Generating a Business Model through the Elicitation of Business Goals and Rules within a SPEM Approach

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Abstract. Business Models play a pivotal role in organizations, especially in building bridges and enabling dialogue between business and technological worlds. Complementarily, as Use Cases are one of the most popular techniques for eliciting requirements in the design of Information Systems, Business Goals and Business Rules associate with Business Process Use Cases to compose a Business Model base structure. However, methods for relating Business Processes, Goals and Rules (PGR) are scarce, dissonant or poorly grounded. In this sense, we propose the specification of a method, within a SPEM approach, covering the elicitation of Business Goals and Rules from Process-level Use Cases, and their mapping to a Business Model representation. As a result, a tailorable method for the generation of a solution Business Model, by aligning the resulting trios (PGR) with a Business Model Canvas, is presented and demonstrated in a live project.

Keywords: Business Model, Business Goals, Business Rules, Business Use Cases, SPEM.

1   Introduction

Business Models play an ever more pivotal role in the development and continued management of Information Systems (IS). Nevertheless, recent literature review on Business Models (BM) results show that there is no agreement on what a BM is, although some emerging common themes already exist [22]. Overall, the BM artifact, as a conceptual tool that contains a set of elements and their relationships, expressing the business logic of a specific firm and the value it offers, is seen as crucial for improving the dialogue between Business and IS/IT.

Our recent work in generating a BM in ill-defined contexts, within a RUP-based approach and grounded on reference model representations, stands as a contribution inside this topic [15]. The use of Process-level Use Cases, together with Business Goals and Business Rules associated information (PGR), allows developing an activity direct-mapped BM to present to stakeholders for validation. Also, the use and adaptation of 'standard' methods and techniques to infer goals and rules requirements

from scenarios and process-like diagrams, mapping backwardly the traditional business to process workflow, could allow for better and continuous alignment between Business and IS/IT, with improved traceability.

Accordingly, the knowledge represented in terms of goals, rules and methods can make reengineering tasks more systematic and effective [21]. Whether it involves the development of a new system or the reengineering of business processes, decisions about what goals to pursue and on selecting the appropriate strategies to achieve them are always vital. The discovery of goals and rules is part of requirements elicitation, recognized as one of the most critical activities of software development, with many prescribed methods and techniques.

However, it is virtually impossible to define a unified model for the elicitation process, due to the constantly changing needs associated to requirements activities. Even if specific methodologies, broken down into multiple steps, describe general approaches and overall principles to assist analysts in understanding needs, only the experienced analyst understands intuitively which method or technique is effective, in each circumstance, and applies it [5]. This raises issues as lack of formality and analyst dependency.

Our approach, first detailed in [14], tries to obviate to these, presenting a method to guide the analyst in the elicitation of Business Goals and Rules from Process-level Use Cases, and transforming them, in order to arrive at a Business Model representation. This later can then be presented to the involved stakeholders for review, validation and further negotiation. As the entire method follows a model-based approach, the changes agreed upon could be traced back to the original Use Cases, allowing for requirements traceability and a Business-IS/IT aligned solution.

To support this solution, a specification of the method in Software and Systems Process Engineering Meta-Model (SPEM) [12] is presented and then demonstrated in a live project. As a result, due to the SPEM features, the method is tailored and applied in the project, according to the involved teams and analysts preferences.

This document follows with background research reviews on Business Model representations and on diverse methods, techniques and guidelines for the elicitation of Business Goals and Rules, and also a synthesis on SPEM. Following, we present a specification in SPEM of our proposed method, covering the elicitation of Business Goals and Rules from Process-level Use Cases, and their mapping to a BM representation, resulting in a generated BM aligning our PGR trios with the original Use Cases. Next we apply and demonstrate it in a live project setting, instantiating the SPEM process definition, and analyze the results obtained and future work ahead. Finally, some conclusions are drawn for this paper.

2   Related Research

This section presents related research regarding Business Models representations, and Business Goals and Rules elicitation approaches. For the BM topic, it focuses solely on the Business Model Canvas (BMC) [13] and its early connection with the Balanced Scorecard (BSC) [7], mainly due to their popularity in Business-IS/IT communities.

Relating to methods and techniques for eliciting goals and rules, it falls in their associated combination of checklists and guidelines from the Rational Unified Process (RUP) [10], and in the business plans representation of the Business Motivation Model (BMM) [11]. Notwithstanding other elicitation methods and techniques associated to i*[20] or KAOS [3], this choice is due to the more complete and business oriented side of RUP and BMM, which help in defining the business requirements specification for business modeling, and promote the Business and IS/IT alignment questions that are comprised in process-oriented approaches.

Finally, a brief characterization of the SPEM specification is presented.

2.1   Business Models

The BMC, a strategic management template for developing new or documenting existing business models, currently stands out as one of the preferred tools for their generation, especially in business related audiences. The BMC is based on the Business Model Ontology proposed by [13], where the formal descriptions of the business become the building blocks for its activities. These are divided in nine different business conceptualizations, organized by four dimensions: Infrastructure, Offering, Customers and Finance. In turn, this division was based on the early work of [7] with the BSC four perspectives: Financial, Customer, Internal Business Process and Learning & Growth.

BMC and BSC are two different but complementary tools to achieve innovation, tactical directions and action plans in an existing or planned organization. While BMC determines part of the business strategy, BSC is aimed to track implementation and ensure that the organization strategy is executed. Recent research by [2], classified BMC and twenty nine other relevant literature sources on business model, with BMC obtaining interesting global results: positive on 66,7% of all the criteria analyzed, checked on all of the top-six criteria items and on 50% (six out of twelve) of the second-level ones.

2.2   Business Goals and Rules Elicitation

A recurrent question in research over Business Goals (BG) elicitation is that Use Case (UC) notation is intended for functional requirements and not non-functional requirements, which oversimplifies assumptions on the problem domain. Nowadays, in order for a software system to be of value, it should meet both functional and non-functional requirements, these last by using a goal-oriented representation [17]. In recent years, goal-oriented requirements engineering (GORE) current states and trends from the viewpoints of both academia and industry have been fully scrutinized, with results pointing for goal models to be useful for supporting the decision making process in the early requirements phase [19].

GORE is generally complementary to other approaches, well suited to analyzing requirements early in the software development cycle, especially with respect to non-functional requirements, but its analysis and evaluation also leads to many challenges [1]. A great variety of techniques for analyzing goal models have been proposed in

recent years, but, on the other hand, this diversity creates a barrier for widespread adoption of such techniques, also due to the lack of guidance in literature on which one to choose [6].

Business Rules (BR) are an important artifact in the requirement elicitation process of IS and a vital part in its development cycle, as they describe ongoing policies, procedures, and constraints, which concern an organization in order to achieve its business goals and objectives [16]. Its concept has been examined from different points of view, whether as extensions of business goals, or as limitations or constraints on business activities. By structuring, organizing and expressing tactics and policies in a way that is close to business viewpoints, it helps collecting and organizing supports for the implementation of change for the associated IS [9].

It is important for software to evolve according to changes in its business environment, having BR as an integral part of the software system, its management and evolution. This improves requirements traceability in design as well as minimizes the efforts of changes, as when they are systematically identified and linked to design elements, these are easier to locate and implement [18]. Even so, the quality of software engineering projects suffers, due to the large gap between the way stakeholders present their requirements and the way analysts capture and express them, with representation of BR as one problem, and also because   requirements elicitation techniques tend to be much analyst-oriented and dependant [8].

2.3   Software and Systems Process Engineering Meta-model (SPEM)

The development of artifacts in information systems, as business models are, encompasses the application of several good practices and diversified knowledge as well as, eventually, the introduction of new ideas or strategies. This results on the possibility of existence of several distinct approaches or ways for their development. In order to be able to express, establish, or organize the structure of activities inherent to the development approach, it is convenient a standard way for expressing the process structure. In this context, the SPEM 2.0, standardized by the Object Management Group (OMG), is a process engineering meta-model that provides to process engineers a conceptual framework for "modeling, documenting, presenting, managing, interchanging, and enacting development methods and processes" [12].

SPEM is used to define software and systems development processes and their components, trying to accommodate a large range of development methods and processes of different styles, but on the other hand, it does not intend to be a generic modeling language and provides only the minimal concepts needed to describe a development process. Though, for many development approaches and methods, human consumable documentation providing understandable guidance for best development practices is more important than precise models, with higher value than strict obedience to a formally defined process, as they cannot be formalized with models, but can only be captured in natural language documentation.

With SPEM 2.0, users can define Method Content, primarily expressed using work product definitions, role definitions, task definitions, and guidance, in a general

direction, building up a knowledge base of development methods. This supports development practitioners in setting-up a knowledge base of intellectual capital for software and systems development that allows them to manage and deploy their content using a standardized format. Then, development teams are able to define how to apply the development methods and best practices throughout a project lifecycle, selecting and tailoring the development process as they require.

In a recent study [4], SPEM was considered the most widespread and popular language for representing development processes, with a high degree of acceptance of its metamodel, and its uses and applications. Over half of the papers collected only used SPEM as an annotation to represent certain activities in the context of the research performed in each case, while many others described extensions for improving certain deficiencies in the SPEM metamodel. Despite these weaknesses, SPEM is considered as a suitable language for representing development processes, and attending to this, we use it to describe our approach.

3   Generating a Business Model Canvas

In a previous work [15], we proposed the adaptation of standard techniques to infer goals and rules from scenarios and process-like diagrams, mapping backwardly the traditional business to process workflow, which helped in building a business motivation model and defining a strategy for the information system. With an approach based on a BMM representation and guided by a RUP-based backward transformation from process to business, it could allow for better and continuous alignment between Business and IS/IT, with improved traceability.

Following this research work, supported in the previously proposed PGR metamodel [15], we then proposed a method to guide analysts in the elicitation of goals and rules from use cases, and transforming them, in so generating a business-oriented business model for an IS [14]. This is achieved by combining the use of Business Goals and Rules elicited from Business Process Use Cases in a BSC structure, and then performing their mapping to a BMC panel.

Our proposed method, here presented in a SPEM perspective (Fig. 1), is composed by two activities ("Inferring Goals and Rules from UC" and "BSC to BMC mapping") and involves three work products ("Top-level Use Cases", "Balanced Scorecard", "Business Model Canvas"). The activities are sequentially performed in a way that an activity starts only when its predecessor activity has finished (as indicated by the «predecessor» dependencies), and use and produce (as indicated by «input» and «output» associations) artifacts.

The first activity aims to elicit and represent the PGR business-side information by following a 'standard' referential, spanning the four perspectives of the BSC, in so improving the consistency of the use cases coverage. The second activity analyses and maps each previous elicited item in an adequate section of the BMC panel, linking them to the more abstract level of business modeling, thus delivering an integrated business model canvas to present to stakeholders.
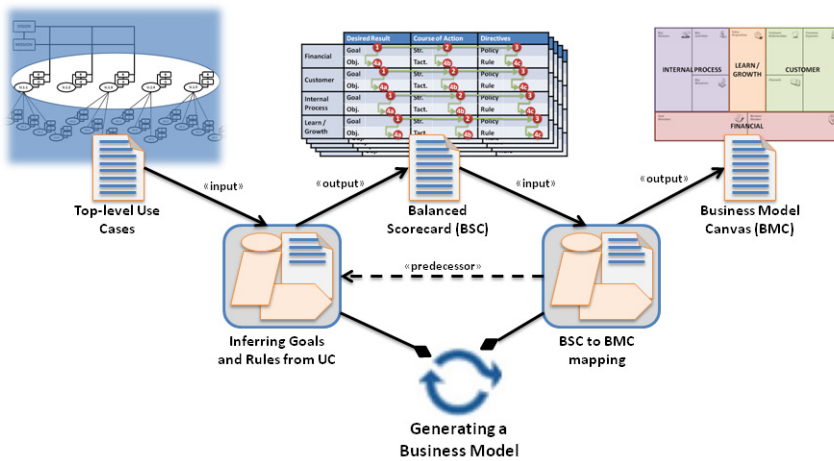
Fig. 1. SPEM diagram of our approach process

3.1   Inferring Goals and Rules from Use Cases

The first activity receives a set of Use Cases and outputs a Balanced Scorecard, being composed by two sets of three tasks each. It starts with the elicited top-level UC for the proposed IS and involves two iterations, one for each UC and another one for each BSC perspective (Financial, Customer, Internal Business Process and Learn & Growth) with the added BMM representational elements (Goal, Objective, Strategy, Tactic, Business Policy and Business Rule item).

Inside the double-iteration, there are three tasks to be performed (Fig. 2), covering the elicitation of Goals and Rules, with its associated strategies and policies, for each root UC:

1. Envision the UC associated **Goal**;
2. Determine its governing **Strategy**;
3. Associate the controlling **Business Policy**.

These are the more abstract BMM items, the ones preferable to start with due to their business nature, as they should be easier to elicit using the available business documentation. Also, depending on the project, the elicitation of these first elements could be enough for the generation of a high-level, more abstract Business Model to present to stakeholders for review.

Thereafter, in a second three tasks sequence (Fig. 2), the more concrete and specific goals and rules items should be determined:

4. a) Define a (SMART) **Objective**, associated to **Goal**;
4. b) Determine a **Tactic**, associated to **Strategy**;
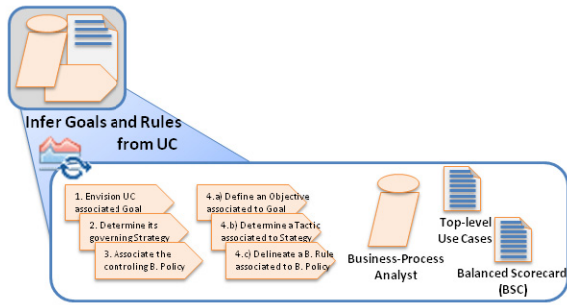4. c) Delineate a **Business Rule** item, associated to **Business Policy**.

Fig. 2. SPEM Activity "Infer Goals and Rules from UC" constituents

Here, more detailed, concrete information is needed from the project documentation to be able to elicit these items. Although not all fields are mandatory, it is important to fill the most part of them, for higher system specification coverage and future implementation purposes.

All these tasks follow on the guidelines and checklists from RUP and BMM [15], for the elicitation of Business Goals and Rules, and its associated inner constituent elements. Any further knowledge of other associated techniques by the analysts involved, as well as heuristics associated to their previous experience in the specific domain of the project, are valuable to aid in these tasks. All referred tasks are to be performed by a Business-Process Analyst role.

3.2   BSC to BMC Mapping

As stated earlier, BMC stands as one of the preferred tools for the generation of business models, especially in business related audiences. Also, BMC relates its roots with BSC, an also popular strategy performance management tool.

According to the Business Model Ontology work [13], the nine elements of the BMC relate directly to the four perspectives of BSC, namely:

— Financial – Cost Structure and Revenue Streams;
— Customer – Customer Relationships, Channels and Customer Segments;
— Internal Business Process – Key Partners, Activities and Resources;
— Learn & Growth – Value Propositions.

Therefore, our proposal for the mapping of the sentences from our BSC-like structure to the BMC panel follows on this same line of thought: each sentence in BSC maps to a correspondent element in BMC. When there is a correspondence to two or three elements in BMC, any necessary decisions to choose on which specific element the sentence maps or on the separation in two or three statements, is responsibility of the analysts involved, whether based on the Business Model Ontology guidelines or on their own business heuristics.

So, the second activity receives the previous set of BSC and outputs a BMC, being composed of four tasks (Fig. 3). All referred tasks are also to be performed by a Business-Process Analyst role.
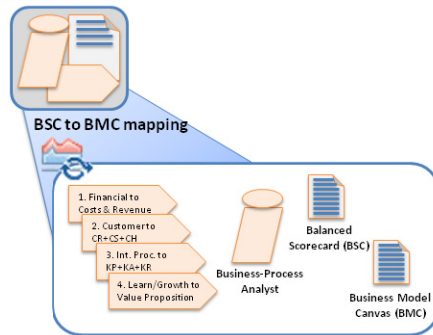
Fig. 3. SPEM Activity "BSC to BMC mapping" constituents

Surely there can be some overlaps between some elements, for example, the value proposition is closely related to any other element, especially the customer ones, so it is not impossible for mappings to occur outside elements than the ones here proposed. Other solutions in the business market propose slightly different mappings, but overall it depends on each particular case business type, and the informed or heuristic-based decisions of the analysts. All these matters should be the target for a final round of negotiations with the stakeholders, with the possibility for backtracking the changes made, back onto the Use Cases.

Several iterations of this entire process should be performed until all parts are comfortable with the obtained solution. The generation of a Business Model through the use of this first PGR step serves two purposes: on one hand it allows to communicate with the stakeholders of the project in a more business-like language, in a format that is familiar to them; on the other hand, it allows for a direct alignment and enabled traceability between the Use Cases elicited for the proposed Information System and the Business Model to be analyzed and validated by the stakeholders.

4   Demonstration Case

The demonstration project is a new job matching and e-learning, cloud based platform, sponsored by technology-leading European companies, which aims to recognize and develop talents on the skills searched by employers, in order to tackle the shortage of professionals in technical areas. Core ambition is to offer targeted online education programs to improve ICT-skills, leveraging demand/supply on the European ICT job market, for STEM engineers, preparing graduates for an industrial career and offering new skills and capabilities to empower current workforce.

Although diverse forms of information are available in the project (informal text, activity diagrams etc.), a structured description per Use Case during elicitation is not enough to generate the inputs for the Business Model as the stakeholders needed. This due, it was decided to apply our developing method in this live setting.

As described in the previous section, our proposal involves two activities which envision the filing of until twenty four (four BSC times six BMM) statements, not all

mandatory, per Use Case, and a mapping to a BMC panel. At this point, the previously SPEM Method Content definitions (work product, role, and task) for each activity are tailored and applied in this project by the development analysts.

4.1   Activity "Inferring Goals and Rules from Use Cases"

Although some projects require only the generation of the high-level and abstract BM information, including only the filling of the three more abstract tasks, in this case, the developers decided to tailor the first activity of the previously defined process (Fig. 2) with the total three plus three tasks for the first activity (Fig. 4).
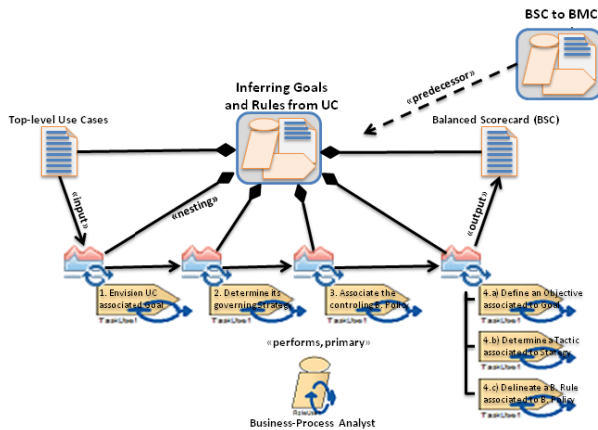

Fig. 4. Tailored development process for activity "Inferring Goals and Rules from UC"

Due to the strong business-orientation of the first three tasks, it was decided to iterate individually each one at a time, eliciting first all the goals for each top-level UC, then passing on to all the strategies and then to Business Policies. This allowed keeping the mindset about the business guidelines for each BMM item, throughout all the UC analysis. Next, the remaining three tasks were grouped and iterated sequentially, as their composition is somewhat easier to develop, highly-dependable of the previous elicited items.

This activity is itself iterated through the four dimensions of the BSC grid, which after being populated with all the elicited BMM items for all the five UC, is ready to follow as an input to the next activity.

4.2   Activity "BSC to BMC Mapping"

In this first round of execution, only the three more abstract items of each BSC perspective were considered relevant to be transposed to the BMC elements, due to this high-level positioning, and also to the shortage of information and ill-definitions of the project.

This second activity has less flexibility for tailoring, nevertheless each task can be enriched with guidance information for its execution, depending on the project cha-

racteristics. In this case the four available tasks (Fig. 3) were sequentially iterated through the BSC dimensions (Fig. 5), splitting and adapting items as needed to map in the BMC sections. This activity is itself iterated through all the BSC cards served as input from the previous activity, giving origin to a complete BMC panel.
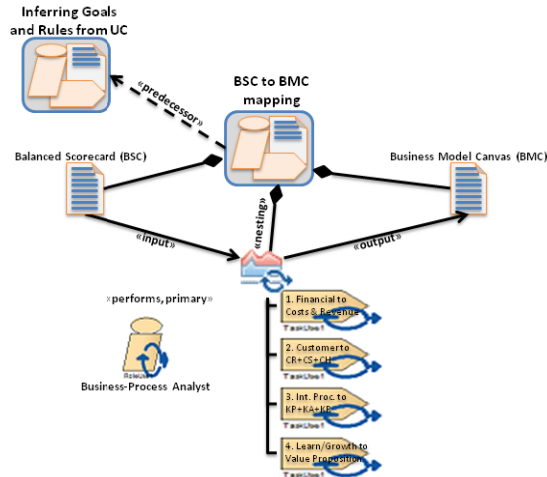

Fig. 5. Tailored development process for activity "Inferring Goals and Rules from UC"

The solution business model for this project, after the first iteration, generated by aligning the resulting trios (PGR) with the BMC, was presented to the project stakeholders. In the actual phase, they are currently analyzing the information received, which is being used as a token of discussion for the meetings adjourned.

4.3   Discussion

Our proposal for generating a Business Model through the elicitation of Business Goals and Rules from Process-level Use Cases has a dual standpoint, while it relies on 'traditional', established reference techniques and model representations; it also innovates on the organization and relationship of these to achieve a solid solution. The basis on established references strengthens the solution and the innovative organization allows for advances in research. Flexible and open solutions maintain an open door for dialogue between Business and IS/IT, leaving to the analysts the choice for using other complementary techniques at some points, as some room for negotiation with stakeholders.

The proposed method supports the effectiveness of BSC due to the individual connection to each UC and the associated elicitation of Goals and Rules elements, as they are segmented in the four BSC perspectives. Also, it allowed for negotiating the positioning of this previous information in the BMC elements and supported the business-IT dialogue, by triggering interactions from the stakeholders.

One of the purposes for the proposal of this method was to overcome the lack of data in the initial documentation and more specific inputs from stakeholders to define

the business requirements. The use of mixed techniques between Business and IS/IT allowed the analysts to, simultaneously, advance in the development of the IS and communicate with stakeholders, which helped in overcoming those issues.

The solution obtained already had a positive impact in the development, sustainability and evolution of the project. The results have been promising so far, with positive feedback from involved stakeholders and research peers, but further work is needed in order to solve issues and validate the entire process.

The need for formality on the process representation, especially for the lower-level items, led us to use SPEM, and for now the only tool used to aid in this process are some spreadsheets, but as this research evolves, the development of an Eclipse-based tool is being considered. Also, for all the tasks to be performed by a person with a Business-Process Analyst profile seems too broad. In this project we observed that the first activity requires a more IS/IT-oriented profile while the second activity requires a more Business-oriented profile.

5 Conclusions

Business Models are a top concern in todays IS research, helping to link business and technological worlds, with Balanced Scorecard and Business Model Canvas as recurrent references. Also, the PGR information trio is ever more interconnected and involved in issues of requirements elicitation, process modeling and business strategy.

Our work integrates all of these topics and proposes a SPEM-tailorable method to generate an aligned Business Model for a desired Information System, based on elicitation of Use Cases and its related Business Goals and Rules.

In this paper, we present a method to support the connection between a BMC and the four perspectives of BSC, eliciting BMM Goals and Rules for each designed UC. The method is specified in SPEM, then tailored and applied in a live project to infer its adequacy. The promising results obtained point to future work for solving issues on roles and tasks, develop support tools and ensure validation of the proposal.

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