Application of the Eclipse EMF technology for multifaceted organization modelling

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Abstract

This research paper explores the most developed methodologies used for multifaceted modeling of organizational structures. It is asserted that the existing methodologies (DEMO – Design and Engineering Methodology for Organizations, BORM – Business Object Relation Modeling and OntoUML) provide tools for analysis of the organization and its business processes through different ways. They lead to different results and make the process of organization modeling complicated. There is no software to support work with these methodologies together. The purpose of this research is to create a unified meta-model (within the Eclipse EMF technology) for a new methodology based on the existing ones and to analyze the completeness of these methodologies for describing enterprise architecture. It will serve as a basis for a new open software platform for multifaceted modeling of the organization.

In this research, we have compared the above-mentioned methodologies and concluded that despite the fact that these methodologies provide an analysis of different aspects of organizational structure, they have a common basic set of concepts. This study demonstrates the implementation of the Ecore model that is built on the basis of the selected group of common elements of these methodologies. We have also found that the combination of the considered methodologies contains all the concepts inherent in the systematic approach to the modeling of organizational structure. Furthermore, we have demonstrated the aspects of the organization that can be modeled by the methodologies considered. Using the Zachman framework, it was shown that: the DEMO, BORM and OntoUML methodologies allow us to describe in detail the business processes that take place at different levels of the organization, from the ontological to the datalogical, and therefore provide comprehensive information for the multifaceted modeling of an organization. However, none of the existing methodologies takes the time component and goal-setting into consideration.

Key words: multifaceted organization modeling, enterprise architecture, DEMO, BORM, OntoUML, unified methodology, Zachman framework, Eclipse EMF, systematic approach to the modeling of an organization.

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Introduction

Background of the study. The process of enterprise modeling is highly complicated. At present, there are many different approaches for modeling an organizational structure, for example, ARIS, UML, IDEF, PICTURE [1], which are flexible enough to perform modeling in various areas but insufficient to cover all the aspects. That is why our research focuses on studying the DEMO [2], BORM [3] and OntoUML [4] methodologies, which are more suitable for multifac-

eted modeling of the organization and business process analysis.

When reviewing the literature, it became apparent that each of these three methodologies has a lot of advantages. For instance, the main contribution of DEMO is to provide the essential model of an organization using several diagramming techniques. The DEMO methodology makes it possible to abstract from the informational, documentary and organizational realization, while the BORM approach is easier for understanding by those who are unfamiliar with notation. Moreover, the existing methodologies allow us to perform an analysis of different areas of organizational structure, thereby giving different recommendations. An additional point is that there are many practical examples showing that the structure and processes of organization continue to be described using different notations and techniques [1]. However, all the notations used are based on a number of basic concepts that can be reused and interpreted in accordance with other notations and methodologies. In the framework of this study, the DEMO methodology was taken as a basic concept. The reason is that the DEMO has the strongest methodological justification and there are many examples demonstrating the successful and efficient use of the DEMO in practice. However, using this methodology alone is insufficient to solve a number of problems. To overcome these limitations we decided to use the concepts of other models and notations that are also popular in practice – BORM and OntoUML.

While the debate over these methodologies seems to gain popularity, one of the main issues remains unresolved. Today there are a lot of tools that support different methodologies, but none of these tools provides a platform for multifaceted modeling of organizations combining the DEMO, BORM and OntoUML methodologies. That is why it seemed appropriate to introduce a new methodology developed on the basis of the three existing ones and create an object-oriented graphics editor.

Statement of the problem. The general purpose of this study is to create a unified meta-model for a new modeling methodology based on DEMO, BORM and OntoUML and to analyze the completeness of these methodologies for describing enterprise architecture. The present investigation focuses on determining the common principles of these methodologies, finding common objects and developing a meta-model, which will be used to create the final software product. It is important to note that our goal is not only to create a new unified meta-model, but also to generate an extension of this meta-model using Eclipse EMF [5] technology. This should be done in order to integrate the final software with other Eclipse projects and analyze the completeness of these methodologies within the Zachman framework [6].

In addition, this investigation should reveal some ontological drawbacks of the above-mentioned methodologies for analysis of business processes and attempt to overcome them.

Professional significance. In the framework of this work, our immediate goal was to create a unified meta-model for the DEMO, BORM and OntoUML methodologies using Eclipse EMF technology. In order to achieve this goal, the following specific tasks of further analysis should be performed:

✦ exploring principles and objects of the DEMO, BORM and OntoUML methodologies, their advantages and disadvantages within Eclipse EMF technology;

✦ identifying common principles and elements of these methodologies;

✦ creating a unified meta-model based on the common principles and elements using Eclipse EMF technology;

✦ analyzing the completeness of these methodologies for describing enterprise architecture within the Zachman framework.

The problem as stated is of great interest to people engaged in the process of organization modeling and dealing with issues of business processes analysis. Moreover, the research will contribute to development of a new approach for multifaceted modeling of organizational structures. At the same time, this study might be useful for many organizations which have taken the decision to modify their business processes.

In Section 1, we present a review of the literature on the subject. Section 2 offers a comparison of the existing methodologies. Section 3 presents the development of a common meta-model for the DEMO, BORM and OntoUML methodology. In Section 4 we assess the completeness of the DEMO, BORM and OntoUML methodologies for describing enterprise architecture within the Zachman framework. Section 5 presents the example – "Pizzeria" – to assess the possibilities of the existing methodologies. Finally, we summarize the work accomplished.

1. Literature review

The following review was made after studying a large body of literature on the subject. Since there are numer-

ous methodologies that include the notion of "organization modeling" it seemed appropriate to define it in accordance with the most developed methodologies: DEMO, BORM and OntoUML. Most researchers take into account just the most elementary characteristics of these methodologies, but a few investigations have explained how these methodologies could be used for different systems.

Our theoretical review starts off with the explanation of the key definitions of the afore- mentioned methodologies.

DEMO, which stands for Design and Engineering Methodology for Organizations, is based on Enterprise Ontology, defined by J. Dietz (the author of this methodology) [2]. In turn, Enterprise Ontology is based on the theory of Communicative Action and the Language-Action Perspective. According to J. Dietz, DEMO is a methodology for designing, modeling and engineering organizations, whose main contribution is to provide the essential model of an organization using several diagramming techniques, thereby abstracting from the informational, documentary and organizational realization (as defined by the DEMO theory) [7].

Numerous studies have demonstrated only the most elementary fundamentals including explanations of the basic definitions such as communication, information, action, organization as a part of the DEMO methodology and analysis of four axioms of the Enterprise Ontology theory, such as distinction, production, transaction and composition. However, information about the methods and diagrams of the DEMO methodology has been provided by only a few researchers, among one can namee Ph. Huysmans, Kr. Ven and J. Verelst [8]. These authors applied the Actor Transaction Diagram (ATD) and Process Structure Diagram (PSD) to obtain abstracts and high-quality Open Source Software Development (OSSD) process models, but other diagrams were left beyond the scope of these research studies.

According to the afore-mentioned group of researchers, DEMO has a strong theoretical foundation and provides clear and unambiguous definitions for the constructs used in the various models. It gives clear guidelines on how and why abstractions can be made [7]. In other words, DEMO analyzes processes at the ontological level, studying the communication patterns between human actors, instead of the sequences in which activities are performed. Therefore, DEMO helps us to understand the process of organization modeling by providing a high-level and abstract view of the organization.

It is difficult to exaggerate the importance of the described methodology for the process of information systems development and Business Process Reengineering. However, the DEMO methodology is not devoid of some drawbacks, the most important of which concerns the understandability and extensibility of DEMO. In order to optimize the process of organization modeling, it would be appropriate to combine DEMO with other techniques and methodologies, such as BORM.

BORM, which stands for Business Object Relation Modeling, was developed in 1993. The theoretical foundation of this methodology is the theory of finite-state machines. Since 2000, R. Knott, V. Merunka and J. Polak [3] have published a significant number of works with the support of the Czech Academic link program of the British Council as a part of the VAPPIENS research project. According to them, BORM is a complex method for systems analysis and design; it utilizes an object-oriented paradigm in combination with business process modeling.

Many articles written by R. Knott, V. Merunka and J. Polak fully explain the basic definitions and principles of BORM, OBA (Object Behavior Analysis) and ORD (Object Related Diagram). Researchers realize that BORM differs from other business-oriented development methodologies. The difference is as follows: in BORM, all objects are defined as business objects. During the design process, these objects are changed into a conceptual object, and then during the implementation they are evolved into software objects. Thus, BORM requires that the degree of knowledge about an object is only what is required to enable the development process to proceed [9]. OBA is a step-by-step, iterative approach to analysis that helps you cross the conceptual gap between a description of the "real world" and the syntax of object-oriented modeling techniques. The result of OBA is a description of a model for the problem being analyzed. That is why this model is essential for object related diagrams (ORD).

R. Knott, V. Merunka and J. Polak point out that BORM has a lot of advantages. The most important is that the BORM approach is very easy and simple for understanding and it makes faster and better analysis of some business problems. However, its biggest disadvantage is a lack of formal foundations which are necessary for clear and precise definition of the structure and semantics of ORD. M. Podlouck'y and R. Pergl found this fact in their article "Towards Formal Foundations for BORM ORD Validation and Simulation" [10]. These researchers attempted to create formal foundations for BORM which would help not only in under-

standing the semantics of BORM, but also in implementation of advanced software tools for this method. That is why the punch line of their article was to identify several flaws in the diagram's behavior semantics and to propose minor changes and enhancements for the model.

The researchers mentioned above have formulated their own theoretical principles named the "simultaneity" and "dependency principles" [10]. The "simultaneity principle" states that no participant can be split into multiple instances and thus perform several tasks in parallel. The "dependency principle" means that a task A may require another task to be completed before this task A can be completed. In order to realize these new principles, researchers have introduced the concepts of "input conditions" and "output conditions" [10]. The "input condition" is a Boolean expression, whose variables are the ending transitions in that state. The "output condition" is a Boolean expression, whose variables are the outgoing transitions from the given state. Their new definitions have had a significant influence on the development of the BORM methodology.

Talking about the process of organization modeling, it is essential to describe one more methodology, – OntoUML. OntoUML is a conceptual modeling language, whose meta-model was designed to comply with the ontological distinctions and axiomatization of foundational ontology [4]. It has been proposed as an extension of UML that incorporates in the UML 2.0 original meta-model a number of ontological distinctions and axioms put forth by the Unified Foundation Ontology (UFO). Many researchers in the field of Conceptual Modeling attempt to explain the basic concepts of this methodology and explore a number of patterns, which can show how OntoUML will be useful for analyzing business objects and some systems. Among these researchers, G. Guizzardi, A.P. Graças and R.S.S. Guizzardi wrote an article entitled "Design patterns and inductive modeling rules to support the construction of ontologically well-founded conceptual models in OntoUML" [11]. They attempted to explore an inductive strategy in the construction of OntoUML models. In their paper, the authors developed a number of design patterns and demonstrated how their strategy could reduce the complexity of the modeling process for the novice modeler. These patterns have had a great consequence for the OntoUML methodology and the process of business organization modeling in general.

To summarize, there are a considerable number of works investigating the basic concepts and principles of these three methodologies, demonstrating their advantages and drawbacks, providing new definitions and patterns. Notwithstanding the fact that these methodologies provide an analysis of different areas of the organizational structure, today there are no approaches combining the DEMO, BORM and OntoUML methodologies. In order to completely define the model of an organization, it is essential to combine these three methodologies, prepare a unified meta-model for existing methodologies and analyze the completeness of these methodologies for describing enterprise architecture within the Zachman framework.

2. Comparison of the methodologies

From the review above, it is appropriate to underline that these methodologies consider various aspects of an organization. For that reason, they are suitable for use in different sorts of situations. In order to solve operational problems which have no effect on the process as a whole, the BORM methodology is more useful, because only using BORM does it become clear which stage of the process had failed. When it is necessary to change the process of work in general affecting the ontological level of the organization, the DEMO methodology is more appropriate. When you need to provide a fundamental change in the process of work including staff changes, it is advisable to use the OntoUML methodology in addition to the DEMO methodology, because it analyzes the relationships and employee hierarchy. Since we consider an organization as a complex system, a complete analysis of the systematic approach is to be made. This means that the methodologies that we have taken as a basis should meet its basic principles [12]. That is why it is appropriate to identify the key concepts inherent in the methodologies in order to perform an analysis of the organization and to evaluate these methodologies for conformity to the identified principles and concepts. These concepts have been developed on the basis of the Levenchuk [13] study. The results are presented in *Table 1*.

As we can see, these methodologies include almost all the concepts inherent in the systematic approach to the modeling of an organization and meet almost all requirements. But none of these methodologies embraces all of the concepts reviewed above. Thus, in order to overcome this drawback and provide a multifaceted analysis of the organization, it is appropriate to consider them together.

Table 1.

The methodologies for relevant concepts of the systematic approach

Concepts	DEMO	BORM	OntoUML
Examination of the organization not only as a "black box", but as a "white box" [5]	+	+	+
Examination of three levels of organizational structures: human activities, the operation of computer programs, supporting infrastructure for programs	+ / – (does not examine the functioning of computer programs)	+	+ / – (does not examine the functioning of computer programs)
Investigation of the activities of objects and actors, processes and data, the functional components of programs and IT equipment	+ / – (does not analyze the functional programs and IT equipment)	+ / – (does not analyze IT equipment)	+ / – (does not analyze IT equipment)
Exploration of answers to the questions: how to divide responsibilities and authority between people and groups of people and what practices (technology) are used within the enterprise	+	+ / – (has no information about employee hierarchy)	+
Examination of the organization throughout its life cycle	+	+	-
Examination of the controlling, controlled subsystem, as well as external systems	+	+	+

The analysis of comparisons allows us to understand that despite what these methodologies have in common, they consider different areas of the organizational structure. Exactly the combination of these two factors leads us to conclude that in order to completely describe the organization and provide its multifaceted modeling, it is appropriate to bring together these three methodologies on the basis of their common concepts, ideas and elements.

3. The development of a common meta-model for the DEMO, BORM and OntoUML methodologies

In order to create a common meta-model, it is advisable to use the Eclipse EMF technology. Eclipse EMF or Eclipse Modeling Framework is a basis of the Eclipse Modeling Project, that is one of the most promising platforms for developing tools for visual modeling using the Eclipse technology. EMF is a technology for code generation in order to create tools and other applications based on structured data diagrams of the model specification presented in XMI. In order to ensure the generation of a complete meta-model, it seems appropriate to use the Domain Model (*.ecore and *.ecore_diagram): a meta-model that defines all of the elements, attributes, relationships that are used in the model [5].

DEMO consists of 4 models that can be represented in the form of certain diagrams:

✦ ATD and OCD corresponds to the Construction Model;

✦ for Process Model, it is necessary to prepare a Process Structure Diagram;

✦ for construction of the Action Model, it is a common practice to use Action Rule Specifications;

✦ Object Fact Diagram is used for the State Model [11].

Exactly the ADT, OCD, OFD and PSD diagrams are reflected in the final meta-model. In the process of organizational modeling, it has been appropriate to stress that many objects are duplicated. This fact has helped to identify common elements and to create them once for reuse. Based on an analysis of the relationship between the diagrams, it has been extremely interesting to identify three types of common elements for which this possibility could be provided. These groups of elements are presented in *Table 2.*

Table 2.

General elements of the DEMO methodology

General elements	ATD	PSD	OFD	OCD
Actor	Elementary Actor	Actor Boundary	General Object	Elementary Actor
	Composite Actor		External Object	Composite Actor
Transaction	Transaction	Transaction Boundary and four steps: Request (rq), Promise (pm), State (st), Accept (ac)	Result Fact	Transaction
Boundary	Boundary	–	–	Sol

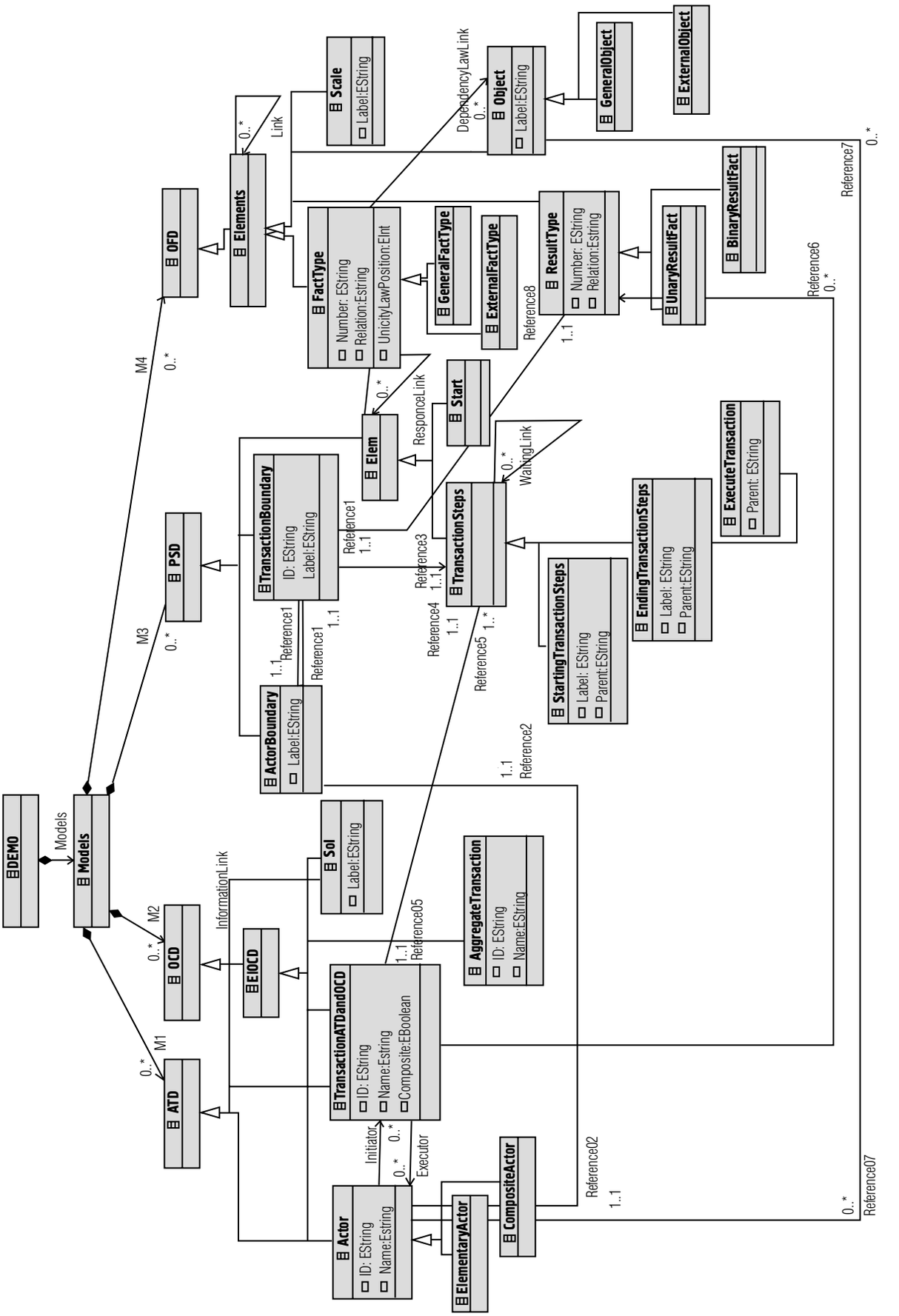

Fig. 1. A general meta-model for the DEMO methodology

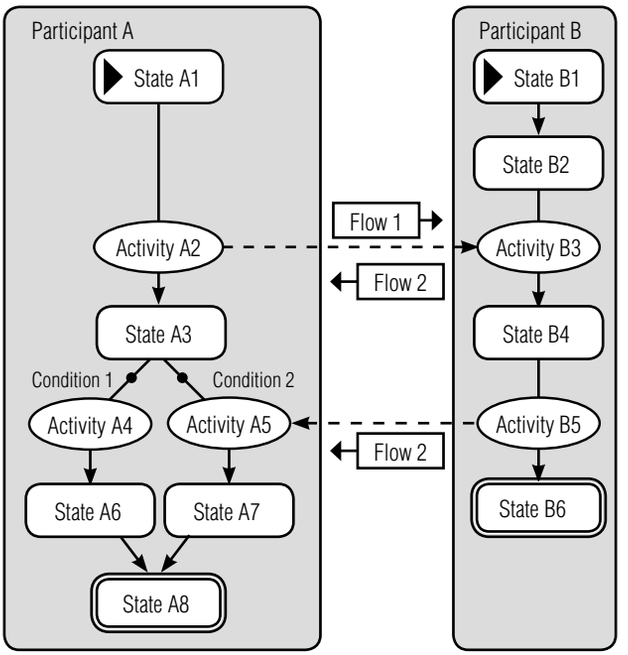

Fig. 2. Schematic representation of the ORD

Based on the identified groups of common elements, a common meta-model for the DEMO methodology has been constructed (*Figure 1*).

In the framework of this research, one more methodology, – BORM, – has been considered. For the BORM methodology, it has been accepted to allocate the basic elements of the Object Relational Diagram (ORD), such as [9] (*Figure 2*):

✧ participants – employees, organizations and systems involved in the process;

✧ states – intermediate phases;

✧ activities (transactions) – the channels representing interaction between users.

A general meta-model for the BORM methodology is presented in *Figure 3*.

For the OntoUML methodology. it has been essential to identify common objects, elements and connections for all three levels of methodology: UFO-a, UFO-b, UFO-c [14] (*Figure 4*).

Comparing the descriptions of these methodologies in order to construct a common meta-model, it has been appropriate to select four groups of general objects that have similar characteristics, attributes and functions in all three methodologies (*Table 3*).

Table 3.

General elements of the DEMO, BORM and OntoUML methodologies

General objects	DEMO	BORM	OntoUML
Actors	ATD, OCD: Actors PSD: Actor Boundary OFD: Objects	Participants	Universal Object, excl. Antirigid Sortal
Transactions	ATD, OCD: transaction, PSD: Transaction Boundary OFD: Unary/Binary Result	Actions	Action event
Databases	OCD: Aggregate Transaction	–	Aspects
States	OFD: Fact Type	States	Antirigid Sortal

On the basis of the selected groups, a final meta-model is presented in the following scheme:

• Level 1 – Entities: The total essence of all elements of the methodology;

• Level 2 – General objects: Four groups of shared objects described above;

• Level 3 – Methodologies: All the elements of the DEMO, BORM and OntoUML methodologies.

The common meta-model is constructed on the base of this scheme.

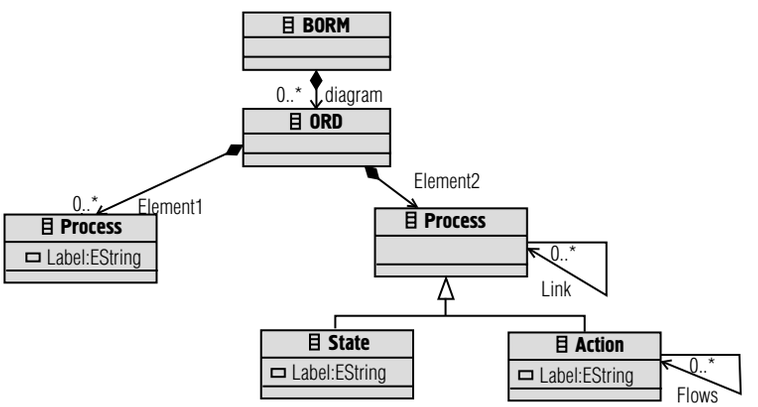

Fig. 3. A general meta-model for the BORM methodology

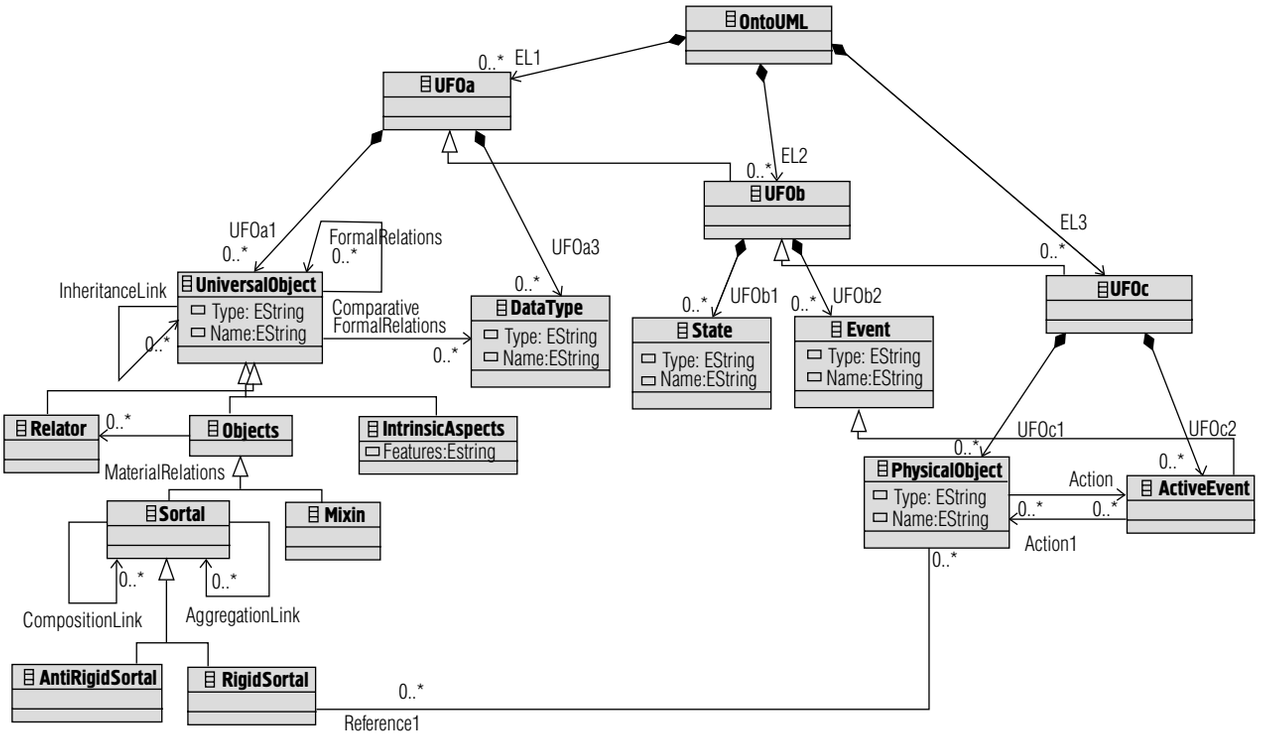

Fig. 4. A general meta-model for the OntoUML methodology

4. An assessment of the completeness of the DEMO, BORM and OntoUML methodologies for describing enterprise architecture within the Zachman framework

The above analysis shows that the set of the DEMO, BORM and OntoUML methodologies covers many areas and aspects of the organization. In order to clarify them, it was deemed best to use one of the most common tools – the Zachman framework [6]. The main objective of this model is a logical partition of the enterprise architecture into sections in order to consider the enterprise architecture with different levels of abstraction.

Since each of the cells of the Zachman framework describes an architecture or independent model that an organization might have, it was essential to make an attempt to relate each of them with at least one of the three investigated methodologies. The results of this correlation are shown in *Table 4*. In this table:

✦ light-gray cells correspond to the OntoUML methodology;

✦ dark-gray cells correspond to the BORM methodology;

✦ vertically shaded cells correspond to the DEMO methodology;

✦ white cells – without existing methodologies.

The results presented in *Table 4* complement our findings above and identify a number of additional deficiencies:

✧ the DEMO describes an organization as a system; that is why it can be used for the complete description of the System Representation Models;

✧ the set of the DEMO, BORM and OntoUML methodologies allows us to describe in detail the business processes of the organization at different levels, from the ontological to the datalogical;

✧ none of the reviewed methodologies is intended to describe the program code and program implementation (Operations Instances);

✧ none of the reviewed methodologies takes the time component and goal-setting in the Scope Context and Business Concepts perspectives into consideration.

Thus, the set of the investigated methodologies:

• contains all the concepts inherent in the systematic approach to the modeling of organizational structure;

• allows us to provide a detailed analysis of the business processes of the organization, its objects and relationships;

• and thus provides information sufficient for multifaceted modeling of organizational structure.

Table 4.

Assessment of completeness of the DEMO, BORM and OntoUML methodologies in the frame of the Zachman framework

	What?	How?	Where?	Who?	When?	Why?
Business context planners	BORM OntoUML	DEMO	OntoUML	DEMO OntoUML		
Business concept owners	OntoUML	DEMO	OntoUML DEMO	DEMO OntoUML		
Business logic designers	DEMO OntoUML	DEMO BORM	DEMO BORM	DEMO OntoUML BORM	DEMO BORM	DEMO BORM
Business physics builders	OntoUML	BORM	BORM	BORM OntoUML	BORM	DEMO BORM
Business component implementers	OntoUML	BORM	BORM	BORM	BORM	BORM
The enterprise	OntoUML	BORM	BORM	BORM		

However, these methodologies don't take the time component, goal-setting and description of program implementation into account. But the assessment of the transactions duration and the impact of a particular transaction on the business process in general is important to achieve the strategic goals of the organization. Hence, it is advisable to consider the possibility of combining the DEMO, BORM and OntoUML methodologies with other tools to overcome the shortcomings. BMM (Business Motivation Model) [15] can serve as an example of such tool. It combines elements of the objectives definition (mission, goals, vision, tactics, strategy), as well as elements of business – processes (Business Rules, Course of Action, Desirable Result), establishing a link between them. That is extremely helpful for the integration of this model with the investigated methodologies and for covering the sixth aspect of the Zachman framework (*Figure 5*).

However, as the *Tables 1–3* show, the set of the DEMO, BORM and OntoUML methodologies is enough for multifaceted modeling of organizational structure.

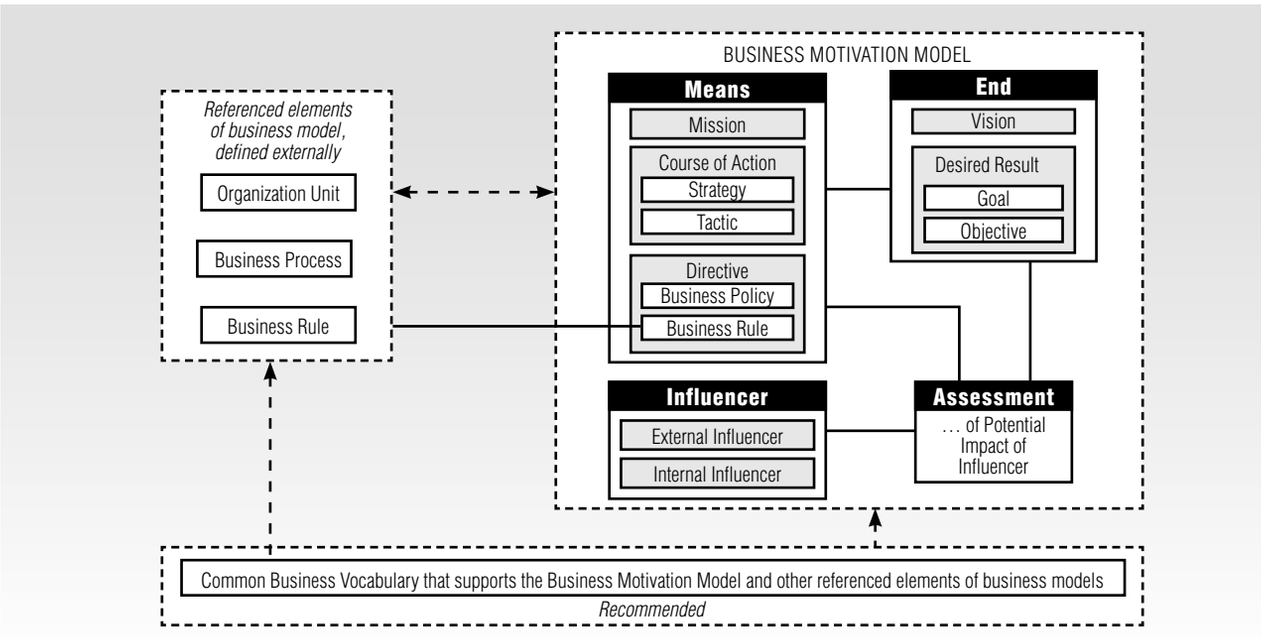

Fig. 5. The structure of BMM (Business Motivation Model)

5. Application of the DEMO, BORM and OntoUML methodologies

In order to assess the possibilities of the existing methodologies, it is essential to consider a popular example of a "Pizzeria" such as was used by J. Dietz [2].

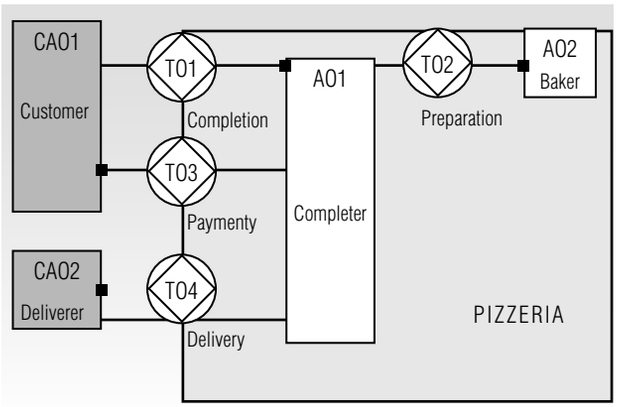

Fig. 6. The ATD diagram for the DEMO methodology (for the "Pizzeria")

Problem Statement: To order a pizza, the client needs to come into a pizzeria or make a phone call. In both cases, the manager writes down the name of the customer, the products ordered, the total cost, and the delivery address of the customer if necessary. After baking, the chef sends the order to the order box. If the client does not need the order to be delivered, the order is given to the customer. If delivery is ordered, the order is transferred to the courier. The courier delivers the pizza to the customer to the address specified in the order. After delivery, the customer pays the order.

There is the following description for the DEMO methodology (*Figures 6–9*).

These diagrams describe the organization as a system and give a complete picture of its activity, but omit the description of the technological content of the activi-

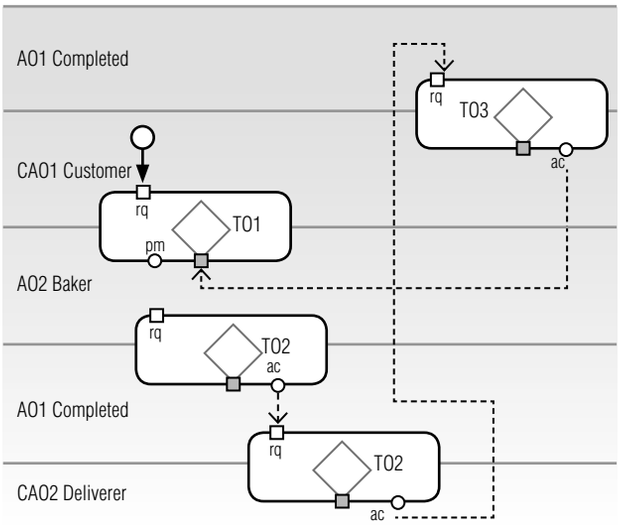

Fig. 8. The PSD diagram for the DEMO methodology (for the "Pizzeria")

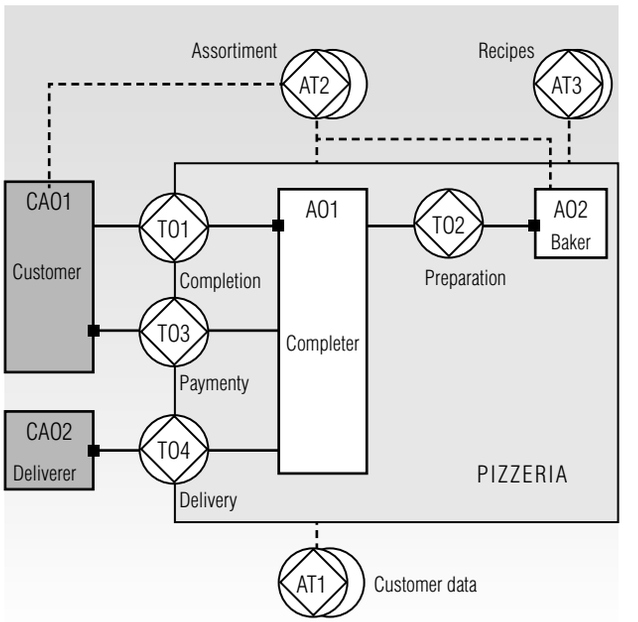

Fig. 9. The OCD diagram for the DEMO methodology (for the "Pizzeria")

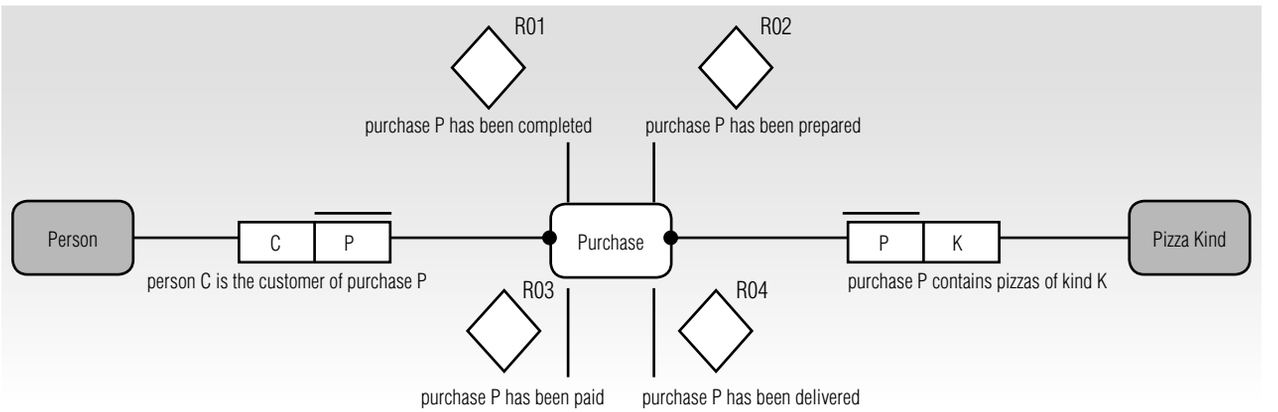

Fig. 7. The OFD diagram for the DEMO methodology (for the "Pizzeria")

ties, because the DEMO methodology describes the ontological level of the organization.

Let's consider the "Pizzeria" example using BORM (*Figures 10–12*) methodology. This methodology involves the description of not only the ontological level of organization, but also datalogical and infological. That is why the business processes are considered with the demonstration of all involved technologies and data-

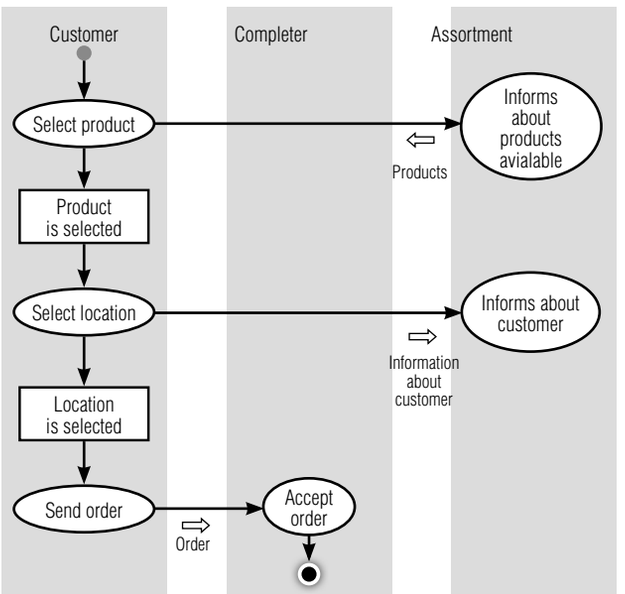

Fig. 10. The description of the ordering process with the BORM methodology (for the "Pizzeria")

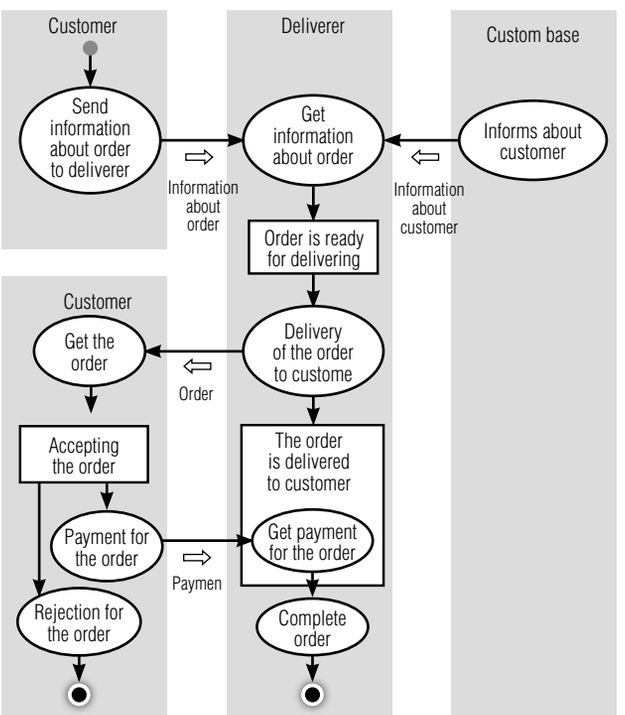

Fig. 11. The description of the process of order preparation with the BORM methodology (for the "Pizzeria")

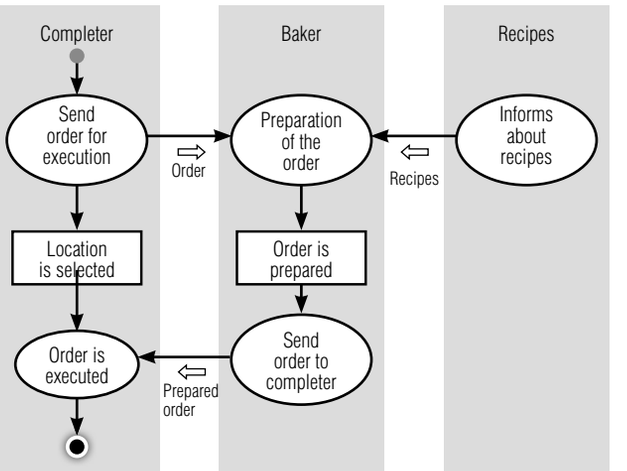

Fig. 12. The description of the process of order delivery with the BORM methodology (for the "Pizzeria")

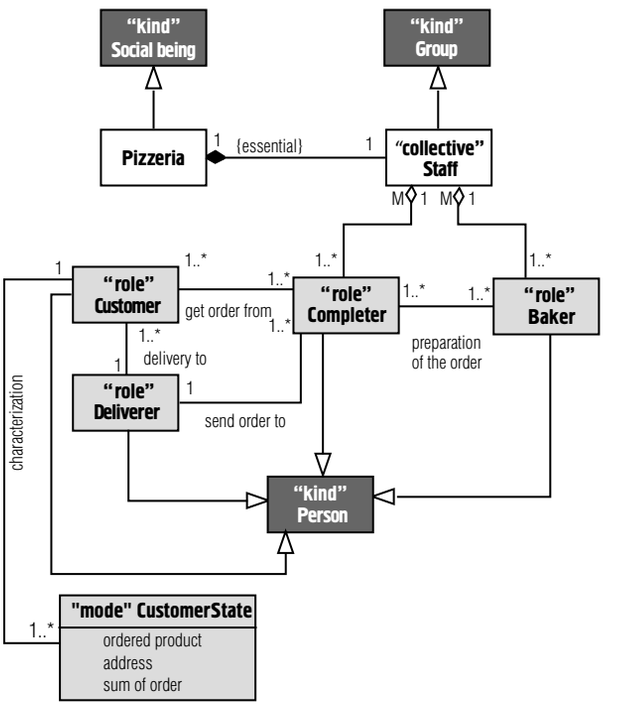

Fig. 13. Description of "Pizzeria" within OntoUML (UFO-A) methodology

bases, so the description with the BORM methodology takes a few diagrams.

Furthermore, it is essential to give a description of this case using the OntoUML methodology. Because the presently existing version UFO-A describes only objects, their interaction and hierarchy, it is difficult to assess it with the DEMO or BORM methodologies, which focus on the description of the organization's business processes (*Figure 13*). But OntoUML, as well as the DEMO methodology, considers the ontological level of the organization and describes its objects.

In order to evaluate the effectiveness of the existing methodologies, we conducted a survey in which we asked a group of business analysts to choose the methodologies that are more suitable in the specified business situation:

1. The company "Pizzeria" has lost 30% of its revenue today because a few orders were delivered to the wrong address, despite the fact that information obtained by a person with the role of "Completer" was correct. What was the reason?

2. The company "Pizzeria" decided to create a website so customers could place an order online. What changes are needed in the current process?

3. The company "Pizzeria" has decided to open another branch in the city center, which is going to operate in the same way as the existing one. But it needs to reorganize the staff and hire full-time couriers. How will this affect the current process of work?

4. It became clear that it is unprofitable for the organization to keep two full-time cooks, because their workload is 50%. Therefore, to reduce costs, it has decided to keep the process of orders preparation within one market place. The other branches just deliver ready semi-finished products. What influences the decision?

Analysis of expert responses shows that it is appropriate to use the BORM methodology in case the changes do not affect the course of the process as a whole, because only this methodology shows the details of the process and allows us to understand which stages of the process have failed. When it comes to changing the working process in general, which affects the processes at the ontological level, the DEMO methodology is more suitable. When we are talking about fundamental changes in the process of work, affecting the employee hierarchy, it is advisable to use the OntoUML methodology along with the DEMO methodology, because they describe the relationships and staff communication within the company (*Table 5*).

From the examples and the results provided, we may conclude that the methodologies considered have a lot of similarities and differences, but they focus on the different aspects and activities of the organization using different methods of analysis. That is why for the multifaceted analysis of organization it is essential to take into account the results of simulation analysis using the methodologies investigated combining their results.

Conclusion

As noted above, the DEMO, BORM and OntoUML methodologies use different ways for analysis of the organization and its business processes. In order to completely realize the process of organization modeling, it has been essential to combine these three methodologies, comparing them and identifying common elements and concepts.

Firstly, it has been useful to describe in detail each of the specified methodologies, reveal the essence of their

Table 5.

The responses of experts to the questions above

Experts	Answers to Question 1	Answers to Question 2	Answers to Question 3	Answers to Question 4
Expert 1	BORM, as it will require evaluation at the infological or datalogical level in order to get a full picture of the situation	DEMO, because there will be changes of the process at the ontological level, and BORM, because it will be necessary to show peculiar features at the infological level due to the new information flows	OntoUML – because there will be changes in relationships.	OntoUML – because there will be changes in relationships, and DEMO, because the process of work will be changed radically.
Expert 2	BORM	DEMO	DEMO	OntoUML
Expert 3	BORM	BORM, DEMO	DEMO, OntoUML	OntoUML
Expert 4	BORM	DEMO, the changes in business model will lead to the changes in the process at the highest level	OntoUML, It needs a new hierarchy, DEMO, If we hire full-time couriers, it will change the model of processes at the ontological level.	OntoUML, DEMO
Expert 5	BORM, because it is probably a failure in the information flow	BORM	DEMO	DEMO, this will require a change in the business-processes of the company due to the change of its business model
Expert 6	BORM	DEMO	DEMO	OntoUML, DEMO
Expert 7	BORM	DEMO	OntoUML	DEMO

diagrams, notations and basic principles. The results have demonstrated that the unified methodology could better serve the purpose of multifaceted modeling of organizational structure.

Secondly, in order to solve the problem of the missing tool support for these methodologies, it has been worthwhile to represent this unified methodology in the form of the meta-model, which has been used as a basis for a future open software platform for multifaceted organization modeling.

Using the Eclipse EMF technology for developing this meta-model, the future software will be provided with extensibility and the opportunity for integration with other Eclipse projects. This meta-model may be presented as a basis for international consulting companies.

Furthermore, in the framework of this research it has been desirable to assess the completeness, validity and scope of the DEMO, BORM and OntoUML methodologies for describing enterprise architecture within the Zachman framework. It was found that the set of the investigated methodologies has allowed a detailed description of business processes of the organization at different levels, from the ontological to the datalogical. At the same time, none of them has involved the description of software implementation, the time component and goal setting. Therefore, it is advisable in the future to consider the possibility of combining the DEMO, BORM and OntoUML methodologies with other tools to overcome the drawback.

The analysis presented above of the investigated methodologies based on the opinions of experts has also shown that only the combined use of the DEMO, BORM and OntoUML methodologies allows us to describe the organization completely. The new methodology is going to make it possible to assess the quality and reflect the whole picture, which is important for the process of multifaceted organization modeling. ■

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Применение технологии Eclipse EMF для многоаспектного моделирования организации

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Аннотация

В данной работе исследуются наиболее развитые методологии, используемые для многоаспектного моделирования организации. Проблематика заключается в различных подходах исследуемых методологий (DEMO – Design and Engineering Methodology for Organizations, BORM – Business Object Relation Modeling и OntoUML) к анализу организации и ее бизнес-процессов, что приводит к различным результатам, усложняющим процесс организационного моделирования. Кроме того, на данный момент нет программного обеспечения, позволяющего работать с данными методологиями. Именно поэтому целью данной работы является создание с помощью технологии EclipseEMF единой мета-модели, базирующейся на исследуемых, и анализ полноты модели для описания архитектуры предприятия. Созданная мета-модель будет служить основой для новой открытой платформы для многоаспектного моделирования.

В ходе изучения и анализа данных методологий было выявлено, что их совокупность содержит все концепты, присущие системному подходу к моделированию организации, а также позволяет провести детальный анализ бизнес-процессов организации, объектов и их взаимосвязей. Поэтому совокупность методологий предоставляет исчерпывающую информацию для многоаспектного моделирования бизнес-процессов организации. Именно поэтому данные методологии необходимо рассматривать вместе.

Для оценки возможности объединения данных методологий было проведено их детальное сравнение. Результаты показали, что, несмотря на то, что данные методологии анализируют разные сферы деятельности организации, у них есть общий базовый набор концептов, принципов и элементов. На базе выделенных групп общих элементов и с помощью технологии Eclipse EMF была создана обобщенная мета-модель в форме Ecore-модели, являющаяся основой полноценной среды моделирования. Эта модель не только включает инструментарий для DEMO, BORM и OntoUML, но и содержит их связи, что предоставляет пользователю возможность для проведения многоаспектного анализа организации и способствует выработке нового подхода к моделированию организации. С помощью модели Захмана было выявлено, что эти методологии позволяют провести описание бизнес-процессов на разных уровнях организации, от онтологического до даталогического, представляя исчерпывающую информацию для многоаспектного моделирования. Однако все исследуемые методологии упускают из внимания временной аспект и целеполагание.

Ключевые слова: многоаспектное моделирование организации, архитектура предприятия, DEMO, BORM, OntoUML, унифицированная методология, модель Захмана, Eclipse EMF, систематическое моделирование организации.

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