Towards an Agile Business Modeling and Requirement Specification on Interorganizational Environments: a MDD approach

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(Thesis Project)

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Abstract

The main goal of business modeling is understand the organizations in order to provide software solutions. However, this is a hard task, and it's more hard when the modeling is not for a isolated organization but several organization that interacting.

Despite the importance of business modeling are still problems to solve: (i) current proposals for business modeling has centered his efforts for representing only business process, generally of isolated organizations, leave aside both organizational models and strategic information; (ii) the models used by software engineers have a semantics with which a business manager is unfamiliar, which causes the validation of these models, which interorganizational environment is essential, clearly becomes very complex; and (iii) imitating a classical scheme of engineering requirements, it is possible to construct a textual document business requirements to further analyze the business models currently available, however, this is a costly task both in time and resources.

In the PhD thesis, our main goal is to present and approach for business modeling, in which we link business process to organizational goals and interaction models. We propose a set of tools in order to maintain traceability among all viewers and we provide descriptions in several levels of abstraction, so that the more abstract models are useful for managers, while, refined models are useful for software engineers. Finally, through a set of MDD transformations, we find generate a requirements specification document for interorganizational environments *RSDIO*, that it's based in a previous work in the field of economic sciences.

Thus, graphical models are useful for engineers and the subsequent construction of the software, while the textual document is useful for business managers. This facilitates the validation phase of the requirements, improves the traceability between models and analysis of business requirements and lowers the cost in time and resources. The work will be validated in a real case study.

Chapter 1

Introduction

The current economic outlook has led to the rise of business modeling. Business modeling allows, inter alia, (i) understand the structure and dynamics of organizations, (ii) visualize their problems and identify potential improvements, (iii) ensure that clients, users and developers have a common understanding of the organization and the subsequent derivation of the system requirements. Therefore, make this model is not an easy task, even more, when the models are for several organizations that interact.

Through a review of the literature, we found tree basic problems in the area of business modeling:

- The current business models represent only business process, however, important information that researches as John Nash and Hau Lee in the field of economic sciences, and Mike Papazoglou in the field of software engineering, that they were considered essential to be included.

  In the field of economic sciences, both John Nash in his works about game theory [17] and Hau Lee, in his works about supply chains [11], have agree in saying that when two or more organizations join in partnership to achieve the greatest benefit, each organization must be concerned about compliance, not just their individual goals but the fulfillment of the objectives of the alliance. So, it's important that in a business model, exists information about goals. Lee also says that to make more efficient a supply chain, both profits and losses must be shared.

  In the field of software engineering, Mike Papazoglou in [18], has determined that models which represents the interaction between two or more companies seeking to achieve a business objective is necessary to include additional information to business processes. This information is called *business transaction*. A business transaction includes comple-

mentary information such as role, participants, legal constraints, invariants, documents, business functions, attributes and relationships.

- Current business models are developed in complex languages such as UML or BPMN. This difficult the process of model validation by the client. Furthermore, this validation is a crucial step in an interorganizational environment in which several organizations interact to fulfill their business goals [19]

- Finally, although it may translate from textual document to business model to be validated by the customer, the subsequent specification of this document is a task far from trivial, and besides being prone to errors, and it is to obviously costly, both in time and resources [5], [6], [8], [15].

All drawbacks mentioned above, we motivate to complement the related work.

Structure of this thesis project

The structure of thesis project is divided in the following six blocks:

- Background: in this chapter we study the proposals for business modeling. In addition, we list and comment our main contributions

- Hypothesis and Objectives: in this chapter we describe our starting hypothesis to develop the thesis project. In addition, we briefly present our objectives that we want to achieve throughout the project.

- Methodology: in this chapter we describe the research methodology we are going to follow.

- Work plan: in this chapter, we describe roughly our work plan for the thesis project, and also present a schedule summary in which are distributed the main activities to be performed.

- Conclusions: finally, in this chapter, we present the conclusions we have been able to draw from the preliminary research carried out.

Chapter 2

Background

Specification of Requirements

In this subsection we analyze the proposals related to specification of requirements. The summary of this analysis can be seen in Table §2.1.

To determine what information should be available in a *RSDIO* we rely on previous work of author J. Peña in [19].

In [24], authors propose a meta model called *REMM (Requirements Engineering Metamodel)*, which includes some elements that should appear in a *RSDIO*. Furthermore, the authors propose a modeling tool that can graphically see elements like stakeholders, test cases and a glossary of terms. However, elements of both objectives and organizational roles, business processes or interactions are not taken into account. Also, do not arise automatically transform this model to a textual document.

Winkler in [26] proposes a set of meta models as part of an integration mechanism for managing the requirements in a software project in a common repository. Unfortunately, meta models are purely conceptual, the proposal not detailed its structure and content and the author do not proposes ways of transforming these models into text. In addition, work is not focused on interorganizational environments.

In [23], authors propose a tool for elicitation, classification, analysis and selection requirements. Although the tool is visual, the requirements remain captured in textual form.

A useful meta-model in order to capture a set of requirements is proposed by Vogel et Al. in [25]. Unfortunately, author does not take into account the

Feature	Proposals					
	[24]	[26]	[23]	[25]	[16]	[2]
Interoganizational approach	-	-	-	-	-	√
Automatic transformation	-	-	-	~	√	-
Specification of requirements	√	√	√	√	√	-
Specification of analysis	-	-	√	-	-	-

Table 2.1: *Comparison of proposals in specification of requirements.*

interactions and inter-business processes. However, although the author proposes model to text transformations, article does not detai those transformations.

Meziane et Al., in [16], propose a mechanism for generating natural language specifications from UML class diagrams. Despite the novelty of the proposal, class diagrams covered only a proportion of the required information in a *RDSIO*.

Software tools for elicitation of requirements such as REM, or CALIBER or DOORS are focused toward a more textual than graphic elicitation of requirements. This leads to formal models, should be from scratch, with the consequent spend in time and money.

To conclude, none of the proposals above takes as reference models for modeling interorganizational business, or provide mechanisms for automatic transformation of these models to textual documents using an MDD approach.

Business modeling

In this section we make an analysis of proposals for business modeling. Summary of this analysis is in Table §2.2.

In order to determine the desirable information in a business models, we have taken the proposal of M. Papazoglou in [18] complemented with proposal of Peña et Al. in [21] y [20].

Feature	Element	Proposals									
		[18]	[27]	[7]	[10]	[1]	[12]	[9]	[3]	[4]	[14]
Process	Business process	√	√	-	-	-	√	√	√	√	-
Goals	Organizational goals	-	-	-	√	√	-	-	-	√	√
	Role goals	-	-	-	√	√	-	-	-	√	√
Business information	Parties and roles	√	-	√	√	√	√	√	√	√	√
	Constraints and invariants	√	-	-	-	-	-	-	√	-	-
	Business objects / documents	√	√	√	-	-	-	-	√	-	-
	Business functions	√	√	-	-	-	-	-	√	-	-
	Class attributes	~	-	-	-	-	-	-	√	√	√
	Graphical notation	-	-	√	~	~	√	√	√	-	√
Abstraction	Levels	-	-	-	-	-	-	-	-	√	√

Table 2.2: *Comparison of proposals in business modelling.*

In [18], the author proposes a model called Business Transaction Model - *BTM*. In *BTM*, author includes five additional elements: (i) the parties that interact in transaction and the role that play those parties, (ii) constraints and invariants agreed among the parties, (iii) a set of documents used in transaction, (iv) a predefined business functions, (v) the process performed in trasaction, and (vi) bussines functions and a set of attributes and relationships.

However, this approach has a set of drawbacks, including, classes without attributes in meta model, associations without name i.e. between class *BusinessTransaction* and class *Party*. Aditionally, author not include information about goals both roles and organizations.

As we can view in Table §2.2, in [27], authors suggested an MDD approach to modeling business process, in which, includes roles and exchanged information among parties. Unfortunately, there is not information related with goals, levels of abstraction, and complementary information for the business.

In [7], the authors propose the alignment between business view and information system view through and MDD approach. Although this approach is aligned with our proposal, and the value models are very closed to required semantic for managers, the proposal no take into account important features such as business process, goals, levels of abstraction, etc.

As discussed in previous section, a key element that should be included in a business transaction are goals. Goals is taken into account in [10], [1] and [14]. Authors apply TROPOS methodology to systems based on Web services. However, in this work does not take into account business processes, constraints, business functions, attributes of classes or documents exchanged. In addition, another shortcoming that has made the proposal is to use a notation of its own that does not conform to a standard, i.e, UML.

In Table §2.2 we can show that proposal [12], that seeks the implementation of business processes with human intervention, as proposal [9] applying a methodology for agent-based modeling business, are focused only on modeling business processes, leaving out the information associated with goals, business data and levels of abstraction.

In [3], we propose a set of extensions Papazoglou work, whit a ISOA methodology called MaACMAS. These extensions are summarized in the use of UML2 collaborations for interaction and organizational models. With an MDD transformation can map some features of *BTM* to business processes using BPMN notation and vice versa. Unfortunately, and as shown in Table §2.2, this proposal does not include information related to goals, levels of abstraction and vertical traceability of models.

The EKD method, detailed in [4] is one of the most comprehensive proposals for modeling business. However, aspects such as constraints and invariants, business objects, business functions are not taken into account.

Other proposals for business modeling like Penker et Al [22] and Marshall [13], do not focus on modeling interorganizational or maintain the traceability between models.

In conclusion, none of the revised proposals covering all aspects that we believe must be present in a business model. Since our previous proposal is the most complete, we rely on it to extend it.

Summary of Contributions

In the following, we comment our obtained publications for now in the context of business modeling.

- DSDM Paper 2008: in this paper we propose a metamodel adapted to MDA/MDD and a notation based in Collaborations on UML2 with small extensions to the instantiation of metamodel. In adition, we develop a MDD transformation that can map elements of metamodel to business processes using BPMN notation and vice versa.
- IDEAS Paper 2009: in this paper we present an approach to business modeling, based in methodology for agents called MaCMAS, in that we associate business processes to the objectives and organizational models of interaction. We also provide mechanisms to maintain traceability between all views and provide descriptions at different levels of abstraction, so that more abstract models are useful for business managers, while the more refined are useful for software engineers. This paper was honored with the *best paper award*.

Chapter 3

Hypothesis and objectives

Hypothesis

> ***Our Hypothesis****: It is possible to improve the business modeling and requirement specification on interorganizational environments using MDA/MDD techniques. In addition, it is possible link business process to organizational goals and interaction models. Finally, it is possible propose a set of tools in order to maintain traceability among all viewers and provide descriptions in several levels of abstraction, so that the more abstract models are useful for managers, while, refined models are useful for software engineers.*

In order to demonstrate our hypotesis, our PhD dissertation must answer some questions. In the following we state some of them and envision their possible answers:

- *Which are the business models for interorganizational environments available in the literature?* After reviewing the state of the art we have identified a few number of techniques for business modeling on interorganizational environments.
- Is it possible to provide a tool that allows the traceability among models (goals, organizational and business process)? In order to achieve this, we aim to use model-to-model transformation in order to generate (i) a organizational model from a goal model and vice versa, (ii) a business process model from a organizational model and vice versa.
- Is it possible to provide a tool that allows the traceability between models and a requirement specification document? In order to achieve this, we aim to use text-to-model transformation.

Objectives

- Elaboration of the PhD Thesis document: our main objective is the elaboration of our PhD Dissertation.
- International and National participation: Up to now we have published our first research results in some important conferences in our area, such as: *Taller de desarrollo de software dirigido por modelos* and the *XII Conferencia Iberoamericana de Ingeniería de Requisitos y Ambientes Software*. In the near future, we intend to participate in the main forum in our area: International IEEE Requirements Engineering Conference.
- Publications: we aim to publish our results during and after the PhD dissertation in some of the journals related with our research area, out of which we have considered the Requirement Engineering Software.
- Transference of Results: We will integrate the results of our PhD Thesis in e-MaCMAS, a Spin Off of University of Seville.

Chapter 4

Methodology

To decide about the methodology to be used in Software Engineering is not trivial because there is no consensus about the research methods to apply. Based on the experience of our research group in research and transfer of results, we have decided to combine two methodologies, the Action Research and the Unified Process. On the one hand, Action Research is an approach provided by our research group as a contribution to the debate about the problems in software engineering research [5, 6]. In this methodology two important factors to be considered are research results dissemination and technological transfer. On the other hand, the Unified Process is a framework that provides an iterative and incremental development process. It is highly appropriated for our project, since we aim for a dynamic development by applying constantly knowledge updating in a controlled way.

The first two phases of our methodology is based on Unified Process, as follows:

- **Inception**: At this phase, we define what is the problem that we will solve. Identified the work to be done, we have to identify the key points of it. Based on our previous experience in the research context of our work, we define a possible solution. This phase was finished on the research period in which the Advanced Studies Diploma (DEA) was obtained. We carried out this activities through meetings with the PhD thesisŠs supervisors.

- **Elaboration**: The main goal of this phase is to identify and define the relevant work packets and their tasks. At this phase we develop a coarse-grained project plan for the Action Research methodology. During the execution of the work project, those tasks are reviewed and refined in order to achieve the best solution.

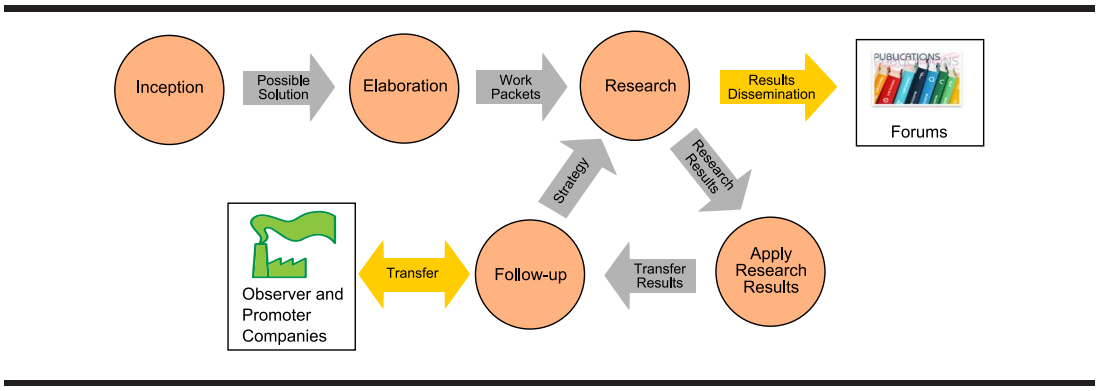

Figure 4.1: *Our research methodology.*

We consider that the next two phases of the Unified Process, the Construction and Transition phases, are embedded in the Action Research methodology. At this point we use this methodology because it is focused on research results dissemination and technological transfer. Then, for each task defined in the elaboration phase we proceed with the following phases:

- Research At this phase for each task defined in the work packets we review the literature, design a solution and validate it by means of tools, prototypes or validation tests. In addition, we determine the workshops, conferences or journals where the Research Result (RR) can be disseminated. After the validation of the RR, we disseminate it in the forums previously identified. The work method used to define steps and objectives during this phase is through periodic meetings with PhD thesisŠs supervisors and research reports. In this way, the researcher will present and document the advances achieved, whether they are research results or conclusions about literature reviewed.

- Apply Research Results at this point we stablish a transfer planning of RR to the interested companies as Transfer Result (TR).We apply our main RR to real contexts, converting them into TR.

- Follow-up At this phase, we are ready to transfer our main results to the research projects Observer and Promoter Companies (EPOs) in which is placed this thesis. At this point another important step is essential, to redefine our strategy based on the feedback obtained fromthe interested companies.

Figure §4.1 depicts an overview of out research methodology.

Chapter 5

Work Plan

Our work plan for the thesis period is organized to be realized in approximately two years, considering that we have already passed the lecture and research periods to obtain the Advanced Studies Diploma (DEA) in June 2008. Roughly speaking this work-plan is divided into five main groups of activities:

- Publications: it is the activity that has more scope in the timetable. The objective of this activity is to publish all results to be obtained throughout the course of our research in the different forums presented in Section Background Information.. The dissemination of our research results is an important task in our research methodology.
- Writing PhD thesis dissertation: this activity will be undertaken throughout the whole schedule, however we would like to highlight two specific points in time. In mid-2010, we intend to have a preliminary version of the thesis dissertation, indicated at Preliminary version. Later in the timeline we set Final version, the point at which we believe that the final version of the thesis will be ready to submit to the doctoral committee. In order to obtain the European PhD degree, we must fulfill some requirements, such as: 1)Writing the PhD dissertation in English; 2) Send the PhD dissertation to two European doctors who will send back their insights, and 3)Proceed with the steps the University of Seville has established to inscribe an European PhD thesis.

Figure §5.1 depicts the work plan.

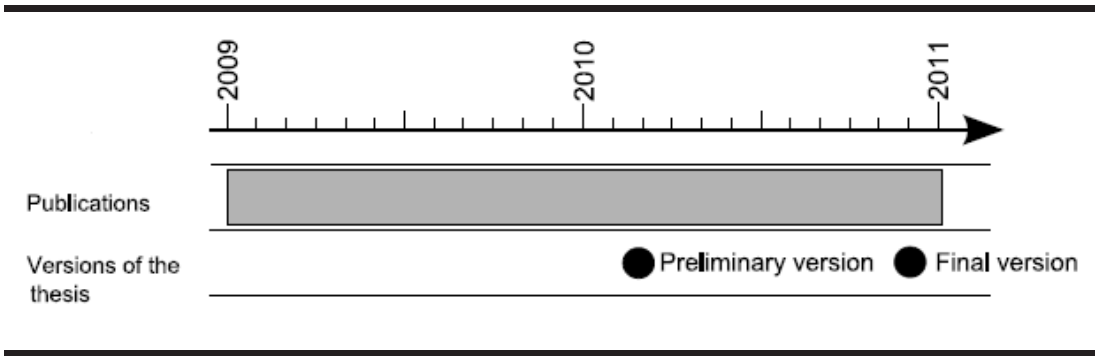

Figure 5.1: *Work plan.*

Chapter 6

Conclusions

In this paper we have focused the problem of modeling interorganizational and we desire present those contributions:

- We take into account the elements necessary for interorganizational business model: goals, interactions between organizations and business processes.
- We want provide the ability to model the business at different levels of abstraction, from a more strategic level to more operational level.
- We want provide traceability both horizontally (among the three types of models) and vertical (among different levels of abstraction).
- We want validate our proposal with a MDA prototype with Eclipse technology that can draw the models and maintain traceability between them.

These contributions observed from a viewpoint of business managers and software engineers provide the following advantages:

- *business managers*: managers can translate the documents exchanged with the software development company that truly crucial elements motivate them to buy software. These elements are: the strategic objectives, operational objectives that serve to fulfill the strategic objectives, costs and benefits, the way in which organizations of the participants have to align thanks to the software, etc.
- *Software engineering*: with our models software engineers can understand in a better way, what really worries the customer. So you can see,

without losing traceability, the relationship between business processes and strategic objectives. Traceability maintained to facilitate transmitting the following phases of the life cycle objectives and main concerns of software buyers.

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