

Strategic reasoning about business models: a conceptual modeling approach

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Abstract Strategic reasoning about business models is an integral part of service design. In fast moving markets, businesses must be able to recognize and respond strategically to disruptive change. They have to answer questions such as: what are the threats and opportunities in emerging technologies and innovations? How should they target customer groups? Who are their real competitors? How will competitive battles take shape? In this paper we define a strategic modeling framework to help understand and analyze the goals, intentions, roles, and the rationale behind the strategic actions in a business environment. This understanding is necessary in order to improve existing or design new services. The key component of the framework is a strategic business model ontology for representing and analyzing business models and strategies, using the i^* agent and goal oriented methodology as a basis. The ontology introduces a strategy layer which reasons about alternative strategies that are realized in the operational layer. The framework is evaluated using a retroactive example of disruptive technology in the telecommunication services sector from the literature.

Keywords Business modeling · Strategic reasoning · Requirement engineering · Business model ontologies · Service science

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1 Introduction

In the new economy that is driven by the growth of the Internet, businesses struggle with two interrelated challenges: the pressure of change, and the search for technologies to build flexible operating infrastructures that allow them to respond to change. Changes come from different sources such as new entrants, customers, suppliers, technology providers, investors, stock market, and government. The success or failure of businesses in such an environment highly depends on the *Business Models* they choose in order to react to change. Their success or failure in technology investments such as the adoption of Service Oriented Architectures (SOA), also depends on an articulation of the vision for the business which is expressed by a business model. A business model is an important artifact that conveys a high-level understanding of the overall vision and strategic goals of a business (Alt and Zimmermann 2001). As businesses must be able to recognize and respond strategically to disruptive change, they rely on business models to answer crucial questions. What specific innovations matter for the business? What customer groups should they watch? Which emerging technologies may consumers embrace? Is the new technology disruptive? Who are the competitors? How will the competitive battle form? How may the environmental factors and non-market players affect the battle (Christensen et al. 2004)? Our work aims to provide an appropriate modeling framework in order to systematically tackle such questions. The two major requirements that hamper existing business modeling approaches is the widening scope of business models, and the need to focus on strategy.

1.1 Widening scope of business models

In this new and globalized world, the role of corporations widens beyond just maximizing investor returns (Bonini et al. 2006). Economic development, consumer goods, social justice and an environmentally friendly attitude are among the societal expectations from global organizations. The new role for corporations comes along with new stakeholders, new objectives and more importantly creates a more pluralistic, externally mediated discourse that may be outside the realm of the organization's ability to control (Wheeler 2003). In this new role stakeholders are not limited to those who directly participate in value creation and exchange. There are other non-market players such as government, unions, social justice advocacy groups that can significantly influence a firm's business model (Christensen et al. 2004, p. 20). These players shape the context for business models that wider scope and capacity to consider for goals, motivations, intentions and opportunities they are seeking to pursue.

1.2 Focus on strategy

The success of a business depends heavily on its strategic positioning in the market (Porter 1985). The corporate strategy provides the driving force behind the activities in a firm's business model and its interaction with rivals (Magretta 2002). Therefore,

an integrated approach to investigate and analyze corporate strategies together with business models is required. In recent years, graphical models have been used widely to visualize and understand business relationships (e.g., Kaplan and Norton 2000; Weill and Vitale 2001). Current business modeling techniques have been proposed to address a variety of needs, e.g., to understand target customers, product and service offerings, business processes for creating a value proposition, and other value-oriented issues in businesses. Yet to date, most of them have focused on the structure and functions of transactions in a value network. These approaches do not take into account the intentional dimensions of stakeholders participating in a business. Creation and exchange of value in a business is triggered and influenced by the goals and motivations of stakeholders. Goals and desires are more fundamental concepts while exchange is derivative. Exchange of value is a consequence of the pursuit of goals by participants. Furthermore, a value-centered view of business limits attention to those players who are participating directly in a value exchange. Therefore, we hypothesize that a goal-oriented modeling technique which expresses business models in terms of relationships among diverse stakeholder interests and how these interests materialize into strategic actions would provide better support for strategic business reasoning.

This paper defines a strategic modeling framework to help understand and analyze the goals, intentions, roles, and rationales behind the strategic actions of each participant that motivate the exchange in a business environment. We apply systematic goal modeling and strategy analysis techniques and show how they help to analyze a current business model, subsequent market change, and the strategic repositioning of the business to that change. The technique defines the concepts of the *state of a business model* and *business model dynamics* in order to analyze the effects of change and predict strategic movement trajectories. The concept of *state* allows to depict the model before and after a transition in response to market change. For each state, we distinguish the strategy and operational concerns and explicitly represent the interconnections among their respective elements. The framework also aims to express intentions of business actors, such as “improve customer satisfaction”, and mechanisms to represent and reason with them in the strategy and operational levels. It also supports representation and analysis of available alternatives in the course of changes that help to manage competing interests and exploit opportunities in a way that satisfies stakeholders’ strategic goals.

The core of the framework is an informal strategic business model ontology that offers the conceptual abstractions needed to represent and analyze a business situation. The ontology is developed using *i**, a goal-oriented conceptual modeling framework that supports strategic reasoning (Yu 1995). The *i** framework has been applied in different modeling situations such as requirements engineering (Chung et al. 1999; Yu 1999), business process reengineering (Cysneiros and Yu 2004; Yu 1999) and modeling trust, security and privacy in social settings (Liu and Yu 2002; Yu and Cysneiros 2003). The *i** based business model ontology enables business people and analysts to identify the reasons behind a player’s actions, explore alternatives, rationalize the process of making a choice, and briefly manage the evolution of business models over time. A distinctive feature of the proposed framework is its support for expressing intentions which is not supported by other

existing business modeling techniques. As a result, it should be seen as complementary to most existing modeling methods, rather than as an alternative.

The rest of the paper is organized as follows. In Sect. 2, we review the current state of the art in business modeling. In Sect. 3, we introduce the main constructs and elements of the strategic business model ontology (SBMO) where we map the responses of a business to a disruptive technology change to SBMO. In Sect. 4, we specify a methodology for applying the SBMO in a business problem. Finally, in Sect. 5, we summarize the contributions of the paper and discuss future work.

2 Business models representations

The term *business model* is used with different meanings. This is partly because of the absence of consensus on the definition of a business model and partly because of the different contexts in which the term is used. The most common conceptualization of the term is as a description of the way a firm does business at the strategic level (Osterwalder 2004, p. 14).

Many different approaches have been proposed and studied for representing business models. Graphical notations are very common in business modeling as they render a semi-abstract visualization that improves understanding of the business logic. There is a growing body of literature that describes general classifications of business modeling approaches and representations (Alt and Zimmermann 2001; Afuah and Tucci 2003; Linder and Cantrell 2000; Osterwalder 2004; Rappa 2007; Timmers 1998; Weill and Vitale 2001). Business modeling approaches are classified as strategy analysis based (Porter 1996, 2001; Kaplan and Norton 2000; Magretta 2002), business model taxonomies (Afuah and Tucci 2003; Linder and Cantrell 2000; Rappa 2007; Timmers 1998; Weill and Vitale 2001), ontology based business modeling (Gordijn 2002; Osterwalder 2004), and goal oriented approach on business and organization architecture (Yu 1999; Yu et al. 2006, 2001). The last two are the most relevant to our research.

Several prominent existing business model ontologies, e.g., BMO (Osterwalder 2004), REA (Hruby 2006), and e^3 value (Gordijn 2002), focus on modeling business actors, and the way they create and exchange value. With the exception of BMO, there is little attention to the modeling of strategy. BMO builds a rigorous conceptual model that provides generic definitions for all constructs of business models in order to be used in the analysis of strategy and information system alignment of a firm, however, it excludes elements related to the competitive landscape in which a business model is located. In a recent work, Andersson et al. (2006) complements these three ontologies by proposing a reference ontology for business modeling which focuses on value exchange, but makes no reference to a firm's strategy.

The concept of business strategy has also received different interpretations in the business model literature (Kaplan and Norton 2000; Porter 1996; Magretta 2002). However, it is commonly accepted that business modeling, analysis, and reasoning should bring into play elements such as business drivers (Amit and Zott 2001), presence of rivals (Magretta 2002), strategic positioning, trade-offs, differentiation (Porter 1996, 2001), and other strategic goals (Kaplan and Norton 2000). For

example, Porter's *activity system map* (Porter 1996) visualizes the relationship between a firm's strategy and the activities in the business model that can deliver those strategies. Kaplan's *strategy map* (Kaplan and Norton 2000) is another visualization tool to show how operations in different sections of an organization contribute to the pre-defined strategic objectives. Kaplan's framework provides a practical way to group high level activities and their relationships to strategic goals. While both of these frameworks are helpful for connecting a firm's activities with its high-order strategic themes (Porter 1996), the concept of different actors involved in a business model and their motivations and intentions are not addressed in these frameworks. Andersson et al. (2007) identified needs for an integrated framework for analyzing business model and enterprise goals. They formulated how to construct business models based on goal models.

It is evident that an effective business modeling framework should bring closer the concepts of business model ontology and strategy modeling techniques. Our work aims to address this gap. We extend business modeling ontology with strategy modeling features (see Sect. 3) and we provide a visual modeling framework with rich semantics that is suitable for describing and analyzing a firm's strategy, business actor's goals, intentions, and motivations, and the exploration of alternate ways of exploiting business mechanisms. A holistic modeling framework is necessary to meet contemporary business modeling challenges outlined in Sect. 1. For example, the switching of a firm to service oriented architecture involves technological and strategic changes. The technological implementation of SOA is usually not the major issue. The success or failure of an SOA adoption depends on cultural, organizational and managerial, and behavioral aspects (Marks and Bell 2006). In situations like this, our proposed framework allows the formulation of stakeholder goals and motivations which are rooted in the corporate strategy. It then establishes the correspondence between strategic concerns and the operational level of a business in order to analyze and evaluate the consequence of the SOA implementation. As illustrated later, our modeling framework offers a systematic method to make corporate strategy explicit, connect it with the realization of that strategy at the operational level, and formulating its reaction to change.

3 Strategic business model ontology (SBMO)

Strategic business modeling requires conceptual abstractions to express stakeholders' goals, motivations, intentions, and relationships. Ontologies typically provide these. The development of a strategic business model ontology (SBMO) will establish a common understanding of the concepts that are needed in order to facilitate communication between stakeholders (Fensel 2001). The effectiveness of a business model ontology increases if it is associated with a visual representation. SBMO is developed using the i^* strategic modeling framework as a basis. The i^* framework provides support for representing participants and their different roles and goals in a business, their strategic relationship, and their rationale behind their strategic moves. In addition to the ontology, business modeling requires a usage methodology to conceptualize and generate insights about a firm. Although there are

no standard methodologies for business modeling, in Sect. 4 we propose a set of practical steps required to systematically analyze a business.

3.1 SBMO scope

The focus of SBMO is on business participants and their goals as opposed to conventional business modeling, where the focus is on the creation and exchange of value between business players. Therefore, support of the following key five intuitions is central to the ontology:

3.1.1 *Network of dependencies*

Typically, a participant cannot achieve a business goal alone and hence has to depend on other participants, forming a dependency network. In the *i** framework, a dependency relationship involves two participants: a depender and a dependee. The depender depends on the dependee for certain things, such as achieving a goal, performing a task, or obtaining a resource. In SBMO, a business model will be seen as a network of dependencies among stakeholders trying to achieve their goals, each with their internal motivations and rationales.

3.1.2 *Reasoning*

The focus on goals of participants, as opposed to flow of money or value, demands a higher-level, more abstract characterization of participants' behavior in a business model. This characterization amounts to an understanding the participant's intentions (Yu 2001a). The explicit representation of intentions or goals in a business model allows the modeler to explore the motivations and rationales of the participants. Consequently, capturing motivations and rationales builds up an opportunity for analyst to ask and answer "why" questions in a business model.

3.1.3 *Stakeholders' autonomy*

Participants in a business model are able to act freely. Even if the relationships are bound to an agreement, participants such as customers, partners or channels significantly have freedom for their actions. This autonomy and unpredictability of behavior may seem a barrier for business model analysis. However, the use of intentional elements, such as goals, makes possible to model freedom of the participant in a business model. By using goals and methods for achieving goals in our ontology, we are able to explicitly define the spaces of possible freedoms for a participant (Yu et al. 2006).



3.1.4 *Strategic reflectivity*





Autonomy of participants in a goal-oriented environment leads to different ways of achieving one goal, necessitating dealing with alternatives. Reasoning about

alternative arrangements of mechanisms in a business model is a reflective process. Each participant in a business model needs to refer and compare alternate ways of performing tasks, rather than executing the tasks without question (Yu 2001b). The reflective process is strategic because participants in a business model want to determine which changes would better serve their strategic interests.



These intuitions define the building blocks of the SBMO strategic business model ontology. Instead of constructing the ontology from the ground up, we adopt the i^* modeling framework as the starting point, as described in Sect. 3.2. Therefore i^* acts as the scaffold ontology upon which we develop SBMO. Our goal is to present SBMO as a fairly informal ontology (Ushold and Gruninger 1996), i.e., avoid user-unfriendly axiomatic definitions of its concepts. Instead we use a restricted and structured form of natural language to state and clarify the definition of its concepts. The details of SBMO may be found in (Samavi 2007). A brief description of its elements and how they are mapped to the i^* ontology is introduced in the following sections.

3.2 A strategic actor modeling framework

Goal modeling aims to determine what various actors want and how (and whether) those wants are achieved. The name i^* stands for distributed intentionality (Yu 1995), referring to the premise that actors are intentional and that they do not necessarily share common goals. An actor () interacts with other actors not only through actions or information flows but also relate to each other at an intentional level. They depend () on each other to achieve goals, perform tasks, and furnish resources. While each actor has strategic goals to pursue, they are achieved through a network of intentional dependencies. The following terms and their visual notations are adopted from i^* :

- Goal () is a condition or state of affairs to be achieved. An actor can choose freely among different ways to achieve a goal.
- Task () is a course of action to be carried out. It specifies a particular way of doing something, typically to achieve some goal.
- Resource () is a physical or informational entity needed to achieve some goal or to perform some task.
- Softgoal () is a goal without a clear-cut criterion for achievement, thus requiring further refinement and judgment. Softgoals are typically used to represent quality goals.

Goals, tasks, resources, and softgoals are used to distinguish the nature of the dependency links between actors. These intentional elements are also used to analyze the reasoning structure within each actor, using these additional types of links:

- Means-ends (). Shows a particular way (typically a task) to achieve a goal.
- Decomposition (). Shows how an intentional element (typically a task) is decomposed into sub-elements, which can include goals, tasks, resources, and soft goals.

- Contribution (---Help---). Shows a contribution toward satisfying a soft goal, typically from a task or another soft goal.

The process of analyzing a softgoal into subgoals that contribute towards it is called *refinement*. The process of reducing goals into tasks that can be implemented is called *operationalization*.

A *role* (\bigcirc) conveys the notion of an abstract actor. An *agent* (\bigcirc_{Agent}) is a concrete, physical actor. A role can be played by one or more agents. Actors in i^* are strategic in that they seek relationships that will best suit their strategic interests. Dependencies offer opportunities but can also create vulnerabilities. Through the goal structure, represented as a graph, an analyst can construct and explore the space of alternatives available to each actor. Graph-based algorithms, such as qualitative label propagation, can be applied to interactively evaluate whether goals are achieved (Mylopoulos et al. 2001; van der Raadt et al. 2005; Gordijn et al. 2006). Five type of qualitative i^* labels *satisfied* ✓, *denied* ✗, *weakly satisfied* ⚡, *weakly denied* ✗, *unknown* ?, and *conflict* ⚡ are used for this purpose.

3.3 Main components of SBMO

We present the main components of SBMO using a motivating example from the historical emergence of mobile telephone services (Christensen et al. 2004). Consider an incumbent (Telco) in the telecommunication industry, which provides wired voice services, facing disruptive change in the market by a new entrant (Cellco) that starts offering wireless voice services. Telco, a traditional incumbent, has always focused on its high-end market with a strategy to incrementally improve its wired voice services by offering products with higher performance and with new features for its high-end market. A disruptive innovation is a change in technology, product or a process that targets low-end market (those who are usually ignored by incumbents) of an existing business, threatening to replace it. Cellco's wireless offering is disruptive in the sense that it could completely replace the wired voice service or at least cause the incumbent Telco to dramatically lose its market share. Therefore, Telco needs to know how it should react to this change, and how it can make its existing business model sustainable while embracing this change. Furthermore, since a change in the (operational) business model needs support from the corporate strategy, Telco needs to consider its strategic moves. For example, currently Telco follows a positioning strategy¹ (Mintzberg et al. 1998, p. 83) and differentiates itself from other competitors with its *leadership in the market* and a *high quality image* positions. Telco then enjoys higher profits than others in its current business model while occupying this position in the market.

It is said that enterprises react to the market changes based on their strategies (Christensen et al. 2004, p. 30). When encountering a disruptive wave, the Telco strategist may ask—should we invest in this new technology? If so, should we change our positioning strategy? Should we form a partnership with Cellco? If we

¹ In a positioning strategy, a firm believes that there are a few positions in the economic marketplace for any given industry. A firm that occupies those positions can defend itself from existing and future competitors (Mintzberg et al. 1998).

partner with Cellco, what are the consequences if it requires a change in the configuration of my services from an *integrated process* (where Telco has proprietary rights to everything in the value chain) to a *modular process* (conservation of integration, Christensen et al. 2004, p. 19)? In such a scenario, the incumbent first needs to identify the signals of change, then analyze how the battle may form between the firm and new entrants, and finally identify its strategic choices.

This kind of analysis goes beyond the traditional view of value creation and exchange analysis in business modeling which deals with the structure of revenue generation (Rappa 2007) in a business. It demonstrates that strategic and operational decisions are tightly linked and therefore should be supported by the ontology and modeling methodology. SBMO provides new ontological support where the strategic goals are integrated with the operational structure of doing business in an organization. According to Mintzberg et al. (1998, p. 35) in an organization the structure follows strategy the way the left foot follows the right foot. This analogy provides the intuition for SBMO that the corporate strategy and the operational structure of business model must be analyzed together, with changes in one affecting the other, although not in a definite sequence. We capture this intuition in SBMO by introducing the three concepts of *strategy layer*, *operational layer*, and *layer interface*.

The second intuition for SBMO stems from the fact that business modeling in this new economy inevitably should embrace the concept of change and provide insight about how a business will change over time to remain sustainable in a dynamic environment (Linder and Cantrell 2000). This intuition is captured by the concepts of *state*, *transitional state*, *as-is* and *to-be* business models. All these concepts are further elaborated in the following sections using the example outlined above.

Figure 1a and b schematically shows the main components of SBMO and their relationships. The strategic aspects and operational aspects are grouped in two layers based on the common semantics declared in the layer's definition, with an interface in between (Fig. 1a). The intuition behind the layering includes hiding the complexity of each layer, flexibility in using different modeling approaches for each layer, and the coherence of the ontology by grouping components with similar properties in the same layer. The dynamics of business model is represented as a set of “as-is” and “to-be” models, while the transitional states are represented as interim models (Fig. 1b).

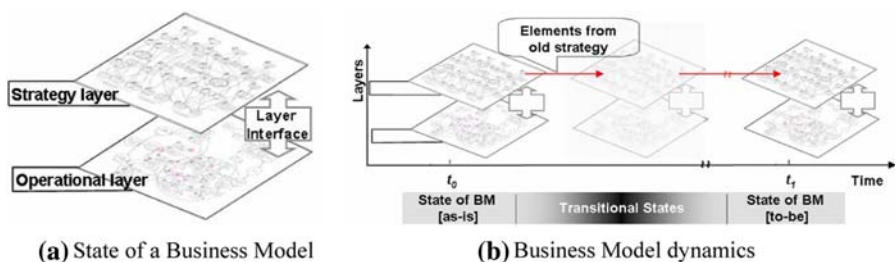






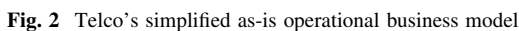
Fig. 1 a State of a business model. b Business model dynamics

3.3.1 Modeling operational aspects

A business model in SBMO is a representation of the logic of doing business by a firm of interest (FOI) (Weill and Vitale 2001). It depicts the network of dependencies among *participants* who exploit certain *mechanisms* to pursue their *objectives* over *time*. In this view, a business model is an abstract concept comprising of elements, components and relationships in *strategic* and *operational* levels while dealing with *change*. As Fig. 1a and b depict, SBMO separates *operational* and *strategic* concerns in a business, while representing their coupling through a *Layer Interface*. The operational layer describes the working structure of a business model in terms of its participants, mechanisms and activities which form the relationships among these participants. For instance, the pricing method of products or services, the kind of processes that a firm deploys to produce or deliver a service, the revenue model, cost structure, partnership mechanism are examples of operational concerns in a business model. The operational components that are included in SBMO are selected from Afuah and Tucci (2003), Osterwalder (2004), and Linder and Cantrell (2000), however, the SBMO provides a framework that can capture any other components in business model that can be represented in a network of actor dependency as described below. With the inclusion these components in SBMO, the operational layer intends to answer questions such as how value is created in a business; who the target customers are; who the firm's partners and allies are; who the rivals and their roles are, and what the participant's goals are. Participants in the operational layer are connected to each other via a network of dependency links to achieve their goals, perform their tasks and/or furnish a resource. This dependency network in the operational layer answers the "why" questions that reveals the reason for dependency among participants.

Figure 2 shows the operational layer of Telco's business model. We use the i^* concept of Actor () to represent participants in SBMO. We understand that Telco plays different roles in the business model. Its Management role provides resources for the business, while its Value Creator and CRM role configures the process of offering value proposition and manages relationships with customers. In the model, we include Telco customers' goals to understand why they are doing business with Telco. We understand that they depend on Telco for Voice service to be provided. This relationship is modeled as a goal () dependency, since the customer does not care how Telco provides the service technically (e.g., whether it uses an integrated proprietary network and process, or a modular process). Furthermore, it is modeled as a goal, as opposed to a softgoal, in that its achievement can be clearly judged. In addition to this goal dependency, the current customer wants the service always to be in its highest performance in the market. They will continue to do business with Telco if Telco continues to be the leader in the market and offers leading edge products. These attitudes are modeled with Higher Performance Product and Most Improved Product softgoals dependencies () because there are no "clear-cut" criteria to judge their achievements. On a different front, Telco depends on its shareholders for investment. This dependency is modeled as a resource dependency (). As we proceed to represent Telco's business model in SBMO, we examine the nature of the relationships involved in Telco's business

The example model is greatly simplified but provides some hints on the type of reasoning to be supported. These include the identification of alternatives and



recognition of correlated issues. For example, Telco has the option to align its value configuration using Time based Payment or Fixed Price for its Billing Mechanism, or configure its process as an Integrated Process or a Modular Process. The impacts of each alternative on relevant softgoals, Technology Leadership and High Performance Product, are different. While Integrated Process helps to increase product performance, Modular Process hurts it. The i^* means-ends link (\longrightarrow) captures the alternate ways for achieving a goal. Contribution ($\xrightarrow{\text{Make}}$) and correlation ($\xrightarrow{\text{Help}}$) links show the impact of each choice. We use the “Satisfied” label (✓) to indicate that an intentional element is sufficiently satisfied or achieved. We also use it to indicate the current selected mechanisms in the Telco business model (Fig. 2). In this example, propagation of this label via contribution links and dependency links shows that currently customers who are always looking for higher performance products are satisfied in Telco’s as-is business model.

During the course of modeling, we apply the goal evaluation procedure to the model to better understand other alternatives. In the case of Telco, we may ask if all of its customers are the same. This leads us to consider subclasses of customer groups to see how their needs are addressed in the current business model. We represent the needs of each customer group with its associated goals in the dependency network. It turns out that currently Telco only targets Undershot Customers—customers who are looking for high performance products (Fig. 3). However, there are two other customer groups—customers not consuming Telco’s services or customers who are consuming the service only in an inconvenient setting (non-consumers); and customers for whom the current product exceeds their expectations and is simply too good for them (Overshot Customers) (Christensen et al. 2004). The is-a specialization link in the i^* model (shown in Fig. 3) is introduced to separately analyze these three customer groups. Unlike in conventional modeling, our aim in the SBMO ontology is to analyze how these customers differ at an intentional level—what strategic interests they have and whether they are met. Qualitative evaluation of stakeholders’ goals shows that non-consumers and overshot Customers have goals that are different from those of Undershot Customers, and that these goals are not satisfied in Telco’s current business model.

We have presented the operational layer of SBMO in terms of the graphical notation of the i^* framework. i^* modeling is implemented on top of the Telos conceptual modeling language (Mylopoulos et al. 1990), which offers knowledge structuring mechanisms (classification, generalization, aggregation, attribution, and time). Generic knowledge codified in terms of methods and rules provide semi-automatic support from a knowledge base. A number of software tools have been developed to support i^* modeling and goal evaluation (Horkoff and Grau 2007).

3.3.2 Modeling strategy

In the above, we presented how SBMO captures the operational aspects of a business model. However, there are sets of policies in a firm that drive the operational directions. The SBMO should also be able to capture these drivers in a business and identify how changes in some components of the business model will

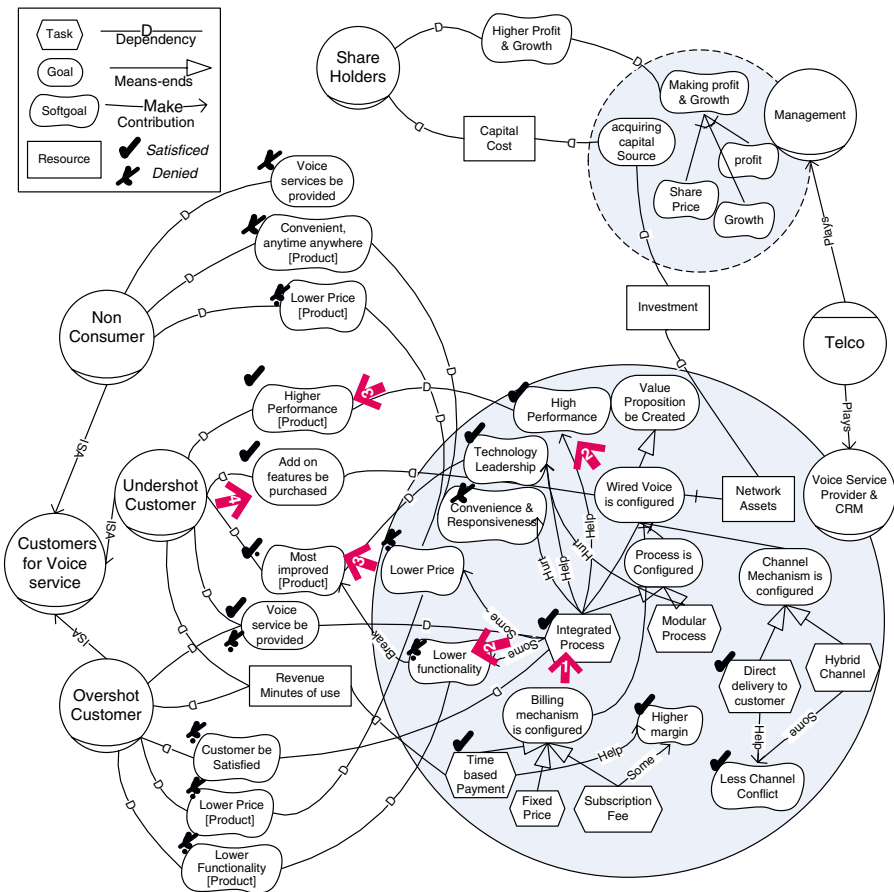


Fig. 3 Telco's as-is operational business model, understanding different customer groups

affect the firm's strategy. Conversely, if a firm's strategy changes, it should capture the implications of these changes in a firm's business model. The decision of which components need to be included in the SBMO strategy layer and their relationship to the operational layer is influenced by a review of the literature on strategy definition.

Strategy in management science is defined in different ways. Michael Porter (Porter 1996, 2001) introduced concepts of *strategic positioning*, *trade-offs* and *fit* as elements of a firm's strategy. In his view "strategy is the creation of a unique and valuable position, involving a different set of activities". Porter also argues that if there were only one ideal position for a firm, there would be no need for strategy (Porter 1996). As such, the strategy captures presence of the alternatives and reasoning behind the selected alternatives. Amit and Zott (2001) define four value drivers, namely *efficiency*, *complementarities*, *lock-in*, and *novelty* which cover the area in e-business models that can not be investigated through the configuration of the value chain (Porter 1985). Their empirical study shows that an e-business may position itself in the market by efficiency enhancement, or by an offering that

enhances the complementarity of an existing product and so forth. In their view a firm defines its strategy with proximity and level of achievement of these four drivers. Kaplan and Norton (2000) emphasize on role of assumptions and argumentation of executives, managers, and other key players that form a firm's strategy. Kaplan and Norton also introduced *improve shareholder value* as a high level strategic goal with different levels of operations in financial, customer, and internal processes which support this goal. They also offered a traceable cause-and-effect link among firm's activities at bottom and this high level goal at top. The extensive analysis by Mintzberg et al. (1998) on strategic management identifies five different definitions as five Ps for strategy (Pattern, Plan, Position, Perspective, Ploy) and ten different schools of thoughts in strategy formation process. The Porter definition of strategy for instance falls in the positioning school of thoughts in Mintzberg analysis.

In SBMO, however, the emphasis is on generic elements which are agnostics to the type of strategy processes in a firm, while captures the common grounds between them. The top level generic goals in strategy layer of SBMO includes and not limited to *shareholders value, fit, positioning, complementarity, novelty*, and so forth. Depending on what type of strategy process in Mintzberg taxonomy a firm selects, it may target one of these goals and does not care about the others. For example in the positioning school of thoughts (Mintzberg et al. 1998, p. 82), the firm targets *fit* and *positioning* high level goals and its strategy delineates based on the supporting network of operations for these goals. Nevertheless, the strategy formed based on positioning will have effect on *novelty* or other strategic goals that were not the intention of the strategy designers at the first place. In this sense, SBMO is a framework for analysis of strategic goals regardless of the type of the school of thoughts for processing strategy.

The following four points about the nature of strategy summarize our intuitions for strategy layer ontology.

- Strategic goals or quality attributes of a business are beyond the operational aspects of a business, nevertheless they are influenced directly or indirectly by the way those actions are decided and implemented.
- Strategic goals cut across the different operational components of a business model.
- These goals are qualitative, coarse grained and without clear cut for their achievements.
- The level of proximity or achievement of these goals identifies a firm's strategy.

These intuitions are reflected in the design of the ontology for the strategy layer in SBMO. For the representation of strategy layer, we used the NFR framework, which was originally developed for dealing with non-functional requirements (NFR) in software engineering (Chung et al. 2000). Evaluation of a firm's strategy is analogous to the situation for software quality attribute analysis in requirements engineering. The NFR consists of defining a set of imprecise nonfunctional goals (softgoals) which express criteria for system quality (e.g., usability, adaptability), and evaluating the degree to which an alternative model structure would lead to an information system (IS) that satisfies those qualitative goals. Links between top level qualitative goals to

alternative models for IS creates a softgoal interdependency graph (SIG). Argumentation and prioritization are used for justification of one path over the other in SIG (Mylopoulos et al. 1992). A goal graph provides vertical traceability from high-level strategic concerns to low-level technical details (van Lamsweerde 2001).

The strategy layer in SBMO is represented as a softgoal interdependency graph. In this graph, the generic quality attributes, such as *positioning*, *fit*, *complementarity*, and *novelty* are resided on top and design choices (mechanisms) at the bottom of graph (Fig. 4). Having these generic elements on top does not imply that a firm intends to achieve all of them in its strategy. Therefore some of them may be left unrefined. As described by Mintzberg et al. (1998), a firm based on the type of the school of strategic process may target only one or two of them and the firm's strategy towards other generic goals might be unknown or even conflicting. As moving downward (top-down), the generic elements can be refined to some elements which are contextual and domain dependent (Porter and Siggelkow 2001). At the end they can be operationalized to mechanisms in operational layer at the bottom. We use decomposition relationship for this purpose. Conversely, when moving upward (bottom-up), the graph shows the contribution and correlation of design choices (mechanisms which come from the operational layer) towards the

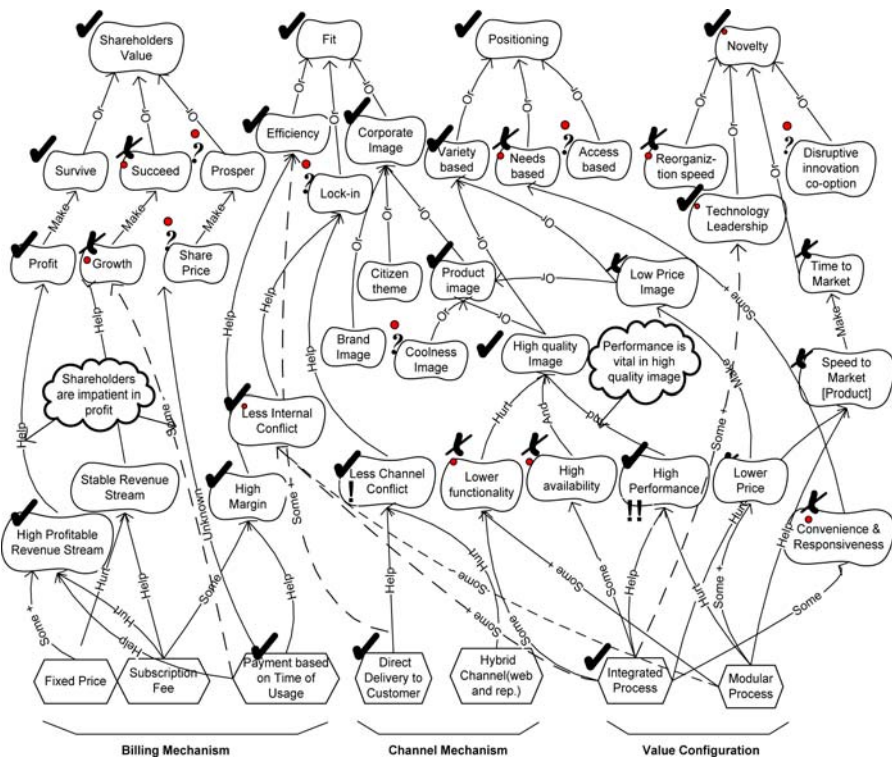




Fig. 4 An excerpt of Telco's as-is strategy layer

business drivers or strategic goals (positioning, fit, etc.) on top. In this way, the strategy layer makes the corporate strategy explicit and creates a bridge to the operational aspect of a business.

Other elements of strategy that need to be captured in strategy layer are reasoning about alternatives, trade-offs (Porter 1996), and management argumentations and prioritizations (Kaplan and Norton 2000). Managers prioritize or make argument about some specific goals in a firm strategy. By doing this, they influence the operationalization of the top level strategic quality attributes of a business model. Belief () in the i^* framework is mapped to the strategic assumptions in SBMO.

Strategy in our business model ontology is the collective notions of business players' visions (argumentation and prioritization), and the alignment of these visions with the operational mechanisms. Strategy layer captures these notions at each relevant point of time in a business model. In this sense, strategy layer makes the relationship between different strategic goals explicit. This expressiveness in turn helps a firm to reduce the source of inertia (Moore 2005) and enables the firm to more flexibly change the strategy when it is facing a market change.

In Fig. 4 we demonstrated the strategy layer of Telco's business model. In this model, the top row displays the quality attributes that are the elements of Telco's strategy, and the bottom row displays the support mechanisms which are imported from the operational layer. Payment based on the Time of Usage is a billing mechanism introduced in operational layer, Direct Delivery to Customer is a channel mechanism, and Integrated Process is one kind of value configuration. These are currently the selected mechanisms in Telco's business model. Strategic goals are modeled as softgoals and mechanisms as tasks (). Refinement and operationalization of top level goals allow exploring way to achieving them or making the rationale behind the strategy explicit. For example, Variety based Positioning decomposed to Low Price Image and High Quality Image. However, each of these attributes individually can be used to meet the Variety based Positioning, therefore the decomposition links for these offspring softgoals are considered as OR. Correlation links are used to show trade-offs or synergies among quality attributes. For example, since an Integrated Process positively contributes towards a higher performance service, it has synergy with Technology Leadership for Telco. On the other hand, since an Integrated Process is less flexible, it has some negative correlation with Reorganization Speed as described in (Christensen et al. 2004, p. 20).

In developing a strategy, usually managers prioritize some goals against the others. For example in Telco's case, the management believes Higher Performance Product has the most priority in the current Telco's business model. Therefore, this softgoal is marked by (!) in order to capture notion of prioritization. Managers also influence a corporate strategy by their beliefs, claims, and assumptions. In its extreme, the entrepreneurship school of thoughts in Mintzberg taxonomy is where every aspect of strategy is delineated by the central leader beliefs and assumptions (Mintzberg et al. 1998, p. 354). Therefore, these assumptions also need to be captured in modeling the strategy. For example, Telco's management believes that the shareholders are not patient to see the results. This argument is modeled in a

form of claim (☁) Shareholders are impatient in receiving profit, which is pointed to the correlation link between the billing mechanism and the Growth softgoal.

As strategy evolves, the model will evolve. We may bring into account other strategic goals and understand their position with regard to the current business model. In Telco's case we need to know how the strategic goal Novelty is positioned in current strategy. As such, we show a sub part of Telco's strategy layer dealing with the high level Novelty goal in Fig. 5. In brief, the strategy layer of Telco's business model is made connected the high level strategic quality attributes and the operational level mechanisms. It also recorded the Telco's management argumentation and prioritization. Qualitative evaluation of strategy layer shows how top level strategic goals are satisfied. For instance, the model in Fig. 4 is descriptive to show that Novelty softgoal is satisfied (✓) by Technology Leadership and the situation of Disruptive Innovation co-option² in current strategy is unknown (?). In Sect. 3.3.4 we will show the model is also prescriptive in terms of revealing a circumstance that can lead to achieving Disruptive Innovation co-option goal.

3.3.3 Strategy and operational layer interface

The layer-interface in SBMO manages relationship between operational and strategy layers. As described in above, the operational layer and strategy layer are closely related to each other and a change in one layer will affect the other one. Moving from operational layer to strategy (bottom-up), softgoals with global scope (softgoals in the operational layer which are strategic and judgment on their achievement affect the firm's strategy) will move upward to strategy layer in order to participate in the strategic goal refinement process. The available alternatives in the operational layer also move to the strategy layer in order to study their effects on strategic goals. Conversely, during the course of strategic goals operationalization, some new alternatives may be identified. In a downwards direction, these alternatives will be moved to the operational layer in order to investigate their workability in the business model. The layer interface triggers a change in the other layer whenever a change in softgoals with global scope or the availability of alternatives in one layer is identified and explored. In this way the layer interface provides coupling between two layers.

3.3.4 Managing change in SBMO

Until now, we showed that we can use strategic modeling framework in order to represent a snapshot of a business. In this sense, the model is descriptive and allows observing how in a given point of time, strategy and operational business model are aligned. In this section we will show the ways that strategic modeling can be used in order to incorporate the element of *time* in business modeling. Concepts of *time* and *change* are usually used interchangeably to reflect the dynamic nature of business models. In SBMO, we use the term *state* in order to reflect the continuous notion of

² Co-option is a situation in which an incumbent acquires the required skills to mimic the disruptive technology and integrate it in their own business (Christensen et al. 2004, p. 46).



Fig. 5 An excerpt from Telco's strategy layer in the first transitional state

a business in a period of time in which the firm's strategy is aligned with its operations. Each business has an *as-is state* reflecting the current state of a business. In contrast, we use *transitional state* for when a firm changes its way of doing business, either because of the change in firm's vision and strategy on top or a dramatic change in the business operations at the bottom which affects the strategy. Ontologically, *transitional state* is composed of several interim *states* and concludes to a new state for a business which we call it *to-be state* in SBMO. In this sense, the framework creates a prescriptive view of a business.

Each state comprised of components *Operational layer*, *Strategy layer*, and *Layer interface* (Fig. 1a). Within a state, at any point in time, a firm of Interest (FOI), whose business is under analysis by a modeler, operates based on a given business model. A business model in any state has a *collective evaluation* property that depicts the qualitative assessment of participants' strategic goals. For example,

a firm may target different customer groups, while the adapted business model may not allow satisfying all of them at the same time. In this case the collective evaluation will generate insight about the business model to show which customer groups are satisfied and which are left not served.

Transitional state in SBMO visualizes and captures how a business transforms from a current state (as-is) at the time of analysis to a new state (to-be) in the future (Fig. 1b). Each transitional state has some elements from old state strategy (arrows between states in Fig. 1b), because reactions to the change in a business are partially based on the rooted regiments (Christensen et al. 2004). *As-is*, *to-be*, and each interim state are instances of *state of business model* and can be modeled as described in above. The number of interim states may vary based on the complexity of change, projection of the analysis and other related factors. The collective evaluation of each state will justify if it can be considered as the ultimate strategic choice (*to-be* business model).

Normally, a current state of a business model continues to work unless an input triggers a change. Input from environment such as, arrival of a new rival, emergence of a new technology, new regulations and deregulations are examples of such triggers. In the example outlined in this paper, wireless voice technology is a change in the technology. This change in the market may trigger a change in the state of a business model, if the change in the market is recognized as a signal and not as a noise. For example, as shown in Telco's business model in Fig. 3 having two groups of customers that their needs are not satisfied in the current Telco's business model could be a signal of change. Another signal according to Christensen et al. (2004) is sensing that a competitor is also capitalizing on this opportunity. Because of the space limitation we have not covered the latter in this paper and refer you to (Samavi 2007) for more detail. However, the situation in the example, identified as signal of change. When there is a signal we expect a battle between incumbent and a new entrant (Christensen et al. 2004). Interim states formulate how the change moves the as-is operational and strategy layers to a new interim state. In this new state, the new participant, Cellco, plays a new role in Telco's business model. Presence of Cellco and its perceived actions are reflected as set of assumptions in Telco's strategy layer. For instance, Cellco has two alternatives in its own value configuration, either to Build its Limited Proprietary Network or Sign a Roaming Agreement with Telco and connect its newly wireless network to Telco's landline infrastructure. When Cellco chooses the former, it is required to Comply Telco's Pricing Mechanism. In this case, Cellco also should Reveal its Wireless Know-How in order to get access to Telco's network. These elements are modeled as assumptions (☁) in Telco's strategy layer (Fig. 5). These assumptions explicitly reflect the ways Telco's rival decides based on its own strategy to grow and attack Telco. Now, the question for the Telco will be how its current business model and strategy need to be aligned in order to counterattack Cellco's actions. The battle starts exactly from here. According to Christensen et al. (2004), an incumbent needs to know its strategic choices in order to make the right move in the battle. In our example, for sake of brevity, we only focus on Telco's business model, however, the same strategic modeling technique can be used to investigate the new entrants strategic choices in the battle.

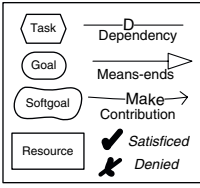
The first interim state for Telco starts by responding to this strategic question, saying yes or no to Cellco's request to Sign a Roaming Agreement with Telco. We expect the SBMO makes the implication of each strategic choice explicit for Telco. According to Christensen et al. (2004, p. 66) successful strategy for an incumbent encountering a disruptive wave is co-option. The incumbent, Telco, may achieve co-option by reduction of skill asymmetry (capability to internalize the technology used by new entrant) and motivation asymmetry (if the new entrant targets the current incumbent market).

This situation is modeled in Telco's strategy layer (Fig. 5). We introduced, the Disruptive Innovation co-option as a top level goal, and then we examined a top down process to refine and operationalize this high level softgoal. Other source of forces that may affect the achievement of the Disruptive Innovation co-option goal are the current regime in the firm (e.g., the relationship between mid managers and high level managers), the management prioritization, their argumentation and so forth. For example in this interim state, the assumption that Telco's Investors are Patient in Growth which positively contributes towards the task Spin out a Firm for Wireless Services introduced as management assumption which is in conflict with the assumption in the Telco's old strategy. This implies that if Telco stays on its old strategy, it would not be able to satisfy these softgoals and consequently to co-opt disruptive innovation. Similarly, a conflict (↗) explored in the model between High Quality Product Image on top and Making the Process Modular at the bottom, because shifting the process from an integrated process to modular process negatively contributes towards High Performance Product Image. In summary, saying yes to Cellco has the following implications on Telco's strategy.

- A low quality image for Telco is assumed okay in its new strategy
- In its new strategy, Telco can convince its investors to be patient in growth
- Despite that Cellco is Telco's rival, cooperation with them is okay in new strategy

We need also analyze Telco's operational layer in this interim state in order to evaluate the implication of this new strategy. As shown in Fig. 6, Cellco is now an active participant in Telco's business model. However, Cellco's role is not limited to its partnership with Telco, it also competes with Telco to capture market share. Thus, in this state Cellco plays three different roles: Compete with Telco, Wireless provider, and Partner with Telco. On the other hand, Telco also plays different roles including the traditional role as Voice Service Provider, and that of the Network Provider. The latter is a new role to comply the requirements identified in Telco's strategy to make partnership with Cellco.

Cellco in the Wireless Provider role depends on Cellco in Partner with Telco role to provide Network Availability and at the same time depends on Cellco in Compete with Telco role to Capture Telco's Market Share. Each role has its own internal goal that the actor tries to accomplish. In the Partner with Telco role, Cellco's main goal is the Network be Available, with the task Conformity in Billing Mechanism, while in the Compete with Telco role the main goal is Co-option to be Avoided with the softgoal Higher Skill Asymmetry. On the other hand, a reciprocal relationship between the Telco's Voice Service Provider role and Network Provider role is



option to be made. The explicit representation of the relationship between roles helps understand how a chain of dependencies may create opportunity or vulnerability for a participant in the business model. To investigate each actor's goal, we again use the qualitative assessment method, as proposed in *i**.

The evaluation shows that in this situation Telco will satisfy goals of previously unsatisfied customer groups. The situation also is in favor of satisficing the goal co-option to be made. This implies that the change made by Telco on its strategy paved the way for a successful internalization of the disruptive wave. The situation might be opposite if Telco stayed on its current strategy and said no to its rival (Cellco) for cooperation. Success or failure in a disruptive battle depends on not only the right strategy, but also the realization of the strategy in the operational business model.

Although this example is historic, we emphasize that our aim is to show how the strategic modeling generates insight into the future when a business facing strategic change. In the next section we propose a methodology based on the *i** strategic modeling framework to analyze similar cases. The method potentially helps analyst answer other real-life strategic changes emerging with service science.

4 A methodology for modeling a business using SBMO

Concepts, their properties and relationships introduced in the last section provide the necessary building blocks for strategic reasoning on business models. In this section we propose a set of practical steps to systematically analyze a business model. The proposed modeling methodology expresses one particular way to model a business using SBMO, however, this may not be the only way. The characteristics of the domain and the nature of problem intended to be analyzed may suggest a different modeling processes.

4.1 Modeling the state of a business

First, we must express the state of a business model. Figure 7 describes a proposed set of steps for modeling the current state of a given business. The resulting artifact is called the “*as-is business model*” and is comprised of an operational and a strategy layer.

4.1.1 Operational layer

The systematic analysis of a business suggests to establish first the operational layer, i.e., to explore the participants (steps O1), their roles (step O2) the mechanisms they are involved and so forth. While we explore mechanisms such as pricing, partnership, and value configuration in step O3, we also map out how participants depend on each other. A partnership mechanism for instance, brings a dependency from FOI to its partner on different goals and resources. When the network of dependency is created in step O4, we apply a qualitative evaluation method, as provided in the *i** framework (Sect. 3.2), to assess the operational business model.

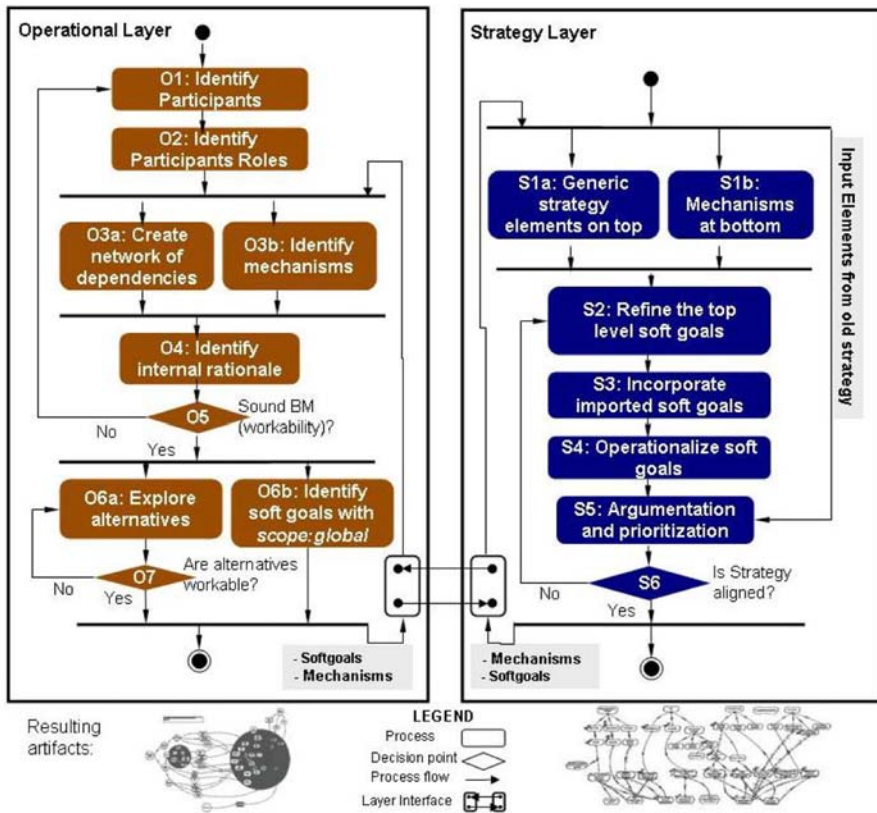


Fig. 7 Process overview to model a state of a business model

We assume that a working business has a workable business model, thus the purpose of modeling in this stage is to make the reasoning behind this business model explicit. Since usually there is more than one way to achieve stakeholders' goals in a business model, SBMO allows the modeler to express available alternatives in the model in step O6a.

As not all objectives that are defined in the operational layer are strategic, the modeler identifies the objectives with global and strategic scope that need further refinement in the strategy layer, in step O6b. These objectives (soft goals with global scope) and workable alternative mechanisms will move to the strategy layer via the layer interface. Any change in the operational layer that affects these two artifacts will trigger a possible change in the strategy layer and vice versa.

4.1.2 Strategy layer

The purpose of modeling the strategy layer is to make the as-is strategy of a firm explicit. In step S1a the modeler places the generic elements of strategy like *novelty*, *efficiency*, and other business model quality attributes at the top, and the

mechanisms imported from operational layer at the bottom. In steps S2, S3 and S4, the modeler refines top level quality attributes and connects them to the imported mechanisms as operationalization of the current strategy. Since a major part of any strategy is based on a set of assumptions and beliefs in the minds of the executives and managers, step S5 encodes these assumptions into the model. If the strategy layer belongs to a transitional state, elements from the old strategy will also be presented as assumptions in the strategy layer. During the course of refinement and operationalization, contribution and correlation links between elements of strategy will be established. Conflicts and/or synergies between strategy elements will be explored by the qualitative assessment of strategy layer in step S6. Any change in mechanisms in order to realize the strategy in the operational layer will trigger a possible change in the operational layer via the layer interface.

A state of a business model is sustainable when its operational layer is workable and its strategy and operational business model are aligned. Therefore, the resulting artifacts of modeling the state of a business will be an explicit representation of strategy and operational aspects of a firm in a point of time.

4.2 Modeling business model dynamics

Figure 8 shows generic steps towards modeling the dynamics of a business model. The detailed steps typically depend on the problem domain and type of change that is being analyzed. The first major step is to understand the change in the market place.

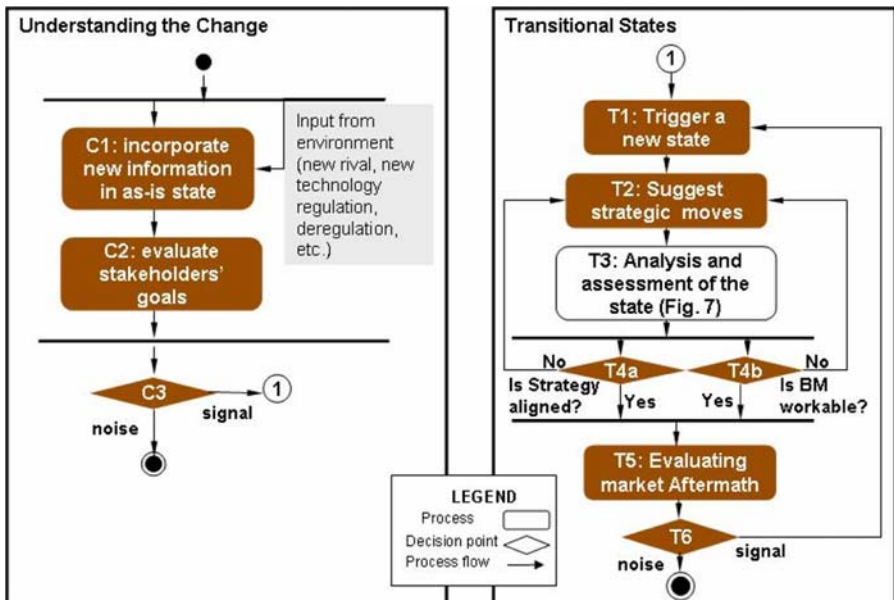


Fig. 8 Process overview to model business model dynamics

4.2.1 Understanding the change

An operating business receives input from its environment such as presence of a new rival, a new technology and regulation or deregulation by government. In step C1 the new information will be incorporated into the as-is state of the business. Then in step C2, objectives of stakeholders will be assessed in order to identify whether the change in the market is a real *signal* for the firm or it is just a *noise* that can be ignored.

4.2.2 Transitional states

A signal of change triggers a new state. In order to analyze the change aftermath, the modeler adds new set of assumptions and suggests strategic moves in step T2 and then analyze the state as described in Sect. 4.1 in step T3. SBMO helps analyze and understand whether the new set of assumptions satisfies the FOI's goals, and that its strategy is aligned with the workable operational layer. If yes, the business model is sustainable to respond to the change, otherwise more strategic moves need to be investigated and source of conflicts between firm's strategy and operation need to be explored. Furthermore, a strategic move may change the situation and trigger new moves from other stakeholders in the business. In step T4, the model is re-assessed in order to accommodate the reaction to the evaluation of the first move. If the reaction causes another signal of change a new state will be triggered and the investigation will continue. The resulting artifact of modeling business model dynamics will be the *to-be* business model.

5 Conclusions and future work

Strategic business modeling complements current business modeling techniques by shifting focus from value exchange and creation to stakeholder goals, motivations, and intentions. The systematic application of strategic business modeling requires an appropriate business modeling framework. In this paper, we presented such a framework. The strategic business model ontology (SBMO) is defined as a layer on top of the *i** goal-oriented modeling framework. The main contribution of the SBMO ontology is its ability to express the overall decision making process by capturing the cooperation and communication between different stakeholders inside and outside a firm. SBMO is one of the two parts that a practical strategic business modeling framework requires: the representation language. The second part is a modeling methodology, that is, a sequence of steps that enable us to build and reason with the states of a business from "as-is" to "to-be". In order to manage the complexity and large number of parameters in business modeling we introduced a layered methodology. Layering and separation of concerns in business models facilitates understanding and reduces complexity. This approach also paves the way for the future to incorporate other modeling techniques for one layer while using a strategic reasoning framework for the other. Finally, we developed an integrated

approach towards business model and strategy analysis. It helps managers describe their strategies in a more unambiguous and disciplined way.

Modeling intentions and motivation in business modeling has received more attention in recent years. For example the Business Motivation Metamodel (BMM) (Business Rules Group 2007) focuses on modeling intentionality by providing a scheme for developing, communicating and managing business plans in an organized manner. This study can be seen as a complementary work, where it takes advantage of i^* framework ability to determine whether goals can be achieved in a business settings. The viability of strategy in its operational business model can be qualitatively evaluated. Such an intentional evaluation mechanism allows for reasoning about intentionality and for exploring solutions and choosing among alternatives. We are currently working on incorporating the concept of “strategy score card” within the strategic modeling framework. Using a score card representation, we intend to improve description of a firm’s strategy and help managers to switch between different alternatives in a more structured way. Another direction for extending our work is to strengthen the formal framework behind SBMO. This will enhance the model with reasoning operations with well-defined semantics that will enable more efficient, tool-assisted creation of models and automation of business model reasoning tasks. Additional areas for future research also include the definition of a multi-actor view for strategy layer, and the exploring of other business modeling frameworks, for instance e^3 value (Gordijn 2002) or BMO (Osterwalder 2004), as candidates for the operational layer while i^* is used for the strategy layer.

Strategic reasoning about business models is an important part of a service design. As we demonstrated with the application of SBMO in analyzing a disruptive innovation example in telecommunication services, businesses (the incumbent) had to modify their operating strategy which leads to modifying business process or introducing new ones. We envision that modeling tools with strategic business reasoning capability will be used for designing new services as well as for retrospective analysis.

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