BUSINESS MODELLING THROUGH ROADMAPS

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Abstract: Business modelling is a central activity to many different areas, including Business Process Reengineering, Organisational Development, Enterprise Modelling & Integration, Business Process Management and Enterprise Application Integration. It is well known that the business domain is not easy to understand neither to represent even for specialised people. The success of most of the contemporary methods for modelling Business Organisations is strongly associated with the level of understanding that the modelling team can attain about the specific situation being modelled. This understanding is directly related with the degree of modelling experience that the team has, as well as their ability to work with the techniques and tools prescribed by a specific method. Nowadays, most of the existing business modelling methods is concentrated in what the business concepts are and how to represent them. But, they lack of process guidance, which is needed to help the team through the modelling process. We elaborated the method BMM for modelling business application domains that provides working guidelines for the modelling team. This method, based on method engineering concepts helps teams to, not only, get a comprehensive knowledge about the business domain being modelled, but also, about the process of modelling the domain itself. This paper concerns with the representation of the process of modelling a business by using decision oriented process model formalism. The main contribution of our work is a set of roadmaps that contains the knowledge associated with team member's modelling experience in business modelling and EIS development. This knowledge arises from several case studies.

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1 INTRODUCTION

Business modelling is a central activity to many different areas, including Business Process Reengineering, Organisational Development, Enterprise Modelling & Integration, Business Process Management, Enterprise Application Integration, ERP System Configuration, E-Commerce, Software Development and Information System (IS) Planning and Development. For instance, authors, such as Avison, Fitzgerald (Avison, 2003) and Flynn (Flynn, 1992) emphasise the importance of modelling the application domain, i.e. the business organisation, before eliciting IS requirements. A business model – a model of the Enterprise IS application domain - can help IS developers to gain a more comprehensive understanding of the business, its information problems, and the functional requirements that the IS must satisfy.

The success of most of the contemporary methods for modelling business organisations is strongly associated with the level of understanding that the modelling team has or can achieve about the specific situation being modelled. This understanding is directly related with the degree of modelling experience that team members have as well as the abilities, they have working with the techniques and tools specified for the method. A good method should help teams acquiring experience and tools abilities by providing them with working directives that they can use while they are modelling.

Until now, method use and success are rigorously associated to team leader experience. That is, all his/her experience about how to manage specific modelling situations or projects is acquired from working in many projects and applying many times the same method. Experience it's just an individual knowledge that only belongs to the team leader. Any other person in the organisation can not reuse this knowledge. Reusing is a paradigm that allows organisation to take advantage of its previous experience, not only to gain time and money but to get things done better.

Nowadays, most of the existing business modelling methods lack of this kind of guidelines. Some of the methods found in the literature are Business Engineering (Taylor, 1995), RUP (Krutchen, 2000), Watch (Montilva et al., 2000), MERISE (Piattini,1995), EKD (Bubenko, 1994), Mainstream Objects (Yourdon et al., 1995), Information Engineering (Martin et al., 1994), Business Modelling with UML (Eriksson et al., 2000), and Enterprise Modelling with UML (Marshall, 2000). They just describe, in one way or another, the activities, artefacts and workflow that are needed to model a business. Nevertheless, none of them considers and models the process of modelling a business itself. In other words, they do not give explicit details and guidelines related with the *how* and *when* building each one of the elements or artefacts representing a particular business domain; i.e. about the process model associated to the method. We consider that, to guide a process is not just to prescribe a set of steps to be followed or to define a set of activities that must be done in a certain order. To guide a process involves the situational definition of what, when, how and under what circumstances a modelling activity could be done.

In (Montilva et al., 2003) we introduce a business modelling method called BMM (Business Modelling Method) that captures and represents the main concepts of a business system and their relationships, including the technologies that are applied by the business system. According to method engineering concepts, BMM has three main components– the product model, the process model, and the team model. The first component has already been described in the referred paper; here we will concentrate our effort in describing the second one, i.e. the process model. Thus, this paper concerns with the representation of the process of modelling business by using BMM method. The process model is situational oriented and it is represented at the higher level by a *roadmap*. A roadmap is based on a set of modelling intentions related by modelling strategies. It also contains a set of modelling routes which describe specific sequences of the execution of map intentions. Each route expresses a way of working defined and followed for modelling a particular business context. A map route may be selected, reused and modified by a modelling team in a similar modelling context. Situational oriented process models permit to model a business from reusing previous modelling experience or even the experience coming from outside the organisation.

The paper is organised as follows. In Section 2, we present the working definition of business systems used by the BMM method and the relationships between the notions of enterprise, business systems, and enterprise information system. The scope and structure of the BMM method are summarised in Section 3. Section 4 presents the process model

along with its background concepts. Section 5 presents an example of how to use the process model, i.e. how to navigate in a roadmap. Finally, section 6 discusses the significance of the process model, its advantages and limitations.

2 THE BUSINESS SYSTEM

An enterprise is a business organisation that may be seen as a human activity system whose main activities, called business processes, are designed and executed to reach a set of pre-defined goals (Fuenmayor, 2001). A business system is part of a major system: the enterprise. A production enterprise, for example, is structured into several business systems, such as the engineering system, the production system, the marketing system, the personnel system, the finance system, and the accounting system. The execution of the enterprise's business processes is normally supported by a kind of software applications called Enterprise Information Systems (EISs). Some common types of EISs are enterprise resource planning (ERP), legacy applications, OLTP applications, EAI applications, e-business systems, e-commerce applications, management information systems, and executive information systems.

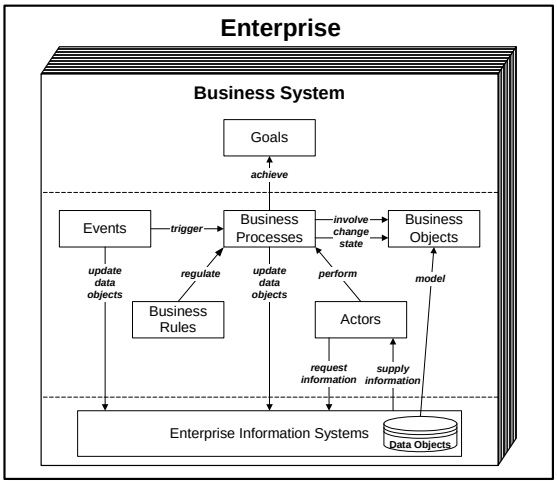

Figure 1: Relationships between an enterprise, its business systems and its EISs

A business system is comprised by an organised set of activities called business processes that are designed and performed by a group of actors with the purpose of achieving a set of pre-defined goals. Actors are organised into a job structure composed by business units (e.g. departments, divisions, and sections). Actors have associated roles that define the responsibilities for performing processes. Each processes requires, uses or involves a set of business objects (e.g., personnel, clients, raw materials, products and clients) and one or more technologies (e.g., information systems, production methods, techniques or instruments). A business process is triggered by an event (e.g., the arrival of raw material or a service order) which may modify the state of the objects involved in the process. A process is regulated by business rules (e.g. laws, policies, norms and procedures). Therefore, an enterprise is seen as a set of business systems. Each business system has associated one or more EISs, as shown in Figure 1.

The tight relationships between a business system (goals and processes levels) and its EISs illustrated in Figure 1 can be summarised as follow: "Actors request information from an EIS to perform business processes. The EIS supply the requested information by processing the data stored in its database. An EIS database is a model of the business objects associated with the business processes. Each relevant object of the business system is represented in the database by a data object, which captures the state and behaviour that the business object has in the business system at a given time. The business processes and the events that occur in the business system, or in its environment, generate data that are used by the EIS to update the database".

3 THE BUSINESS MODELLING METHOD (BMM): Scope And Components

The BMM method for business modelling uses the notion of business system developed in Section 2, in order to create business models. The BMM is based on principles, processes and concepts borrowed from Method Engineering (Odell, 1996), (Brinkkemper, 1996), Enterprise Modelling (Eriksson et al., 2000), (Marshall, 2000), (Montilva, 1999), and Object Oriented Software Engineering (Bruegge, 2000). From the point of view of method engineering, a method must be composed of three interrelated components: a *product model*, a *process model* and a *team model.* The *product model* describes the generic structure and characteristics of the product to be elaborated using the method. The *process model* describes the structure and dynamics of the activities needed to produce the product; and the *team model* describes the roles of the team's members to be

played during the application of the method (Montilva, 2003). BMM is structured as follows:

a. **The BMM product model.** It describes the generic concepts that characterise any business system and the relationships between these concepts. It defines the structure of the business model and indicates what must be captured and represented during the business modelling process.

b. **The BMM team model.** It describes an appropriated way of organising the business modelling team and describes the roles that the members of this team must play during the business modelling process.

c. **The BMM process model.** It describes modelling intentions along with a set of guidelines that guide modelling team through the process of building a business model. This business model is an instantiation of the product model concepts.

The first two components are briefly described in the next subsections. The process model will be described in detail in section 4.

3.1 The Product Model

Based on the notion of business system elaborated in Section 2, we built a product model that identifies and represents the set of generic concepts that may be found in any business system (see Figure 1). The importance of this model is that it identifies the set of business concepts that must be represented during the process of modelling the business system. An important decision to be made during the business modelling process is the notations and languages that the modelling team must use to represent the structure and behaviour of the business concepts. We chose UML (Booch et al., 1999) as the main modelling language. UML is the de facto standard for modelling software and is used by many well-known methods involving business modelling (see, for example (Krutchen, 2000), (Eriksson et al., 2000), (Marshall, 2000). The main business concepts manipulated by our method are: Business goals, business processes, actors, business units, technologies, business rules, business objects, and events. For further details about the product model, see (Montilva et al., 2003).

3.2 The Team Model

An important element of any method is the organisation of the team that will develop the product. Defining the roles of the team members is crucial to the application of the process model, because it helps the team leader to select the right people and assign the appropriate activities to them. A business modelling team can be organised in many different ways depending on the size and complexity of the business system. For instance, for small and medium size projects, the business modelling team can be organised by a *team leader* who is responsible for planning, organising, directing, and controlling the effort and resources needed to model the business system; one or more *adviser users* that bring to the modelling process their knowledge about the business system; one or more *business analysts* who interpret the user's knowledge and represent this knowledge using the modelling languages indicated in the product model. Business analysts are responsible for building the components of a business model; and, one or more *business system managers* who are responsible for validating the business model.

4 THE PROCESS MODEL

A process model prescribes the set of possibilities for manipulating and relating the concepts described in the product model, in order to build a *product* – a business model. A process model should guide the modelling team while they are building a business model. For instance, the hierarchy of goals representing the future situation of a public organisation is a product built by using product model concepts according to process model prescriptions and guidelines. The guidelines allows team members to select, according to current business and modelling situations, what are the intentions associated to goals hierarchy that best match the current modelling situation.

Commonly, process models associated to business modelling methods are activity oriented. They organise modelling activities in different ways. It could be for example, a set modelling phases, a set of steps to be followed or even a cyclic iterative process. However, the fact of prescribing a strict set of sequential activities that should be followed, one after another, limits the application scope of designer knowledge and experience. Consequently, listing activities and tasks restricts the selection of

what activity is more appropriated to solve a particular modelling problem or what should be the precedence order of these activities. Summarising, an activity oriented process model restricts the creativity that should be present in any design process.

BMM process model inspired on the intention oriented paradigm described in (Jarke et al., 1999) is presented as process maps that contain multiples roads for building any of the business products listed in section 3. In our case, an intention expresses a current or a future modelling state, a vision or future modelling direction to be followed. Usually, it is expressed as a verb that expresses an action to be executed over a subject. For instance, "*Build IS model*" is a modelling intention.

The intention-oriented formalism allows us to express, directly, the modelling intentions associated with business model construction. Each time that an intention is executed as a consequence of a decision, the current modelling situation is transformed into another situation. This new situation is submitted to a new decision process that will allow modeller to transform the current state of the product being built, and so on. This way of working characterises decision oriented process models, it allows us to define non-deterministic process models expressed at different levels of granularity.

Finally, the BMM process model represent directly team modelling intentions (which are based on current and future modelling situations) without restricting and encapsulating his/her creativity, knowledge and experience. The intention oriented process model formalisation is carefully described in (Rolland et al., 1999) and (Barrios, 2001).

4.1 The roadmaps

A roadmap is a multi-process model that comprises a set of modelling routes that can be followed to build a particular product. We called roadmap because its analogy with a traditional map of routes where for going from one point to another may be several different routes (see figure 2). By using a roadmap, team members can see at a glance, the set of possibilities they have for progressing in the process of building a business model (or a part of it). The selection of a specific route depends on what are the current decider needs; i.e. taking into account the current modelling situation and the team experience, team members select what to do next and how to do it. Observing figure 2, we note that each modelling intention is a node in the map, each different way of achieving an intention is a road between one intention and another (an arc between two intentions). A roadmap has always two fixed intentions called *Start* and *Stop*. They represent the intention to start navigating and to stop doing so, respectively.

An intention oriented process model is organised into three levels of abstraction, which allows us to represent guidelines at different levels of detail. At the two higher levels, the granularity of the guidelines is gross, i.e. the intentions are expressed by global verbs whose decomposition in low level verbs is always possible. At these levels, the process model is presented as process maps: a global map for the higher level intentions and several local maps according to the decomposition of each one of the higher level intentions. Each process map may contain multiple routes for building specific product parts by following different modelling strategies according to particular modelling situations. For instance, the route followed in the study case presented in section 5 is sequentially numbered (steps 1 to 7) in the global depicted in figure 2.

At the lowest level, the guidelines are expressed by contexts according to Nature Project (Jarke et al., 1999). A context expresses a specific way of achieving a specific intention according to a specific strategy already chosen. A context may be a set of steps to be executed in a particular order – it is called a plan context, a set of alternative ways which can be selected according to context directives – a choice context. At the end of any of these two kinds of context, there is always an executable context. It prescribes, in detail, the set of actions needed to achieve an intention. This set of actions is expressed by adapting the notion of context that has been conceptualised in the Nature Project according to business model representation needs. For a more detailed description of this formalisation review (Barrios, 2001) and (Rolland et al., 1999).

4.1.1 Map Guidelines

As we explained above, a roadmap is a navigational structure that supports the dynamic selection of the next intention to be achieved along with the appropriated strategy to execute it. A strategy defines a particular way or approach of achieving an intention. In order to facilitate decisions about what intention will be next and which strategy is the most appropriated, we use three types of guidelines according to (Barrios, 2001). These guidelines or directives provide the situational modelling support needed to follow a process map: the Intention Selection Directive (DSI) the Strategy Selection

Directive (DSS), and the Intention Execution Directive (DAI). The DSI permits to progress in the process of building a product by selecting the next modelling intention. The DSS permits to select a strategy for executing the modelling intention already selected. The DAI describes the set of activities and tasks that should be performed for building the product according to the strategy already selected.

The guidelines are expressed by considering a triplet of concepts (Ii, If, S). Ii represents the initial intention – associated to the current modelling situation, If represents the final intention – next intention to be executed, and S represents the strategy that guides the way of passing from Ii to If. Each directive comes along with a set of arguments that help during the process of choosing a particular intention to be achieved and the way it will be achieved.

Due to space restrictions, in Table 1 there is an example of each type of guideline. They are part of the global map depicted in Figure 2.

Table 1. Examples of Roadmap Guidelines

DSI1	<(Business Modelling Problem) ; **Progress** from **Start**> := <(Business Modelling Problem) ; Select (DAI9 : < (Business Modelling Problem) ; Build Business Goal Model by following Analyst Driven Strategy>) *(A7)* **U** <(Business Modelling Problem) ; Select (DAI16 : < (Business Modelling Problem) ; Build Information System Model by following EIS strategy>) *(A8)* **U** <(Business Modelling Problem) ; Select (DAI1 : < (Business Modelling Problem) ; Build Business Process Model by following Analyst Driven strategy>) *(A9)*
DSS2	< (Business Goal Model) ; **Progress** to **Build Business Process Model** >:= <(Business Goal Model); Select (DAI10 : < (Business Goal Model) ; Build Business Process Model by following an Chain Valued Strategy >)> *(A1)* **U** <(Business Goal Model); Select (DAI19 : < (Business Goal Model) ; Build Business Process Model by following a Technology based Strategy >)> *(A2)*
DAI16	<(Business Modelling Problem); **Build Information System Model by following an EIS Strategy**> : = <(Business Modelling Problem) ; Determine IS Domain > **.** <(Business Modelling Problem, IS domain) ; Revise IS initial requirements > **.** <(Business Modelling Problem, IS domain, revised list of requirements) ; Define IS Scope >

5 HOW TO NAVIGATE IN A ROADMAP

In this section we will illustrate through an example, the way roadmaps guide the process of doing business modelling. First, we will characterise the current modelling situation in order to establish the set of parameters that should be taking into account when deciding how to model a business. Then, we will describe systematically how to select a new modelling intention, the strategy to achieve it and the consequences of making that selection. Consider that each time that a decision is made, the current situation is transformed into a new situation. This new modelling situation is then submitted, through a new process of decision to select an intention to transforming it into a new situation. This process is repeated again and again until the product part (or the whole business model) is obtained.

Our case study takes place inside a public organisation, highly dependent on government regulations and country laws. Its initial need is to build an integrated information system for supporting the financial process of the organisation.

As we explained before, the process of modelling begins in the “start” intention in figure 2. The modelling problem described in the previous paragraph take us to decide that the modelling process must starts with the “Build Information Systems Model” global intention. We see that there is only one strategy to achieve it from the start intention; that is the “EIS – Enterprise Information System – strategy” (DAI16). In that particular case, the decision is supported by the guideline DSI1, which arguments match with the modelling problem exposed in this section. Each guideline always has a set of arguments that permits to make a decision about which one of the alternatives is the most appropriated for a specific modelling situation. For instance, the argument associated to the “Build the Information System Model” intention is A8. It prescribes the existence of a specific information system need inside an integrated work environment; it assures that the list of the IS initial requirements, already exist. In addition, it guaranties that there is enough managing support and resources availability. Thus, the modelling decision is to build an information system model by following the EIS strategy (1).

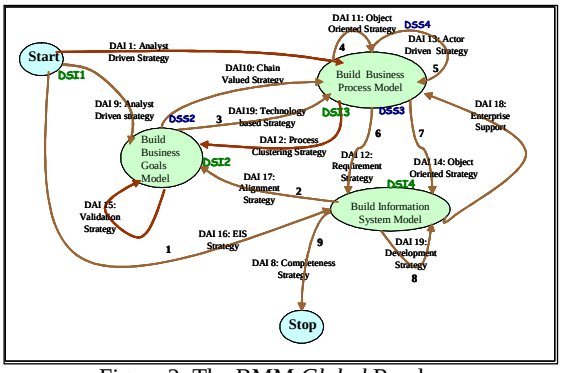

Figure 2: The BMM *Global* Roadmap

Once the scope of the Financial Information System – FIS project is established, and keeping us at the global map level (figure 2), the modelling team passes to associate the IS local goals with the business goals. This decision will permit to define an information system that really helps to accomplish the business goals and to assure that it is integrated to the others IS already built in the organisation. Therefore, the "Alignment Strategy" is followed for achieving the "Build the Business Goals Model" intention (2). This decision has been supported by the DSI4 guideline.

Continuing with the modelling process, and considering that the organisation is highly dependent on government regulations and laws, the next decision is associated to the intention "Build Business Process Model" by following the "Technology based Strategy" (3). This decision takes us to, first, modelling business processes according to business rules and business technologies, and then, to model primary and support processes. The object oriented and the actor's driven strategies are executed in order to complete and validate business process model. They are represented in the global map as steps (4) and (5). A more detailed view of the process followed - the route- to build the business process model is depicted in the local map showed in figure 3. This modelling route is a set of 13 steps numbered sequentially.

After the business model is built and validated, the modelling team can start to modelling system requirements and to defining business objects to achieve the intention "Build Information System Model". They are represented by steps (6) and (7) in the global map.

It is important to mention that this modelling process is iterative. That is, the selection and execution of a specific set of intentions has been repeated many times until the relationships between Business Process and FIS were well understood, defined and represented by the business model. Once the business model is ready, the Financial Information System FIS can be developed (8). The whole modelling process ends with a "Completeness Strategy" to achieve the "Stop" intention. These decisions are supported by the guidelines DSI3, DSS3, DSI4, and DSS4, respectively.

Finally, it is important to mention that for really take advantage of this notation, team members must remember that: a DSI guides the selection of the next intention to be achieved from a certain departing intention; a DSS guides the decision about which is the most appropriated strategy to achieve the intention already selected; and a DAI guides, in precisely manner, the execution of the selected intention with the selected strategy.

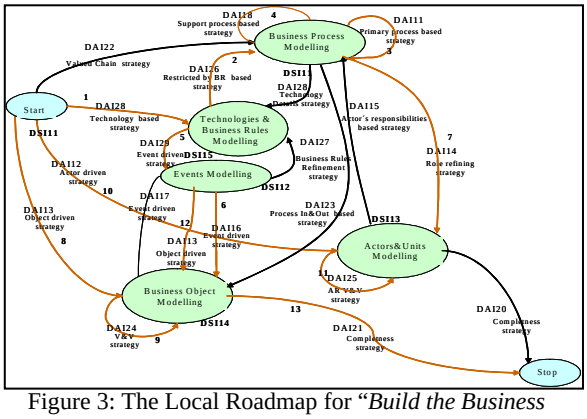

Figure 3: The Local Roadmap for "*Build the Business Process Model*" intention

6 CONCLUSIONS AND FUTURE WORK

We have presented in this paper the process model – the roadmap of the business modelling method called BMM. This method helps business modelling teams to plan, organise, and control the process of modelling a business organisation. BMM provides a clear and precise definition of the enterprise as a system. A system view of the enterprise helps organisational members to get a wider and complete picture of the enterprise, its components, and their relationships.

The process model of the BMM, not only guides the business modelling team to get an understanding of a business system they are modelling, but to get a comprehensive knowledge about the process of modelling the business itself. This knowledge is formalised through a roadmap containing strategies for achieving typical business modelling intentions. This formalisation permits to express, select, update

and reuse experience about the process of modelling business context with BMM. This knowledge is very useful for team modellers that do not have enough experience about BMM, when they are modelling similar business contexts in the same organisation or in other ones.

The significance and contribution of our process model are summarised as follows:

- A roadmap provides a global view of what has to be done for building a business model.
- A roadmap comprises the set of typical modelling intentions associated to the process of modelling a business context. This set of related modelling intentions comes along with a set of achieving strategies. These strategies can be selected for specific modelling situations according to the predefined guideline arguments.
- A roadmap is an easy way of expressing reusable experience that can be updated when knowledge about the process of modelling a business is incremented or refined. Thanks to the guidelines provided, a roadmap can be followed by anyone even by non-specialised people.
- A roadmap is a way of collecting the organisational knowledge involved in the process of modelling a business domain or context. It can be the starting point for building, exploiting and controlling an important part of the organisational memory. Besides, BMM helps in capturing two types of the organisational knowledge. First, the knowledge about business artefacts or elements such as goals, technologies, business rules, business processes, business objects, actors, job structure, and events. Second, the knowledge about the way these elements are captured, i.e. the process of modelling the business itself.
- This knowledge may be selected, adapted and reused as a whole or by process fragments (specific sets of DAI´s) for modelling different business contexts or domains.

Our future work will be concentrated in finding and expressing more reusable experience for specialised business domains. We work also, in the development of a business modelling tool that will permit to model a business by using BMM concepts and roadmaps. By now, the tool is a working prototype that allows modeller to define and represent hierarchies of business goals and its corresponding business processes.

It is important to mention that the BMM was used in the development of a business model for the Mérida's Free Trade Zone office. This case study provided a real environment that was complete and complex enough for the purpose of evaluating and improving the method. This experience is reported in (Barrios et al., 2002) and (Barrios et al., 2003). A first version of the BMM has been included as a business modelling phase in METAS, a method for planning the integrated automation of industrial plants (Montilva et al., 2001). The method has been extensively used as a teaching instrument for developing small projects in several courses on information systems and business modelling conducted at the University of Los Andes in Mérida, Venezuela. The knowledge expressed in the roadmaps, comes from all these modelling experiences and from others professional ones acquired after 20 years working with IS contexts.

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