Enterprise Sustainability through the Alignment of Goal Models and Business Models

Birger Andersson[1], Maria Bergholtz[1], Ananda Edirisuriya[1], Tharaka Ilayperuma[1], Prasad Jayaweera[2], Paul Johannesson[1], Jelena Zdravkovic[1]

[1]Department of Computer and Systems Sciences
Stockholm University and Royal Institute of Technology
Forum 100, SE-164 40 Kista, Sweden
{ba, maria, si-ana, si-tsi, pajo, jzc}@dsv.su.se

[2]Department of Computer Science
University of Ruhuna
Matara, Sri Lanka
prasad@ruh.ac.lk

Abstract. Business modelling can be used as a starting point for business analysis. The core of a business model is information about resources, events, agents, and their relations. The motivation of a business model can be found in the goals of an enterprise and those are made explicit in a goal model. This paper discusses the alignment of business models with goal models and proposes a method for constructing business models based on goal models. The method assists in the design of business models that conform to the explicit goals of an enterprise. Main benefits are clear and uniform goal formulations, well founded business model designs, and increased traceability between models.

1 Introduction

The arguably most important objective of an organisation is to be sustainable. By sustainable is meant that the organisation should be able to produce value to its environment that are in demand over time. In doing so the organisation in turn needs to import resources, such as labour or information, from its environment. By engaging in such imports and exports of resources the organisation becomes part of constellations of cooperating actors.

A major concern for all actors is how to adapt to change. If an enterprise is unable to adapt to changes in environmental conditions then it will fail and hence render the enterprise unsustainable. To understand where and how to adapt, models of the enterprise are made and used for analyses. The models can be separated into layers where each layer is concerned with one particular aspect:

– Goal layer. The goal layer is described by means of goal models. Goal models are used in the earliest phases of business and information systems design, where they

help in clarifying interests, intentions, and strategies of different stakeholders answering to the "why" of the business.
- Business layer. The business layer is described by means of business models. Business models give a high level view of the activities taking place in and between organizations by identifying agents, resources and the exchange of resources between the agents. So, a business model focuses on the “what” of a business.
- Process layer. The process layer is described by means of process models. Process models focus on the “how” of a business, as they deal with operational and procedural aspects of business communication, including control flow, data flow and message passing.

While the overall goals can remain the same over long periods of time the procedures that realize these goals may change frequently. A similar abstraction from another domain, IT system design, is the model driven architecture (MDA). In there the specifics of a system are placed in a separate layer from the general and thereby creating a more stable set of models. The layered abstraction is a valuable tool to understand enterprises or systems in the light of change.

It is important that the activities performed at the process layer are aligned with the declarations in the business layer. Likewise, it is important that the declarations of what to do are aligned with the goals of the enterprise. If not, what is done is not properly motivated, and the things done are not necessarily what should be done. Research and motivations on the importance of alignment can be found e.g., in [8], [15], [9].

In this paper we will investigate the relation between the notions of goal models and the notions of business models. We will argue that bridging the gap between business layer and the goal layer amounts to formulating goals in business model notions. We acknowledge that not all kinds of goals are possible to formulate in this way but we argue that a sufficient amount of them are to make this work worthwhile and the results useful.

For illustration purposes we will use the framework and terminology of the Business Motivation Model (BMM) [3] to capture goals and use the framework and terminology of *e*^{3}*value* [6] for business modelling. We will illustrate how the connection between goal models and business models can be exploited by proposing and outlining a method for model alignment. The method amounts to decomposing goals to the level of means and expressing the means using *e*^{3}*value* notions. The method approach is to use templates for means formulation to accomplish the alignment. The main benefits of the method lie in its simplicity and uniformity in goals formulations.

A benefit of this work is that business models become more closely connected to strategic concerns while considering the role that the enterprise has in business collaboration. It also provides a possibility to validate the business models against the goals of an enterprise. Both benefits are instrumental for the sustainability of an enterprise.

The remainder of the paper is structured as follows: Section 2 gives related research on business model and goal model alignment and Section 3 provides an introduction to business model ontologies. A running Massively Multiplayer Online

Games (MMOG) modelling example is introduced that describes the chosen business modelling notation. Section 4 gives an overview of goal models while Section 5 addresses how goal models can be related to business models by means of a number of templates for structuring means formulation. In Section 6 a method for transforming a given business model into a new business model based on a goal model is suggested. Its main points are illustrated through an application on the MMOG example. Section 7 concludes the paper and gives suggestions for further research.

2 Related Work

Recent research emphasizes that compelling IT solutions need to be derived from business goals, further structured in business models with particular value propositions. In [7], the authors discuss the relationship between goal and business models as a foundation for the identification of goal-aligned and economically profitable business services, but without proposing a method for relating goals with business model components. In [8], the authors propose a method for transforming the goal-oriented i* framework [14] to the value-based e3value framework [6]. The method starts by modelling the goals, the dependencies and the tasks of the collaborating actors using the i* technique, and ends with deriving a goal-aligned e3value model using the guidelines for mapping the elements of the two frameworks. Our work differs in two major aspects: a) to achieve uniformity in goal modelling, we suggest formulating the elements of goal models in terms of business model concepts in general, and b) to enable a transparent mapping from goal to value models. In the goal-analysis we set the focus to the perspective of single enterprise and its primary business activities to formulate a set of templates for a seamless connection of the two models. The proposed approach also extends [1], which has introduced the notion of the means-templates for transforming a business model into one that also takes goals into consideration.

2.2 Business Models

There exist a number of approaches, languages, and ontologies for business models in the literature, e.g., [2], [5], [11], [12]. For the purpose of this paper we will make use of a comprehensive and well established business model ontology, the *e^{3}value* [6].

The *e^{3}value* ontology aims at identifying exchanges of value objects between the actors in a business case. It also supports profitability analyses of business cases. The ontology was designed to contain a minimal set of concepts and relations to make it easy to grasp for its intended users. The *e^{3}value* model also includes a graphical notation to design business models. The basic concepts in *e^{3}value* are actor, market segment, value object, value port, value interface, value activity and value exchange.

- An *actor* is an economically independent entity. An actor is often, but not necessarily, a legal entity, such as an enterprise or end-consumer or even a software agent. A set of actors can be grouped together into a *market segment*.

- A *value object* is something that is of economic value for at least one actor, e.g., a car, Internet access, or a stream of music.
- A *value port* is used by an actor to provide or receive value objects to or from other actors. A value port has a direction: in (e.g., receive goods) or out (e.g., make a payment), indicating whether a value object flows into or out of the actor.
- A *value interface* consists of in and out ports that belong to the same actor. Value interfaces are used to model economic reciprocity.
- A *value exchange* is a pair of value ports of opposite directions belonging to different actors. It represents one or more potential trades of value objects between these value ports.
- A *value activity* is an operation that can be carried out in an economically profitable way for at least one actor.

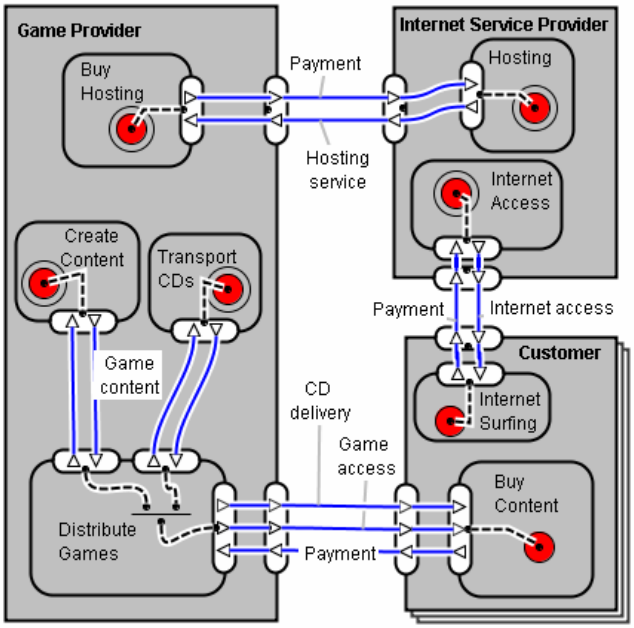

Fig. 1. *e³value* model for the MMOG case

Figure 1 is an *e³value* model of a real world business case that will be used as a running example. It models the various value exchanges between a provider of Massively Multiplayer Online Games (MMOG), its customers and a business associate, an Internet Service Provider (ISP). Actors are shown by rectangles, value activities by rounded rectangles, value ports by triangles, value interfaces by oblong rectangles enclosing directed value ports, and value exchanges as lines between value ports with the names of value objects as labels. In this business model there are two actors and a market segment involved – the Game Provider, the ISP and the Customer. The Game Provider is responsible for producing the Game Content and selling and distributing its software on CDs to the customers. In order to play the game, the customers need internet access, which they get from the ISP. They also need access to the game server, which they get from the Game Provider.

2.3 Goal Models

Goal models are used to capture and make explicit the goals of an enterprise. They direct the enterprise toward concrete actions, and as a consequence, the elicited actions are firmly based on a business motivation. A goal is defined as a desirable state the enterprise wants to reach.

As with business models, there exists a number of different goal models where some are used in Goal Oriented Requirements Engineering (GORE) for IT systems, for instance the KAOS model [4], and some are used for business analysis, for instance i* [14], or the Business Motivation Model (BMM) [3]. Since the purpose of our work is analysis and design of business models, we need a goal modelling approach that uses a small set of concepts that can be understood by business experts and that support the representation of vague, human-based intentions, actions and relations. For this reason, we use the BMM, as the technique focuses on the states an enterprise (i.e. the *principal actor*) wishes to achieve, as well as on the actions that will enable the achievement of those states. The technique relies on the use of three major concepts – Ends, Means, and Influencers.

- An End is something the enterprise seeks to accomplish, without any indication of how it will be achieved. When an enterprise intends to describe ends in the form of desired qualitative business results, it uses the notion of goal. A goal is a statement about a condition of the enterprise to be achieved. A typical goal of a car-rental company could be “to provide leading customer service”.
- A Means represents any capability or instrument that may be used to achieve Ends. BMM categorizes means into three categories: missions, courses of actions and directives. A mission indicates the ongoing operational activity of an enterprise and describes what the business is or will be doing on a day-to-day basis. A course of action “is an approach or plan for configuring some aspect of the enterprise involving things, processes, locations, people, timing, or motivation” [3]. A directive governs a course of action, i.e., it describes how the course of action should, or should not, be carried out. For the previously given goal example, a means for providing a leading customer service can be “hire experienced customer service personnel”. When a goal is described in a highly abstract manner, it is common to first divide it into sub-goals down to the level where they can be supported by concrete means. Means are represented as leaf nodes in a goal tree.
- An Influencer is anything that may impact the achievement of means (and thereby goals). An influencer is either external to the enterprise (such as customers, competitors, environment, technology, etc.) or internal (for instance, resources or infrastructure). An influencer is neutral until its impact on means or goals is assessed. An impact may be categorized in different ways; a simple and commonly accepted classification is as strength or weakness for internal influencers, and as opportunity or threat for external ones [10].

In Figure 2, we illustrate the basic BMM elements and their relations using a small excerpt of a goal model for the MMOG case.

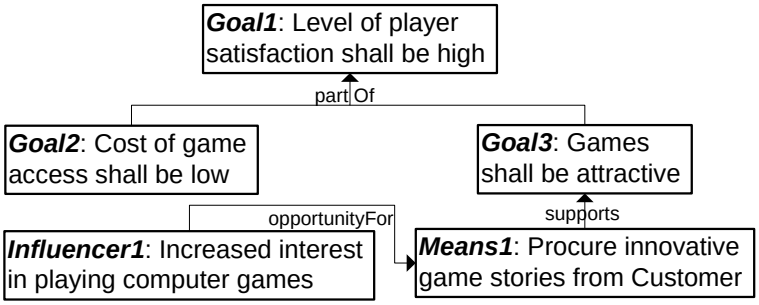

Fig. 2. Excerpt of a goal model for the MMOG case

In the given example, the goal "Level of player satisfaction shall be high" is analysed into two sub-goals; "Cost of game access shall be low" and "Games shall be attractive". The latter is, as an illustration, supported by the means "Procure Innovative Game Stories from Customer". The influencer "Increased interest in playing Computer games" is assessed as an external impact providing an opportunity for obtaining innovative game scenarios.

4 Bridging Goal Models and Business models

4.1 Relating Goal and Value Concepts

A common problem in goal modelling is that goals are difficult to formulate, that is, the formulations of goals and means often become loose and highly abstract. In [13], the authors argue that goal models become unfocused because goals range from the value propositions of an enterprise to general goals of economic sustainability. We suggest overcoming this problem by expressing goal model elements in terms of business model notions. As discussed, business models describe the use and exchanges of resources that are of economic value for the participating actors. Means in BMM play a key role in aligning a business model with a goal model. The most important category of means for this purpose is the missions, i.e., the means that describe the day-to-day activities of an enterprise. According to BMM, a mission statement consists of three parts: an action part, a product or service part, and a market or customer part. Thus, the parts of a mission statement map directly to the components of a business model. After surveying a large number of goal models, we have found that the action part of a mission statement typically concern the acquisition, production or provisioning of value objects.

These observations motivate the following guidelines for formulating goals and means in BMM (the guidelines for means are elaborated in Section 4.2. Guidelines for influencers are not considered in this paper).

- A Goal is expressed as a desired condition on one or more features of a resource, from one particular actor's point of view. One example from the MMOG case is

"Level of player satisfaction (resource) shall be high". Formulating a goal in this way makes the expression more uniform.

- A Means that is a mission should be formulated according to the templates in Section 4.2. Courses of actions and directives are to be formulated as requirements on, or actions taken on, value objects, value exchanges and value activities. For the MMOG case, some examples of means may include "Outsource (action) 50% of production of Game Content (value object)", or "Procure (action) Innovative Game Stories (value object) from Customer (market segment)".
- An Influencer is expressed as a condition that leads to support, refinement or removal of one or more means. For example, an "Increased interest in playing computer games" supports the means (see Figure 2) for acquiring innovative Game Stories from customers.

A problem in goal models concerns the resolution of conflicts among goals and means. This is, as proposed in [4] and [14], typically solved by determining the conflicting goals and then evaluating which of the goals to preserve by, for instance, categorizing their importance. In our goal-value analysis, we allow the discovery of goal conflicts at two levels – either as described previously at the goal model level, or at the business model, i.e., when the means are realised by employing certain value components in the business model. For instance, if a means requires the use of a value activity, and another prevents its use, the business modeller will discover the conflict, which in turn might origin from the goals that do not appear to be in conflict.

4.2 Means Templates

In this subsection, we elaborate the guideline for formulating mission statements by introducing a number of templates. As stated in the previous subsection, almost all action parts of BMM mission statements concern the acquisition, production, or provisioning of resources. In other words, these BMM means address the fundamental entities of business models describing with whom the principal actor exchanges value objects, what value objects are exchanged and what value activities there are to produce and consume these value objects. Thus, it becomes possible to formulate all BMM mission statements according to a small number of templates. Furthermore, some courses of actions can also be formulated using the templates below. However, most courses of actions are about refining and stating requirements on existing value objects, value exchanges and value activities, which have already been addressed by mission statements. This means that the guideline in the previous section is to be used for these courses of actions.

The following syntax is used for the templates. Each template has two parts, one compulsory and one optional, which is written within square brackets. The optional part describes possible actions that could be carried out in order to fulfil the action named in the compulsory part. The sign '|' is interpreted as exclusive-or. Words in italic are non terminals and are replaced by actual goal model terms when formulating the mission statements of BMM means. An optional discriminator can be pre-pended to a value activity filling the same function as a grammatical adjective. A "decrease production" is an example of a value activity "produce" pre-pended with the optional discriminator "decrease".

The compulsory part contains the most important piece of information, while the optional part provides complementary information about the consequences of the compulsory part. A goal modeller may choose to fill in the optional part in order to provide complete information, but in many cases it is preferable to leave it out in order to make the goal model less complex. However, the business modeller has to complete the optional part before she is working towards the to-be business model.

Templates are composed of triplets representing activities at value interface, and pairs representing value activities in the principal actor. An activity name in the templates represents the enactment (start) of that activity and is pre-pended with "stop" to represent the termination of an activity.

The intuition behind the identification of following template categories is that any enterprise can be seen procuring value objects (input) from suppliers, producing value objects (process) within the enterprise and then offering value objects (output) to its customers. In this paper, nine means templates have been formulated. As mentioned above, a goal modeller starts with the compulsory part (triplet) of the following templates. Each activity in the compulsory part of templates falls into one of the categories; value object offering, value object procuring or value object production. For all means template categories listed below, enactment (start) and termination (stop) of relevant activities are identified. For the most central value object production category, in addition to start and stop, activities with discriminators have also been introduced.

Value Object Offering Means Templates

All mission statements that deal with value object offering towards customers could be captured using this template category.

1. offer $ValueObject_1$ to $Actor_1$ [use $ValueActivity_1$ | produce $ValueObject_1$ | procure $ValueObject_1$ from $Actor_2$ AND receive $ValueObject_2$ from $Actor_1$]
2. stop offer $ValueObject_1$ to $Actor_1$[stop procure $ValueObject_1$ from $Actor_2$ | stop produce $ValueObject_1$]

The first template addresses the business activity of exchanging value objects between actors. The compulsory part deals with the business activity of providing a value object to an actor. The first optional part addresses the origin of the value object and offers three alternatives: use an existing value activity, start a new value activity in the principal actor to produce the value object, or procure it from another actor. The second optional part specifies what value object is received as a compensation for the resource provided by the principal actor.

The second template addresses the issue of stopping providing a certain value object. The optional part of the template has an effect only if the principal actor stops offering the value object to all actors. In that case, the optional part says that this can be done by either stopping producing the value object or by stopping procuring it from another actor.

Value Object Procuring Means Templates

All mission statements that deal with value object procuring from suppliers could be captured with this templates category.

3. procure *ValueObject*$_1$ from *Actor*$_1$ [use *ValueObject*$_1$ in *ValueActivity*$_1$ | offer *ValueObject*$_1$ to *Actor*$_2$ AND provide *ValueObject*$_1$ to *Actor*$_1$]
4. stop procure *ValueObject*$_1$ from *Actor*$_1$ [stop offer *ValueObject*$_1$ to *Actor*$_2$ | produce *ValueObject*$_1$ in *ValueActivity*$_1$]

The compulsory part in third template is related to the procurement of a value object by the principal actor from another actor. The optional part describes the possible effects of the procurement of the value object. The value object procured may be used as an input to produce a certain value object or it may be offered directly to the principal actor's customers.

The fourth template addresses the issue of stop procuring a value object from another actor. The possible effects of this action is that the principal actor may have to start the production of the value object in order to be able to continue providing the value object to the customers or he may have to stop offering that object. However, the actions in the optional part depend on whether the principal actor stops procuring the value object from all the suppliers or not. Depending on that, one of the alternatives in the optional part is chosen.

Value Object Producing Means Templates

All mission statements that deal to value object productions in an enterprise could be captured with this templates category.

5. produce *ValueObject*$_1$ in *ValueActivity*$_1$ [offer *ValueObject*$_1$ to *Actor*$_1$]
6. stop produce *ValueObject*$_1$ in *ValueActivity*$_1$ [procure *ValueObject*$_1$ from *Actor*$_2$ | stop offer *ValueObject*$_1$ to all]
7. (increase | decrease) produce of *ValueObject*$_1$ in *ValueActivity*$_1$
8. insource produce of *ValueObject*$_1$ in *ValueActivity*$_1$ [(increase) produce *ValueObject*$_1$ AND stop procure *ValueObject*$_1$ from *Actor*]
9. outsource [fraction of] produce of *ValueObject*$_1$ in *ValueActivity*$_1$ [(stop | decrease fraction of) produce of *ValueObject*$_1$ AND procure *ValueObject*$_1$ from *Actor* AND provide *ValueObject*$_2$ to *Actor*]

The fifth template states that if the production of a value object is started then it must be offered to some actor.

The compulsory part in the sixth template deals with the issue of stopping the production of a value object. The optional part describes the possible actions to deal with that situation. The first choice is to start procuring the value object in order to offer it to the customers. The other option is to stop offering the value object to all the customers.

The seventh template deals with the increment or decrement of the production of a value object. Furthermore, means of this kind have no effect on the business model but only on the process model.

The compulsory part of the eighth template takes care of the situation where the production of a value object is insourced. If the production is insourced, then it will lead either to an increase of the production in an existing value activity or to start a new value activity to produce the value object.

The compulsory part of ninth template is applicable to the situation where the production of a value object is outsourced, which will lead to either a decrease or stopping of production. In addition to that the principal actor must also start procuring the value object, whose production has been outsourced, and start providing a value object as compensation.

In this subsection, we have shown in detail how some goal model components can be related to business model notions. This could also be viewed as a formalisation of BMM mission statements using *e³value* model notions. We have focused on mission statements as these have a direct impact on the design of business models. Mission statements will result in additions, deletions and modifications of a business model as discussed in the method in the next section. In contrast, other parts of a BMM goal model do not directly influence the design of the business model. In particular, most courses of actions and directives concern details and lower level aspects that only have an impact on process design.

5 A Method for Creating a Goal Based Business Model

In this section, we discuss how business models should be aligned with goal models. For that purpose, we propose a method that takes as input a business model and a goal model and produces a new business model conforming to the goal model. In other words, a to-be business model is constructed using an as-is business model and a goal model as inputs. The main instrument used in the method is the means templates discussed in the previous section.

Using this method the goal modeller first needs to construct the goal model expressed in terms of business model notions, which is accomplished by formulating the means according to the aforementioned means templates. It is the responsibility of a business modeller to make use of the means supplied by the goal modeller and construct the to-be business model. For some means, the goal modeller may have filled in only the compulsory part of the means template and left out the optional part. In such cases, it is the responsibility of the business modeller to first elicit the missing information and fill in the optional part of the means template. The method can be summarized as follows:

1. The goal modeller constructs a goal model using the means templates
2. For each means the business modeller
   - complements the means by filling in the optional parts of its template when needed
   - modifies the business model based on the completed means template

An Application of the Method

In this section, we use the means templates to construct the to-be business model using the goal model from section 3 and the Massively Multiplayer Online Games (MMOG) business model example as input (see Figure 1).

The MMOG case includes three actors: An ISP, a Game Provider and a Customer. The Game Provider is the principal actor responsible for producing the Game Content. In this particular MMOG the Game Provider has the intellectual property right and players are not allowed to create their own content or do special customizations. To sell and distribute games the Game Provider obtains the services of an ISP, who in turn receives payment as compensation. Customers pay the Game Provider to access games. Finally two value exchanges take place between the ISP and the Customer: Internet access from the ISP to Customer and Payment from Customer to the ISP.

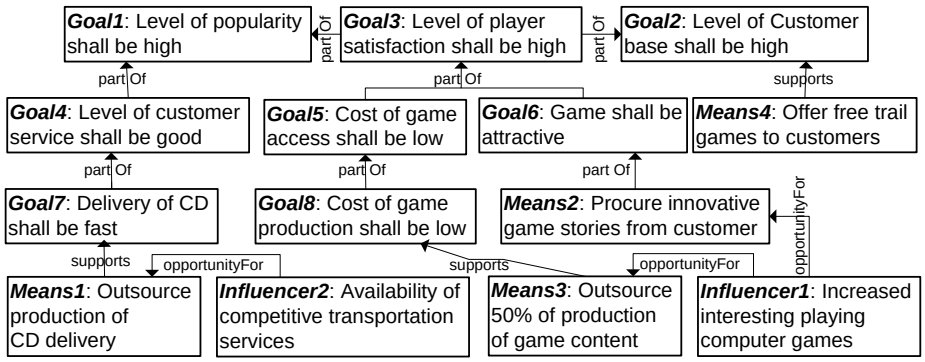

Fig. 3. A goal model for the MMOG case

Figure 3 shows a goal model for the MMOG business scenario from the Game Provider's (the principle actor's) point of view. The figure describes the top goals, sub-goals and their relationships. Each means in the goal tree is a leaf node. The means "Outsource CD delivery" supports fulfilling the goal "Delivery of CD shall be fast". The influencer "Availability of competitive transport services" is assessed to provide an opportunity to obtain low cost transport services.

In most cases value objects are explicitly modelled in each means, for instance in Means 1: "Outsource CD delivery", the value object affected is "CD delivery". In mapping these means onto the corresponding templates it is, however, assumed that the explicitly present value objects (and corresponding value exchanges) are related to additional value exchanges in the opposite direction, most commonly payment for receiving a good or service. In some cases other ways of providing compensation for a value exchange are present, such as in the case of Means 2: "offer Free trial games to Customer". Here the Game Provider offers the value object "Free trial games" to the Customer, and receives the value object "Attention" in return.

Method Application to the running case

For each means in the goal model (1) select the means template and if needed complement the means with the optional part of the template, and (2) use the business model components (e.g. Value Objects, Value Exchanges, etc.) in the template to construct the to-be business model. The following examples show the result of applying the method to the business model of Figure 1.

Means 1: Outsource production of CD delivery

Select template 9 and complement with the optional part.

outsource produce of *CD delivery* (value object) in *Transport CDs* (value activity) [stop produce of *CD delivery* (value object) AND procure *CD delivery* (value object) from *Shipper* (actor) AND provide *Payment* (value object) to *Shipper* (actor)

According to the information given in the template to realize the Means1, we need to introduce a new actor Shipper to the business model to provide a shipping service. The value activity (Transport CDs) that currently provides the transport service (CD delivery) should be removed from Game Provider. It also leads to adding one value exchange to procure the transport service from the Shipper and a corresponding reciprocal exchange for the Payment. Those exchanges are added to a new value interface. See ①, in Figure 4.

Means 2: Procure Innovative Game Stories from Customer

Select template 3 and complement with the optional part.

procure *Innovative Game Stories* (value object) from *Customer* (actor) [use *Innovative Game Stories* (value object) in *Create Content* (value activity) AND provide *Payment* (value object) to *Customer* (actor)]

This means will lead to the addition of a new value exchange and a new interface for procuring Innovative Game Stories from the Customer. It will also add a new value exchange related to the Payment from Game Provider to Customer. Those exchanges will then be connected to the existing value activity Create Content that uses these Innovative Game Stories to produce Game Contents. See ②, in Figure 4.

Means 3: Outsource 50% of production of Game Content

Select template 9 and complement with the optional part.

outsource 50 % of produce of *Game Content* (value object) in *Create Game Content* (value activity) [stop 50 % of produce of *Game Content* (value activity) AND procure *Game Content* (value object) from *Customer* (actor) AND provide *Payment* (value object) to *Customer* (actor)

This means will result in using the customer market segment to outsource 50% of the production of the Game Content and decreasing the production of Game Content by 50% in the Create Content value activity in the Game Provider. The decrement of the production will not be visible as a structural change in the model. It will be addressed at the process level of the Game Provider's business. The outsourcing is visible in the model by means of new value exchanges: one for procuring the Game Content and the other for making the payment to the Customer. See ③ in Figure 4.

Means 4: Offer Free trial games to Customer

Select template 1 and complement with the optional part.

offer *Free Trial Games* (value object) to *Customer* (actor) [use *Distribute Games* (value activity) AND receive *Attention* (value object) from *Customer* (market segment)

Offering free trial games to the customer will add new value exchanges between Game Provider and Customer for both offering Free trial games and receiving customer attention as a compensation for that. See ④, in Figure 4.

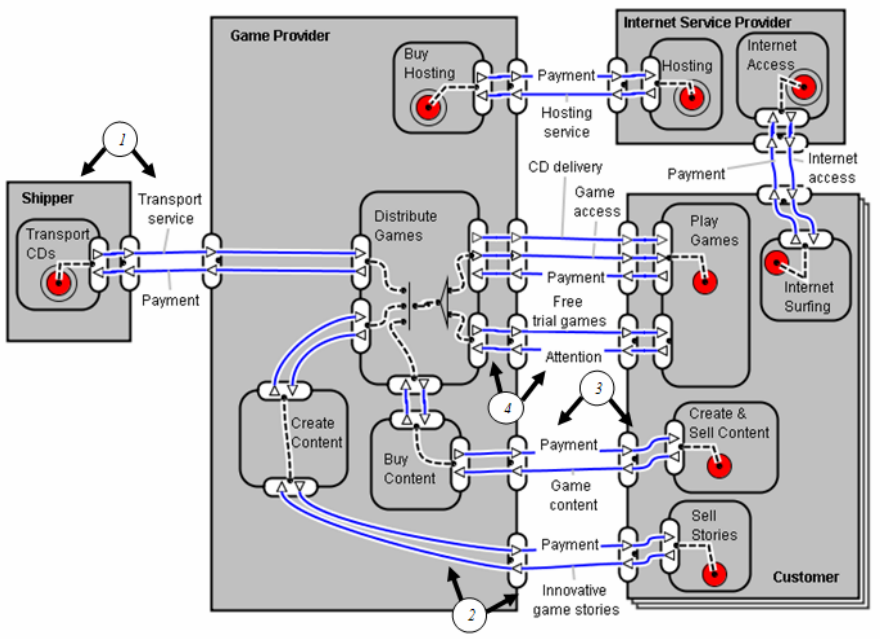

Fig. 4. Extended *e*^{3}*value* model for MMOG case

6. Conclusion and discussion

This paper has argued that for an enterprise to be sustainable its operational processes should conform to its strategic goals. A mismatch may occur as a consequence of e.g, change in the environment, and cases of non-alignments must be discovered, analysed, and corrected. Instrumental for this is the use of different kinds of enterprise models. We have focused on a part of the complex issue of business and IT alignment by addressing the problems of aligning business models with goal models. A method was proposed that takes as input a goal model and an as-is business model and makes the business model conformant through transformation. The method relies on the existence of a link between goal and business models, which is primarily provided through the notion of means.

The proposed approach offers a number of benefits:

- Clear and uniform goal model formulation. Formulating goals and means in terms of the business model notions encourage precise expressions and clarify the

relationships among the components of a goal model. Furthermore, this approach of formulating goals and means make goal models more uniform and objective in the sense that different designers will express a given goal or means in similar ways.

- Well founded business model design. The proposed method provides a way for designing business models that are firmly based on the goals and needs of an enterprise as expressed in a goal model.
- Traceability. It is possible to relate the components of a goal model to those of a business model, as the goal model has to be formulated in terms of the notions in the business model. Furthermore, components of a business model are directly motivated by the goal model.

A number of issues need to be addressed in future work. One question is about the completeness of the proposed means templates. We have argued that the template list covers a large part of the basic activities of an enterprise – acquire, provide, produce, or maintain resources. It is indeed possible to analyze the activities further and propose a more detailed list of means, e.g., "Provide" may be replaced by "Give access over the web", or "Deliver at the door". Those templates would be more precise but also less general and it is an open issue how to strike the balance between these two properties.

Still another issue is the practical applicability of the approach and what support a designer would need to apply it. This concerns in particular how a designer should be assisted in applying the means templates. The span of assistance ranges from guidelines to encodings it in a tool and what the appropriate level needs further investigation.

Another practical question left for future research is that of changing or extending the syntax of business models to reflect their relations to goal models. We have done a few experiments annotating the constructs in the business model to capture the relations. The main rationale for this was to support the modeller by increasing traceability. The down side was that it introduced clutter into the business model. An open question is to decide precisely how to maintain traceability and, if using annotations, how to keep complexity at an acceptable level.

References

1. Andersson, B., Bergholtz, M., Edirisuriya, E., Ilayperuma, T., Johannesson, P., Zdravkovic J.: Using Strategic Goal Analysis for Enhancing Value-based Models. In: Workshop Proceedings (BUSITAL07) Vol. 1 of the 19th Conference on Advanced Information Systems Engineering (CAiSE´07). ISBN: 9788251-922456
2. Andersson B., Bergholtz M., Edirisuriya A., Ilayperuma T., Johannesson P., Gordijn J., Grégoire B., Schmitt M., Dubois E., Abels S., Hahn A., Wangler B. and Weigand H.: Towards a Reference Ontology for Business Models, *25th International Conference on Conceptua Modeling(ER-2006)*, Arizona, USA
3. Business Motivation Model release 1.3., The Business Rules Group. 2007., Available 071205 at http://www.businessrulesgroup.org/second_paper/BRG-BMM.pdf

4. Dardenne A., Lamsweerde A. and Fickas S.: Goal-Directed Requirements Acquisition. *Science of Computer Programming*, 20 (1-2): 3-50 (1993)
5. Dietz J.L.G.: Enterprise Ontology – theory and methodology, Springer-Verlag, Heidelberg, Berlin, New York (2005)
6. Gordijn J., Akkermans J.M. and Vliet J.C. van.: Business Modeling is not Process Modeling, *Conceptual Modeling for E-Business and the Web*, LNCS 1921, Springer-Verlag:40-51 (2000)
7. Gordijn, J., Petit M., Wieringa R.: Understanding business strategies of networked value constellations using goal- and value modeling. In Martin Glinz and Robyn Lutz editors, *Proceedings of the 14th IEEE International Requirements Engineering Conference*, Pages 129-138, IEEE CS, Los Alamitos, CA, USA (2006)
8. Gordijn, J., Yu, E., Raadt van der B., Exploring web services ideas from a business value perspective. In J. Atlee and C. Roland, editors, Proceedings of the 2005 13th IEEE International Conference on Requirements Engineering (RE05), Los Alamitos, C. IEEE Computer Society (2005) 53-62
9. Pigneur Yves, e-Business Model Ontology For Improving Business/It Alignment, Proceedings of the Open Interop Workshop on Enterprise Modelling and Ontologies for Interoperability (EMOI - INTEROP'05), CEUR Workshop Proceedings. 2005
10. SWOT Analysis, Wikipedia, the free encyclopaedia, available at http://en.wikipedia.org/wiki/SWOT . Last accessed 14.2.2007
11. TOVE project, at University of Toronto, available at, http://www.eil.utoronto.ca/tove/ontoTOCK.html, last accessed 14.2.2007
12. Uschold M. et al.: Special Issue on Putting Ontologies to Use. Mike Uschold and Austin Tate (eds), also available from AIAI as AIAI-TR-195 at, http:///www.aiai.ed.ac.uk/~entprise/ontology.html, (1998)
13. Weigand H., Johannesson P., Andersson B., Bergholtz M., Edirisuriya A. and Ilayperuma T.: Strategic Analysis Using Value Modeling, The c3-Value Approach, *40th Hawaii International Conference on Systems Science (HICSS-40 2007)*, Waikoloa, Big Island, HI, USA. IEEE Computer Society. CD-ROM/Abstracts Proceedings
14. Yu S.: Models for supporting the redesign of organizational work,.*Proceedings of the Conference on Organizational Computing Systems (COOCS 1995)*, Milpitas, California, USA. ACM: 226-236
15. Zachman A. John., A framework for information systems architecture, IBM Systems Journal, 26(3), 1987