The Business Behavior Model

Denis Lemaire [1], Birger Andersson [2]

[1]Faculty of Namur, Department of Computer Science rue Grandgagnage 21,5000 Namur, Belgium. lemaired@student.fundp.ac.be

[2]Stockholm university, Department of Computer and System Sciences SE-164 40 Kista, Sweden. ba@dsv.su.se

Abstract. For solving problems related to business/IT-alignment we propose a model called the Business Behavior Model. The main idea behind the model is to capture the motives that drive an agent to take decisions about what resources he should exchange in a business collaboration. The model draws from the rational agent theory, the resource-based view, the business model ontology, and causal graphs. The usefulness of the model is illustrated through a small case study. The result indicates that the business behavior model is interesting and useful as a complement to goal models and value models.

1 Introduction

A major problem in the area of business/IT-alignment is to ensure that the information technology available to an organization provides the support the organization needs. One demand on the support is that it should be adapted as the organization adapts to changing conditions [1, 13]. In [2] an argument was put forth that alignment of models could be used to meet this demand. Of special interest of that paper was the alignment of goal models [3, 5] and value models [6]. The argument was that by properly aligning goal models and value models (together with process models) sufficient information was available to be able to adapt IT resources to the organization's needs. Thus, alignment of models was considered a means to a Business/IT-alignment end.

In this paper we look further into the link between goal models and value models. We argue that the information contained in both those models can be complemented in order to give a more complete view of the link. Limiting our analysis to some well-known goal models (BMM [5] and i* [3,4]) and value models (e³value [6]), we note that, for example, the goal model is good at describing goals and dependencies between them, but less good at describing the decisions and motivations that lead to the formulation of those goals. We note that the value model is good for describing exchanges of resources, but less good for describing the structure of those resources.

To capture and present this complementary information we propose a model called Business Behavior Model (BBM). We chose to include "behavior" in the name as we aim at capturing the way the agent could interact with its own organization and environment based on its motivation. We have three goals in this paper; first,

M. Petit, G. Gal, A. Castiaux, J. Ralyté, and P. Plebani (Eds.):
CAiSE 2010 Workshop BUSITAL'10, Hammamet, Tunisia, pp. 31-45, 2010.

providing a clear and understandable definition of the BBM. The second is to define the context in which the BBM could be applied and used. The last one is to provide some clues on the usefulness of the model.

The rest of the paper is structured as follows; in section 2 we overview theories that the BBM draws from. In section 3 we define, develop, and explain the BBM. We also discuss how it can be used. Section 4 contains an illustrative example of its use in the form of a case study. An analysis of the case study is done in section 5. Section 6 ends the paper with a concluding discussion and directions for future research.

2 Foundations

The Rational Agent Theory. In this paper we assume that the agents being modeled are rational. The Rational Agent [8] theory is a widely used concept in the Decision theory [10] and Game theory [11]. The rational agent theory aims at describing how actors react in various contexts that involve decision making. An agent is being represented as having beliefs, desires and intentions (BDI, a set of mental attributes) [8]. Beliefs are information about the agent's view of its environment. Desires are information about the agent's motivation. Intentions are about deliberative states of the agent. A rational agent has clear preferences and aims at performing action that result in the optimal outcome from among all feasible actions. In other words, based on its beliefs, an agent takes decisions with the intention to fulfill its desires. In a resource-based view those desires are fulfilled by exchange of resources.

The Resource-Based View of the firm. The Resource-Based View (RBV) [9, 19, 20] is an economic tool used to determine the strategic resources available to a firm. All firms possess resources. A subset of those resources could provide a competitive advantage and a further subset (the strategic resources) could lead to the sustainable competitive advantage. Whether a resource is considered strategic depends on its properties and how well those meet a set of criteria. Commonly used criteria in RBV are proposed by Barney [20]. He suggests that a strategic resource must possess the following properties: value, rareness, inimitability and non-substitutability [14]. In other words, in the resource-based view of the firm an agent, in order to survive, must exchange resources considered valuable for its environment. We note, however, that some resources are not exchangeable but actor inherent. Those resources are valuable in the sense that they are used to produce exchangeable resources.

The Business Model Ontology The Business Model Ontology (BMO) [17, 7] describes the logic of a "business system" for creating valuable resources. In BMO a business model is understood as the conceptual and architectural implementation of a business strategy and as the foundation for the implementation of business processes that uses and produces resources. The BMO is useful for sorting out a resource's properties in an elegant and structured way. This framework is composed of four pillars representing four different aspects of the business organization:

- Offering: Value proposition, target customer segment and capabilities.

- Infrastructure management: Activity configuration, resources and assets and partner network.
- Customer relationship: Information strategy, channels and trust and loyalty.
- Financial: The financial aspect is modeling the firm's profit and therefore its ability to survive in competition.

We learn from BMO that the resources handled by an agent have properties (reflecting four different aspects of the organization) and depending on from which aspect the organization is analyzed those properties become more or less relevant.

The Causal graph. A Causal graph is a set of nodes and arcs. The Causal graph was chosen as the syntactical basis for the BBM as it is well-founded and contains the concepts we needed for BBM development structured in a coherent way. Table 1 overviews the basic concepts of the Causal Graph.

Table 1. Basic concepts of Causal Graph [14].

Nodes	**Arcs**
Chance: A variable that could conditionally be influenced by other nodes.	*Informational:* The out-node is considered before the in-node is analyzed.
Utility: The expected utility of the outcome from decision nodes.	*Causal:* The in-node has conditional probability to take a certain value considering a previous out-node.
Decision: The alternatives that are possible considering the studied domain.	*Definitional:* The in-node is composed of the all nodes linked to it.

Related models. For this research, some models from strategic and business layers are used as comparison basis. For the strategic layer: i* and BMM and for the business layer: e³value. i* is a goal and agent oriented framework developed to model the goals of an agent or organization. The main idea of i* is to model an agents intentions, i.e. its goals, beliefs, abilities, or commitments [16]. Business Motivation Model is a model for expressing means for an agent to achieve goals or objectives. The BMM answers the following questions [5]; what is needed to achieve what the enterprise wishes to achieve? Why does each element of the business plan exist? BMM is present in this paper because it offers a compact notation that makes it convenient for short case study. e³value model is a value model focused on the analysis of a value proposition [6]. The e³value provides concepts for showing which parties exchange resources of economic value with whom, expecting what in return.

3 The Business Behavior Model

3.1 Definition

The definition of the BBM is based on three concepts that come directly from the Rational Agent theory and the Resource Based View – decision, resource and motivation. Those concepts are not independent and are therefore linked through causal relation with a value that indicates the intensity of the link (table 2).

Definition: *"The Business Behavior Model is a model which describes the impact of the participation of agents in a business by integrating their resources in a causal graph. The participation is realized through decisions and driven by motivations."*

3.2 Syntax and semantics

Table 2. Syntax and semantics of BBM (see also figure 4)

BBM Name	Syntax	Semantic
Economic resource properties	Rounded box	Property of a resource evaluated on a qualitative or quantitative scale. Property concerns inner characteristics but also customer, financial and infrastructural aspects
Non-economic resource	Diamond box	Resources which are not transferable directly to another actor or to another resource. They are concerning inner value for the actor.
Economic resource	Dotted square box	Resources which are transferable and described by a set of properties. One economic resource is present in the actor model if the actor rents or owns the resource.
Decision	Square box	Decision nodes represent identification of (alternative chains of) goals and means in order to reach an objective
Informational link	Arrow	The information from the out-node decision is available at the time the in-node decision is taken. Similar to a temporal meaning.
Causal link	Arrow with value link	Out-node has an impact on the value assigned to the in-node depending on the value link.
Definitional link	Empty arrow	The connected nodes are decision nodes. The purpose is to improve the definition of a decision by using sub-decisions (which are more detailed).
Creation link	Dotted links	Creation link are used in order to trace the reason why a resources is analyzed. The reason is linked to a specific decision.

XOR-relation	Bounded connector	A connector between links of same type. Those connectors act as constraint on the nodes attached to the links; at least one out-node have to be considered to grant the consideration of the in-node but not all of them.
AND-relation	Double bounded connector	A connector between links of same type. Those connectors act as constraint on the nodes attached to the links; all out-nodes have to be considered to grant the consideration of the in-node.
Value indicator		
Strongly positive	++	Strong positive influence.
Positive	+	Positive influence.
Negative	-	Negative influence.
Strongly negative	--	Strong negative influence

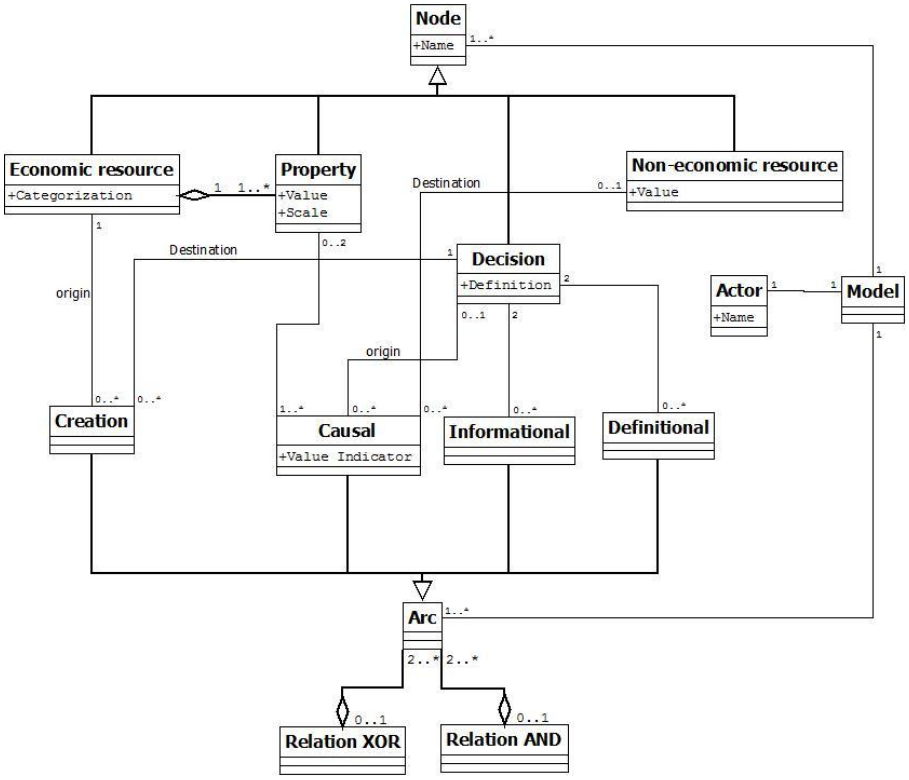

Figure 1. Meta-model of BBM

To complement the meta-model of figure 1 we use an additional methodological tool which we call a categorization. The main point of categorizing a resource is to

emphasize from what aspect a resource's property is important for a particular analysis. This tool is inspired by the Balanced Score Card (BSC) [18] approach. The categories we use, however, come from the four pillars of BMO as those pillars are more adapted to the RBV. Figure 4 shows this categorization of the MMOG resource (rectangle box). Note that we do not prescribe that all resources should be subject to categorization at all times; this is determined by the modeling purpose.

Motivation for syntax and semantics. A rational agent has beliefs, desires, and intentions. It chooses from a set of available actions and performs one in order to reach an optimal outcome. Therefore the model is structured according the following pattern (figure 2): actors have motivations (desires-outcome) that are fulfilled by actions and supported by decisions (Intention-actions) in the presence of environmental constraints (belief). In order to integrate RBV, actions are led on resources that are changed and exchanged through agent activities. Furthermore, to provide a deepest view of resource, the model analyzed them through their properties as proposed by Petit [12]. Figure 2 captures the idea of this pattern starting from decision in the bottom and ending at the motivation at the top. Figure 2 also positions the developed model between the goal layer and the business layer and shows the added value of the model (detailed in section 5).

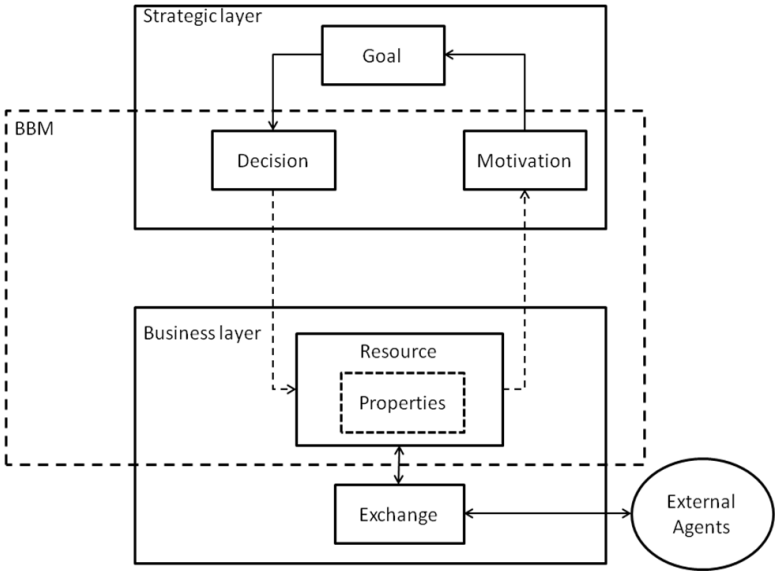

Figure 2. The position of BBM and the added value for alignment (dotted elements)

As action are completed on resource, motivation is the result from improvement on specific resources; non-economic resources. Those non-economic resources emphasize the selfish process of the outcome's optimization (the motivation). For instance, profit is often not an end in itself but a specific feeling is. The feeling of

high esteem or respect in the society is a resource as it can help in forging new alliances, but it is not an economic resource as it cannot be traded. It is strictly attached to a particular agent.

3.3 Usage

As we focus on the alignment of models on goal and business layers we use i* [3, 4] and the Business Motivation Model (BMM) [5] as goal models and e³value [6] as a value model for illustrative purpose in this paper. Finding correspondences between the notions of the different models is important for solving model alignment problems.

As shown in figure 1 the BBM model is based on three notions; decision, actor, and resource. Moreover, the model includes the notion of property and captures different kinds of relations. Motivation is, as said, a derived notion in the model.

Decisions. As Means-End links in i* are an envisaged solution for the accomplishment of a goal, they are translatable in term of valuable decision. Indeed, a solution to fulfill a goal has to lead to a decision in the business process or otherwise the goal will not be achieved. Decision that implies actions toward another actor also emphasizes the Dependency Link between actors in i*. From a different perspective, a decision is taken as it generates valuable improvement for the motivation and Value Activities are themselves generating value. Therefore, a Decision can be transformed in a Value activity, but not all the value activities are related to a decision. Start stimulus are also interesting as they emphasize the initial need of the participation, therefore they are providing information on feasible initial decision. Considering the Business Motivation Model, decisions that appeal to factual means can be translated in terms of 'Means'.

Non-economic resources. The End node with a Vision semantic [5] of BMM is similar to a motivation, therefore this node is transformable into a non-economic resources. For i*, top level nodes are sometimes parented with the motivation meaning.

Economic resources. The Resources from i* are economic resources for BBM and their exchanges between actors in i* are modeled by causal links that cross economic resources: an exchange implies modification on properties of the resource (decrease of a resource to the profit of another). Resources are also present in the Value Model e³value within the Value Object.

Properties. Properties are related to the tasks, goals and soft goals of i* considering the fact that those elements are directed in the growth of aspects of a resource for the agent and therefore can provide indices on strategic properties. Properties are related to 'Means', 'Ends' or 'Influencers' from BMM for the same reason. 'Means' are usually related to low level properties at the opposite of 'End' nodes. Influencers are external constraints that can be associated with properties from rented or purchased

resources. Indeed, those resources possess properties that are not directly controllable by the actor.

Table 3. Translation table of related notions. Translation for links is based on semantic comparison. This table should help the modeler to find relevant information in other models for the BBM or the opposite.

BBM	**e³value**	**i***	**BMM**
Actor	Actor	Actor	
Property		Goal, Task, Means Soft-goal	End, Means, Influencer
Decision	Value activity Start stimulus	Means-end link	Means
Motivation		Goal	End : Vision
Causal link	Value exchange	Decomposition link Contribution link Dependency link	Links among nodes
Informational and definitional	Value exchange between value activity of one actor	Contribution link	
Resource	Value object	Resource	
Value indicator		Contribution link	
Alternative decisions	UCM extension (trivial)	Means-end link	

Table 3 emphasizes that it is possible to construct the Business Behavior Model on the basis of the other models or to construct (derive) those models on the basis of BBM. Constructing BBM on the basis of other models or the other way around results in models which are aligned on the same ideas – this reinforces the consistency among models and increases the alignment. For example, in the illustrative case in section 4, a BBM is constructed from an e³value model and subsequently a goal model (using the BMM notation) is constructed from the obtained BBM; the BBM bridges e³value and BMM. Another way of using BBM is to use it for simulation; the final objective is to optimize the motivation, hence the necessity to improve the related non-economic resource (attached to the motivation). When looking at the model, the improvement comes from Causal Links emerging from properties influenced by decisions (figure 1). Therefore, to optimize the motivation, the user has to optimize the improvement on the path through the non-economic resource by selecting the most efficient alternative decisions. By optimizing the improvement is meant comparing the value indicators on the causal links and selecting the one that provide the best end-effect. A simulation is also illustrated in the case study.

4 Illustrative case study

The following example is based on the case of a massive multimedia on-line game (MMOG [16]) provisioning. This case implies exchange of product (the game) and exchange of service (hosting). The idea is to bridge e³value and BMM through an intermediate model – the BBM. The first step is to build the BBM from the e³value model and then to continue with deriving a BMM from it.

The e³value model

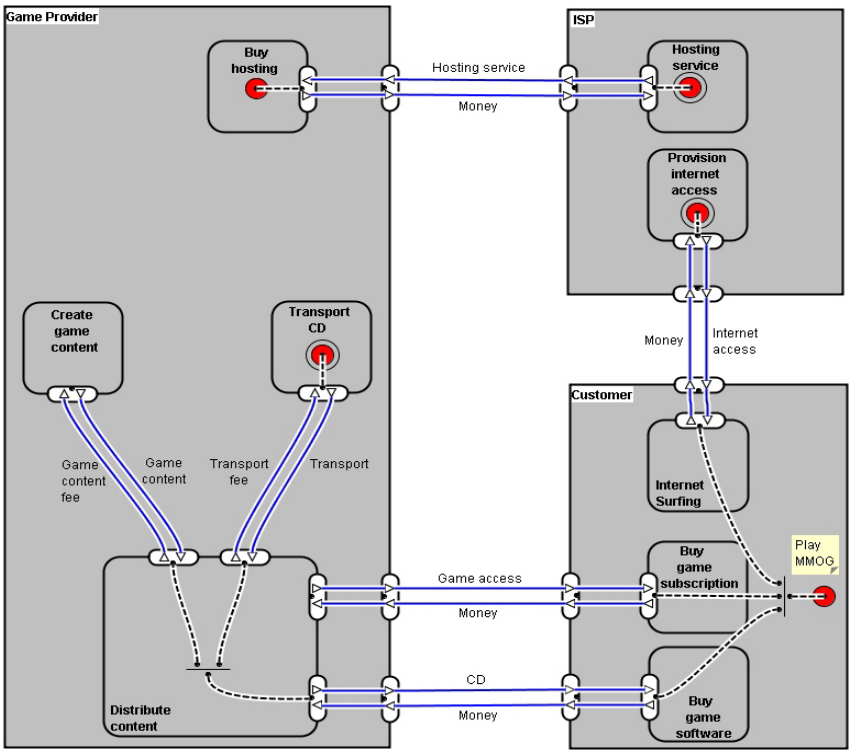

Figure 3. e³value model of the MMOG case (from [16])

By analyzing figure 3 we can sort out the decisions (value activity) and resources (value exchange). The final model considers one resource for both the CD and the Game Access – the MMOG. Motivation (a non-economic resource) is not present in figure 3, but is derived from reasoning about why an actor participates in the business collaboration.

Constructing a Business Behavior Model

As no more information is available in the e³value, the modeler should start to furnish the model with properties and link them together. This information is present in the problem description, and the BBM in figure 4 has been complemented based on this information. The final model is obtained by adding a categorization for the MMOG resource.

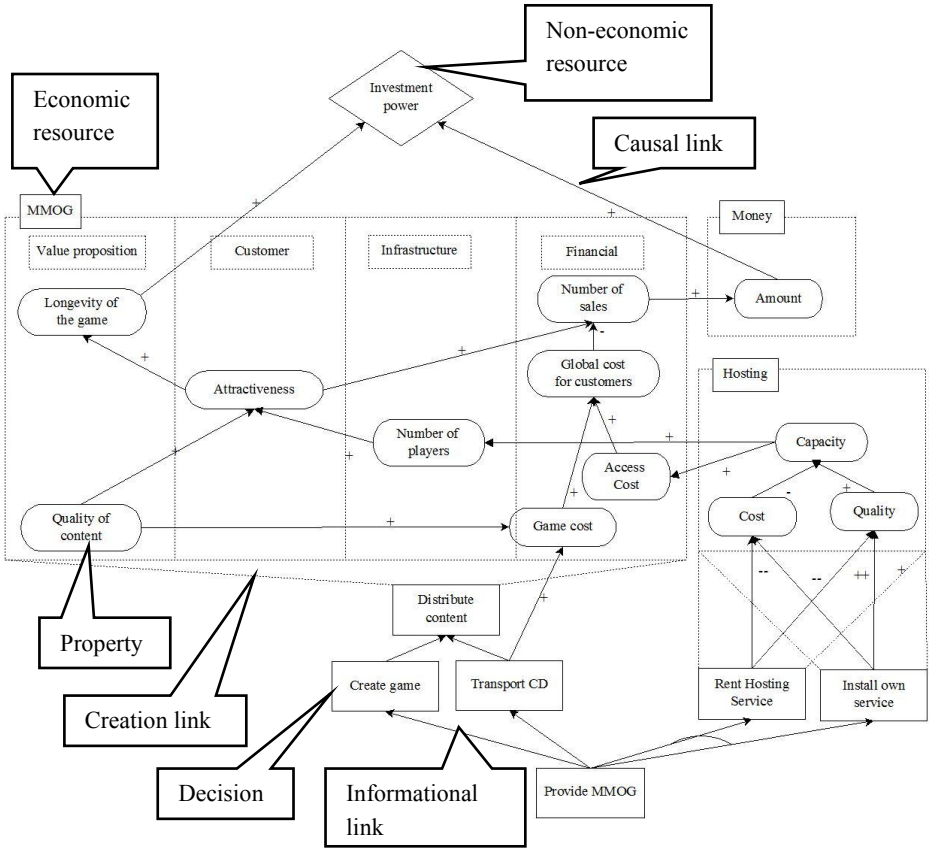

Figure 4. Business Behavior Model (Game provider's view)

Figure 4 shows the initial motivation of the business (improve the investment power), it could have been different but we do not possess the information in the source case. From there, the company decides to provide Massively Multiplayer Online Game. This requires creating the game, preparing a support (CD) and shipping them. On the other hand, the online aspect requires hosting capacity. The result is a MMOG resource with some properties separated in four categories (from BMO) and a Hosting. The company possesses some money as well (a third resource). Properties from the three resources are connected and act as constraints (resources that are not

variable by the considered agent) but also as variables whose values the decision makers can vary.

Figure 4 also illustrates simulation: the model proposes an alternative decision for the hosting resource which is to install a hosting service that would be owned by the game provider (shown in the lower right corner). When comparing Value Link on both out-relations from the two decisions:

- They cost the same (two double minus). For short term the renting is more advantageous, but in the long run owning is more advantageous.
- Quality varies (one is double minus and one is double plus). Renting provide the insurance of experience strengthen by contract. The installation requires experts that are maybe not present inside the companies; therefore, quality may be reduced.

In this case, the choice is quite easy; renting seems to be the better decision.
Similar models are constructible for the customer's and the ISP's point of view.

Business Motivation Model

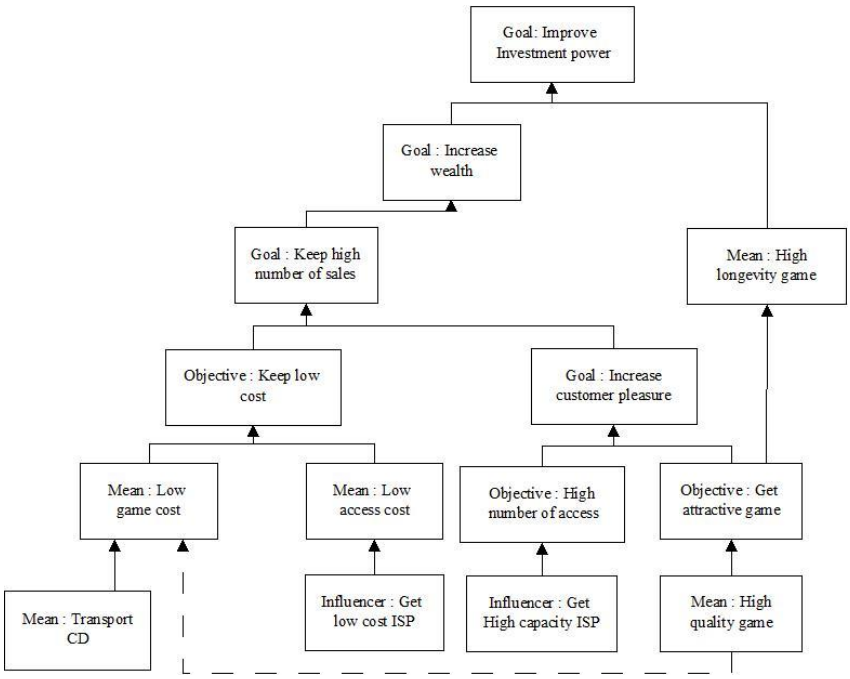

Figure 5. BMM of the MMOG case with conflicting relation

Figure 5 shows a BMM built on the basis of the BBM of figure 4. We opted in this paper to show a BMM instead of an i* model as it is more compact. The used process

did not consider the non-influencing decisions and focuses on the properties to sort them out in one of the following category of nodes: “End”, “Means” and “Influencer”. “End” nodes are top level properties in the graph of the BBM (figure 4). “Means” are low level properties (or leaves of the graph). “Influencer” nodes are external constraints. In our case the constraints come from the renting of the hosting service – the ISP is the one who fix the price and the capacity. The influencing decision (Transport CD) is also “means”. As it is visible in figure 5, the BMM conserves all the relation among nodes from figure 4. The negative causal relation between the “Game cost” and the “Quality of content” (in figure 4) is modeled through a dotted link in the figure below to avoid using Assessment elements from BMM.

5 Results

This section highlights the value of two approaches of using BBM. The first consists in comparing the model in both the strategic level and in the business level with the BBM by pointing out some valuable added notions. The second focuses on improving the analysis for both the strategic and the business level.

5.1 Added notions

Motivation oriented: Motivation is the engine that drives problem solving for a business. Therefore, modeling the engine of the participation is crucial to reach an optimal solution. Including motivation also brings the possibility of giving a non-profit oriented view of the business by focusing on this non-economic resource. The motivation can be present in goal model, but in our case, the motivation is linked with actions on resources (figure 2).

Decision oriented: Decisions are the first step towards the achievement of a solution. Plus, alternative decisions provide the possibility of reflecting on which solutions are the best for the business through simulation. In terms of alignment, it bridges the establishment of goals with their application in the value proposition. Once again, some decisions could be drawn in the strategic layers but here we connect them with motivation and action on the resource (figure 2).

High resource granularity: Modeling resources as a set of properties gives insights about the weakest and the strongest points of resource configurations. The categorization of resource properties improves the structured view of the resource. Modeling inter-resource relations gives a wider and a sharper view of the studied system and detailed descriptions of property dependencies emphasizes different aspects of a system.

RBV (resource based view): The Business Behavior Model is not a tool to determine the strategic resources. However, it is a view of the internal and external mechanisms that involve those strategic resources. Indeed, the analysis of the properties and their impact on the global system gives a wider understanding of the engaged resources. As

far as the BBM is connected to the RBV [19, 20] and gives interesting analysis of the resources management, it should be considered as a step towards obtaining a strategic advantage.

5.2 The usefulness of the BBM as an analysis tool for the business

The use of the developed model improves the analysis of the business on several aspects thanks to the introduction of new aspects for the studied layers. Indeed, the business and the goal layers are focused on goal and value proposition. The BBM brings a new approach by the way of the motivation, the resources view and the possible decisions. The introduction of the decision concept allows analyzing whether or not the motivation is fulfilled by decisions and how. Decisions are also the basis of simulation for optimization through their alternativity. The developed model also emphasizes the weakest and strongest point of resources by pointing out their negative and positive impacts. The analyst gets a view on the mechanisms that are linked to the resource and therefore, he owns clues for further improvement of the organization (considering the RBV). The model also improves on the possibility to analyze interdependencies between resources as it shows those interdependencies at a sublevel (as relations between properties).

6 Discussion

In this paper we have proposed a novel model, the Business Behavior Model, to be used when solving a part of the business/IT-alignment problem. The underlying idea of the model is to understand what are the motives that drive a collaborating agent to take decisions about resource exchanges.

The alignment problem is a complex issue that hits the organizations in their process of adaptation to the changing environment. In that context, this research aimed at achieving a support to improve the adaptation capacity. To do so, we had three goals; providing a clear and understandable definition of the developed model that we called the Business Behavior Model. The second was to define the context in which the BBM could be applied and used. The last one was to provide some clues on the usefulness of the model. This research has fulfilled the desired goals by the use of various theories, e.g. the causal graph, the resource-based view and BMO. The result of this research is a definition of the model and an indication of the usefulness of the model for solving the alignment problem. This is due to an analysis of the related model (BMM, i*, e³value) and the treatment of cases such as the MMOG. As shown, the BBM supports the bridging of two layers in an organization – the goal layer and the business layer. Through this research we also pointed out that the BBM could be used as an independent tool. It can emerge as a third kind of model next to the goal model and the value model with its own independent usage.

Future work: Improving the valuated causality relation among nodes by giving them real values is the most relevant further work. Doing so opens the possibility of using

calculation on large and complex models that are based on the Markov theory [15]. A non-economic resource could also be analyzed analogously to economic resources for the benefit of improved understanding of motivations. Additional modeling and evaluation of cases with different generic scenarios is also relevant for the study of the Business Behavior Model. This could widen the scope of usage and also establish the boundary of the model.

Acknowledgements: We thank two anonymous reviewers for very valuable comments on an earlier version of this paper.

7 References

1 Chan Y.E., Reich B.H.: IT alignment: what have we learned? Journal of Information Technology 22**,** pp. 297–315 (2007)
2 Johannesson P., Andersson B., Bergholtz and M., Weigand H.: Enterprise Modelling for Value Based Service Analysis. The Practice of Enterprise Modeling (2008)
3 Yu E.S.K.: Agent Orientation as a Modeling Paradigm. Wirtschaftsinformatik, Deutschland (2001)
4 Yu E.S.K.: Towards Modeling and Reasoning Support for Early-Phase Requirements Engineering. Third IEEE International Symposium (1997)
5 The Business Motivation Model Business Governance in a Volatile World. The Business Rules Group (2007)
6 Gordijn J., Yu E., Van der Bas R.: E-Service Design Using i* and e3value Modeling, In IEEE Software, Vol. 23(3):26-33, May 2006
7 Pigneur Y.: E-business model ontology for improving business/IT alignment. CAISE-EMOI'05 (2005)
8 Anand S.R., Michael P.G.: BDI Agents: From theory to practice. Conference on multi-agent systems (ICMAS-95) (1995)
9 Barney J.: Firm Resources and Sustained Competitive Advantage. Journal of Management (1991)
10 Wald A.: Contributions to the Theory of Statistical Estimation and Testing Hypotheses. Annals of Mathematical Statistics (1939)
11 von Neumann J., Morgenstern O., Theory of games and economic behavior (1944)
12 Petit M.: Relationships between value and goal modeling: revisiting a case study in e³value. Value Modeling Workshop, Tilburg. (2007)
13 Henderson J.C., Venkatraman N.: Strategic alignment: Leveraging information technology for transforming organizations. IBM Systems Journal, vol 32, no 1, pp. 4-16 (1993)
14 Gammelgård M., Närman P., Ekstedt M., Nordström L.: Business Value Evaluation of IT Systems: Developing a Functional Reference Model. Conference on Systems Engineering Research, Los Angeles, USA (2006)
15 Ben-Gal I., Ruggeri F., Faltin F., Kenett R.: Bayesian Networks. Encyclopedia of Statistics in Quality & Reliability, Wiley & Sons (2007).
16 Halleux P., Mathieu L.: Using Goal Modeling During the Definition of Business Models. Master Thesis FUNDP (2008)
17 Osterwalder A., Pigneur Y.: An e-Business Model Ontology for Modeling e-Business. 15th Bled Electronic Commerce Conference e-Reality: Constructing the e-Economy (2002)

18 Kaplan R.S., Norton D.P.: Putting the Balanced Scorecard to Work. Harvard Business Review Sep – Oct pp. 2–16 (1993).
19 Wade M., Hulland J.: The Resource-Based View and Information Systems Research. MISQ Review (2004)
20 Barney, Jay B and Hesterly, William S.: Strategic Management and Competitive Advantage: Concepts. Pearson Education (2005)