MPMM-BPMLS; A MULTI PERSPECTIVE META MODEL OF BUSINESS PROCESS MODELING LANGUAGES

NajmehAkbarpour*

MohammadrezaHatami**

MajidAboutalebi*

Abstract:

Nowadays, organizationshave the increasing tendency to the use ofbusinessprocesses, thus choosing apropermodeling languageis so important.Severalmodelinglanguages have been introducedinindustry and academia, but this issue obstructs to select aproperlanguage.Also, there is a largegapbetweenbusinessprocess modelinglanguages andtheir evaluation.Forqualitativeassessment ofabusiness processmodeling language, acomprehensivemeta-model is needed. Meta-model offers a usefulunderstandingof themodeling.So thatby understandingthebehavior ofcomponents ofameta-model canbejudgedamodeling language.The mostimportantfeature ofa meta-modelissimplicity and completeness.Inthisstudy,amulti perspectivemeta-model of businessprocessmodelinglanguagesis presented.The proposed meta-modelis expressiveanditcan beusedforanaccurateandformalevaluation.

Keywords*:Business Process Modeling Languages, Meta Model, BPMN,YAWL, Formal Evaluation*

*Department of Computer Engineering, Islamic Azad University, Sari Branch, Sari, Iran

**Department of Industrial Engineering, IranUniversity of Scienceand Technology, Tehran, Iran

1. Introduction

Given thegrowingbusinessprocess modeling languages (BPMLs)inrecent years, anunderstandablemodelof modeling languageis very valuable.So far,severalconceptualmodelsforbusinessprocess modeling languages have been proposed, butmost of themareambiguousand complex[1]. Asin[3] haspointed out, in general the evaluation ofBPMLsisvery difficultfor the following reasons:

- Oftenaprecise and comprehensive descriptionoftheir elementsdoes not exist.
- Elementshavesometimesambiguousmeanings.
- Formostlanguages,there are nocomprehensivemeta-models.

To evaluate BPMLs, at first the general concepts of the language and the connection between them shouldbe understood. Also, the different aspects of the language should be considered [2]. The meta-model isincludingthe main conceptsof a language, which isthe foundation ofa successful evaluation [3]. The main objectiveofthisstudyisproviding acomprehensive meta-modelfortheBPMLs. Inthismeta-model, all aspects ofBPMLshasbeen considered.So it has been called MPMM-BPMLs (Multi Perspective Meta Model of Business Process Modeling Languages).MPMM isso useful and effective to evaluate the BPMLs.

This paper is structured to study, in the next Section,the main concept of meta-model andrelatedworksin this fieldarereviewed.The proposed meta-modelwillbeintroducedinSection 3.In section 4, BPMN and YAWL as two of the most well-established and widely-used BPMLs, are reviewed. Finally,conclusionsandfutureworkarepointed outinSection 5.

2. Meta Model

A model is a simplifiedrepresentation of a certainrealityfor the given purpose, according to therules of a certain modellinglanguage. In general, the model is an abstraction of reality inthe sense that it cannot represent all aspects of reality[19].A system can be set to display several different models, so that each of these models point to a particular view of the system[9].AlsoHommes in [2] mentioned,meta-mathematicalmodels, or meta-models in short, are models that are used to understandmathematical models themselves. A meta-model is a model that is constructed tounderstand another model. But the expression "model of a model" is

particularly confusing. So it is better to said,a meta-model is a special kind of model that specifies the abstract syntax of a modeling language [9].Figure 1 shows the relationship between system,model and meta-model.

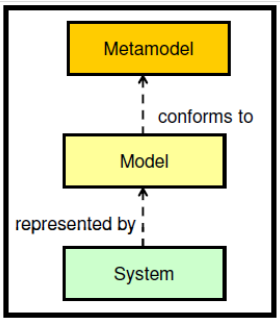


Figure1. The relationship between the system, model and meta-model

So far, several meta-models of BPMLs have been introduced. But most of them are too complex or ambiguous[1]. Also these meta-models are not suitable and useful to evaluate BPMLs [2].

Halpin in [5] provides a meta-model based on the ORM (Object Role Modeling). Nijssen in [6] suggested the Fact Modelingapproach. In this work, NIAM introduced a framework for linguistically oriented to represent objects and the relationship between them. In [2], a comprehensive meta-model called C-Me (Capturing Models for Evaluation) has been introduced. But C-Me focuses more on the syntax of the modeling language rather than the notation used in language. Also this meta- model has low comprehensibility because it is too complex. Eva-Söderströmet al in [4] suggested a meta-model based on What, How, Why, When and Where. But it is not possible to evaluate BPMLs formally based on this meta-model.

The most important feature of meta-model is unambiguity and high comprehensibility, so that can help to better understand the modeling language. The main objective of this study is providing a useful and multi perspective meta-model for BPMLs, so that it could be the basis of formal evaluation.

3. Proposed Meta-Model (MPMM-BPMLs)

This approach presents a multi-perspective meta-model of BPMLs. Business process has different perspectives. To evaluate BPML accurately and formally, all of themodelling

language's views should be considered. Also the BPML should be formalized. The following subsections describe the different perspectives in general and the formalization of BPMLs.

3.1. Perspectives of BPMLs

Modellinglanguages havedifferent aspects. To propose a comprehensive meta-model, all of these aspects should be considered. Curtis et al in [20] suggested a framework consists of four perspectives: Functional, Behavioural, Organizational and Informational perspectives. A new perspective of BPMLs is mentioned in [3], because these perspectives cannot capture importantinformation like process goals or measures. The five main perspectives for BPMLs have been introduced as follows:

- Functional Perspective: represents what process elements (Atomic Activities and Sub-Process) are being performed.
- Organizational perspective:represents where and by whom process elements are performed.
- Process perspective: represents when process elements are performed, as well as aspects of how they are performed through feedback loops, iteration, complex decision making conditions, entry and exit criteria, and so on.
- Informational perspective: represents the informational entities produced or manipulated by a process and their relationships.
- Business process context perspective: represents an overview perspective of the process and describes major business process characteristics. This perspective is so useful for people who do not know or do not need to know the process in detail.

These five perspectives can capture all important information of BPMLs. They present different views of people who observe the business process. Since different people will be involved in the process of process modeling, it isimportant to catch different modeling perspectives in order to support communication,strengthen understanding and coordinate co-work.The proposed meta-model considered all of these perspectives, so called multi perspective meta-model of business process modeling languages (MPMM-BPMLs). Figure 2 shows the views of BPMLs.

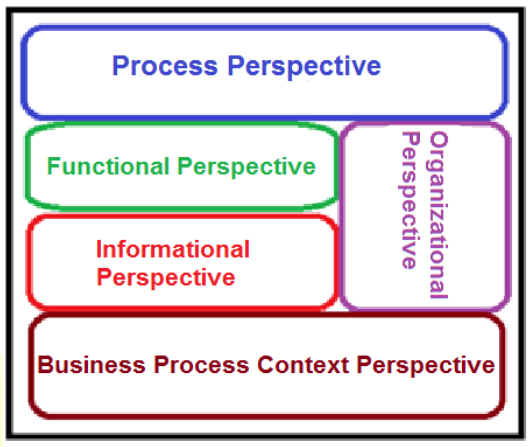


Figure 2. Different perspectives of BPMLs

3.2. Formalization of the BPMLs

A BPML is defined as a 3-tupleBPML= <P, O, R>, where:

- P is a set of perspectives;
- O is a set of generic objects;
- R is a set of generic Relationships;

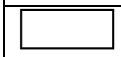
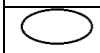
Complexity of the BPMLs: The meta-model's complexity is so important factor in evaluate BPMLs. This criterion in [11] referred as Graphic Parsimony. It is one of the measurement metrics of effectiveness in BPMLs. If the effectiveness of a language is more, then designing a model is done with less effort and time. Also learning the language make easier. The effectiveness of language is more, the resulting models can be created more easily be interpreted as, or more correct interpretations of the model.

Meta-Model's complexity can be calculated as follows [10]:

$$\text{Complexity} = \sqrt{|O|^2 + |R|^2 + |V|^2}$$

MPMM-BPMLs are presented based on <P, O, R>. The symbols used in the proposed model are shown in Table 1.

Table 1.Summary graphical symbols used in the MPMM-BPMLs

Symbol	Name	Description
	Perspective	ThissymbolrepresentstheperspectivesofBPML.
	Object	Thissymbolindicatesthe core objects or class of objects ofthe BPML.
	Relationship	Thissymbolshowshowthe relationship betweentwoclassesof objects.
	Generalization	Thissymbolrepresentsthe inheritancerelationshipbetweentheobjects.

4. Case Study

Business Process Modeling (BPM) has emerged as a dominant technology in current enterprise systems and business solutions, BPM solutions have been prevalent in both industry products and academic prototypes since the late 1990s [12]. Process modeling is a key instrument for the analysis and design of process-aware IS, service-oriented architecture, and web services [13].

In a graph based modeling language, process definition is specified in graphical process models, where activities are represented as nodes, and control flow and data dependencies between activities as arcs. The graphical process models provide explicit specification for process [12].

In this section, BPMN and YAWL as two of the most well-established and widely-used BPMLs,are selected.Then the MPMM of them are provided.

4.1. BPMN

The Business Process Modeling Notation (BPMN) [7] is a graphical standard notation for capturing business processes, especially at the level of domain analysis and high-level system design. BPMN creates a bridge between business process design and implementation [14, 15]. As Michael Havay in [3] mentioned, the main goal of BPMN is to provide an understandable notation for those who are dealing with business processes in various fields.Today, BPMN has become a complex language that is constantly changing. As in recent years, it is presented in variousversions [16, 17].Figure 3 shows the meta-model of BPMN based on MPMM.

4.2. YAWL

Given thegrowingbusinessprocess modelinglanguagesandworkflowlanguages, a new workflow language called YAWL(Yet Another Workflow Language)[8] was introducedbyWil van der Aalst (Eindhoven University of Technology, the Netherlands) and Arthur terHofstede (Queensland University of Technology, Australia) in 2002.This language was based on the one hand on Petri nets, a well-established concurrency theory with a graphical representation and on the other hand on the well-known WorkflowPatterns [18].

The workflow patterns as a benchmark for the suitability of BPMLs. YAWL extends Petri nets with dedicated constructs to deal with some well-known workflow patterns. In general, YAWL is a simple and expressive language that can support many workflow patterns [8].Figure 3 shows the meta-model of YAWL based on MPMM.

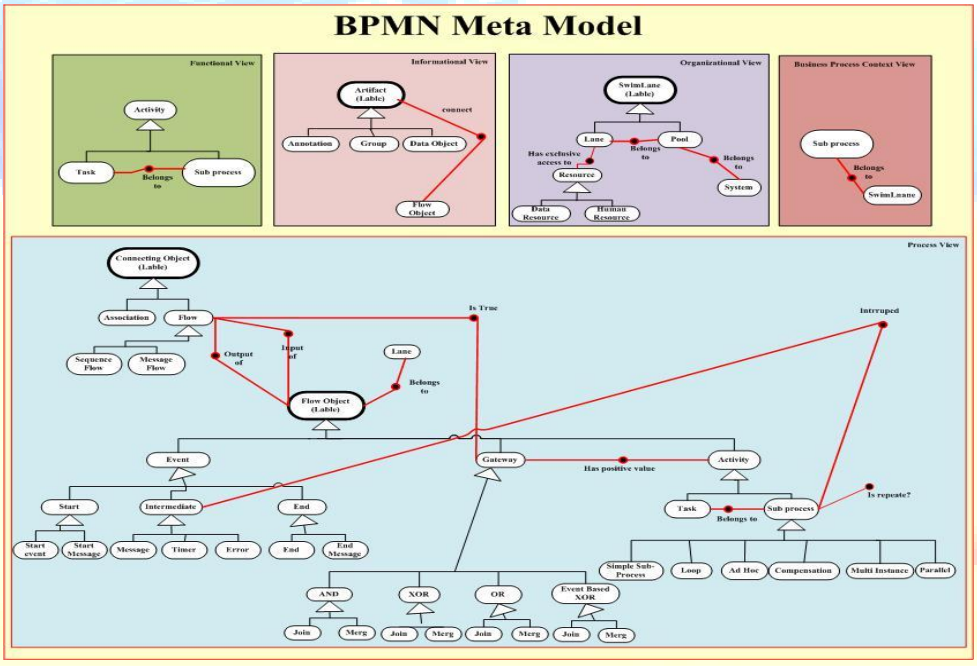


Figure 3. The meta-model of BPMN

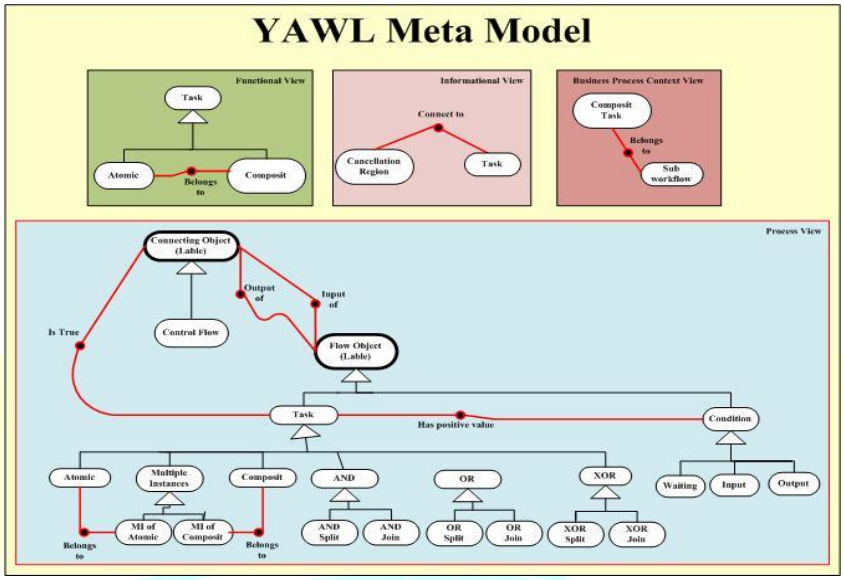


Figure 4. The meta-model of YAWL

4.3. Results

According to the results, meta-model of BPMN (MPMM-BPMN) can provide more aspects than meta-model of YAWL (MPMM-YAWL). The MPMM-YAWL cannot view the"Business Process Context Perspective". On the other hand, the complexity of MPMM-BPMN is more than MPMM-YAWL.Therefore BPMN is more difficult to understand and learn. Table 2 shows the complexity of MPMM-BPMN and MPMM-YAWL.

Table2.Complexity of MPMM-BPMLs

Language	Complexity
BPMN	35.8
YAWL	22.3

5. Conclusion

Meta-model is a model of a modeling language that defines the structure, semantics and constraints for BPMLs. A complete meta-model is the foundation of a successful evaluation.In this paper, a comprehensive meta-model of business process modeling languages is introduced. The proposed meta-model is considered all perspectives of BPMLs.Also it designed based on the formalized structure. So MPMM can be the basis of formal evaluation of BPMLs. In future work we are going to provide a formal evaluation of BPMLs based on MPMM.

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