A BPMN 2.0 Extension to Define the Resource Perspective of Business Process Models

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Abstract. One of the primary motivations of BPMN is to provide an easy to understand standard way to define and visualize business process models. This goal is addressed with respect to the control flow perspective. However, the support it provides to the resource perspective is poor. This work presents an extension to the BPMN 2.0 metamodel and notation to support the modeling and visualization of resource perspective requirements. It considers three aspects of the resource perspective: resource structure, authorization and work distribution. This extension is validated against the Workflow Resource Patterns that define recurrent requirements regarding this perspective. The aim of this BPMN extension is to improve the communication of the resource perspective requirements between business analysts and technical developers.

Keywords: BPMN, Resource Perspective, Organizational Perspective, Workflow Resource Patterns.

1 Introduction

The Business Process Model and Notation (BPMN) [1] is a broadly accepted business process modeling language. One of its primary motivations is to provide an easy to understand standard way to define and visualize business process models. BPMN includes a set of diagrams designed to bridge the gap between the way in which business analysts and technical developers see these models. BPMN is aimed to provide a human level of interoperability and portability not provided by languages like WS-BPEL [8], which are aimed to support the execution of business processes.

The resource perspective of business processes refers to the link between the activities defined in the processes and the entities that carry out the work related to them, which are called resources [3]. The way in which the work is distributed to the resources is significant to the efficiency and effectiveness of a process. It is necessary to ensure that its different activities are carried out by suitable resources. Excessive activity automation and poor design of work assignment strategies are critical issues in workflow projects [10]. For that reason, it is necessary to define resource perspective aspects at both business and technical levels.
BPMN 2 [1] includes resource perspective concepts like resource assignment and extends the definition of human interactions. However, it does not allow the representation of resource perspective concepts supported by execution languages like BPEL4People [7] and WS-HumanTask [6] (extensions to WS-BPEL) or other languages like YAWL [5]. Therefore, it is possible to state that from the point of view of the resource perspective, BPMN does not provide the human level of interoperability and portability that is required in business process models.

The goal of this work is to propose an extension to the BPMN 2.0 metamodel and notation to support the representation of the resource perspective by means of this language. The purpose is to improve the communication of resource perspective requirements between business analysts and technical developers. The aim is also to enable the application of model-driven development approaches for generating the resource perspective of business process specifications from BPMN process models.

The proposed extension considers three aspects of the resource perspective: resource structure, work distribution and authorization. It focuses on the distribution of work corresponding to atomic activities among human resources. Whenever the terms activity or task are used in this work, they will be referring this kind of activity.

This extension is validated against the Workflow Resource Patterns [2] that define a set of recurrent requirements regarding the resource perspective which should be captured in business process models or specifications.

This article is structured as follows. Section 2 discusses the proposed extension to BPMN. Section 3 presents the visual extension to the BPMN diagrams with an example. Section 4 shows how the proposed extension provides support to the resource patterns. Section 5 discusses related work. Section 6 concludes the paper.

2 BPMN Extension for Modeling the Resource Perspective

This work proposes a BPMN extension to define the resource perspective. This extension considers three aspects to be defined in a process model to describe the resource perspective: resource structure, work distribution and authorization.

The Resource Structure aspect is concerned with the characterization and classification of resources. The characterization is the description of different features of the resources. The classification is the association of resources with a concept. The classification allows to reference the resources associated with a concept and to assign them sets of common properties. There are different forms of resource classification such as the functional classification (e.g: roles) and the organizational classification (e.g: organizational units). The Resource Structure aspect is typically represented in Resource Models or Organizational Models. This aspect is developed in section 2.1.

The Work Distribution aspect deals with how work is advertised and ultimately bound to specific resources for execution [2]. This work adopts and extends the approach for work distribution used by BPMN, which is based on the assignation of work distribution roles to resources. This concept of role is different from the concept of role used in resource structure models. Work distribution roles are defined in terms of the set of privileges they give to the resources to execute operations that progress the work related to the task being distributed. This aspect is developed in section 2.2.
The Authorization aspect is concerned with the definition of privileges that the resources own with regard to the execution of operations to see and progress the work distributed to them. Resource privileges depend on the resource structure and grant to the resources the execution of worklist operations to see the work distributed to them. This kind of privileges is developed in section 2.1. Task privileges depend on the task to be performed and the way the work is distributed. These privileges grant the execution of work item operations in order to progress the work of the task. This kind of privileges is developed in section 2.2.

These three aspects of the proposed extension were developed using the extension mechanism provided by the BPMN metamodel. This extension mechanism consists of a set of extension elements which allow the attachment of additional attributes and elements to the BPMN elements [1]. This extension mechanism keeps models interchangeable between different tools because the standard elements are not modified by extensions. The BPMN extension elements are four. The ExtensionDefinition element allows the definition of a new concept which groups additional attributes for a BPMN element. The ExtensionAttributeDefinition element defines a new attribute that can be specified for an ExtensionDefinition element. The Extension element binds/imports an extension definition and its attributes into a BPMN model. The ExtensionAttributeValue element contains the values for the additional attributes of a BPMN element instance defined in a BPMN model. All BPMN elements inheriting from BaseElement can reference any ExtensionDefinition element imported in a BPMN model to represent an extension of a BPMN element.

Figure 1a shows the structure of the proposed extension. The BPMN Metamodel package contains the classes of the original BPMN elements. The ResourceStructure Extension package depends on the BPMN metamodel package. This package defines the concepts corresponding to the Resource Structure aspect and concepts of the Authorization aspect related with the resource structure. The WorkDistribution Extension package depends on the other two packages. This package defines the concepts corresponding to the Work Distribution aspect and concepts of the Authorization aspect related with the work distribution. The concepts of both the ResourceStructure and the WorkDistribution extension packages are defined by means of the BPMN extension mechanism. This is described in the next subsections.

Figure 1b shows the structure of BPMN models using the proposed extension. An Extended BPMN Process model contains a BPMN process definition which is extended with the concepts provided by the proposed Work Distribution extension. This type of model includes the typical BPMN representation of a process plus the representation of the work distribution requirements. The resource structure of an
organization can be defined in a separated BPMN Resource Structure model by using the concepts proposed by the Resource Structure extension. This resource structure model can later be imported in an Extended BPMN Process model by using the Import element of the BPMN metamodel. Thus, this model can be reused in different process models that represent the processes of an organization. The reuse of a resource structure model is desirable to avoid redundant representations which may lead to inconsistencies [3].

Both the Extended BPMN Process model and the Resource Structure model require binding the concepts of the proposed extensions by means of BPMN Extension elements. In both types of model, the instances of the BPMN elements being extended will make reference to ExtensionDefinition element instances representing the concepts defined in the proposed extension.

The next subsections describe the conceptual models of the proposed extension, which are shown in the UML class diagrams of Figures 2 to 6. In these diagrams, the concepts of the BPMN metamodel are directly associated with the concepts of the proposed extension. The diagrams include stereotypes to distinguish the standard BPMN elements of the additional ones and to show the way in which additional attributes and elements can be represented by means of the BPMN extension mechanism. Four stereotypes are used: BPMN for original BPMN elements; ExtensionDefinition for the additional concepts represented as ExtensionDefinition elements; ExtensionAttrDefinition for the attributes that define the information contained in ExtensionAttributeDefinition elements; and ExtensionType for indicating the complex data types of the different extension attribute definitions. Attributes corresponding to standard BPMN elements and types defined in the extension are not stereotyped as they do not have to be represented by means of the BPMN extension mechanism.

2.1 Resource Structure

The class diagram of Figure 2 shows the conceptual model of the proposed extension for the definition of the resource structure aspect. The BPMN elements regarding this aspect are Resource and ResourceParameter. They provide an abstract definition of human or non-human resources that can be referenced by process models and parameters that can be bound and queried at runtime.

The Resource element is extended by the ResourceBase extension definition (see Figure 2). ResourceBase and its subclasses act as a surrogate of the Resource class in the context of the elements added for this extension. ResourceBase contains four extension attributes. The first is resourceRef which references the resource being extended. The name and resourceParameters extension attributes are derived to be the same as the ones of the resource being extended. The resourcePrivileges extension attribute corresponds to the authorization aspect and provides a way to define the privileges of resources to execute worklist operations. The types of resource privilege considered in this work were extracted from the Resource Patterns [2] and are enumerated by ResourcePrivilegeType. See the Resource Patterns definition for details on the meaning of the particular resource privilege types.

ResourceBase has two subclasses: ResourceClassifier and HumanResource.
ResourceClassifier addresses the resource classification introduced earlier and defines three extension attributes. The population attribute allows identifying the human resources grouped by the classifier. The subsumedBy attribute allows the representation of a relationship between a more general and a more specific resource classifier. In such relationship, the more specific classifier inherits all the attributes of the more general one and the population of the more specific classifier is included in the population of the more general one. The references attribute enables the definition of named associations between ResourceClassifier elements. The meaning of the resource classifiers is defined by the modeler. Hence, resource structure models can be successively refined to match with a platform-specific metamodel.

![Diagram](image)

**Fig. 2.** Extension definition for the Resource Structure Aspect.

The HumanResource extension definition represents a single person. It defines two extension attributes. The resourceClassifications extension attribute allows characterizing the human resource with the set of properties defined for zero or more resource classifiers and including the resource in the population of these classifiers. The classification of a human resource can be changed during its life cycle. The parameterValues extension attribute provides a way to store the values associated with each of the parameters defined for the resource itself and its classifiers.

### 2.2 Work Distribution

The class diagram of Figure 3 shows the conceptual model of the proposed extension for the definition of the work distribution aspect. The BPMN element extended is UserTask. It represents an atomic activity which is performed by a person with the help of a software application. UserTask inherits from Activity, which represents any step of the process requiring some work to be performed, through Task, which represents an atomic activity. The WorkDistribution extension definition includes six...
extension attributes: resourceResolution, resolutionConstraint, distributionAgent, trigger, role and taskPrivileges.

The resourceResolution extension attribute describes what information needs to be evaluated to determine the set of resources that can perform the work related with the task. In BPMN, resource resolution is termed Resource Assignment. The types of Resource Assignment provided by BPMN and the way this work proposes to extend them are discussed in section 2.2.1.

The resolutionConstraint extension attribute allows limiting the size of the set of resources which result of the resource resolution process. The BPMN metamodel does not provide any element to deal with this concept. The different types of ResolutionConstraint are discussed in section 2.2.2.

The distributionAgent extension attribute indicates if the work distribution is performed by the system (SystemAgent) or by a resource (UserAgent). In the last case, it will be required to indicate the resource or group of resources that will be able to perform the distribution.

The trigger extension attribute consists of a reference to a BoundaryEvent attached to the task being distributed. In case of setting this reference, the work distribution will be commenced upon the occurrence of the event. If WorkDistribution does not specify any trigger, it will be supposed to be commenced when the task is activated.

The role extension attribute allows defining the aforementioned assignment of roles to resources. It expresses concepts corresponding to both the work distribution and authorization aspects. In the context of this work, a work distribution role is a predefined set of task privileges. This is represented by the HumanRole extension definition which is a surrogate of HumanPerformer in the context of WorkDistribution. The types of HumanRole considered in this work and the set of task privileges they enable to be granted to resources are discussed in section 2.2.3.

The taskPrivileges extension attribute expresses concepts of the authorization aspect. It defines the set of task privileges enabled to be granted for a task. The task privilege types were extracted from the Resource Patterns [2] and are enumerated by TaskPrivilegeType (see Figure 6). The set of task privileges granted to a resource as result of the work distribution process will be the intersection of the set of task privileges corresponding to the human role assigned and the set of task privileges enabled for the task being distributed.
2.2.1 Resource Resolution

The ResourceResolution extension type was defined to provide a mean to support the evaluation of resource structures described in section 2.1. BPMN offers two elements called ResourceParameterBinding and ResourceAssignmentExpression which allow determining the resources that can be associated with a certain role for the task being distributed. These BPMN elements are reutilized by two subclasses of ResourceResolution (see Figure 4).

![Fig. 4. Extension type for Resource Resolution.](image)

The first of these subclasses is ResourceStructureBasedResolution. It defines the resourceParameterBindings attribute which allows evaluating the value of different parameters specified in the resource structure model for the resource indicated by resourceRef. These parameters can be compared with values in the scope of the activity or with literal values by means of an expression. The resourceRef attribute of ResourceStructureBasedResolution references ResourceBase, which enables it to evaluate resource models using the extensions defined in section 2.1.

The second subclass of ResourceResolution is DataBasedResolution. It specifies an expression that evaluates data defined in the scope of the activity and returns resource related data identifying the set of resources to be associated with the role specified in the corresponding WorkDistribution element.

2.2.2 Resource Resolution Constraints

Resource resolution constraints allow limiting the set of resources specified by the resourceResolution extension attribute of WorkDistribution. The BPMN metamodel does not provide any element to specify such constraints.

This work defines two types of ResolutionConstraint. SingleResourceConstraint ensures that the set of resources specified by the resourceResolution attribute of WorkDistribution has a size of one, producing an exception if its size is not one. SelectedResourceConstraint allows the specification of a SelectionStrategy to choose one resource in case the set of resources specified by the resourceResolution attribute of WorkDistribution has a size greater than one. The selection strategies in the class diagram of Figure 5 were extracted from the Resource Patterns [2]. See the Resource Patterns definition to know details on the meaning of each kind of SelectionStrategy.
2.2.3 Roles

For the purposes of this article, a work distribution role is a predefined set of task privileges that can be granted to human resources as result of the work distribution. In WS-HumanTask, this notion is referred to as Generic Human Roles [6]. In BPMN, this concept is covered by the HumanPerformer element. This work proposes the HumanRole extension definition that is a surrogate of HumanPerformer in the context of work distribution (See figure 6). It defines three extension attributes. The roleRef attribute references the HumanPerformer element being extended. The roleType attribute, in terms of which the set of privileges that can be granted to the resources as result of the work distribution process are defined. The taskPrivileges attribute specifies the set of task privileges corresponding to each type of HumanRole.

This work considers three types of HumanRole enumerated by HumanRoleType. PotentialOwner represents people who can claim a task instance to work on it. It grants the task privileges Select and StartOffered. Owner represents people who are responsible for a task instance and can decide when to start executing it. Owner grants the task privileges Start, Delegate, Deallocate and Skip. Executor represents people who are already working on a task instance. It grants the privileges Suspend, Complete, ReallocateStatefull, ReallocateStateless, Pile, Fail, AdditionalResources.

There is a correspondence between the privileges granted by the PotentialOwner, Owner and Executor role types, and the operations enabled for the work item states
Offered (Single or Multiple), Allocated and Started respectively defined in the Resource Patterns [2]. Thus, it is possible to use evaluations with respect to the Resource Patterns [2, 5, 9] to identify the relationships between the human role types defined in this work and concepts of languages like WS-HumanTask or YAWL.

3 Extended BPMN Notation for the Resource Perspective

This section describes the graphical notation to visualize the concepts of the proposed BPMN extension. Figure 7 shows an example of the notation proposed to represent a resource structure model. The gray labels on the icons indicate the related concepts of the resource structure extension described in section 2.1. The example describes the structure of a Service Company that has five resources. Four of them are grouped by the Support resource classifier, which is subdivided into two more specific resource classifiers: FirstLevelSupport and SecondLevelSupport. The remaining resource, Paul, is classified as Manager and is the chief of the resources classified as Support.

![Sample Resource Structure Diagram](image)

Fig. 7. Sample Resource Structure Diagram

Figure 8 shows an example of the extended notation of BPMN process diagrams. It allows the visualization of extended BPMN process models with concepts of the work distribution aspect and task privileges which belong to the authorization aspect. It imports and uses the resource structure model defined in the diagram of Figure 7.

The process starts with a message event, which is triggered by a customer sending an email requesting help because of a problem in the purchased product. After receiving the email from the client, the Open Ticket script task is activated and the system parses the received email and opens a ticket for it.

Then, the system routes the ticket to a first level support agent who will resolve the ticket. This is represented by the Edit 1st Level Ticket user task. This user task has attached a rectangle that defines four attributes to represent its work distribution and authorization aspects. The role parameter valued as PotentialOwner expresses that the resources will voluntarily undertake and start to resolve the ticket. The distributionAgent parameter defines that the work will be distributed by the system. The resourceResolution parameter shows that the ticket will be offered to all the
resources classified as FirstLevelSupport. Finally, the privileges parameter defines the operations the resources will be able to execute to complete the work of the task.

![Sample Extended BPMN 2.0 Process Diagram](image)

If any of the first level support agents resolve the ticket after two days, an escalation event is thrown, as it is indicated by the timer activated in parallel to the Edit 1st Level Ticket user task. This user task has a boundary event catching this escalation event and defining a new work distribution to be applied in such case. This second work distribution defines that the system will assign the ticket to the first level agent with less work load who will immediately start to work on it.

Once a first level support agent edited and could resolve the ticket, an email with the corresponding comments is sent to the customer and the ticket is closed.

In case the first level agent could not resolve the ticket, then he/she marks the ticket as unresolved and the system routes it to a second level agent who will voluntarily undertake and start to resolve it. This is defined by the work distribution element associated to the Edit 2nd Level Ticket user task.

Finally, when the second level agent resolves the ticket, an email with the corresponding comments is sent to the customer and the ticket is closed.

The above example describes a simple case of a process requiring the definition of resource perspective requirements that cannot be represented and understood in BPMN process diagrams without using the proposed extension.

4 Supported Resource Patterns

The Resource Patterns are an abstraction of a set of recurrent requirements regarding the resource perspective that can be used as an evaluation framework of process languages with respect to this perspective. They are organized in seven categories.

Creation patterns consist in design time work distribution directives that are applied when the instances of the activities requiring the work of resources are created [5]. Push patterns characterize situations where the system proactively distributes work to resources. Pull patterns describe situations where resources are made aware
of work that needs to be done and the commitment to undertake its execution is initiated by the resource itself rather than the system. Detour patterns describe situations where work distributions that have been made for resources are modified. Auto-start patterns refer to situations where execution of work is expedited by automating different phases of work distribution. Visibility patterns classify the various scopes in which work availability and commitment can be viewed by resources. Multiple resource patterns identify situations where the correspondence between work and resources is not one-to-one.

This work was validated by evaluating the resource patterns that can be supported by BPMN using the proposed extensions. The following sections explain the ways the proposed extensions support these patterns.

4.1 Patterns Supported by Work Distribution.

This section describes the patterns supported by concepts of the work distribution aspect in conjunction with concepts of the resource structure aspect. This group of patterns includes Creation, Push, Escalation and the two first Auto-start Patterns.

The supported Creation Patterns are nine. WRP-01 Direct Allocation is supported by ResourceStructureBasedResolution referencing HumanResource. WRP-02 Role-based Allocation is represented by ResourceStructureBasedResolution referencing ResourceClassifier since a resource structure role is a functional classification of resources [4]. WRP-03 Deferred Allocation is expressed by DataBasedResolution. WRP-04 Authorization is supported by activity and resource privileges. WRP-05 Separation of Duties is specified by setting the SelectedResourceConstraint resolution constraint and the FourEyes selection strategy. WRP-06 Case Handling is not supported. WRP-07 Retain Familiar is indicated by SelectedResourceConstraint and the RetainFamiliar selection strategy. WRP-08 Capability-based Distribution is supported by ResourceStructureBasedResolution referencing a subclass of ResourceBase and defining its resourceParameterBinding attribute. WRP-09 History-based Distribution is not directly supported. It could be represented by DataBasedResolution if the resource execution history is available in the scope of the distributed activity. WRP-10 Organizational Distribution is expressed by ResourceStructureBasedResolution evaluating resource classifiers referencing other resource classifiers. WRP-11 Automatic Execution is directly supported by BPMN.

The supported Push Patterns are eight. WRP-12 Distribution by Offer - Single Resource can be specified by distributing the PotentialOwner role type and setting the SingleResourceConstraint resolution constraint. WRP-13 Distribution by Offer - Multiple Resources can be expressed by distributing the PotentialOwner role and avoiding setting a resolution constraint. WRP-14 Distribution by Allocation - Single Resource is supported through the distribution of the Owner role and the indication of the SingleResourceConstraint resolution constraint. WRP-15 Random Allocation, WRP-16 Round Robin Allocation and WRP-17 Shortest Queue can be represented through the distribution of the Owner role and the specification of the SelectedResourceConstraint resolution constraint with the selection strategies Random, RoundRobin and ShortestQueue respectively. WRP-18 Early Distribution is not supported. WRP-19 Distribution on Enablement is the moment in which work
distribution starts if the trigger attribute is not specified for the work distribution.
WRP-20 Late Distribution is supported by the definition of a BoundaryEvent for the
trigger attribute of WorkDistribution.

The WRP-28 Escalation Detour Pattern is supported by associating the activity
with a second WorkDistribution having an Escalation boundary event as trigger. The
WRP-36 Commencement on Creation and WRP-37 Commencement on Allocation
Auto-start Patterns are supported through the distribution of the role Executor.

4.2 Patterns Supported by Authorization.

This section describes the patterns supported by concepts of the authorization aspect
in conjunction with concepts of the resource structure aspect. This section comprises
Pull, Detour, the two last Auto-Start, Visibility and Multiple Resource Patterns.

The six Pull Patterns are supported. WRP-21 Resource-Initiated Allocation, WRP-
22 Resource-Initiated Execution - Allocated Work Item and WRP-23 Resource-
Initiated Execution - Offered Work Item are expressed by granting the Select,
StartAllocated and StartOffered task privileges respectively. WRP-24 System-
Determined Work Queue Content is expressed by rejecting the Choose and Reorder
resource privileges. WRP-25 Resource-Determined Work Queue Content is supported
by the Reorder resource privilege. WRP-26 Selection Autonomy is defined by the
Choose resource privilege.

In addition to the aforementioned WRP-28 Escalation, six Detour Patterns are
supported. WRP-27 Delegation, WRP-29 Deallocation, WRP-30 Stateful
Reallocation, WRP-31 Stateless Reallocation, WRP-32 Suspension-Resumption and
WRP-33 Skip represent situations in which the work distribution is changed at
instigation of resources. They are supported by granting the Delegate, Deallocate,
ReallocateStateful, ReallocateStateless, Suspend and Skip task privileges
respectively. WRP-34 Redo and WRP-35 Pre-do are not supported.

The WRP-38 Piled Execution and WRP-39 Chained Execution Auto-start Patterns
can be specified by granting the Pile activity privilege and the Chain resource
privilege respectively. The Visibility Patterns WRP-40 Configurable Unallocated
Work Item Visibility and WRP-41 Configurable Allocated Work Item Visibility are
represented by the ViewOffered and ViewAllocated resource privileges respectively.

Finally, the two Multiple Resource Patterns are supported. WRP-42 Simultaneous
Execution is expressed by the Concurrent resource privilege. WRP-43 Additional
Resources is indicated by the AdditionalResources activity privilege.

5 Related Work

There are previous works on the representation of the resource perspective of business
process models based on BPMN 1. One of them proposes an extension for BPMN 1
enabling the expression of different resource assignment constraints defined in OCL
resource layer for BPMN via the Business Process Definition Metamodel (BPDM)
proposal. It supports eight Creation Patterns and five Detour Patterns. Compared to
our work, these proposals do not provide extensions to define resource structure models and assume the default pull approach of BPMN for work distribution.

Another work addresses the definition of the resource perspective of business processes by means of a UML Profile based on use case models [13]. It provides an MDA approach to generate WS-HumanTask specifications. It allows representing the concepts of resource structure and work distribution role. This approach does not allow the reutilization of resource structure models because it represents the resource structure and the work distribution aspects in a single diagram. Also, the models defined using this profile can only describe resource perspective concepts. This can lead to inconsistencies between the model that describes the control flow perspective and the model that describes the resource perspective. In our approach, both perspectives are integrated in an Extended BPMN process model.

Another work [14] based on a specific view-based modeling framework defines metamodels for the representation of the resource perspective at both conceptual and technology specific levels. This work provides a transformation for the generation of BPEL4People/WS-HumanTask specifications from technology specific models. However, the metamodel proposed for the conceptual representation of the resource perspective only provides an abstract work distribution role. It is not possible to describe resource structures or to specify push or pull work distribution strategies without extending that metamodel with technology specific concepts.

6 Conclusions

This work presented a BPMN 2.0 extension to support the definition of resource perspective requirements in business process models. This extension is suited for direct use by business people and can be used for communicating and coordinating resource perspective requirements between business and technical people.

The proposed BPMN extension, which was developed using the extension mechanisms provided by the BPMN 2.0 metamodel, focuses on three main aspects of the resource perspective: resource structure, work distribution and authorization.

The proposed extension allows defining two types of models: resource structure and extended BPMN process models. The resource structure model describes the classification and characterization of resources, and authorization concepts which depend on the resource structure. The extended BPMN process model imports a resource structure model and represents work distribution requirements and authorization concepts which depend on the tasks and the way they are distributed. The separation of these models allows the reuse of the resource structure model of an organization in all of its process models.

The proposed extension for the resource structure provides a high degree of flexibility since the modelers can define the meaning of the resource classifiers, allowing them to define a broad range of organizational structures. Also, the proposed extension for work distribution allows the representation of work distribution requirements using a reduced set of concepts that are added to process models.

This work also proposes graphical notations to represent the work distribution in an extended BPMN process diagram and the resource structure in a separated diagram.
The proposed extension was validated using the Workflow Resource Patterns as evaluation framework. The evaluation indicates that this BPMN extension allows the representation of a wide range of resource perspective requirements providing full support to 38 of 43 Resource Patterns. Hence, a high level of expressiveness of the resource perspective is achieved with this BPMN extension.

Finally, the automatic generation of executable resource perspective specifications for different languages like BEPL4People/WS-HumanTask or YAWL by means of a model-driven development approach using the proposed BPMN extension is considered as future work.

References

1. OMG: Business Process Model and Notation (BPMN), FTF Beta 2 for Version 2.0 (June 2010), http://www.omg.org/spec/BPMN/2.0/Beta2/PDF