

## An eBusiness Model Ontology for Modeling eBusiness

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### **Abstract**

*After explaining why business executives and academics should consider thinking about a rigorous approach to e-business models, we introduce a new e-Business Model Ontology. Using the concept of business models can help companies understand, communicate and share, change, measure, simulate and learn more about the different aspects of e-business in their firm. The generic e-Business Model Ontology (a rigorous definition of the e-business issues and their interdependencies in a company's business model), which we outline in this paper is the foundation for the development of various useful tools for e-business management and IS Requirements Engineering. The e-Business Model Ontology is based on an extensive literature review and describes the logic of a "business system" for creating value in the Internet era. It is composed of four main pillars, which are product innovation, infrastructure management, customer relationship and financials. These elements are then further decomposed.*

## 1. Introduction

Nowadays new business models are constantly emerging in electronic commerce and can become a major stake in the e-business game (Bloch et al., 1996; Kalakota et al., 1999; Maître et al., 1999). It is even possible to patent them in some countries (Pavento, 1999). Understanding new business models and helping to design them are important research issues, not so well covered until now.

Of course every manager and entrepreneur has an intuitive understanding of how his business works, of the logic that creates its value, in other words the companies business model. But even though this business model influences all important decisions, in many cases she or he is rarely able to communicate it in a clear and simple way (Linder et al., 2001). And how can one decide on a particular issue or change it, if it is not clearly understood by the parties involved? Therefore it would be interesting to think of a set of software tools that would enable business people to understand what their business model is and of what essential elements it is composed. Tools that would let them easily communicate this model to others (such as to the IT responsible) and that would let them change and experiment with it in order to learn about business opportunities.

In this paper we construct and outline the sketch of an ontology (rigorous framework) for e-business models based on an extensive literature review. This paper aims at showing how the fusion of the ideas in business model literature and the ideas of enterprise ontologies creates an appropriate basis for the development of a range of new management tools in the e-business domain. By merging the conceptually rich business model approach with the more rigorous ontological approach and by applying it to e-business, we achieve an appropriate foundation for tools that would allow the understanding, sharing and communication, change, measuring and simulation of e-business models.

In the next section we give an overview of related work. As shown by Linder (Linder et al., 2001), most people speak about business models when they really only mean parts of a business model. We think that the existing business model literature essentially attacks one, two or rarely all of the following three elements, which make up a business model: revenue and product aspects, business actor and network aspects and finally, marketing specific aspects. This extensive literature review has helped us build the ontology outlined in section three.

In the third section we propose an e-business model ontology that highlights the relevant e-business issues and elements that firms have to think of, in order to operate successfully in the Internet era. An ontology is nothing else than a rigorously defined framework that provides a shared and common understanding of a domain that can be communicated between people and heterogeneous and widely spread application systems (Fensel, 2001). This formal approach is necessary in order to achieve the business model advantages described below. The e-business model ontology we propose in this section is founded on four main pillars, which are product innovation, customer relationship, infrastructure management and financials. These main elements are then further decomposed.

In the last section we show that it makes sense to follow three levels of research issues in e-business models in order to achieve the development of a set of tools for management or IS Requirements Engineering. This project shares with the *Process Handbook* project of the MIT (Malone., 1999) the key idea that a repository and the associated computerized tool can significantly enhance the creativity and the efficiency of business model designers (process model designers in the case of the MIT). Further, we outline a range of research projects that can be placed in one of the three mentioned research levels.

## 2. eBusiness Model

"Business model" is a buzzword with no commonly accepted meaning. In this paper we try to change this, to define the concept and to show that business models represents a way of improving doing business under uncertainty. As explained by Petrovic et al. (Petrovic et al., 2001), a business model describes the logic of a "business system" for creating value, that lies behind the actual processes. In this paper we use the following working definition for business models, which will serve as a starting point for the more rigorous and detailed e-BMO. A business model is nothing else than a description of the value a company offers to one or several segments of customers and the architecture of the firm and its network of partners for creating, marketing and delivering this value and relationship capital, in order to generate profitable and sustainable revenue streams.

Therefore we suggest adopting a definition which emphasizes on the following issues that a business model has to address:

- [Product innovation] What business the company is in, the product innovation and the value proposition offered on the market.
- [Customer relationship] Who the company's target customers are, how it delivers them the products, and how it builds a strong relationships with them.
- [Infrastructure management] How the company efficiently performs infrastructure or logistics issues, with whom, and as which kind of virtual enterprise.

and finally,

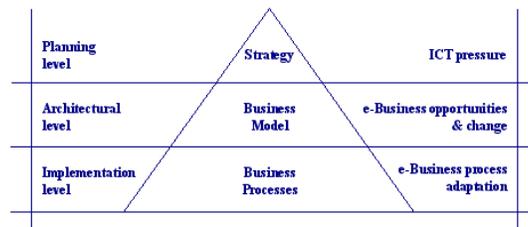
- [Financials] What is the revenue model (transaction, subscription/membership, advertising, commission, licensing) and the cost model (cost of goods sold, operating expenses for R&D, sales and marketing, general and administrative)?

We understand business models as the missing link between strategy and business processes. Often there is quite a substantial gap between these two "worlds". Strategy people position the company, define and formulate objectives and goals,

whereas business process and information system designers have to understand and implement this information. In order to guarantee a smooth strategy execution, firms require a very clear communication of concepts between the implicated parties. This is where rigorously defined business models come into play. By using an ontological approach to e-business modeling, one could create a shared and common understanding of the domain and facilitate communication between people and heterogeneous and widely spread application systems (Fensel, 2001). As illustrated in figure 1 a business model is the conceptual and architectural implementation (blueprint) of a business strategy and represents the foundation for the implementation of business processes and information systems.

We think the understanding and use of e-business models is essential in an increasingly dynamic and uncertain business environment for the following reasons:

1. The process of modeling social systems or an ontology – such as an e-business model – helps identifying and **understanding** the relevant elements in a specific domain and the relationships between them (Ushold et al., 1995; Morecroft, 1994).
2. The use of formalized e-business models helps managers easily **communicate and share** their understanding of an e-business among other stakeholders (Fensel, 2001).
3. Mapping and using e-business models as a foundation for discussion facilitates **change**. Business model designers can easily modify certain elements of an existing e-business model (Petrovic et al., 2001).
4. A formalized e-business model can help identifying the relevant **measures** to follow in an e-business, similarly to the Balanced Scorecard Approach (Norton et al., 1992).
5. e-Business models can help managers **simulate** e-businesses **and learn** about them. This is a way of doing risk free experiments, without endangering an organization (Sterman, 2000).



**Figure 1:** Business Logic Triangle

## **Related Work**

There exists a growing literature on (e-) business models by academics and consultants. Some speak of “Internet business models” and others of “business models for the web”, but they all mean certain aspects of the business logic of a firm that have a strong IT-component. The early authors have mainly written about the classification of models in different categories (Timmers, 1998; Rappa 2001; Tapscott et al., 2000). By contrast, the latest literature has started decomposing business models into their “atomic” elements (Afuah et al., 2001; Hamel, 2000; Petrovic et al., 2001; Weill et al., 2001; Rayport et al., 2001). This section gives an overview of the existing literature considering different aspects of business models, which are revenue- and product-specific, business actor- and network-specific and marketing-specific. This review is necessary in order to provide a sound ontology of the e-business model domain and to understand what a business model should be composed of.

**Revenue/product aspects.** Rappa (2001) and Tapscott et al. (2000), provide a taxonomy of e-business models rather than an explanation of what elements such a model contains. Both authors concentrate on revenue- or product-specific aspects.

**Business actor and network aspects.** Timmers (1998) provides a taxonomy in which he classifies e-business models according to their degree of innovation and their functional integration. Gordijn and Akkermans (2001) provide richer and more rigorous business model framework, which is based on a generic value-oriented ontology specifying what’s in an e-business model. This framework even allows the graphical representation and understanding of value flows between the several actors of a model. Afuah et al. (2001) and quite similarly Amit et al. (2001) outline a value- and actor-centric framework that provides a list of business model components.

**Marketing specific aspects.** Hamel (2000) identifies four main business model components that are related to each other and are decomposed into different sub-elements. The main contribution of this methodology, as well as the one of Rayport et al. (2001) is a view of the overall picture of a firm. Petrovic et al. (2001) divide a business model into sub-models, which describe the logic of a business system for creating value that lies behind the actual processes. Weill et al. (2001) also suggest a subdivision in to so called atomic e-business models, which are analyzed according to a number of basic components.

## **3. The eBusiness Model Ontology**

The goal of this sections is to define an approach that brings e-business model literature one step further, by providing a more rigorous building-block-like methodology that defines the essential concepts in e-business models and shows the relationships between them. Our e-business model ontology has in some ways been

inspired by the different enterprise ontology projects described in academic literature (Toronto Virtual Enterprise, Enterprise Ontology, Core Enterprise Ontology) (Bertolazzi et al., 2001). These ontologies mainly concentrate on processes and organizational representation. The work of the Edinburgh Group (Ushold, 1995), for example, is aimed at proposing an enterprise ontology, i.e. a set of carefully defined concepts that are widely used for describing enterprises in general and that can serve as a stable basis for specifying software requirements. The group has developed tools for modeling, communicating and representing enterprises and processes in a unique way. The focus of this work is on the logic and concepts of value creation, at a higher level of abstraction, which is the business model.

Our e-Business Model Ontology (e-BMO) is the conceptualization and formalization into elements, relationships, vocabulary and semantics of the essential subjects in the e-business model domain. e-BMO is structured into several levels of decomposition with increasing depth and complexity. The first level of decomposition of our ontology contains the four main pillars of a business model, which are the products and services a firm offers, the relationship it maintains with its customers, the infrastructure necessary in order to provide this and finally, the financials, which are the expression of business success or failure (see figure 2).

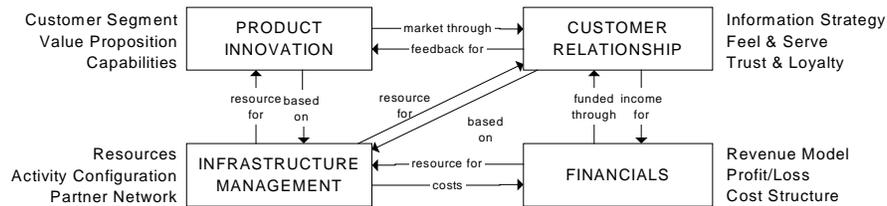


Figure 2: The 4 Pillars of the Business Model Ontology

An e-BUSINESS MODEL ONTOLOGY is composed of the PRODCUT INNOVATION element, the CUSTOMER RELATIONSHIP, the INFRASTRUCTURE MANAGEMENT and its FINANCIALS. These main elements are then further decomposed.

Name of BM-Element	e-BUSINESS MODEL ONTOLOGY (root element)
Consists of	<ul style="list-style-type: none"> <li>• PRODCUT INNOVATION</li> <li>• CUSTOMER RELATIONSHIP</li> <li>• INFRASTRUCTURE MANAGEMENT</li> <li>• FINANCIALS</li> </ul>
Level of decomposition	0 (root element)

## Product Innovation

The PRODUCT INNOVATION element covers all aspects related to the offering of the firm. This comprises not only its products and services but the manner in which it differentiates itself from its competitors. In other words, this means not only the firms market scope (Hamel, 2000; Afuah et al., 2001) - which customers, which geographical areas, and what product segments – but also the explanations why customers will rather buy from this firm than from a competitor. Moreover, the ability to offer value to a customer demands a range of specific capabilities.

<b>Name of BM-Element</b>	PRODUCT INNOVATION
<b>Child of</b>	Root Element: Business Model
<b>Consists of</b>	<ul style="list-style-type: none"> <li>• TARGET CUSTOMER SEGMENT</li> <li>• VALUE PROPOSITION</li> <li>• CAPABILITIES</li> </ul>
<b>Level of decomposition</b>	1
<b>Related to</b>	<ul style="list-style-type: none"> <li>• <i>Marketed through</i> CUSTOMER RELATIONSHIP</li> <li>• <i>Based on</i> INFRASTRUCTURE MANAGEMENT</li> </ul>

The element PRODUCT INNOVATION is *composed of* the VALUE PROPOSITIONs the firm offers to specific TARGET CUSTOMER SEGMENTs and the CAPABILITIES a firm has to be able to assure in order to deliver this value. The outcomes of the PRODUCT INNOVATION element are *marketed through* the CUSTOMER RELATIONSHIP ELEMENT, which at the same time provides a source of *feedback for* product amelioration. PRODUCT INNOVATION is based on the INFRASTRUCTURE MANAGEMENT which provides a *resource for* it (see figure 2).

**VALUE PROPOSITION.** This element refers to the value the firm offers to a specific target customer segment. ICT has created many new opportunities for value creation on the one hand and more efficient value creation on the other hand (Kambil et al., 1997).

**TARGET CUSTOMER.** A firm generally creates value for a specific customer segment. The definition of the market scope (Hamel, 2000; Afuah et al., 2001) captures the essence of where the firm does and does not compete – which customers, which geographical areas, and what product segments.

**CAPABILITIES.** To deliver the value proposition to different customers, a firm must ensure that it possesses the range of capabilities that underpin the proposed value. Several authors describe how value and competencies or capabilities are interconnected (Bagchi et al., 2000; Wallin, 2000). Capabilities can be understood as repeatable patterns of action in the use of assets to create, produce, and/or offer products and services to a market (Wallin, 2000).

A VALUE PROPOSITION is *enabled through* a range of CAPABILITIES and is a *value for* a specific TARGET CUSTOMER segment, which *has needs* to be fulfilled.

### **Customer Relationship**

Through the use of ICT firms can redefine and ameliorate the notion of CUSTOMER RELATIONSHIP. ICT supports and in some cases substitutes direct physical contact with the customer. The CUSTOMER RELATIONSHIP element describes the way a firm goes to market and gets in touch with its customers. Additionally, it contains the strategies of the company to collect and use customer information, in order to improve relationships and adapt the firms offering to customer needs. Finally, the company must define and outline its plans to gain the customers trust and loyalty.

Name of BM-Element	CUSTOMER RELATIONSHIP
Child of	Root Element: Business Model
Consists of	<ul style="list-style-type: none"> <li>• INFORMATION STRATEGY</li> <li>• FEEL &amp; SERVE</li> <li>• TRUST &amp; LOYALTY</li> </ul>
Level of decomposition	1
Related to	<ul style="list-style-type: none"> <li>• <i>Feedback for</i> PRODUCT INNOVATION</li> <li>• <i>Based on</i> INFRASTRUCTURE MANAGEMENT</li> <li>• <i>Income for</i> FINANCIALS</li> </ul>

The element CUSTOMER RELATIONSHIP is composed of the FEEL & SERVE element, which defines the customer “touch points” (e.g. distribution channels), the INFORMATION STRATEGY for the collection and application of customer information and the TRUST & LOYALTY element, which is essential in an increasingly “virtual” business world. The CUSTOMER RELATIONSHIP element *provides feedback for* PRODCUT INNOVATION, *is based on* INFRASTRUCTURE MANAGEMENT and is *and income for* the FINANCIALS element (see figure 2).

**INFORMATION STRATEGY.** The objective of the information strategy is related to information gathering in order to excel in customer relationship (e.g. through personalization and profiling). The information strategy aims at discovering new and profitable business opportunities and to ameliorate customer satisfaction. Data warehousing, data mining and business intelligence are important technologies that allow managers to gain insight on their customers buying behavior. These insights can be used to create what Hamel (Hamel, 2000) calls the positive feedback effect.

**FEEL & SERVE (channels).** This element refers to the way a firm “goes to market” and how it actually “reaches” its customers (Hamel, 2000). This means a company must define its channel strategy : either indirect or direct channels, operated by the firm or provided by a third party (e.g. agent, intermediary). ICT, and particularly the Internet, has a great potential to complement rather than to cannibalize a business’s channels (Porter, 2001). Direct selling over the Web could improve margins, whereas selling through new Internet mediation services (cybermediaries) (Sarkar et al., 1995) could mean new market opportunities. Of course the expansion of the range of channels also increases the potential of conflicts between channels (Anderson et al., 1998) and demands strong management.

**TRUST & LOYALTY.** It is essential to establish trust between business partners when the business environment becomes increasingly virtual and the implicated parties do not necessarily know each other anymore before conducting business. There exists mechanisms to build trust in e-business environments, such as virtual communities (Hagel et al., 1997), performance history, mediation services or insurance, third party verification and authorization, and, clear privacy policies (Friedman, 2000; Dimitrakos, 2001). Customer loyalty can be understood as the outcome of the customer’s trust and satisfaction.

The firm's INFORMATION STRATEGY *refines* the relationship it establishes with its customers through the FEEL & SERVE (channels) element and is "fed" by the latter. The TRUST & LOYALTY element *improves* the FEEL & SERVE through its mechanisms. Vice-versa a good FEEL & SERVE *contributes to* TRUST & LOYALTY.

**Infrastructure Management**

ICT and particularly the Internet have had a fundamental impact on the way companies organize their activities inside and at the boundaries of the firm. Not only that the company boundaries have become more fuzzy, but increasingly the decomposition and re-composition of the industry value chain has redistributed the activities among existing and new industry actors.

<b>Name of BM-Element</b>	<b>INFRASTRUCTURE MANAGEMENT</b>
<b>Child of</b>	Root Element: Business Model
<b>Consists of</b>	<ul style="list-style-type: none"> <li>• RESOURCES</li> <li>• ACTIVITY CONFIGURATION (or VALUE CONFIGURATION)</li> <li>• PARTNER NETWORK</li> </ul>
<b>Level of decomposition</b>	1
<b>Related to</b>	<ul style="list-style-type: none"> <li>• <i>Resource for</i> PRODUCT INNOVATION</li> <li>• <i>Resource for</i> CUSTOMER RELATIONSHIP</li> <li>• <i>Cost for</i> FINANCIALS</li> </ul>

INFRASTRUCTURE MANAGEMENT describes the value system configuration (Gordijn et al., 2000) that is necessary in order to deliver the firm's offering and to establish and maintain a customer relationship. It is *composed of* the ACTIVITY CONFIGURATION and the in-house RESSOURCES AND ASSETS and the firm's PARTNER NETWORK to fulfill these activities. The INFRASTRUCTURE MANAGEMENT element is a *resource for* PRODUCT INNOVATION and CUSTOMER RELATIONSHIP and a *cost for* the FINANCIALS element (see figure 2).

**ACTIVITY CONFIGURATION.** The main purpose of a company is the creation of value that customers are willing to pay for. This value is the outcome of a configuration of inside and outside activities and processes. To define the value creation process in a business model we use the *value chain framework* (Porter et al., 1985) and its extension, as defined by (Stabell et al., 1998), who add the concept of the value shop and the value network.

**PARTNER NETWORK.** The partner network outlines, which elements of the activity configuration are distributed among the partners of the firm. Shrinking transaction costs make it easier for firms to vertically disintegrate and to reorganize in partner networks.

**RESOURCES.** In order to create value, a firm needs resources (Wernefelt, 1984). Grant (Grant, 1995) distinguishes tangible, intangible, and human assets. Tangible resources include plants, equipment and cash reserves. Intangible resources include patents, copyrights, reputation, brands and trade secrets. Human resources are the people a firm needs in order to create value with tangible and intangible resources.

The tasks in the ACTIVITY CONFIGURATION are fulfilled by in-house RESOURCES or a PARTNER NETWORK.

## Financials

The FINANCIALS element is the culmination of an e-business model. The best products and services and the finest customer relationship are only valuable to a firm if it guarantees long-term financial success.

Name of BM-Element	FINANCIALS
Child of	Root Element: Business Model
Consists of	<ul style="list-style-type: none"> <li>• REVENUE MODEL</li> <li>• COST STRUCTURE</li> <li>• PROFIT/LOSS</li> </ul>
Level of decomposition	1
Related to	<ul style="list-style-type: none"> <li>• <i>Resource for</i> INFRASTRUCTURE MANAGEMENT</li> <li>• <i>Funded through</i> CUSTOMER RELATIONSHIP</li> </ul>

The FINANCIALS element is *composed of* the company's REVENUE MODEL and its COST STRUCTURE, which finally define the PROFIT/LOSS of a firm. This element is a resource for INFRASTRUCTURE MANAGEMENT and is funded through the sales in the CUSTOMER RELATIONSHIP (see figure 2).

**REVENUE MODEL.** This element measures the ability of a firm to translate the value it offers its customers into money and therefore generate incoming revenue streams. A firm's revenue model can be composed of different revenue streams that can all have different pricing models. The new pricing mechanisms enabled by ICT should be used in order to maximize revenues. Particularly the Internet has had an important impact on pricing and has created a whole new range of pricing mechanisms (Klein et al., 2000).

**COST STRUCTURE.** This element measures all the costs the firm incurs in order to create, market and deliver value to its customers. It sets a price tag on all the resources, assets, activities and partner network relationships and exchanges that cost the company money.

**PROFIT MODEL.** This element is simply the outcome of the difference between the REVENUE MODEL and the COST STRUCTURE. Therefore it can be seen as the culminating point and as an expression of the entire e-business model ontology. Whereas PRODUCT INNOVATION and CUSTOMER RELATIONSHIP shall maximize revenue, an effective INFRASTRUCTURE MANAGEMENT shall minimize costs and therefore optimize the profit model.

The REVENUE MODEL increases the company's PROFIT (or diminishes its LOSS) whereas the COST STRUCTURE decreases PROFIT (or increases LOSS).

In the following figure 3 we delineate the business model of the European low cost air carrier easyJet.

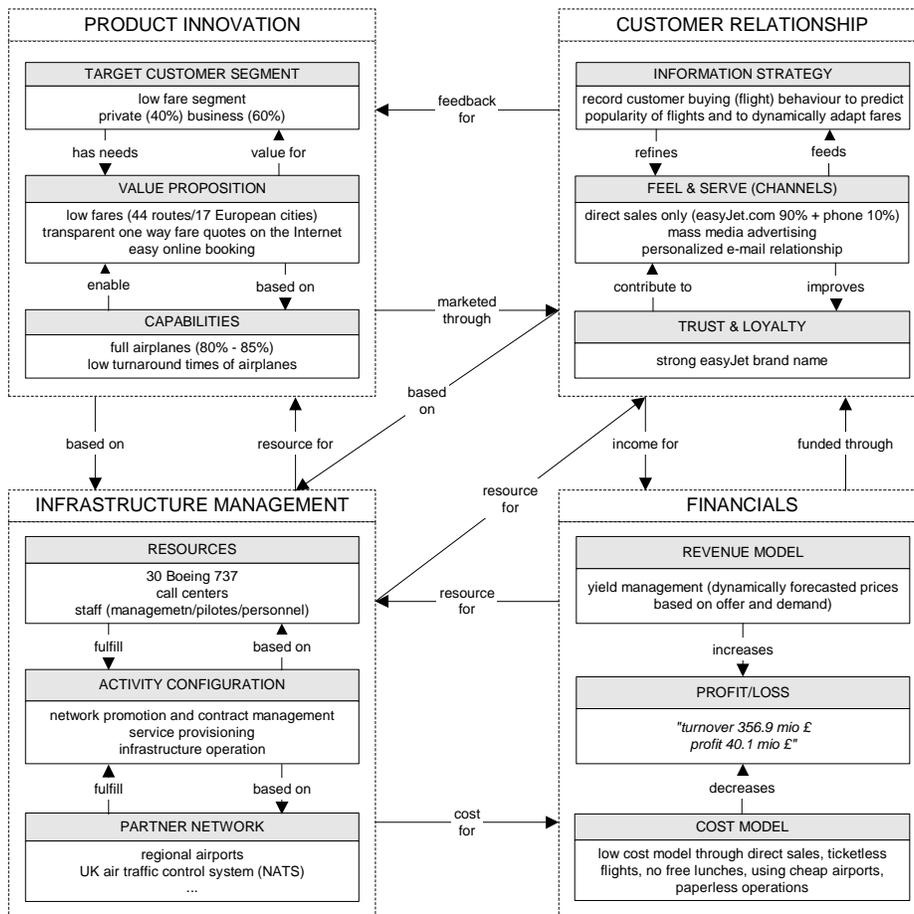


Figure 3: Sketch of the EasyJet Business Model ([www.easyJet.com](http://www.easyJet.com))

#### 4. The eBusiness Model Toolkit

Based on the e-Business Model Ontology provided in this paper, it should be possible to provide business people with a computer-aided design environment in order to help them to define, assess and change their business models. This project shares with the *Process Handbook* project of the MIT (Malone., 1999) the key idea that a repository and the associated computerized tool can significantly enhance the creativity and the efficiency of business model designers. Malone et al. (1995) have created an electronic "process repository"- with thousands of processes that shall enable managers to easily explore different options for performing common tasks, help people learn about organizations, invent new kinds of organizations, and

improve existing processes. In our case, it should be dedicated to the higher level of abstraction of business models.

		Management function	IS application
<b>3 Scenario Level</b>	<b>e-Business Model Equations</b>	Simulate models, play and learn by changing models, understand consequences of change	e-Business Model Simulator, e-Business Model Games
<b>2 Measures Level</b>	<b>e-Business Model Measurements</b>	Pilote, follow, alert	e-Business Model Balanced Scorecard
<b>1 Handbook Level</b>	<b>e-Business Model Ontology</b>	Understanding model elements and relationships, communicate and share models, change models	e-Business Model Framework, Language (eBML), Handbook and Design Tool

Figure 4: Business Model Toolkit

**Handbook Level.** From an engineering tool point of view, the idea of a business model handbook or computer-aided design tool is similar to case-based reasoning (CBR) (Leake, 1996) where reasoning is based on recalling: new solutions, business models in this case, are generated by retrieving the most relevant cases in the memory and adapting them to fit new conditions. The knowledge of a business model designer is ever changing as new business models are emerging and are being stored in the knowledge base for future use. (Leake, 1996) writes that a case-based reasoner learns from previous experience in order to take advance of prior successes and avoid known causes of failures. This makes it possible to compare different business models or to generate different views of the model in function of different needs (such as descriptions, graphical representations, business plans, reports for financing, reports for eventual partners, acquisitions or mergers, etc.) (Ben Lagha et al., 2001). e-Business model design tools shall help business model designers rapidly design, adapt, assess and critic e-business models. These tools refer to the metaphor of the drawing table, where an architect assembles the different elements of a building.

**Measures Level.** The e-Business model ontology also helps to define the relevant indicators to follow in an e-business model. This project is inspired by the balanced scorecard approach (Norton et al., 1992), which follows financial, customer, learning and growth and internal business process indicators. These are quite similar to the four main pillars in our ontology. In e-business it is not yet clear, which indicators are relevant. Literature in the domain is only beginning to give suggestions for e-business metrics (Working Council for CIOs, 1999).

**Scenario Level.** At this research level, the goal is the creation of a sort of e-business model simulator (Sterman, 2000). Managers would gain important insights on their actions and would learn about their e-business models by simulating and experimenting with them in a risk-free environment. Further, the use of system

dynamics could help companies prepare scenario planning in order to trim managers for change management. As the future in this area is so uncertain, a scenario-based forecasting approach could be helpful before defining a strategy of adoption, deployment, and management of a business model. A scenario (Van der Heijden, 1996) is a management tool, focused on a decision issue, for ordering perceptions about a range of uncertain futures using a set of stories built around carefully designed studies. The exercise finishes with a couple of scenarios presenting plausible and surprising alternative futures, instead of extrapolating current trends like in traditional forecasting.

## 5. Conclusion

There are several reasons why academic research should be done in the area of business models and e-business models. First of all, even though many people talk about them, rare are the business model concepts and non-existent a common understanding of what is meant by a business models. Executives, reporters and analysts who use the term do not have a clear idea of what it means. They use it to describe everything from how a company earns revenue to how it structures its organization (Linder, 2001).

The second reason why the e-business model concept is interesting to be studied is that it can be an adequate methodology and foundation for managerial tools and IS Requirements Engineering to react to the increasingly dynamic business environment. As product life cycles become shorter, competition global and the use of ICT an imperative, managers have to find new ways to manoeuvre and decide in this complex environment. Managers have to understand the new opportunities offered by ICT, integrate them into their existing business models and share them with other stakeholders. The e-business model ontology we propose in this paper and the tools that build on it are a first step to facilitating management under uncertainty.

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