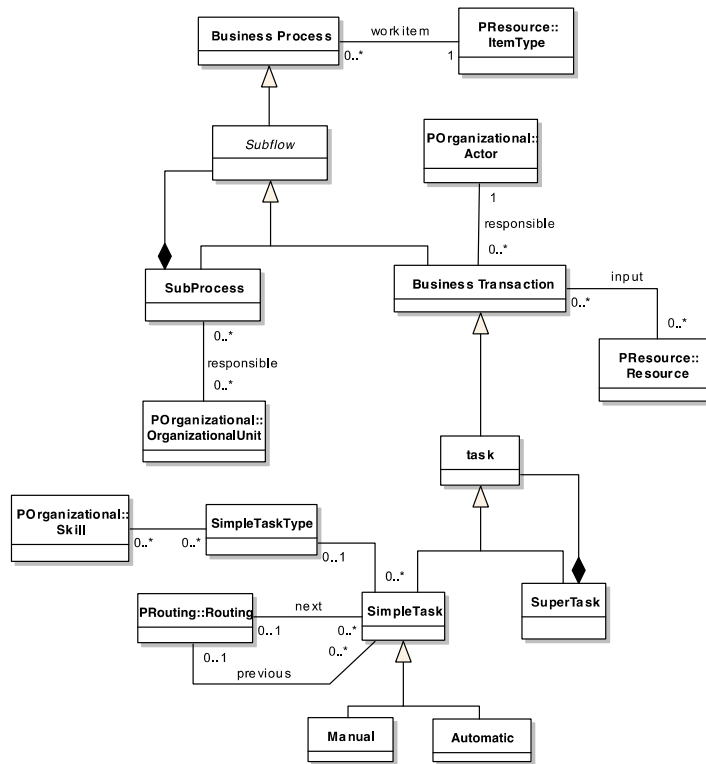


Fig. 3 Business Process package (TMBP) [2]

3. BPPAMeta-model

Business Process and Practice Alignment Methodology (BPPAM) intends to establish disciplined business process practices based on daily actions. To support this approach, it is important to define and describe business processes and daily practices.

Business process modelling aims to describe the actually performed business process, the models are used as the basis for understanding and analysing processes, improving existing processes, as a baseline for process changes or for disseminating process knowledge. Nevertheless, existing meta-modelling approaches don't cover aspects related to daily actions and also do not solve the gap regarding how to use elements from daily practices to create business process elements. In order to provide support for these aspects, an extra layer is included in our meta-model. This extension also intends to describe the relation between business processes and daily practices. Fig. 1 illustrates BPPAM meta-model that has three layers: **service layer**, **structure layer** and **action layer**. Each layer is focused on a specific set of concerns and encompasses several elements that describe the concerns of the layer. Considering the complexity of the action layer, the representation of its elements is showed in a separated figure (Fig. 4).

The service layer offers business products and business service to external costumers, which involves some business collaborations. The basic elements are:

- **Business Service** – unit of functionality that supports a business that hides internal activities.
- **Business Product** - goods that are sold to other businesses, and used to produce other goods.
- **Business Value** – satisfying the needs and expectations of the costumer.
- **Business Collaboration** – join effort of multiple work groups to accomplish a business service.
- **Business Interface** – point of access where a set of activities is made available to costumers.

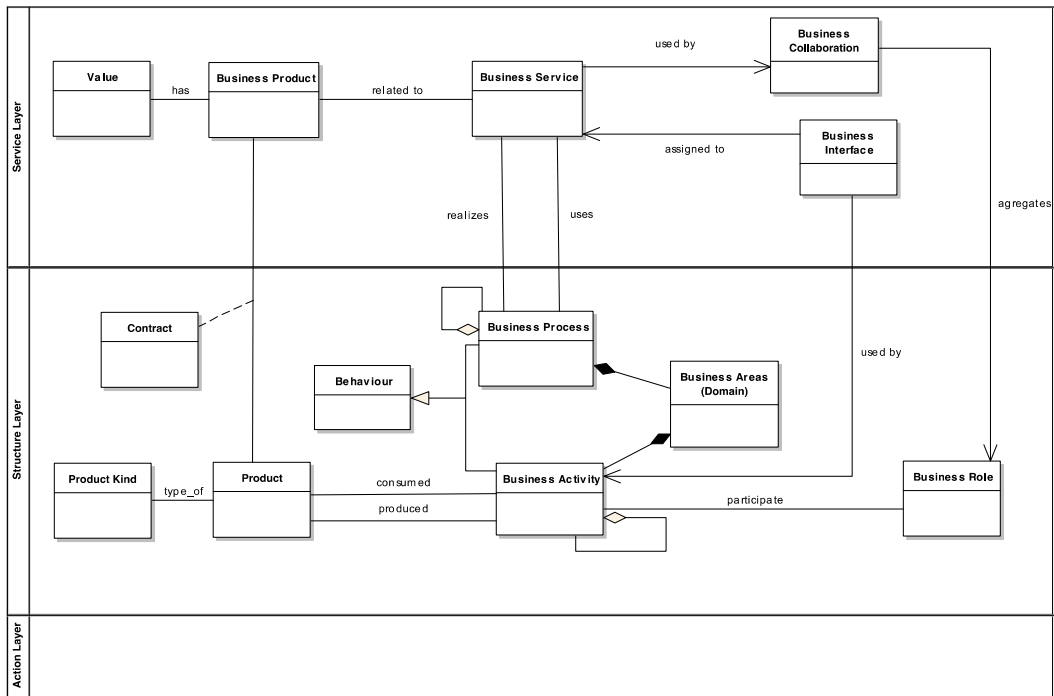


Fig. 4 BPPAMeta-model

The structure layer of the BPPAM meta-model represents the elements (meta-classes) that are relevant for modeling the functional aspect (activity, process), informational aspect (product and product kind), behavioral aspects and organizational aspects (role and actor). These basic elements are:

- **Behaviour** – best practices that guide an organization.
- **Business Process** - is a behavior element based on a set of ordered activities. It is intended to produce products or business services.
- **Business Area** – an organizational unit corresponding to a defined business segment or area of responsibility.
- **Business Activity** – unit of work that consumes and produces products.
- **Product** - item that is produced or consumed during business activities. One or more roles develop a product in the performance of one or more activities. □
- **Product Kind** - represents several types of products. Work products can be classified in several types, which identify the kind of input or/and output expected in an activity. □
- **Contract** - formal or informal specification of agreement that specifies the rights and obligations associated with a business product.
- **Business Role** – responsibility for performing specific activities in order to produce, either directly or □ indirectly, versions of one or more products. □
- **Actor** – organizational entity that performs one or more business roles.

Enriching business process meta-model with work practice information results in the action layer. In order to build a work practice Meta-model (WPM); there is a need for identifying the corresponding work practices constructs before the alignment with business process constructors. Fig. 5 proposes an extension to the meta-model concerning work practice expressed in terms of entities and the relationships among them. The proposal conveys the following ideas:

- The entities individual, dyad and group that can be regarded both as actor or resources (of other actors).
- As actors, they perform several actions that use different kinds of resources (including other individuals, dyads or groups).

- **Actions** are not strictly classified into tasks, projects, etc. Rather, action streams are grouped in personal contexts.
- A single **individual** handles several personal contexts. At any given moment, individuals use personal scheduling rules to choose the context to work in. Likewise, two individuals (**dyad**) and **groups** activate **inter-personal** and **group contexts** using shared scheduling rules.
- An inter-personal context relates two personal contexts of two different individual. Hence, the same two individuals (a unique dyad) may share several inter-personal contexts. □
- Personal and inter-personal contexts may be related to one or several tasks/projects. Conversely, tasks/projects may be associated with several contexts.
- **Actions** create, update or delete **resource**-related items. These items may be related to one or more formal resources. Conversely, several items may compose a formal resource. The association of items with formal resources is user-defined. □
- **Communicative** and **non-communicative actions** must be distinguished. The relationship of communicative actions with the obligations (to-dos) and commitments created, updated or cancelled by them, need to be provided. □
- The notion of a person’s state is included. This state is described in terms of the set of actions to-do and shared commitments. Knowing the person’ state allows defining scheduling rules based on current commitments and actions to-do. □
- Currently, the identification of the current context of an individual is based on the actions performed and resources used. This identification can be greatly enhanced if personal, inter-personal and group-level scheduling rules taking into account the individual state were known.

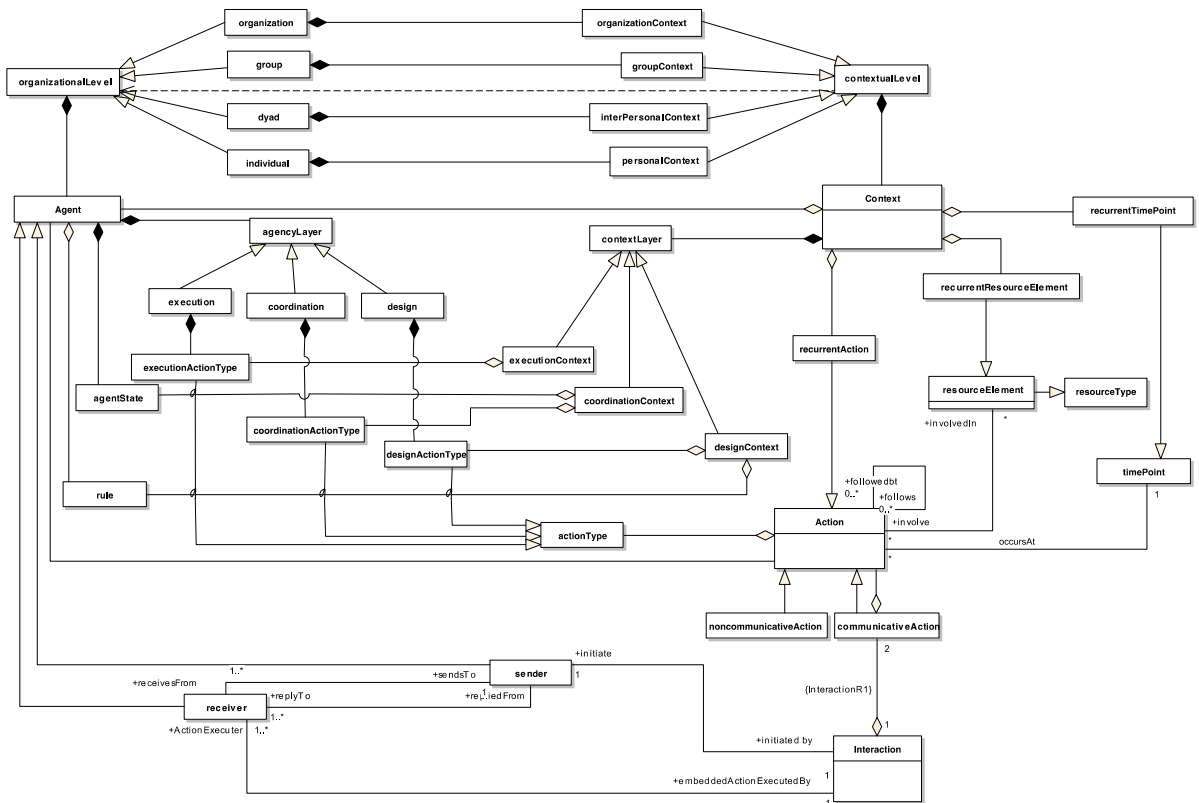


Fig. 5 Action layer of the BPPAMeta-model

The action layer of our meta-model describes a set of constructors to represent the relevant issues of

organizational daily work practices. By instantiating the entities of the meta-model we are able to identify and map work practice constructors to business process constructors. This facilitates analysis and decision-making using views of different actors (individual, dyad and group in the action layer) to describe the actual business process of an organization (structure layer). The alignment between aspects of the action layers and its related business process aspects (Fig. 6) is motivated by two considerations. First, daily actions change over time, and second, that change can be problematic since increases the gap with actual business process descriptions. This continued alignment is crucial for the capacity to manage change.

At the action layer, context is regarded as a group of related actions (personal action and interaction). At this level, personal action context reflects the personal view that the individual has of a given interaction context. The interaction context captures typical interactions between any two individuals. Whereas any two individual share a single inter-personal relationship, they may share several inter-personal contexts. The inter-personal context represents interaction rules shared by two individuals, which governs the interactions patterns among them. The relationship of these patterns with business activities in the structure layer needs to be established through the identification and analysis of such contexts.

At the action layer, each interaction type is related to a specific set of resources types that enable, but also constrain, agent interactions. This relationship is essential to identify and associate products that consumed and produced by business activities in the structure layer.

At the action layer, each agent involved in the execution of specific actions must present a set of abilities and obligations. This means that is possible to infer specific roles (structure layer) of a business process based on agent abilities.

The dependencies of the constructors along these two layers (action layer and structure layer) form the structural backbone of the meta-model (BPPAMeta-model).

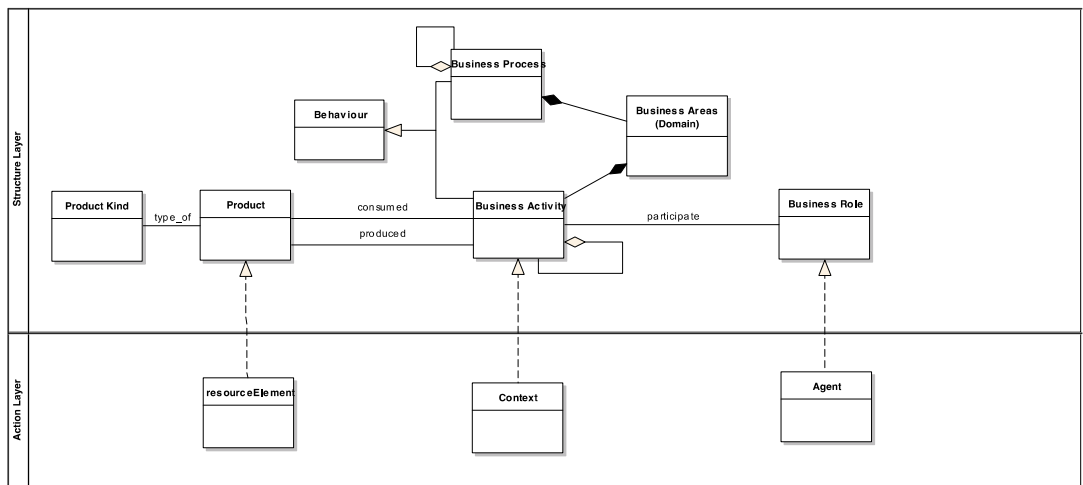


Fig. 6 Alignment between action and structure layers

In order to illustrate alignment between these two layers, let's consider the following actions:

- Prof. Smith requests Alice the payment of a course he has lectured
- Alice checks Prof Smith payment requirements (course report and grades) and notices it lacks the course report
- Alice requests Prof. Smith the course report
- Professor Smith informs that he will sending on date D due to a personal problem

- As she trusts Prof. Smith, she nonetheless decides to order the payment

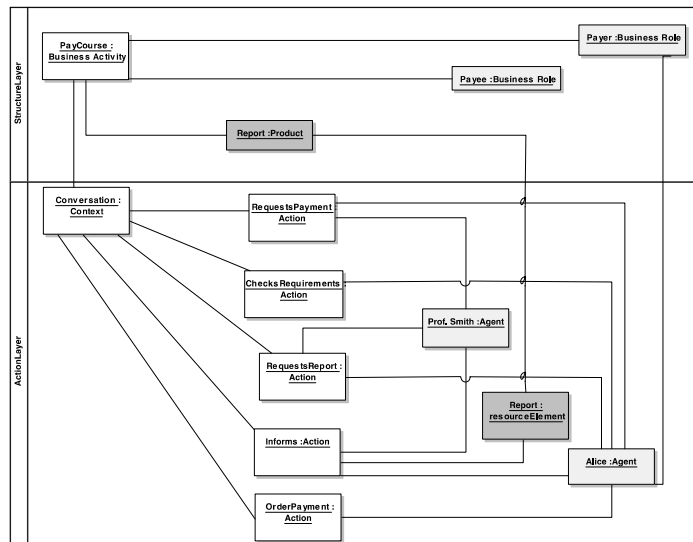


Fig. 7 Example of the alignment between action and structure layers

The previous conversation creates a **context** that is related to the Pay Course **business activity** (Fig. 7). This context has two **agents** that play payer (Alice) and payee **business roles** (prof. Smith). Some of these actions will appear in the formal description of the activity Pay Course (request payment) but some will not (informing that the report will be sent a later date). Some resources are formal activity **products** (course grades and reports), and some will not due to their transient and informal nature (information that the report will be sent a later date and reason for the delay).

4. Conclusions

The different meta-models presented in related work focus different perspectives concerning with business process. The review of these meta-models allowed identifying the advantages and limits of each approach, each one concentrated on different aspects. The BPMN Meta-model belongs to the most well-known approaches that is used to create orchestrations of business processes internal to a specific organizations and allows the definition of choreographies by interconnecting different processes. The QOBPM approach provides an integration of quality information to the corresponding business process constructs because without this quality data it is not possible to assess a business process. The TMBP approach contributes with support between organizational structure aspects and specific business process constructors as well as a catalogue of patterns based on different business process types. This study showed that although exist several business process meta-models, little effort has been devoted to the development of meta-models supporting the alignment between daily actions and business process descriptions as they are really executed in organizations.

In this paper, the BBPAMeta-model has been presented with its extension to integrate work practice information. The structure layer of the BPPAMeta-model allows designing functional, informational and behavioural aspects of business processes. The action layer extends the meta-model with work practice concepts that allow designing several aspects of daily actions. Moreover, structure and action layers had been aligned to perform the definitions of process elements based on work practice aspects. Besides, this meta-model can be used by the methodology BPPAM to specify or improve business processes models based on work practice descriptions.

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