

Applying Strategic Business Modeling to Understand Disruptive Innovation

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ABSTRACT

The Internet and related technologies have created enormous potential for disruptive innovations. Businesses engaging in e-commerce must constantly be examining opportunities and threats arising from disruptive change. Modeling techniques have been introduced to help visualize and reason about business models and strategies. This paper offers a modeling approach which characterizes a business model not in terms of flows or exchanges, but the strategic dependencies among various players. The business model is then analyzed in relation to the high-level strategy of the business. When a change arises, competitive scenarios are analyzed in terms of the strategic choices for the incumbent and new entrants. A historical case study from the telecom sector is used to illustrate.

Categories and Subject Descriptors

J.1 [Computer Applications]: Administrative Data Processing – *business*; H.4.2 [Information Systems Applications]: Types of Systems--*decision support*

General Terms

Management, Design

Keywords

business modeling, strategic modeling, disruptive innovation.

1. INTRODUCTION

A disruptive innovation is described as a technological advancement, product, or service that eventually overturns the existing dominant technology or status quo product in the market [6]. Well known examples of disruptive innovations include: telephones replacing telegraphs, cell phones replacing land lines, digital photography replacing films.

E-commerce offers abundant opportunities for disruptive innovations. With the pervasive adoption of the Internet, more and more industry and business sectors have become susceptible to disruptive change. Witness the rapid rise and dominance of

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Apple iTunes in music delivery. Comparisons may be drawn with Sony, which dominated the media and entertainment industry for decades through a series of disruptive innovations – from the transistor radio, to portable TV, to Betacam video camera and then walkmans, each time creating and defining new markets. In the late '90s, while Sony was focusing on its high-end market aiming to satisfy customers who favored Sony for its incremental and sustainable innovations (better and better products), its music business was side-swiped by Apple's dollar-a-song e-commerce innovation [9].

Typically we recognize the significance of a disruptive innovation only after the fact. Only a few years into the 21st century, we are already seeing a number of emerging disruptive technologies: social networking, personal health records, personalized medicine, and more controversial ones such as synthetic biology, synthetic genomics, and metabolic engineering. Many of these innovations are initially dismissed due to technological immaturity, perceived poor quality, or legal impediments. Yet there have been successful cases in the past where incumbents were able to respond effectively, internalizing the disruptive innovation and co-opting the technology. For example, almost all large landline telephony providers created spinout organizations for wireless services and retained their market share. What were they able to do that Sony was not?

In order to understand the situation, a business must be able to answer crucial questions such as: What customer group should I watch? What specific innovations matter for the business? 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 [7]?

Response to disruptive innovation requires an integrative analysis of a firm's business model and its environment, the firm's strategy, non market forces, and even shareholders and managers mental models. According to Christensen et al. [7], accessing good theories is the only way to look into the future, particularly when the conclusive data or best practices, as it is true for disruptive innovations, doesn't exist. Authors go further to say that such theories need tool support in order to be used effectively [7, p272].

A number of graphical modeling notations have been introduced to visualize and understand business models and business strategies (e.g. [15], [24], [20]). Most of them, however, focus on the structure and functions of transactions in a value network, for

example, the flow of money and information, players in a value network, and so on. These approaches do not take into account the intentional dimension – the goals and motivations of the participants. 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 argue that an agent-oriented modeling technique which expresses business models and its context in terms of strategic relationships among diverse stakeholders with different interests and concerns would provide better support for systematically analyzing a business facing disruptive change.

In this paper, we propose a systematic modeling approach to analyze the situations of incumbents and new entrants facing a disruptive technology. Our approach builds a bridge between strategy, set of heuristics or belief of the managers, the business model, and shareholders values. We provide a means to conceptualize new customer groups and business models when disruptive technology requires it. We use a historical case study from [7] to motivate and illustrate our modeling approach.

Section 2 provides an outline of the historical case study. Section 3 introduces the premises behind the modeling concepts. Section 4 provides a detailed illustration of the approach through the case study. We conclude with discussion of related work and final conclusions.

2. A Case Study

Consider an incumbent “Telco” in the telecommunication industry in the mid 1980’s providing wired voice services. Telco 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 targeted market. According to Mintzberg’s conception of business strategy, Telco follows a positioning strategy¹ [17, p83] and differentiates itself from other competitors with its *technology leadership* and *high quality image* positions. In occupying this position in the market, Telco enjoys higher profits than others in its current business model.

In the meantime, a new entrant “Cellco” starts offering wireless voice services. According to Christensen et al. [7], this innovation was disruptive from a technological point of view. It provided the ability to make calls with added convenience, even though at that time the quality of wireless voice compared to the wired alternatives was relatively low, and battery life was insufficient. The disruptive innovation targets the low-end market typically ignored by incumbents of the existing business, eventually threatening to replace it. Cellco’s wireless offering was disruptive in the sense that it could completely replace the wired voice service or at least cause the incumbent Telco to dramatically lose market share.

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 [17].

To think strategically, Telco’s senior managers need to understand and analyze the change in the market. Is it a real signal of change or it is just noise that can be ignored? Should they invest in this new idea? If yes will their shareholders support the investment? What are the regulatory constraints if Telco were to pursue this new opportunity?

In other words, how can Telco respond to change while keeping its existing business sustainable? Since enterprises react to market changes based on their existing strategies [7, p30], what part of Telco’s current strategy might be compromised if it reacts to the wireless technological change?

On the new entrant’s side, Cellco initiates its own business model and strategy. Cellco aims to increase its market share step by step. Cellco could establish its own proprietary network, or ask Telco to share its existing infrastructure. Telco strategists in turn would ask, should we form a partnership with Cellco? What are the consequences of this partnership? Will it involve a change in the value configuration of our business model from an *integrated process* (where Telco has proprietary rights to everything in the value chain) to a *modular process* (A process that allows Telco to improve its products by upgrading individual subsystems rather than redesigning the entire product) [7, p19]?

These questions on disruptive business models and strategies are the same ones that confront e-commerce initiatives today.

3. A Strategic Business Modeling Ontology

Modeling techniques are widely used to analyze and design information systems for e-commerce. The ontologies of such models typically include concepts such as activities and workflows, information entities and relationships, data flows, transformations and operations, and sometimes value exchanges. However, for the purpose of strategic reasoning about business models and disruptive change, we need an ontology that deals with strategic actors. We need conceptual abstractions for expressing stakeholders’ goals, motivations, intentions, and relationships among them.

We developed a strategic business modeling ontology, called SBMO, using the *i** strategic actors relationships modeling framework as a basis. Details on SBMO and its usage methodology can be found in [22]. The ontology is supported with a graphical visual representation. The development of a strategic business model ontology will establish a common understanding of the concepts that are needed in order to facilitate communication between stakeholders [10].

The *i** agent-oriented modeling framework [25] provides support for representing participants and their different roles and goals in a business, their strategic relationships, and the rationales behind their strategic choices. The core concept in *i** is the strategic actor. The strategic actor is intentional (has goals and beliefs), (semi-) autonomous (has freedom of action), social (actions are enabled and constrained by relationships with other actors), has contingent identity and boundaries, and reflects upon its strategic choices with rational self-interest. Strategic modeling aims to determine what various actors want and how (and whether) those wants are achieved.

SBMO extends *i** modeling with additional concepts that are needed for strategic business reasoning. These concepts include

strategy layer, operational layer, state of the business model, and the business model dynamics [22].

4. Applying Strategic Business Modeling to the Case Study

In this section we illustrate an application of the Strategic Business Model Ontology in the systematic analysis of a disruptive innovation case study. We first develop *descriptive* models of the incumbent’s existing business in terms of its business model and its strategy. These models provide insight about the participants in the business and their relationships, and how they contribute to the current strategy.

When an input from the market or non-market context triggers a change, the existing business model comes under question. Arrival of a new rival, emergence of a new technology, new regulations and deregulations are examples of such triggers. In the example outlined here, emergence of cell phone technology is the market change. In such a scenario, we need a framework to help Telco (the incumbent) identify the signals of changes, then analyze how the battle may form between Telco and Celco (the new entrant), and finally identify Telco’s strategic choices [7]. The model in change analysis will be *prescriptive*. It generates insight about the future of a business.

4.1 Telco’s “State of the Business” Model

Figure 1 shows the relationships between Telco and its customers using an i* Strategic Dependency (SD) model. The concept of

Actor (Actor) is used to represent participants in a business. Actor modeling is the first step in order to know the players and their network of dependencies [21]. Some actors may play different roles. For example Telco in *Management* role provides resources for the business, while its *Value Creator* role configures the process of offering 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 (D) on Telco for *Voice service to be provided*.

This relationship is modeled as a goal dependency, indicating that the customer does not care how Telco provides the service (e.g., whether it uses an integrated proprietary network or outsource part of the job to other). 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 customers have different (and sometimes conflicting) quality expectations. Some of them want the service to have the best performance in the market. They are always ready to pay for new services. 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 the softgoal dependencies *Higher Performance Product* and *Most Improved Product*. The softgoal construct (Softgoal) is used to model qualitative goals which do not have a priori clear-cut criteria for judging its achievement. For example, *lower price* for services and *simpler functionality* for the product are customer concerns that are also represented as softgoals. On a different front, Telco depends on its shareholders for investment. This dependency is modeled as a resource dependency (Resource) (Figure 2). As we proceed to represent Telco’s business model, we examine the

nature of the relationships involved in Telco’s business model one by one. The nature of dependency between Telco and government is a task dependency (Task). Telco is required to comply with specific regulation (*Comply separate subsidiary regulations for wireless service*) if it decides to provide wireless voice service.

The Strategic Dependency (SD) model provides an important level of abstraction for describing Telco’s business model in relation to its surrounding environment in terms of intentional dependencies. This allows the strategist to understand and explore the vulnerabilities of the depender since in each dependency relationship the dependee may fail to deliver.

While the network of dependencies depicts external relationships among actors, we need to know the rationale behind those external relationships. We use a dashed circle to represent an

actor’s boundary (Actor). Inside the boundary, we show the intentional elements that make up the actor’s reasoning structure. We call this the Strategic Rationale (SR) model of the actor. The right half of Figure 1 shows the internal goal structure of Telco. This structure helps analysts 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 [12]. In our running example, Telco has a top level goal which is *Value Proposition Be Created*. To fulfill this goal Telco configures its value proposition around wired voice offering (the task *Wired Voice is Configured*). This is a high level task and need to be refined in order to understand how Telco performs this task. For example the task *Wired voice is configured* can be decomposed to subgoals such as *Process Be Configured* (how the service is created), *Channel Mechanism Be Configured* (how Telco delivers its services to its clients), *Billing Mechanism Be Configured* (how the services are priced), and a resource *Network Assets* (what are the required infrastructure).

We use the decomposition link (Decomposition) to describe the decomposition of a task to other tasks, goals, resources and softgoals.

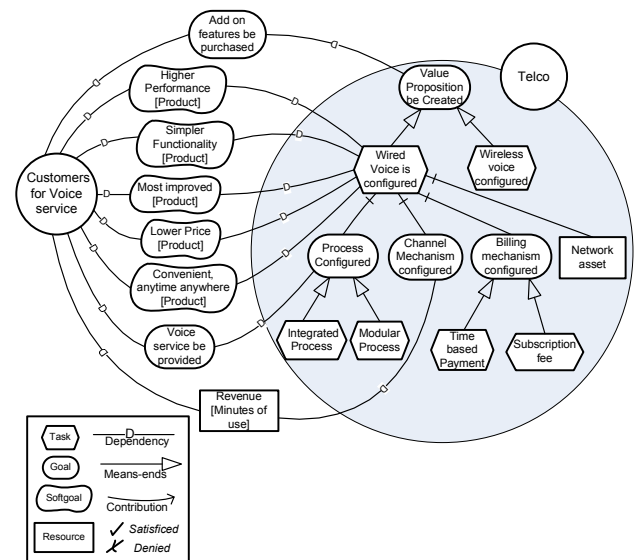


Fig. 1 - Telco’s simplified as-is business model

The example model is greatly simplified but provides several 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 *Subscription fee* for its *Billing Mechanism*, or configure its process as an *Integrated Process* or a *Modular Process* (as described in the beginning of this section). Each means-ends link (\longrightarrow) indicates one particular way of achieving a goal.

During the course of modeling, we applied the goal evaluation procedure to the model to analyze alternative ways for achieving goals and their viability. Starting from Figure 1, we ask whether all of Telco's 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.

In the model shown in Figure 2, three subclasses of customer are identified. *Undershot Customers* – customers who are looking for high performance; *Non-Consumers* – customers not consuming Telco's services or customers who are consuming the service only in an inconvenient setting; and *Overshot Customers* – customers for whom the current product exceeds their expectations and is simply too good for them [7]. In i*, a *role* (○) conveys the notion of an abstract actor. An *agent* (⊙) is a concrete, physical actor. An agent can play one or more roles. The *is_a* association is used to represent specialization of a general class of actors to a more specialized class. Having specialized actors in the model allows us to express specific concerns of each customer group with its associated dependencies. In the SD model in Figure 2, *Undershot Customers* has the softgoal dependency *Higher Performance*, while *Overshot Customers* and *Non-Consumers* have softgoal dependency *Lower Price*. Unlike in conventional modeling, our aim in strategic reasoning is to analyze how these customers differ at an intentional level – what strategic interests they have and whether they are met.

In the model shown in Figure 2, we extended the SR model in Figure 1 by indicating the internal softgoals of Telco, which we

are interested to investigate their status in the current Telco's business model. This also allows us to explicitly express how incoming dependency from different customer groups are connected to internal elements of Telco's SR model. Then, using the internal structure of Telco' SR model, we can evaluate goals of each customer group. In the model, given the softgoals *High Performance Product*, *Lower Price*, *Simpler Functionality*, and *Convenience and Responsiveness*, we want to determine the impacts of each alternative on each relevant softgoal. Due to limited space, the model only shows the different alternatives of the *Value Configuration* and omits impacts of other mechanisms such as billing or partnership mechanisms. These softgoals are influenced differently by the two alternatives of Telco's *Value Configuration*. While the *Integrated Process* helps to increase product performance, the *Modular Process* hurts it. Contribution links (\longrightarrow) show the impact of each choice. Depending on the strength of the impact, a contribution link can be *Make* or *Break* (sufficiently strong to meet, or deny a goal), *Help* or *Hurt* (partial insufficient strength), *Some+* or *Some-* (unknown strength), *And*, *Or*, or *Unknown*. Given a goal structure as represented in an SR model, we can use a graph-based qualitative label propagation procedure to interactively evaluate whether goals are achieved. Five type of qualitative i* labels are used for this purpose – *satisfied* ✓, *denied* ✗, *weakly satisfied* ✓, *weakly denied* ✗, *unknown* ?, and *conflict* ⚡. The "Satisfied" label (✓) indicates that an intentional element is sufficiently satisfied or achieved. In the example (Figure 2), Telco uses an *Integrated Process* for its as-is value configuration. Thus the propagation of this label via contribution links and dependency links shows that currently customers who are always looking for higher performance products (*Undershot Customers*) are satisfied in Telco's as-is business model. In turn *Non-Consumers* and *Overshot Customers* have goals that are different from those of *Undershot Customers*, and that these goals are not currently met.

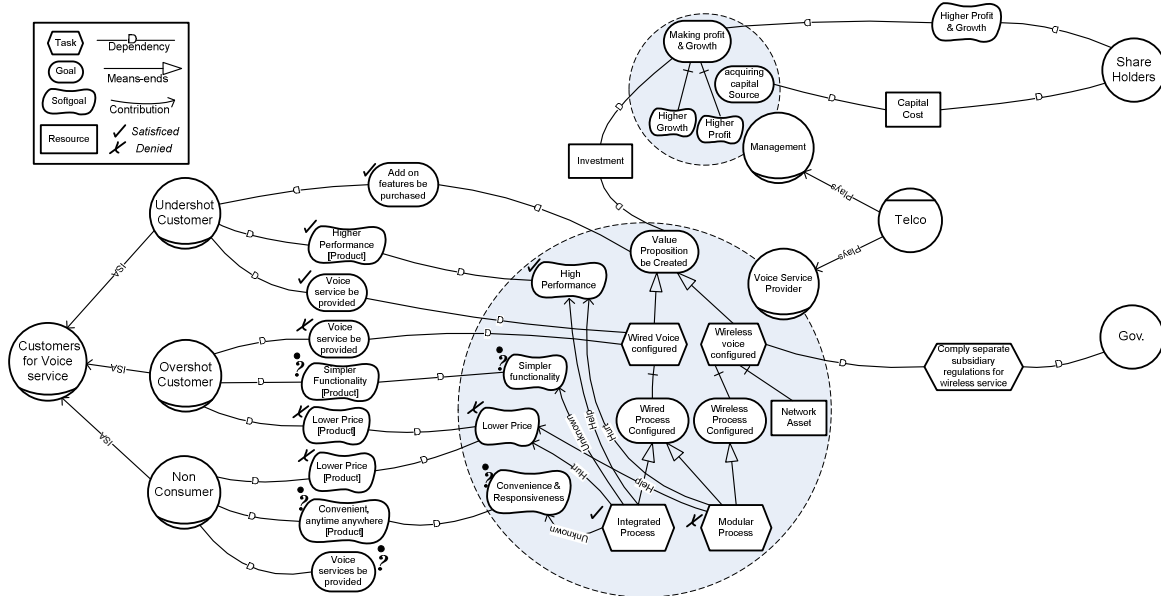


Fig 2. A more detailed analysis of different customer groups as having different preferences

4.2 Telco's Strategy Model

Up to this point, the modelling approach provides an explicit representation of Telco's business model (operational layer in SBMO term) in its context and the reasoning behind the choices of its components. However, there are policies beyond the business model that influence a firm's strategic moves. The management attitude towards change and the rooted regiments in a firm influence its reaction to a disruptive technology [7]. Chesbrough et al. [5] also emphasize that a firm's current businesses influence its choice of likely future businesses. They further state that firms have great difficulty managing innovations that fall outside of their previous experience, where their earlier belief and practices do not apply. Therefore, in order to understand and analyze an incumbent's reaction to disruptive wave, we also need to model the firm's strategy. Michael Porter [20] 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". If we interpret the configuration of set of activities as the business model of a firm, the strategy will be the relationship of these set of activities with respect to the high level strategic goals such as differentiation in the market or being strategically positioned in the market. Other examples of high level strategic goals include the four value drivers of *efficiency*, *complementarities*, *lock-in*, and *novelty* in Amit and Zott's framework [3], or *improve shareholder value* in Kaplan and Norton strategy map [15]. Depending on what type of strategy process in Mintzberg taxonomy [17] a firm selects, it may target a number of these generic goals and rule out the others. For example, in the *Positioning* strategy, the firm targets *fit* and *positioning* as high level goals and its strategy will be developed 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 may not be the intention of the strategy designer in the initial conception.

The framework introduced in [22] describes how business strategy can be represented as a softgoal interdependency graph (SIG) [8]. This framework allows managers, and shareholders belief and assumptions be also incorporated in a firm's strategy model. Back to our running example we model Telco's strategy (Strategy layer in SBMO term) in Figure 3. In this graph, the generic quality attributes, *Fit In The Market* and *Novelty* are introduced on top and the design choices, *Integrated Process* and *Modular Process* as two different alternatives for value configuration at the bottom of the graph. As moving downward (top-down), the generic elements can be refined to some elements which are contextual and domain dependent. At the end, they can be operationalized to mechanisms in the business model. 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 business model) towards the business drivers or strategic goals (positioning, fit, etc.) at the top. In this way, the model makes the business strategy explicit and creates a bridge to the Telco's business model.

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 the

Modular Process allows disintegration and upgrading individual subsystems instead of redesigning the entire product, this contributes towards reducing the *time to market* [7, p20]. In developing a strategy, usually managers prioritize some goals against the others. In Telco's case, managers believe *Higher Performance Product* has the most priority. Therefore, this softgoal in Figure 3 is labeled by (!!)

Managers also influence a corporate strategy by their beliefs, claims, and assumptions. Therefore, these assumptions also need to be captured when modeling strategy. For example, Telco's management believes that the *shareholders are patient for growth* (Figure 4). This belief is expressed in a form of claim (☁) softgoal. Qualitative evaluation of the model shows how top level strategic goals are satisfied. For instance, the model in Figure 3 is descriptive to show that *Novelty* softgoal is denied since achieving this goal requires achievement of both its subgoals. The status of *Incremental innovation* softgoal is satisfied, however the status of *Disruptive Innovation co-option*² in current strategy is denied.

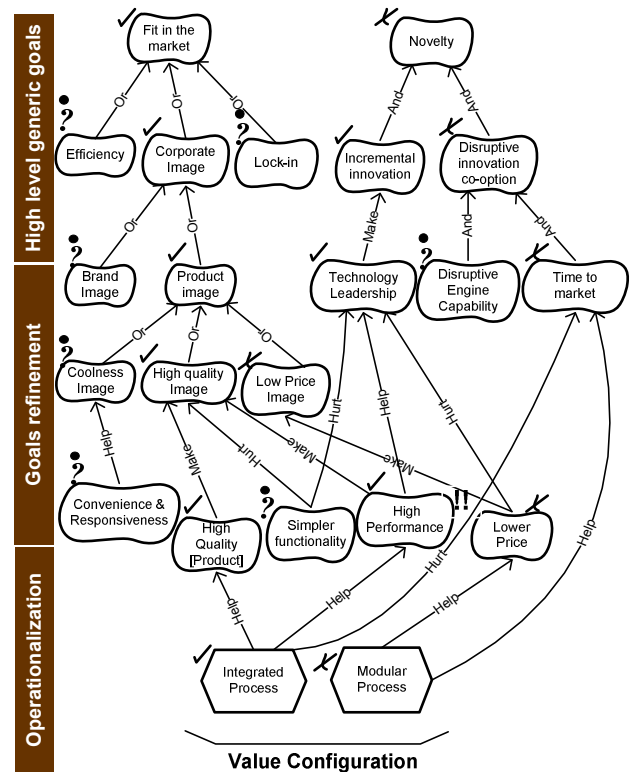


Fig 3. An excerpt from Telco's as-is strategy

4.3 Understanding Signal of Change

So far, we showed that we can use strategic modeling framework in order to represent the current state of a business. In this sense,

² Co-option is a situation in which an incumbent acquires the required skills to mimic the disruptive technology and integrate it into their own business ([7], p.46)

the model is *descriptive* and allows us to make the current business model, the strategy and the reasoning behind them explicit. Normally, 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 Telco's business model, if the change is a real signal and not a noise. For example, as shown in Telco's business model in Figure 2 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. [7] is sensing that a competitor is also capitalizing on this opportunity. So, existence of Cellco and targeting these groups of customers is another signal of changes.

When there is a signal we expect a battle between the incumbent and a new entrant [7].

4.4 Competitive Battle

Modeling the battle between incumbents and new entrants in disruptive technologies is different from modeling attacks and counterattacks in the analysis of security measures and malicious acts. Hence, the battle is more analogous to a strategic game. In disruptive technology, the incumbent knows about the presence of new entrant in the market and the type of its offering. However in many cases, the incumbent does not react in time either because analysis based on past experiences and data does not show a threat from the new entrant side, or the strategy that the firm run upon it does not send any signal for reaction, or simply managers running the firm do not believe that the new entrant is a potential threat. Christensen [6] states that in many cases when the senior managers finally understand that the change is real, it is too late for them to react, and in a worst case scenario they cede the market to the new entrant. In choosing not to take action towards a would-be disruptive technology, managers should know about their own reasoning – was it due to the fact that the change was just a noise, or because the shareholder were not patient enough to see the result of investing on disruptive technology, their business status quo or a technological constraint, a legal issue or simply a management assumption and belief. The strategic modeling introduced in this paper tends to fill this gap. Therefore, in this circumstance what is important is that the managers need to be equipped with a set of analytical tool to see the big picture of industry and their firm in relation to its environment.

Back to our example, we should see whether Telco has motivation to invest in wireless voice technology. A more concrete question could be whether Telco should cooperate with Cellco to share its infrastructure with Cellco or not? In order to answer this question Telco needs to know whether there is any potential for disruptive change, if *yes* does this cooperation help Telco to internalize the disruptive wave?

We used the methodology proposed in [22] to model the battle between Telco and Cellco. The whole process of strategic reasoning is iterative and happens in a progression of states; in each iteration we capture how a business transforms from a current state (as-is) at the time of analysis to a new state (to-be) in the future (Business model dynamics in SBMO term). As we

move forward on agent-oriented modelling we find answers to our questions and identify new opportunities and vulnerabilities. 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. Successful strategy for an incumbent encountering a disruptive wave is co-option [7, p66]. We expect that our modeling framework help understand saying *yes* to Cellco works in favour of co-option for Telco.

In this new state, the new participant, Cellco, also plays a role in Telco's business model. Presence of Cellco and its perceived actions are reflected as a set of assumptions in Telco's strategy in Figure 4. 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 With 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 (Figure 4). 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. [7], an incumbent needs to know its strategic choices in order to make the right move in the battle. In our example, to save space, we only focus on Telco's business model, however the same strategic modeling technique can be used to investigate the new entrant's (Cellco) strategic choices in the battle.

Figure 4 shows partial Telco strategy dealing with *Novelty* and in turn with *Disruptive innovation co-option*. The incumbent, Telco, may achieve co-option by reducing skill asymmetry (capability to internalize the technology used by new entrant) and motivation asymmetry (if the new entrant targets the current incumbent market). We introduced the *Disruptive Innovation co-option* as one of the subgoals of the top goal *Novelty*. Then we examined a top down process to refine and operationalize this high level softgoal. Other sources of forces that may affect the achievement of the *Disruptive Innovation co-option* goal are the current regiment in the firm (e.g., availability of senior managers to hear about disruptive technology), the management prioritization, their argumentation and so forth. For example, the assumption that *Telco's Investors are Patient in Growth* is an assumption made in this state. This implies that if for any reason this assumption does not hold, Telco would not be able to satisfice the softgoal *Mastering in [wireless] Technology* and consequently to co-opt disruptive innovation. Similarly, a conflict explored in the model between *High Quality Product Image* on top (from as-is strategy in Figure 3) and *Making the Process Modular* at the bottom (in to-be strategy in Figure 4), because shifting the process from an *Integrated Process* to *Modular Process* negatively contributes towards *High Performance Product Image*. In summary, based on the model shown in Figure 4, saying *yes* to Cellco has the following implications on Telco's strategy. (i) A low quality image for Telco is assumed acceptable in its new strategy; (ii) In its new strategy, Telco can convince its investors to be patient in growth; (iii) Despite that Cellco is Telco's rival, Telco cooperates with Cellco on sharing its network. Having this new

strategy, we need also to analyze Telco's business model in this interim state in order to evaluate the implication of this new strategy.

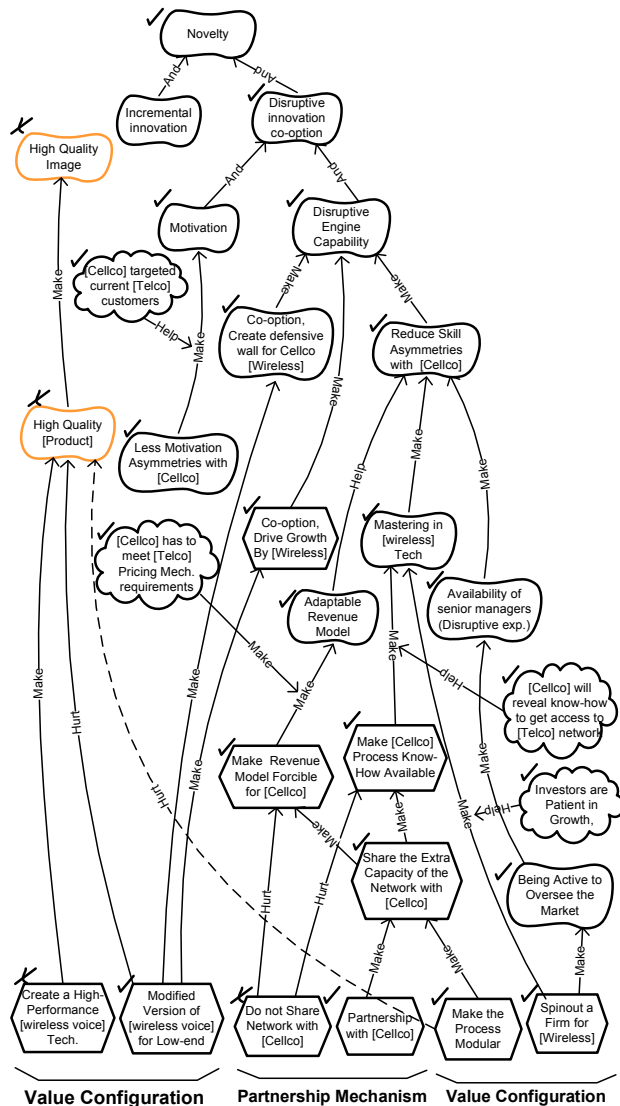


Fig 4. An excerpt from Telco's strategy facing Celco's request to share its network assets

4.5 Strategic Choice

As shown in Figure 5, Celco is now an active participant in Telco's business model. However, Celco's role is not limited to its partnership with Telco, it also competes with Telco to capture market share. Thus, in this new status Celco 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 with the requirements identified in Telco's strategy to make partnership with Celco.

Celco in the *Wireless Provider* role depends on Celco in *Partner with Telco* role to provide *Network Availability* and at

the same time depends on Celco 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, Celco's main goal is *Network be Available*, with the task *Conformity in Billing Mechanism*, while in the *Compete with Telco* role the main goal is *Co-option Be Avoided* with softgoal *Higher Skill Asymmetry*. On the other hand, a reciprocal relationship between the Telco's *Voice Service Provider* role and *Network Provider* role is identified. The *Network Provider* depends on the *Voice Service Provider* for the resource *Sharable Network Module* and in turn, the *Voice Service Provider* expects that the *Network Provider* passes the resource *Wireless Know-How* to them. The top level goal for Telco in *Network Provider* role is to achieve *Co-option 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 evaluation method from i*.

The evaluation shows that in this situation Telco will satisfy the goals of previously unsatisfied customer groups. The situation also is in favour of satisfying the goal *Co-option 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 the opposite if Telco stayed on its current strategy and said *no* to its rival (Celco) for cooperation. On the other side of the spectrum, we observe in the model shown in Figure 5 that the top level goal of Celco *Co-option be Avoided* is denied. Success or failure in a disruptive battle depends on not only the right strategy, but also the realization of the strategy in the business model.

4.6 Modeling the Impact of Non-market Forces

In this case study, we limited our analysis only to the role of rivals on disruptive innovation and illustrated how i* framework can help modeler ask the right questions to predict the dynamics of a business model. However, the non-market factors such as government regulation and deregulation and other interventions may also radically change the disruptive technology landscape. In the example outlined in this paper, government passed a regulation obliging all telecommunication firms to establish a separate subsidiary, if they intend to invest in wireless technology. Now the modeler may ask how this regulation may affect the Telco's strategy and business model.

Throughout the models in Figures 2 and 5 this requirement is showed as a task dependency *Comply separate subsidiary regulations for wireless service* between Government and Telco. The Strategic Rationale model in Figure 5 shows the implication of this dependency. When configuring its process for wireless voice service, Telco has two alternatives, either establish a *Separate Business Unit* for wireless services or make this service as *Integrated in the Current Wired Voice Business*. The recent dependency on complying with the regulation rules out the latter and Telco has no choice but to establish a separate unit for this purpose. With the consideration of the positive contribution link between this newly selected alternative and the softgoal *Minimum internal conflict*, this softgoal receives the satisfied label. However, the negative contribution towards *Low Capital Cost*, makes this softgoal unsatisfied. Thus in this case, the

regulation by government has two different consequences on Telco Business model. If the *low capital cost* is something that Telco can tolerate, then the regulation instead of being an impediment for co-option, in fact results in less internal conflicts which is desirable for Telco. Therefore, this regulation contributes towards internalization of disruptive technology by Telco.

Although this example is historic, we emphasize that our aim is to show how the strategic modeling generates insight into the future for a business facing disruptive technology. A methodology for systematic analysis and reasoning on business models is also proposed in [22] which can be applied for other real-life strategic cases facing disruptive change.

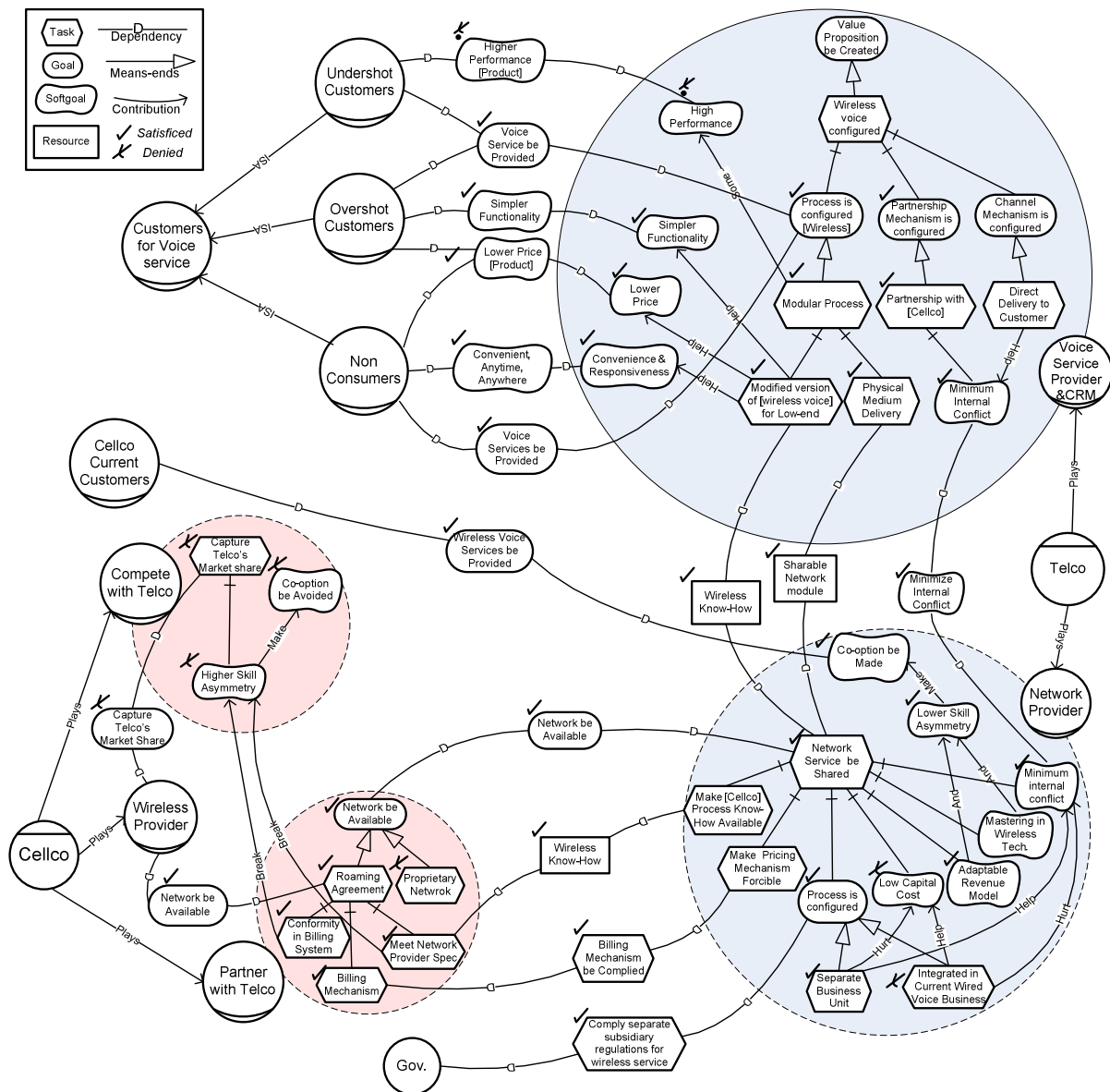


Fig 5. Telco's business model while cooperating and competing with Cellco

5. RELATED WORK

The term business model has gained popularity in the past decade, stimulated by the invention of different ways of doing business over the Internet. The notion provides a helpful reminder that technology innovations need to be coupled with business logic in order to succeed. Nevertheless, there has not

been a consensus on what constitutes a business model [19]. An important starting point was to develop classification schemes from observed business practices (e.g., [23], [24], [2], [1], and [21]). However, these classification schemes do not provide support for detailed analysis and reasoning for specific business models or competitive scenarios.

In the information systems field, conceptual modeling methods are widely used to support requirements analysis and subsequent system development stages. These techniques have been extended to the business domain in recent years, strengthening the link between business level analysis and systems development. Some examples of business modeling methods and ontologies include BMO [18], REA [13], and e³value [11]. Most of these also provide graphical notations which render a semi-abstract visualization to facilitate understanding of the business logic.

The approach proposed in this paper draws on the agent- and goal- oriented requirements engineering framework i*, which situates technology systems within the social context of organizational actors, thus providing a bridge between business design and technology design ([26], [28], [27]). The representation of intentional relationships (e.g. contributions towards goals) provides a systematic framework for detailed analysis of the viability of alternative scenarios.

In the area of business strategy, graphical models have also been used. For example, Porter's *activity system map* [20] visualizes the relationship between a firm's strategy and the activities in the business model that can deliver those strategies. Kaplan's *strategy map* [15] shows 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. These frameworks are helpful for connecting a firm's activities with its high-order strategic themes. Our approach offers a more detailed analysis of the different actors involved in a business model, their motivations and intents, and the reasoning behind a business model addressed all together in an integrated manner.

6. CONCLUSIONS

The main premise of our work is that understanding and responding to change in the business environment can be supported by constructing models that can support strategic reasoning. These models should be able to represent the dynamic aspects of business strategy as well as the multiple stakeholders involved in competitive business battles. In [22], we developed an ontology, called strategic business model ontology or SBMO that possesses these abilities. SBMO is developed as a layer on top of the i* goal and agent-oriented modeling framework. The main focus of this paper is to show how SBMO can be used to model and study disruptive innovation, a particular type of business change. Strategic reasoning about business models is an important part of business and service design. Systematic modeling techniques at the business level can smooth the transition to system development, providing better traceability and alignment [16]. A version of the i* modeling method is being proposed for ITU-T standardization (Z.150) [4]. A number of software tools providing interactive modeling and reasoning support are being developed [14]. This work extends i* towards business strategy modeling and reasoning.

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