The Role of Business Models in Enterprise Modelling

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Abstract. In order to cope with increasingly complex business and IT environments, organisations need effective instruments for managing their knowledge about these environments. Essential among these instruments are enterprise models that represent an organisation including its domain of work, processes, and context. Most enterprise models have focussed on information and process structures, but there has recently also been a growing interest in goal models, describing the intention of actors. We suggest that there is a need for an additional type of model, often called value model or business model, that focuses on the value created and interchanged between actors in a business environment. This kind of model provides a clear and declarative foundation for other kinds of enterprise models and they will become increasingly important in managing a complex environment characterised by collaboration, variety, and change.

1 The Roles of Modelling

Today's enterprises and IT systems are facing an increasingly complex environment characterised by collaboration, variety, and change. Enterprises are becoming more and more dependent on their business networks. In order to cope with tasks they cannot handle alone, enterprises need to collaborate with others in ever changing constellations. Organisations are experiencing ever more variety in their business, including products, customers, and enterprise infrastructure. Organisations have to manage an environment that is constantly changing and where lead times, product life cycles, and partner relationships are shortening. In order to cope with increasingly complex business and IT environments, organisations need effective instruments for managing their knowledge about these environments. Essential among these instruments are models, i.e. representations of aspects of an organisation including the domain of work, the processes,

and the context. Models have been used for a long time in information systems design, and it is possible to identify three main ways of utilising models, [8]:

Models as sketches. Models are used as sketches to describe possible solutions to problems or to document existing solutions in order to facilitate communication among stakeholders. The idea is to use the models as informal support for explanation and communication.

Models as blueprints. Models are used as blueprints for implementing IT systems and services. The idea is that the models shall be sufficiently precise and formal for programmers, database designers and other IT experts to build a functioning system.

Executable models. Executable models take the idea of models as blueprints one step further. The models shall be formal enough to be automatically translatable into executable code. In this way, the coding step is eliminated, thereby reducing cost and risk for introducing errors.

The approach of executable models is not new but has been a vision for many years, [17]. Recently, it has got more momentum through OMG's launching of MDA, Model Driven Architecture, [14]. The purpose of MDA is to support model-driven engineering of software systems. System functionality is first to be defined in a platform-independent model (PIM), typically using UML as a modelling language. This PIM will then be transformed into a platform-specific model (PSM) adapted to a software environment like .Net or EJB.

Realizing the vision of MDA will require the solution of a number of difficult problems and issues including the modelling of dynamics, acceptance of standards by users and vendors, correct and reliable model transformation algorithms, and the spreading of expertise and skills in MDA. Another issue is the choice of model types to be used for PIMs in the context of information systems design. Most models for this purpose, also called enterprise models, have focussed on information and process structures. Recently, there has also been a growing interest in goal models, describing the intention of actors, [16]. In this Chapter, we suggest that there is a need for an additional type of model, often called value model or business model, that focuses on the value created and interchanged between actors in a business environment. We argue that this kind of model provides a clear and declarative foundation for other kinds of enterprise models and that they will become increasingly important in managing a complex environment characterised by collaboration, variety, and change. The Chapter is structured as follows. Section 2 gives a brief overview of enterprise models, in particular conceptual, process and goal models. Section 3 introduces business models, and Section 4 discusses how business models can be related to process and goal models. The final sec-

tion concludes the paper and points out a number of research directions for business modelling.

2 Conceptual, Process and Goal Models

2.1 Conceptual Models

Describing a system by means of conceptual models means viewing the world as consisting of objects that belong to different classes, have distinct properties, and are related to each other in various ways. The objects are born, they are affected by events, they acquire and lose properties, they interact with other objects, and finally they die. This way of viewing a system provides a powerful representation and reasoning tool that has been put to use in many different contexts. It has been used for business engineering, requirements engineering, database design, information systems design, and many other applications. One of the first conceptual modelling languages was the ER approach, which was based on the notions of entities and relationships, [5]. Another influential language is NIAM and its successors, [11], that are based on a binary association approach and provides an expressive graphical notation for rule formulation. UML, which has its roots in software engineering, is today widely used also for conceptual modelling.

2.2 Process Models

Process models are used to represent the business processes of an organisation. A well-known definition of a business process is “a specific ordering of work activities across time and place, with a beginning, an end, and clearly-defined inputs and outputs; a structure for action”, [6]. There are many other definitions, but in principle they all state that business processes are relationships between inputs and outputs, where the inputs are transformed into outputs using a series of work activities that add value to the inputs.

There exist a large number of languages and notations for process models, each focusing on different aspects of business processes. One kind of process model is the Data Flow Diagram, which shows the flow of data from one place to another. A Data Flow Diagram describes how data enters and leaves a process, the data produced and consumed by the activities of the process, the storage of the data within the process, and the organisational function responsible for the process. Another kind of process model

is the Role Activity Diagram, which focuses on the roles responsible for different activities within a process and the interactions between theses roles. Still another kind of process model is IDEF0, which is a graphical notation for business processes showing their inputs, outputs, controls that govern the activities, and resources that are used to carry out the activities of the processes. There are also many other business process languages including EPC, BPMN and UML activity diagrams. Most of these languages are semi-formal and do not provide a precise semantics, but there have been attempts to formalise them using languages like Petri nets and pi-calculus. A formally defined and comprehensive process modeling language is YAWL, [25], which addresses control flow, data flow as well as resource aspects of business processes.

2.3 Goal models

Goal models have been used in requirements engineering to understand a problem domain and to map out the interests of different stakeholders. One of the most widely known languages for goal modelling is i*, [16], which provides constructs for modelling goals, tasks, resources, and dependencies between actors. While i* holds a strong position in the academic community, there are also goal modelling languages with a more practical orientation. One of these languages is the Business Motivation Model, BMM [4]. A basic notion in BMM is that of a goal, which expresses something a business seeks to accomplish, a desired future state of affairs or condition. Examples of goals are being the market leader in an industry or having a profit of more than 1 million euros. Goals can be decomposed, i.e. one goal can be a part of another goal.

Furthermore, BMM includes the notion of means, i.e. something that can be used to achieve a goal. Means can take different forms, as they can be instruments, devices, capabilities, techniques or methods. A means states what an organisation will do or use to achieve a goal, while a goal tells what the organisation views as desirable. There are two main kinds of means, course of action and directive such as business rules and policies. A course of action tells how an enterprise will behave to achieve a goal, while a directive governs or restrains the use of courses of actions. Another component of BMM is the influencer, i.e. something that can impact an enterprise in its employment of means or achievement of goals. An influencer expresses an objective state of affairs, while a goal is something that an organisation decides about – it wants to accomplish the goal. Similarly, a means is something that the organisation chooses itself – it decides to use a means in order to achieve a goal.

3 Business Models

A business model should help to answer a number of questions about a business idea and its realisation. The following are examples of such questions, formulated from one agent's perspective:

- Which is our value proposition?
- What do we offer to our customers?
- Why do the customers find this valuable?
- How do we go about to create this value and how do we market it?
- Can we deliver the value ourselves?
- Do we need to cooperate with other actors?
- Is our network of suppliers and partners sustainable?

These are some basic examples of questions that a business model should help to answer, and they illustrate that a business model is quite different from other types of models used in enterprise analysis and design. In particular, a business model is different from a process model. A business model gives a high level view of the activities taking place in and between organisations by identifying agents, resources and the exchange of resources between the agents. So, a business model focuses on the *what* in business. A process model, on the other hand, focuses on the *how*, as it deals with operational and procedural aspects of business communication, including control flow, data flow and message passing. In other words, a business model takes a declarative view, while a process model takes a procedural view.

There exist a number of languages for business models, where the three most comprehensive and well defined are REA, *e*^{3}*value*, and BMO. These three languages were originally developed for different and specific purposes, but there has also been recent work on expanding their applicability. REA was originally intended as a basis for accounting information systems [15] and focused on representing increases and decreases of value in an organisation. REA has subsequently been extended to form a foundation for enterprise information systems architectures, and it has also been applied to e-commerce frameworks [22]. *e*^{3}*value* focuses on modelling value networks of cooperating business partners and provides instruments for profitability analysis that help in determining whether a certain value network is sustainable [10]. Extensions of *e*^{3}*value* have been suggested that incorporate process related aspects as well as risk management [3] and [23] and strategic analysis, [24]. BMO differs from the two other approaches by being wider in scope, as it also addresses internal capabilities

and resource planning. Furthermore, BMO incorporates marketing aspects describing value propositions as well as marketing channels [19].

3.1 The Resource-Event-Actor Framework

The Resource-Event-Actor (REA) framework was formulated originally in [15] and has been developed further, e.g. [9, 22]. Its conceptual origins can be traced back to business accounting where the needs are to manage and monitor businesses through a technique called double-entry bookkeeping. The core concepts in the REA ontology are Resource, Event, and Actor and the intuition behind them is that every business transaction can be described as two events where two actors exchange resources. To acquire a resource, an agent has to give up some other resource. For example, in a purchase the buyer has to give up money in order to receive some goods. There are two events taking place here from the buyer's perspective: one where the amount of money is decreased and another where the amount of goods is increased. A corresponding change of control of resources takes place at the seller's side, where the amount of money is increased while the amount of goods is decreased. Thus, an exchange occurs when an agent receives resources from another agent and gives resources back to that agent. REA does not model only exchanges but also conversions, which occur when an agent consumes resources in order to produce other resources.

3.2 The *e³value* Ontology

The *e³value* ontology, [10], aims at identifying exchanges of value objects, similar to the resources in REA, between the actors in a business case. It also supports profitability analysis of business cases. *e³value* was designed to contain a minimal set of concepts and relations to make it easy to understand for business and domain experts. The basic concepts in *e³value* are actors, value objects, value ports, value interfaces, value activities and value exchanges. An actor is an economically independent entity, typically a legal entity, such as an enterprise or a consumer. A market segment is a set of actors with similar preferences. A value object is something that is of economic value for at least one actor, e.g. cars, Internet access, and 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 or out indicating whether a value object flows into or out of the actor. A value interface consists of at least two in and out ports belonging to the same actor. Value interfaces are used to model reciprocity in business transactions. 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, similar to conversions in REA, is an operation that can be carried out in an economically profitable way for at least one actor.

Fig. 1 gives an example of an *e*^{3}*value* model, which shows a business case for a Massively Multiplayer Online Game (MMOG). In this business model there are three principle actors involved - the game producer, the Internet Service Provider and the Customers. The game producer is responsible for producing the game content and selling and distributing its software on CD to the customers. In order to play the game, the customers need to have Internet access, which they get from the Internet Service Provider. They also need access to the game server, which is provided by the game producer. In the figure, actors are graphically shown by rectangles, value activities by rounded rectangles, value ports by triangles, value interfaces by oblong rectangles enclosing value ports, and value exchanges as lines between value ports with the names of value objects as labels.

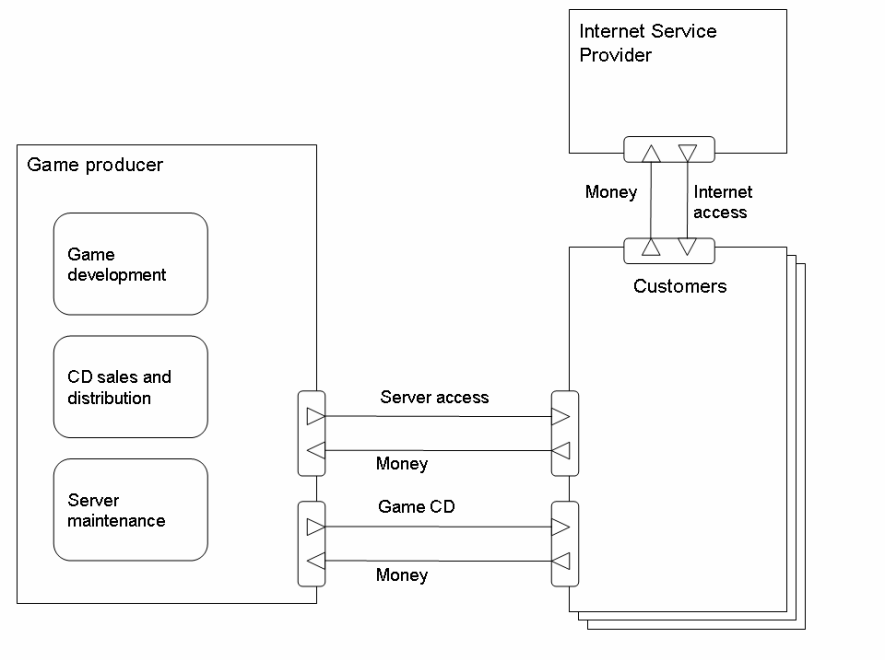

Fig. 1. An *e*^{3}*value* model for an MMOG case

3.3 The Business Model Ontology

The Business Model Ontology (BMO) as proposed in [18] provides an ontology that allows describing the business model of an enterprise precisely and in depth. BMO consists of nine core concepts in four categories. The categories are Product, Customer Interface, Infrastructure Management, and Financial Aspects. The single concept in Product is Value Proposition, which is an overall view of a company's bundle of products and services that are of value to a customer.

Customer Interface contains three concepts; Target Customer, Distribution Channel, and Relationship. A target customer is a segment of customers to which a company wants to offer value. A distribution channel is a means of getting in touch with the customers. A relationship is the kind of link a company establishes between itself and its customers.

Infrastructure Management contains three concepts; Value Configuration, Capability, and Partnership. A value configuration describes the constellation of activities and resources necessary to create value for customers. A capability is the ability to execute a repeatable pattern of actions that are needed for creating value for customers. A partnership is a voluntary, cooperative agreement between two or more enterprises with the purpose to create value for customers.

Financial Aspects contains two concepts; Cost Structure and Revenue Model. Cost structure is the financial representation of all the means employed in the business model. Revenue Model describes the way a company makes money through a variety of revenue flows.

3.4 On Value Exchanges

In all of the approaches above, the notion of resource and value exchange are essential. In order to show the relationships between business models and other kinds of models, these notions need to be analysed in more detail. A first distinction can be made between resources and rights on resources. A *resource* is an object that is regarded as valuable by some actors. A *right* on a resource expresses that an actor is entitled to use that resource in some way. An example is the ownership of a book, which means that an actor is entitled to read the book, give it away, or even destroy it. Another example of a right is borrowing a book, which gives the actor the right to read it, but not to give it away or destroy it. For a value exchange, both the resource being transferred and the right on the resource have to be specified. For example, the two value exchanges in which a car

is sold and borrowed concern the same resource but differ in the rights being transferred.

Another component of a value exchange is the custody of the resource being exchanged from one actor to another. An actor has the *custody* of a resource if she has immediate charge and control of the resource, typically physical access to the resource. If an actor has the custody of a resource, this does not mean that she has any rights on the resource. For example, a distributor may have the custody of some goods, but he is not allowed to use the goods for any purpose. Providing custody of a resource is essential in a value exchange, as the buyer is typically unable to exercise the rights she gets unless she has custody of the resource.

A value exchange may also include the transfer of some evidence document that certifies that the buyer has certain rights on a resource. A typical example of an evidence document is a movie ticket that certifies that its owner has the right to watch a movie. Summarising, a value exchange can be seen as combining four components:

- The resource being exchanged from one actor to another, e.g., a book
- The right that the buyer obtains on the resource, e.g., the ownership of a book
- The custody of the resource, e.g., buyer's physical access to a book
- The evidence document, e.g., a ticket

4 Relating Business models to Other Kinds of Enterprise Models

In this section, we will discuss how business models relate to other kinds of enterprise models, in particular process models and goal models.

4.1 From Business Model to Process Model

A business model has a clearly declarative form and is expressed in terms that can be easily understood by business users. In contrast, a process model has a procedural form and is at least partially expressed in terms, like sequence flows and gateways, that are not immediately familiar to business users. Furthermore, it is often difficult to understand the reasons behind a certain process design and what consequences alternative designs would have. One way to address these problems is to base process modelling on a declarative foundation using business models. Such a foundation would provide justifications, expressible in business terms, for design de-

cisions made in process modelling, thereby facilitating communication between systems designers and business experts. More concretely, a business model can be used as the starting point for designing a process model. However, this design cannot be automated as many different process models can realise the same business model, and additional knowledge about the intended process has to be introduced.

Designing a process model based on a business model can be viewed as a process consisting of three phases. First, the processes needed for realising the business model are identified, which results in a set of process names. Secondly, the internal structure of each process identified is designed according to a number of patterns. Finally, the designed processes are related to each other based on different kinds of dependencies. The following design process is based on and elaborates on the one proposed in [2], and it is assumed that the business model used as a starting point is in the form of an *e*^{3}*value* diagram.

Phase 1: Identifying processes

This phase consists of three steps, where the first two steps extend the business model and the third one identifies a set of processes based on the extended model.

Step 1: For each value exchange, determine whether the custody component of the value exchange exists and shall be modelled explicitly. If so, add one or more arrows to the model representing transfers of custody from one actor to another. This step can be viewed as "factoring out" the custody component of a value exchange and modelling it explicitly by additional flows in the model. It should be noted that several actors, and possibly also new actors, may be involved in transferring the custody from one actor to another.

Step 2: For each value exchange, determine whether the evidence document component of the value exchange exists and shall be modelled explicitly. If so, add one or more arrows to the model that represent transfers of evidence documents from one actor to another. Analogously to the step for custody, this step can be viewed as factoring out the evidence document component of a value exchange. Also in this case, several actors may be involved, e.g., when a ticket office supplies tickets on behalf of other service providers.

Step 3: Identify a set of processes based on the extended e³value model from Step 2 and the Open-EDI transaction phases, [7].

- For each value transaction, one negotiation process is introduced
- For each arrow in the extended model, one actualization process is introduced
- For each arrow in the extended model, optionally one post-actualization process is introduced

Phase 2: Designing the internal structure of processes

The internal structure of each process identified in the previous phase needs to be designed, including control, data, and resource flows. This can be done from scratch but an attractive alternative is to base the design on a library of process patterns. As the number of patterns in such a library will be large, there is a need for structuring mechanisms that facilitate navigation and search. Two well-known structuring mechanisms are generalisation and specialisation, as employed in, for example, the MIT Process Handbook, [13]. Furthermore, the patterns need to be characterised so that a designer easily can choose between patterns for the same purpose. The list of possible characteristics is in principle open-ended, but for processes realising value exchanges, empirical research indicates that there are four main characteristics to be considered, [21]:

- risk - the risk one agent takes in an exchange, e.g. delivering a resource without getting paid
- type of resource - the type of resource being exchanged, e.g. goods, information or services
- time - the time needed for carrying out an exchange
- cost - the cost for carrying out an exchange, often called transaction cost

It is often necessary to make a trade-off between desirable characteristics of an exchange process. For example, the risk of an exchange may be reduced by introducing a letter of credit procedure, which on the other hand will increase costs and lead times. Furthermore, the needs and desires of different agents also have to be balanced, e.g. the risk for one agent may be reduced by requesting a down payment, but this will increase the risk for the other agent in the exchange.

Phase 3: Relating processes

In the two previous phases, a number of processes were introduced and designed. These processes may need to be related to each other, e.g. they

may have to be put into sequence. One instrument for doing this is to use the notion of dependencies between activities as suggested in [1]. The two most relevant dependencies in this context are flow dependencies and trust dependencies. A flow dependency is a relationship between two activities, which expresses that the resources obtained by the first activity are required as input to the second activity. An example is a retailer who has to obtain a product from an importer before selling it to a customer. A trust dependency is a relationship between two activities, which expresses that the first activity has to be carried out before the other one as a consequence of low trust between the actors. Informally, a trust dependency states that one actor wants to see the other actor do her work before doing his own work. From these dependencies, relationships between the previously introduced processes can be added.

Basing process design on business models provides a number of advantages:

- Business Orientation. Instead of going directly into procedural details, a business model allows business experts to describe the underlying business reasons that govern the flow of processes. In particular, relations between activities can be specified in terms of notions like resource flow, trust, coordination, and reciprocity.
- Traceability. Components in a process model can be explained by and tracked back to business oriented notions and motivations expressed in a business model.
- Flexibility. The transformations from business model to process model give the main structure of a process model. However, the approach allows for flexibility by letting the internal structure of the processes be based on patterns. This means that the lower-level details of a process model can be tailored to the situation at hand by selecting appropriate patterns from a library.

4.2 Business Models and Goal Models

Goal models, similarly to business models, are typically used in the earliest phases of information systems design, where they help in clarifying interests, intentions, and strategies of different stakeholders. As suggested in [24], goal models often focus on the capabilities, customers, and competition of an enterprise. An enterprise formulates goals that it intends to obtain and uses its capabilities, i.e. internal resources, for this purpose. An important goal for any enterprise is to establish profitable relationships

with its customers, which are actors or market segments that buy the products of the enterprise. An enterprise also has to closely watch the activities of its competition, i.e. other actors that address the same market segments. Thus, goal models are closely related to business models, as their subject matter naturally can be expressed in terms of the basic notions of business models. This relationship can be used for improving goal modelling as well as business modelling. For example, expressing goals, means and influencers in terms of agents, resources and economic events encourages precise and uniform formulations that make goal models more expressive and easier to understand. Another use is to design a to-be business model based on an as-is business model and a goal model expressing desired changes of a business. Thus, the goal model is used to suggest which actors, resources and exchanges that are needed to realise a business idea. The most important part of a goal model for this purpose are the means as they express how a business should be carried out and be changed in order to obtain certain goals. BMM makes a distinction between two kinds of means, courses of action and directives such as business rules and policies. A course of action tells how an enterprise will behave to achieve a goal, while a directive governs or restrains the use of courses of actions. After having surveyed a large number of goal models, we have found that almost all courses of actions concern the acquisition, production, maintenance, or provisioning of resources. In other words, means address the fundamental entities of business models - resources, events and agents. Thus, it becomes possible to formulate next to all means occurring in goal models according to a limited number of templates as given below ("resource" is here used as a synonym of "value object"):

1. offer <resource> to <actor | market segment>
2. stop offering <resource> to <actor | market segment>
3. procure <resource> from <actor | market segment>
4. stop procuring <resource> from <actor | market segment>
5. produce <resource> in <value activity>
6. stop producing <resource> in <value activity>
7. (increase | decrease) production of <resource> in <value activity>
8. outsource <value activity> to < actor | market segment>

An example of a goal model for the MMOG case, where the means have been formulated according to the templates above, is given in Fig. 2.

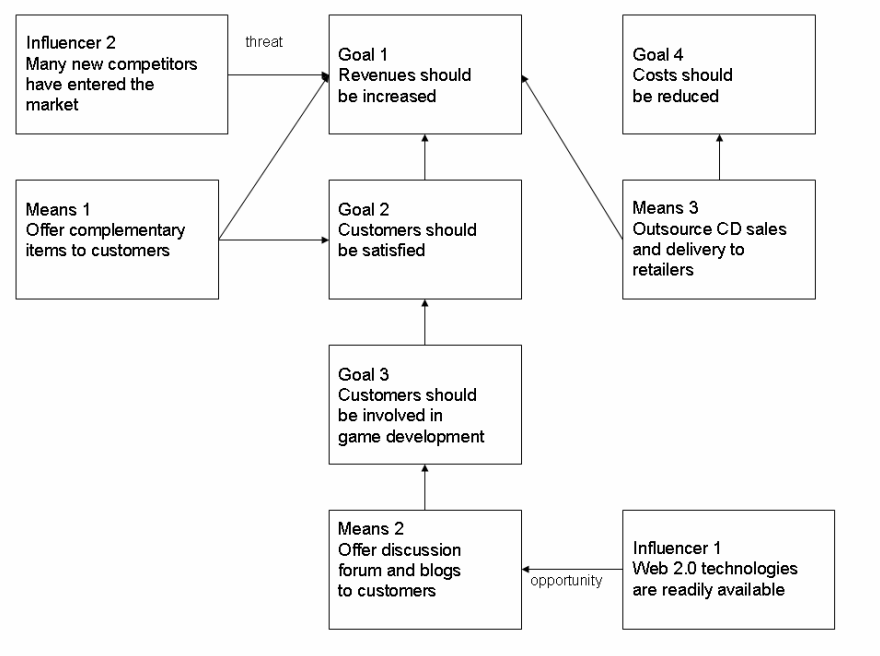

Fig. 2. A goal model for the MMOG case

Given an as-is business model and a goal model, containing a number of means formulated according to the templates above, it is straight-forward to construct a to-be business model that takes the means into account. The following rules can be applied for this purpose:

1. For a means of the form “offer <resource> to <actor | market segment>”, add a value exchange for the resource in existing or new value interfaces
2. For a means of the form “stop offering <resource> to <actor | market segment>”, remove a value exchange for the resource and possibly associated value interfaces
3. For a means of the form “procure <resource> from <actor | market segment>”, add a value exchange for the resource and possibly associated value interfaces
4. For a means of the form “stop procuring <resource> from <actor | market segment>”, remove a value exchange for the resource and possibly associated value interfaces
5. For a means of the form “(produce | create | launch | initiate | ...) <resource> in <value activity>”, add a value activity producing the resource

6. For a means of the form “stop producing <resource> in <value activity>”, remove the resource from the value activity and possibly also the value activity
7. For a means of the form “increase | decrease) production of <resource> in <value activity>”, no changes are made to the business model
8. For a means of the form “outsource production of <resource> to <actor | market segment>”, remove the resource from a value activity and possibly remove the value activity, add a new value exchange with associated value interfaces to a, possibly new, actor or market segment

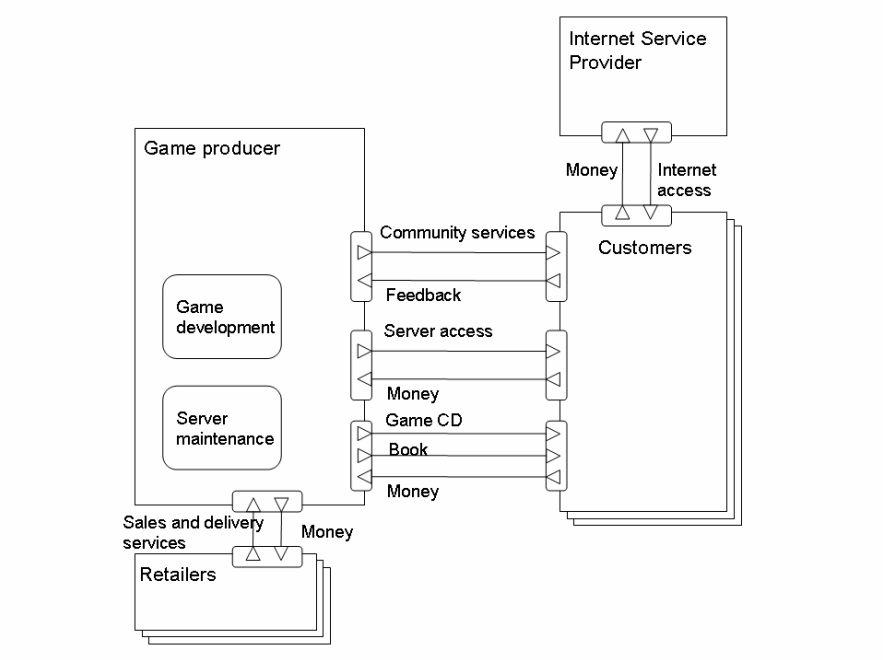

Fig. 3. A to-be *e*^{3}*value* model based on a goal model

Applying the means in the goal model of Fig. 2 to the as-is business model of Fig. 1 will result in the to-be business model of Fig. 3.

5 Concluding Remarks

In this chapter, we have discussed business models, their purpose and how they can be related to other kinds of enterprise models in business, requirements, and information systems engineering. It is envisaged that business models will play a major role in model driven architectures, as they possess important advantages compared to other types of models. In particular, they provide a compact view of a business scenario by focusing on its value aspects and disregarding procedural aspects. This means that business models can be quickly and easily comprehended also by business experts, and they thereby provide an adequate means for explanation and communication. Business models also facilitate communication by being expressed in notions that are directly relevant for business and domain experts, like values, actors, and exchanges. Business models are still a new kind of model, and there remains a number of open issues to be addressed, among them the following:

- Identifying value objects. In principle, anything can be a value object as long as it is regarded as valuable by someone. However, in practice it is important to find guidelines for identifying value objects so that different analysts will produce similar and uniform models. A first step may be to identify typical classes of value objects like goods, services, information, and money.
- Relationships to strategic issues. Business models show the “what” in a business scenario but not the “why”. There is a need to model the motivations behind a certain value proposition and relate the business model to the strategy of an enterprise. One basis for this is Porter's five forces theory, [20], and another is the value theory of Holbrook, [12]. Initial results based on these approaches can be found in [24].
- Relationships to operational issues. In this chapter, we have outlined how business models can be related to process models on the operational level. A related issue is how to identify services based on a business model.

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