A METHODOLOGICAL FRAMEWORK FOR BUSINESS MODELLING[1]

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Abstract: Globalisation phenomenon has created a very competitive environment for modern business organisations. In order to survive and continue being competitive in that environment, an organisation has to adapt to it quickly with a minimal negative impact over its current ways of working and organising. A business model contains the knowledge needed not only to support managers' decisions concerned with change and adaptation, but to ensure the opportunity and relevance of the information produced by the automated systems supporting them. The purpose of this paper is to present a methodological framework for business modelling. This framework allows its users to represent organisation's elements from different perspectives taking into account their relationships. A business model is presented as a set of three interrelated models – the Business Goals model, the Business Processes model, and the Information Systems model. The main contribution of our paper is to make visible and explicit the relationships among the three levels: goals, business processes and information systems. These relationships are commonly hidden or implicit in most business modelling methods. Our proposition has proven its usefulness as a strategic management tool in two studies cases.

1 INTRODUCTION

Nowadays, the globalisation phenomenon leaded by the effective use of information and communication technology (ICT) has created a very competitive environment for modern business organisations. In order to survive and continue being competitive in that sort of environment, organisations have to adapt quickly with a minimal negative impact over their current ways of working and organising. The process of managing an organisational change should be assisted by the use of models to support decision-making. Models act as complementary tools for describing, understanding and interpreting organisational situations and its consequences.

A Business Model describes the goals, the processes, the actors, the activities executed by these actors, and the business entities and rules involved in every business process. It must show explicitly the relation between the business processes and the information systems supporting them. Therefore, a business model contains the knowledge needed not only to support managers' decisions concerned with change and adaptation, but to ensure the opportunity, relevance and pertinence of the information produced by the automated systems supporting the whole organisation. Organisational knowledge – expressed by a business model– becomes a necessary asset for the effective and efficient functioning of any modern business organisation.

Enterprise or business modelling methods can be classified into two categories. In the first category, a business organisation is represented as a set of interrelated elements satisfying collaboratively common objectives. The methods described by Checkland (1990), Espejo (1989) and Flood (1991) can be considered in this category. For instance, VSM (Espejo, 1989) allows us to model an organisation as a set of "viable" sub-systems representing respectively the operation,

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coordination, control, intelligence (reasoning, analysis) and politics (strategy) of an organisation. In the second category (to which our model belongs), the focus is given to developing different views of the organisation dealing with actors, roles, resources, business processes, objectives, rules, etc. (see, for example, (Hung, 1998), (Decker, 1997), (Jarzabek, 1996), (McBrien, 1991), (Rupietta, 1994), (Yu, 1994), (Ericksson, 2000), (Ilog, 2001), (Vernadat, 2001)). None of these methods considers explicitly the relationships between business concepts and the IC technologies that support the business. In modern and competitive organisations, these relationships cannot be ignored, because most of business processes are highly dependent on IC technology.

We present in this paper a complete framework for business modelling that integrates and makes visible the implicit relationship among business levels, i.e. between the goals and information systems levels passing through the business process level. The framework contains a set of organisational and business concepts that may be used by managers in order to represent organisational elements for different purposes and under different circumstances. For instance, managers can represent either a current state or a potential future state of their business caused by problematic situations. They can also use it to define or redefine appropriated information system architectures according to the demands imposed by a dynamic environment without neglecting current business processes and future requirements. The applicability of the framework covers many areas where business models are required, such as Process Reengineering, Organisation Design, Enterprise Architecture Planning, Business Process Management and Software Process Improvement.

From the point of view of method engineering, a business model is a product model (Odell, 1996), (Brinkemper, 1996). A product model describes the set of concepts and their relationships that can be used to build a product, i.e. to build a model representing a given business organisation. Besides, method engineering establishes that a well-defined method should also have a process model that guides step by step how to build a product based on the product model. Therefore, our methodological framework has two interrelated components: the product model (i.e. the business model) and the process model.

An initial version of our business model has been used as a part of a change management method (Barrios, 2001), (Barrios, 2002). It has been tested with success to model organisational change in a European Community Public Company of Electricity (Barrios, 2001), (Nurcan et al., 1999a), (Nurcan et al., 1999b). The version described in this paper is the result of using the business model to complement the process model of METAS (Montilva et al, 2001), a method for enterprise modelling and integration. The framework has been used in a consulting project for a public service organisation named Zolccyt (Zolccyt stands for Zona Libre Cultural, Científica y Tecnológica) in Mérida, Venezuela (Barrios, 2002). Due to space restrictions, in this paper, we just present an overview of the methodological framework along with some illustrative examples that would help to understand the results of its application.

The paper is organised as follows. Section 2 presents the scenery where the framework can be used, which sets the basis for a good understanding of the business model described here. Section 3 presents the methodological framework composed of a Product Model and a Process Model. The Product Model is composed of three sub-models: business goal model, business process model, and information systems model. Section 4 describes the Product Model and its sub-models. Each one of these descriptions is accompanied by an illustrative example taken from the study case. Section 5 presents an overview of the Process Model associated to the product model described in section 4. Finally, section 6 concludes the paper.

2 BUSINESS ORGANISATIONS: THE SCENERY FOR BUSINESS MODELLING

In this section, we show how a business model can help managers to take decisions. This illustration is made through the description of a problematic situation: a reengineering process.

A reengineering process can be seen as a process of redefining current business processes in order to meet new business goals. The management of a reengineering process is a complex task because of the multiple effects that a change in a process may cause. These effects are not only in the relation of one business process with the others, what it is normal, but with the business goals, actor's roles and with the information systems architecture that supports these processes. Usually, new goals are driven by the effective use of ICT in order to support the persistence of a business organisation in a more competitive environment. In this context, a business model helps managers to reengineer business processes and more precisely, to couple processes to support systems.

The methodological framework presented here can

also be used to define the most appropriated information system architecture to support new business processes. This is possible because the framework permits to establish a detailed view of what the relationships between new processes execution and current and potential information systems are. In the study case of the Zolccyt organisation, the use of the business model had a twofold objective: (1) to help organisational members to understand what they wanted to be as a service organisation, to revise their current goals and consequently, to redefine current business processes; and (2) to design the information systems architecture that best fits their current and future needs. Through this way, we place ICT technologies use under the service of business organisations and not the other way, as it is usual.

As shown by the problematic situation described in this section, the knowledge represented by a business model is a valuable tool that supports managers during the decision-making processes. But, it is not enough to build a business model, what it is important is how well a business model represents business elements and their relationships.

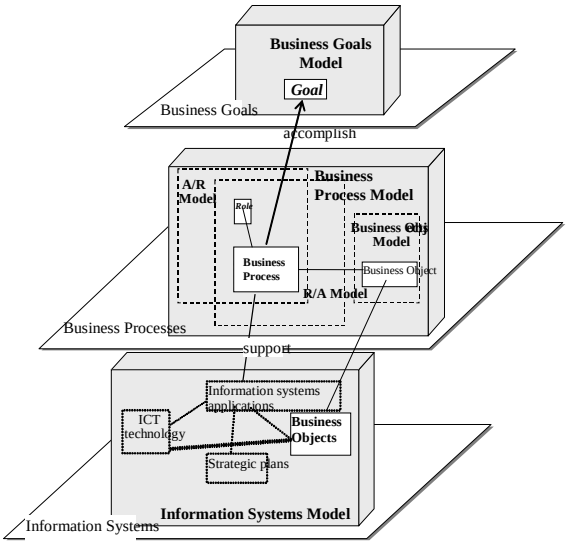

Figure 1:The methodological Framework

3 THE METHODOLOGICAL FRAMEWORK

In order to respond to the business requirements introduced above, we propose to represent a business model by using three interrelated levels of abstraction[2]: the Business Goals, the Business Processes and the Information Systems levels as it is depicted in figure 1.

These three types of models aim to represent the business goals, the business processes, and the information systems architecture of a business, respectively.

The Business Goals Model is an intentional model that represents business goals at different levels of detail. The Business Process Model is a set constituted by three sub-models: the actor/role, role/activity and business objects sub-models. The Business Process Model represents the processes executed in the business organisation. The Information Systems Model represents the set of systems along with the ICT required for supporting business processes execution.

As we have explained early, in this document, models act as complementary tools for describing, understanding and interpreting situations and its consequences. The relevance of this way of structuring a business model lies on how well it permits to define and to represent the business elements and their relationships. Any modification in the elements that constitutes one of these levels must reflect changes in the two others.

For instance, a change in a business goal may cause the introduction, modification or the elimination of one or several business processes as well as of the information systems that support these processes. In the same way, a reengineering process may cause the modification of one or several information systems or the interrelation between them.

The integrated model presented in this paper highlights the relationships between business goals, business processes and business objects.

The association of a goal from the Business Goals model to each process of the Business Process model expresses the relationship between level one and two. The association of one or several information systems with a set of business objects, that are generated and manipulated by business processes, represents the relationship between levels two and three.

4. THE PRODUCT MODEL

4.1 The Business Goals Model

[2] Based on Bubenko's proposition (Bubenko, 1994)

A business goal is an objective that the business organisation wants to accomplish. It can represent an intention of a particular individual, a group of individuals, a unit of the business or the whole business.
An intention expresses a current or a potential business state, a vision or future direction to be followed. The Business Goals Model defines the concepts needed to represent business objectives and every aspect relative to its realisation. It allows justifying the existence of business processes, business activities and business actors and roles, as well as the information systems that support them.
As depicted in figure 2, the central concept of the model[3] is the goal, which is expressed by a verb and a set of parameters that serve to characterise the mode, the source and other complementary factors that add semantic to business intention definition (Pratt, 1997).
Business goals are represented in an intentional manner using a goal hierarchy. The highest levels represent the *non-operationalisable* goals, i.e. those goals that can not be directly attained by the execution of a set of operational activities. These goals must be decomposed into other goals whose accomplishment allows us to achieve the immediately higher goal (Anton, 1994). This decomposition continues until a business goal can be directly associated to a business process, i.e. until a business goal can be made *operationalisable* through the execution of a set of activities performed by business organisation members called actors.
Goals are also typified according to the intentions they represent, i. e. current or future stable state goals, low level goals associated to business processes, and change goals defined during a change process. These goals are called organisational, *operationalisable* and impact goals, respectively.
In order to represent the set of alternatives ways of introducing changes in an organisation, we have added the notion of scenario to the business goals model. A scenario is a set of impact goals.
The business goals model derived in the Zolccyt study case is expressed throughout four main goals. Each one of these goals is decomposed into a set of sub-goals that at the same time are also decomposed into a set of others sub-goals. In this case, this decomposition process stops at the fourth level. The business goals that are positioned at the fourth level of the hierarchy are *operationalisable* goals that are directly attached to business processes.

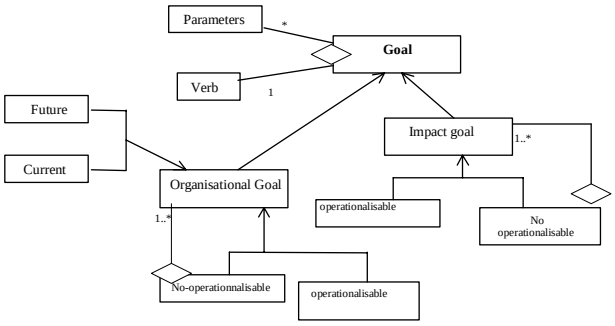

Figure 2. The Business Goals Model

4.2 The Business Process Model

A business process is a set of activities executed by business actors, machines, and/or information systems in order to attain a business goal. This business goal must be an *operationalisable* goal, as it was defined in the previous section.
A business process can be modelled from different perspectives, i.e. by modelling actors that are responsible for its execution and the set of activities that are under his/her responsibility, as well as the resources involved in the execution of those activities. In our model, business process concepts are grouped into three complementary sub-models: actor/role model, role/activity model and business objects model, as it is depicted in figure 3.

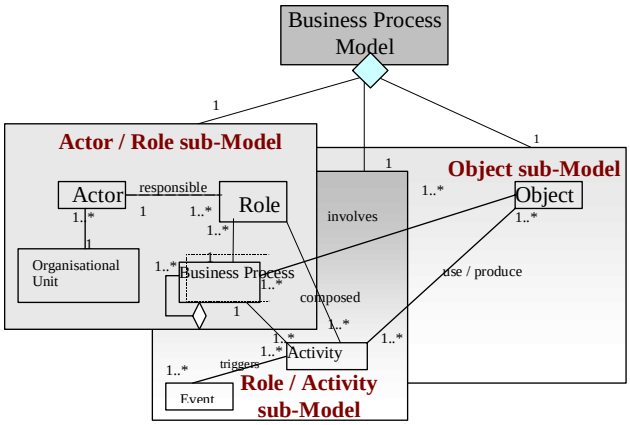

Figure 3. The Integrated Business Process Model

The business object model constitutes the link between the business processes and the information systems that support them. It represents all tangible and/or non-tangible business elements involved in the business processes execution.
Figure 4 shows an excerpt of the business process model defined for the Zolccyt organisation. This

[3] The business model is expressed as an instance of the standard Object Oriented Meta-Model by using the standard notation UML (Booch, 2000). Notice that in figure 2 we use the concepts of class, association and inheritance for representing concepts related to business organisational features.

example presents the relationship among primary and support processes. Each one of them has been decomposed and developed in detail by the actor/role and role/activity sub-models.

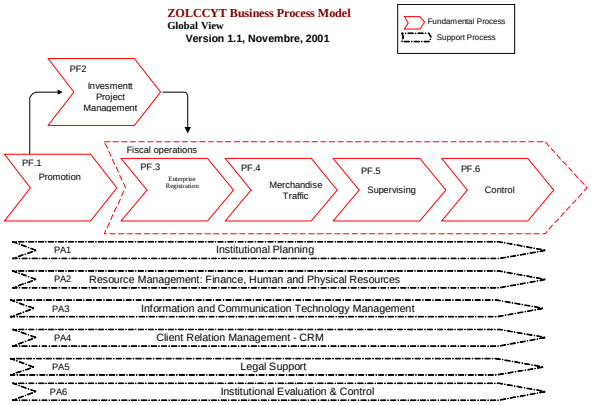

Figure 4: Fundamental and support processes for the Zolccyt Organisation.

4.2.1 The Actor/Role sub-Model

The actor/role sub-model allows representing business processes from the actor's perspective. The actors are responsible for business execution by filling roles. A role is a set of duties of operational nature that we call operational goals. An operational goal represents an objective that is under the responsibility of a role. An actor represents a physical entity (external or internal, an individual or a group, a system or a machine) that can fill a role in a business process. It is important to mention that the concept of actor does not refer to a particular person but to a type of business member. For example, a secretary, a manager or a clerk may be represented as actors.

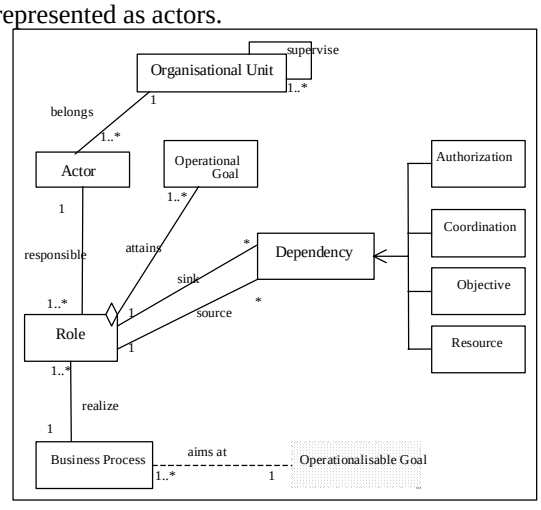

Figure 5. The Actor/Role sub-Model

This model permits also to represent the relationships that exist among roles, as well as the type of dependence between them. The explicit representation of these relationships makes possible to determine which business processes are complementary and what is the degree of dependence between them. In this way, the workflow can be easily defined.
As shown in figure 5, there are four types of dependence: authorisation, objective, coordination and resource. These dependencies may permit the definition of business processes at different levels of detail by grouping those that are related by actor's roles dependencies.

4.2.2 The Role/Activity sub-Model

This model permits to define in detail the set of activities associated to a role assigned to an actor.
The activities description is explicit and allows representing also the relationship between roles that accomplish together the same *operationalisable* goal. As illustrated in figure 6, an *operationalisable* goal is associated to a business process, which at the same time may be decomposed into a set of operational goals that are associated to the same number of actor's roles. Therefore, each role has associated one operational goal.

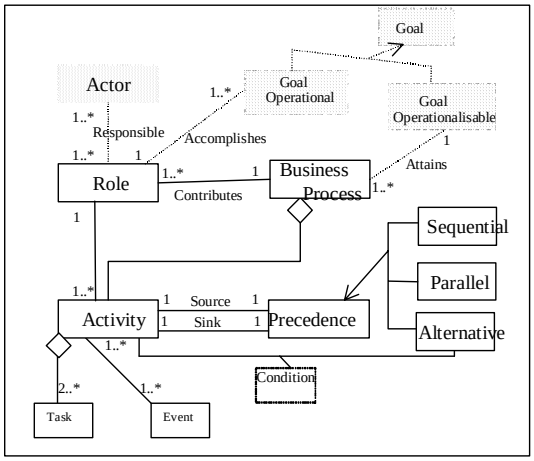

Figure 6. The Role/Activity sub-Model

4.2.3 The Business Objects sub-Model

The business objects model allows the modeller to represent the physical and informational elements (and their relationships) of a business organisation.
These elements are necessary for business functioning, i.e. for business processes execution and, in consequence, for business goals consecution.

This model completes the knowledge collected by the two other business process sub-models: actor/role and role/activity. Furthermore, this model is the explicit link to the Information Systems model, because of the representation of business entities and their association to each one of the business processes. This relationship sets the basis for clustering, distribution and sharing of business objects among individual and complementary information systems. The business objects model is object oriented and is based on all concepts that support this paradigm (OMG, 1996).
Figure 7 shows the concepts that are essential for modelling business objects taking into account several points of view. Detailed descriptions of these concepts can be found in (Barrios, 2001) and (Gandica, 2002).

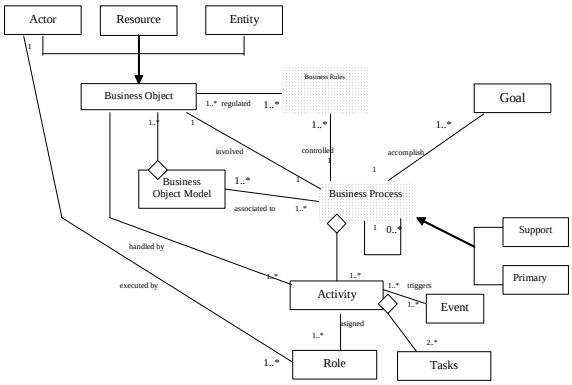

Figure 7. Business Objects sub-Model

4.3 The Information Systems Model

The determination of the technological infrastructure that will support all business processes execution and, in consequence, contribute to the accomplishment of the business goals, is a complex task. Nowadays, it is not easy to define what are the components of an information and communication architecture because of the rapid evolution of IC technologies; but, specially, because of the dynamism that characterises modern business organisations.
The Information System model should contain not only the set of information systems (IS), but the definition of the local and shared databases, as well as the information requirements and management indicators that should be satisfied by the different applications.
The ICT is a factor that can not be neglected by this model because of its crucial role as fundamental support for developing, operating and maintaining all system applications. Without the ICT, the information system model cannot be realised.
Figure 8 shows the main concepts included as part of the Information Systems model. The object model is a refinement of the business object model that has been introduced in section 3.2.3. It must be refined and expressed accordingly to software engineering techniques.
The way this model has been structured assures that business processes are at the origin of the business objects, as well as the definitions of information requirements and management performance indicators. In consequence, they will be taken into account for the design and distribution of the database.

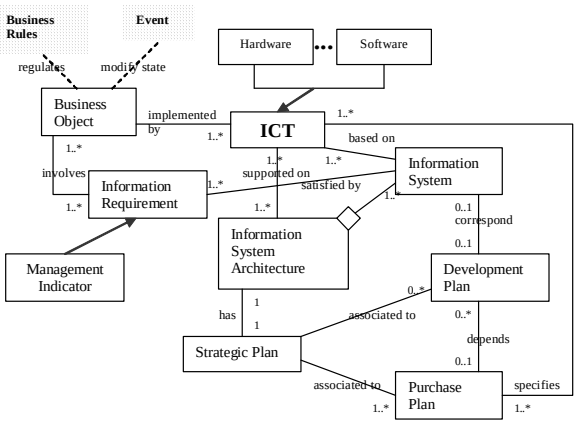

Figure 8. The Information System sub-Model

Besides, they will be used for establishing what should be the information produced and shared by each one of the information systems applications that conform the whole IS architecture. Notice that the model also includes the strategic plan containing all details for developing and installing that kind of information system infrastructure. Figure 9 shows the Applications Architecture defined for the Zolccyt Organisation.

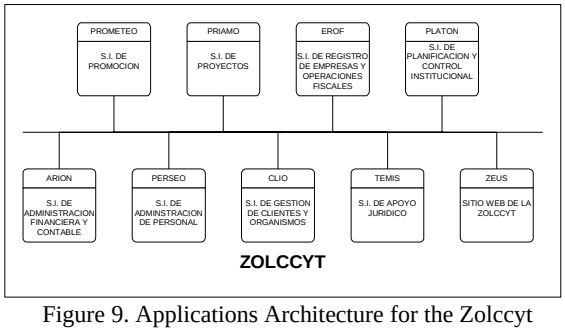

Figure 9. Applications Architecture for the Zolccyt Organisation

5 THE PROCESS MODEL

According to section 3, a Process Model expresses the set of possibilities for manipulating and relating the concepts described in a Product Model, in order to build a specific product. For instance, the hierarchy of goals representing the current situation of an electricity public company is a product built by using goal product model concepts according to process model prescriptions and guidelines.

The Process Model prescribed by the method METAS is summarised in Table 1. This general view is structured as a set of modelling intentions grouped into a set of modelling phases. Each one of the modelling phases addresses the process intentions for building one of the three models associated to the organisational business levels: the goal model, the process model and the information systems model, respectively.

Considering that there exist many ways of building a product (i.e. many ways of executing the prescriptions established by a process model), we adapted the decision-oriented formalism presented in (Barrios, 2001) and (Jarke, 1999) to represent the variety of possibilities to be followed while building a business process model. This decision-oriented formalism allows modelling team to select among different modelling alternatives according to current organisational and modelling situations. For instance, the set of intentions executed by the modelling team[4] in the Zolccyt study case may be different from the set followed by the same team for modelling any other business organisation. Notice that process intentions are also executed in an iterative manner, thus the final product is the result of the improvement of a non-fixed numbers of versions, i.e. the product is built in a progressive way.

Table 1. METAS Process Model

Process Model Phases (Main Intentions)	**Sub-Intentions**
Building a Business Goals Model	Define business vision, mission and top level goals
	Reduce Goals
	Identify the *Operationalisable* Goals
Building a Business Process Model	Conceptualise Business Processes
	Conceptualise Actor/Role sub-model
	Conceptualise Role-Activity sub-model
	Conceptualise Business Object sub-model
Building an Information Systems Model	Determine Information Requirements
	Design Management Process Architecture
	Design Business Objects Architecture
	Design Application Architecture
	Specify Information Systems
	Design ICT Architecture
	Define Strategic Plan

[4] A technical group composed by a representative set of organisational members and external consultants.

6 CONCLUSIONS AND FUTURE WORK

We have presented, in this paper, a methodological framework that can be used as the basis for modelling business organisations. The framework characterises business from different but interrelated perspectives by using a three-abstraction levels model. It integrates objectives, processes and systems in a single view.

The more relevant feature of our framework is that it makes explicit the link between these three organisational levels. This link has been neglected or omitted by most current business modelling methods causing the production of incomplete business models. An incomplete business model does not help managers to make accurately decisions about a problematic organisational situation because of its lacks and deficiencies, as well as the fuzzy definitions of some organisational components.

The framework presented, in this paper, makes clearer the vision of a business organisation and its components. The framework allows visualising, understanding and interpreting many different organisational business situations without neglecting any of the business levels. It adds knowledge about the existing relationships between business goals, business processes that accomplish goals, and the information systems that support both of them. Consequently, our framework contributes to define accurate and precise decision-making processes inside business organisations. Specially, in modern organisations which are highly dependent on IC Technologies. We used a reengineering process case to illustrate the applicability of the framework. But, its applicability covers many other areas such as Organisation Design, Enterprise Architecture Planning, Business Process Management and Software Process Improvement.

Finally, it is important to mention that the framework is not attached to any drawing or graphic tool. For instance, we have used Visio-professional

and UML business notation for building the products presented here. Nevertheless, it should be more helpful for managers and designers if they can count on a dedicated tool that will support the process modelling as well as the process of managing product versions.

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