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# Business and Technology Integrated Model

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## ABSTRACT

There is a growing interest in business modeling and architecture in the areas of management and information systems. One of the issues in the area is the lack of integration between the modeling techniques that are employed to support business development and those used for technology modeling. This paper proposes a modeling approach that is capable of integrating the modeling of the business and of the technology. By depicting the business model, the organization structure and the technology architecture, it can contribute to improve existing development practices.

## Keywords

Business model, organizational design, technology governance, technology architecture.

## INTRODUCTION

For many years, business and information technology strategy alignment has been reported by professional and academic publications as a major concern of top executives (Niederman et al., 1991; Luftman and Ben-Zvi, 2010). Besides the contributions proposed by both researchers and practitioners, e.g., Henderson and Venkatraman (1993), Chan and Reich (2007) it seems that no definitive solution was developed yet. So, it remains an open issue for both CEO and for IT managers.

Schein (1996) suggests that the processes, led by top executives that aim at defining an organization's plan and structure aren't effectively integrated with the processes led by engineers that aim at defining the plans and structure for the organization's IT support. The "executive culture" is distinctive from the "engineering culture". The differences between the two cultures encompass differences in conceptual frameworks, terminology and ways of thinking. Therefore, top managers and engineers do not understand each other and they cannot cooperate.

A CEO has put the problem in his own words (Ross and Weill, 2002),

*"What can I do? I don't understand IT well enough to manage it in detail. And my IT people – although they work hard – don't seem to understand the very real business problems I face".*

To overcome this problem involves providing a common ground for discussion and collaboration. This can be achieved through the usage of models that can be shared by CEO, with general management education and experience, and by IT managers, probably with engineering education and technical concerns.

The use of models that depict the components of the object to create or to intervene upon is typical from the engineering culture. They are crucial to the way of working of those that deal with the creation of artificial artifacts. IT is not an exception. Computers are general purpose artifacts that must be programmed in order to provide support to specific jobs. Modeling techniques are well widespread in the activities related to the development of computer applications and to the design of computer infra-structures that aim at supporting business activities.

General Managers might be not so at ease with the use of models and modeling techniques. However, recent developments have been bringing models and modeling techniques to the management arena (Baden-Fuller and Morgan, 2010).

Business models are a common instrument to assist managers in expressing a business rationale in order to support business change processes. Business models can depict the logic of a firm, how it operates and creates value for its stakeholders (Casadesus-Masanell and Ricart, 2010). Business models provide a means of representing the way an organization operates, highlighting aspects that are key to its sustainability. They can address both static and dynamic views of a business. The static view addresses business core components and their relationships. The dynamic view addresses business transformation and innovation (Demil and Lecoq, 2010).

The work described in this paper aims at proposing a modeling approach that is capable of integrating business, organization and technology concerns, constituting a common ground for CEO and IT managers to work together and achieve a high level of alignment between business and IT strategies.

The models built following the modeling approach will enable executives to analyze, define, and communicate the organization's essence and structure contributing to its development. They will also assist the IT managers to develop the technological architecture adequate to achieve the business' objectives.

This paper is structured as follows, the next section presents a summarized view of modeling approaches and techniques that can be found in the literature that, in some way, influenced the proposed modeling approach. Section three highlights the lack of integration and compatibility among existing modeling approaches. In section four, we outline the main aspects of the proposed modeling approach.

## **BUSINESS DEVELOPMENT MODELING APPROACHES**

Along the time, many modeling approaches have been proposed to support different forms of business development. In the following brief review, modeling approaches have been classified into two dimensions according to the business development contexts where they are used, (1) business development and (2) technology development. Each dimension was further divided in two sub-dimensions, (1.a) Business development approaches, methodologies or practices; (1.b) Business designing or modeling conceptual frameworks; and (2.a) Technology development approaches or methodologies; and (2.b) Engineering, designing, modeling conceptual frameworks.

The following paragraphs refer to the modeling approaches and to their business development contexts.

### **Business development**

#### *Business planning*

Business strategic planning is a traditional approach for business development. In the early sixties, at the Harvard School, Kenneth Andrews and others devised a simple technique for supporting the debate associated to the competitive positioning of a company known - the SWOT analysis (Andrews, 1987). This evaluation technique takes into account organization's internal aspects, strengths, weaknesses; and external environment, opportunities, and threats. These aspects provide the rational for establishing plans, to develop the strengths, to seize the opportunities, to minimize the weaknesses and to avoid the threats.

#### *Business strategy formulation*

Mintzberg and Lampel (1999), in their publication "Reflecting on the Strategy", define ten different theoretical approaches for strategies, the design, planning, positioning, entrepreneurial, cognitive, learning, power, cultural, environmental, and configuration schools. These approaches can be simplified into two categories of strategic thinking, (1) a prescriptive way to formulate the strategy; (2) a descriptive approach, where the strategy is built up in an emergent process focused on gathering experience. The first approach corresponds to those that promote strategic analysis and positioning (Porter, 1996). The second correspond to the learning (Prahalad, 1990) or resource based view theorists (Barney, 1991) and the configuration thinkers in which Mintzberg itself is a great contributor.

Other way to see the strategy is modeling the business. The term "business model" is recent. It started to be used to express different ways of doing business in the internet (Magretta, 2002; Osterwalder et al., 2005). Weill and Vitale (2001) developed a graphical notation to depict different way of setting business in the internet. Currently, the term is being used to express a broader perspective of a business as presented at a recent article by Baden-Fuller and Morgan (2010).

Research on business models is also attempting to solve the problem of linking strategy to tactics (Casadesus-Masanell and Ricart, 2010). Modeling the strategy of business eases the formulation of tactical choices. However, these studies on this new perspective of business models are yet in an early stage.

#### *Business operations management*

Operations development can be described as the effort of optimizing the resources and the processes for the production of goods or services in an organization. According to Porter (1985), production processes are a sequence of activities that add value to the product until its completion. This is a widely accepted view of the value chain of production activities. Porter established the following as the main activities of a firm's value chain, inbound logistics, operations, outbound logistics, marketing and sales and post-sales services. He also identified other activities of the organization that are necessary to support the value chain, the company's infrastructure build up, human resources management, technology development.

A business operations development approach that had wide acceptance is re-engineering or business process reengineering. With the increased use of computers, Hammer (1990) introduced the idea of instead automating existing processes it would be better to rethink the entire way of working and radically redesigning the process. Up to now information technology has been the key factor for business processes optimization approaches (Vergidis, 2008).

Quality management is another operations development approach. Inspired in the practices of Japanese companies (Powell, 1995; Sila and Ebrahimpour, 2002) it focus on the continuous improvement of operations. Quality management became the roots of the quality management standards ISO 9001:2008 and ISO 9004:2009. The Quality Management System standard is based on the management conception known as the Deming's PDCA Cycle (Deming, 1986) that consisting of cyclically follow the steps of plan, do, check, and act.

Many modeling techniques were created to support these operations management approaches (Aguilar-Savén, 2004). Business Process Management Notation – BPMN (OMG, 2009) is the one most used languages in the software modeling tools.

### *Business performance management*

Management by objectives was an important managerial concept created by Peter Drucker. However, its initial implementation had little practical results (Kaplan and Norton, 2001). The objectives were defined locally, at function level, and were not linked to high-level organizational objectives. To overcome this, Kaplan and Norton (1992) proposed the Balanced Scorecard – BSC. The BSC was initially used as strategic performance measurement technique/tool that combines financial and non-financial measures. It provided also a connection between the strategic objectives of these perspectives and all company's functions objectives, including individual objectives of each worker.

The balanced scorecard technique evolved from a performance management system to an integrated strategic management system (Kaplan and Norton, 2001; Speckbacher et. al., 2003) that describes strategy with a set of cause-and-effect associations. The Balanced Scorecard became a popular management practice around the world. However, after more than fifteen years, companies still have difficulties to successfully operationalize their strategies. To solve this problem Kaplan & Norton (2008) proposed a management approach that aims at guiding managers to link strategy to operations.

### **Technology development**

The industrial revolution from the 18th century brought to society a new way of living with many new artifacts. In the early 1980, according Toffler (1981) society underwent an important shift. It moved from industrial age to the information age. Nowadays, the information and communication technologies are present in every aspect of our life. In organizations information technology became a resource as essential as the workers. The following sections present several approaches to manage information technology at organizations.

### *Information technology strategy development*

The most sought goal for IT strategy development is its alignment with business. One of the most referenced alignment approaches is proposed by Henderson and Venkatraman (1993). The authors propose an alignment between the business and IT on two levels, strategic (external) and functional (internal). The authors describe four approaches for alignment.

In the first, the more traditional business strategy and organizational structure are the basic elements that influence the strategy for IT. In the second, by understanding that the IT enables a strategic transformation, top executives align with IT management in an advanced IT architecture that contributes to differencing image to the business. The third is that IT, strategically, provide innovations witch competitive potential to influence the business strategy. Finally, the fourth perspective is observed as IT becomes requested to provide a superior level of service for alignment of business.

An extensive literature review on Business and IT alignment appears in article by Chan and Reich (2007) indicating that the studies can be divided into two distinct conceptualizations of alignment, one is associated with the processes of alignment and the other is related results of alignment. The authors recommend IT managers share responsibilities of alignment, build the correct culture, demonstrate the benefits of it and engage with the change.

### *Information technology governance*

Control Objectives for Information and related Technology – CobiT is a widely accepted international standard for directing and controlling an enterprise's IT. CobiT Executive Summary document (ITGI, 2007) defines that the business orientation of CobiT consists of linking business goals to IT goals, providing metrics and maturity models to measure their achievement, and identifying the associated responsibilities of business and IT process owners. CobiT is a process-oriented framework that

subdivides IT governance into 4 domains and 34 processes in line with the responsibility areas of plan, build, run and monitor.

#### *Information technology evaluation*

McFarlan and Nolan (2003) advise that the CEO should look to IT through three different lenses, focus on cost reduction and improve efficiencies; incremental improvement of the organization, products and services; and creation of strategic advantage through provision of new IT enable extended customer value proposition.

The focus on financial returns of IT has been subject of many academic and professional studies (Bacon, 1992; Milis and Mercken, 2004; Sward, 2006). Organizational efficiency improvement has been main justification for IT adoption (Seddon et al. 2002; Melville et al., 2004, Tallon and Kraemer, 2006; Gunasekaran et al., 2006). Moreover, the strategic usage of IT is not as easy to create and develop, but the short history of information systems has several examples that it has completely transformed companies and even some industry sectors (Powell and Dent-Micallef, 1997; Peppard and Ward, 2004).

Ward et al. (2007) developed an approach to manage the benefits of information technology. The benefits management process consist of cyclically follow the steps of identify benefits, plan realization, execute, evaluate results, look for further benefits. This research group (Peppard et al., 2007) also developed the cause-effect network of benefits named Benefits Dependency Network, which is the relationship network between the ends, the ways and the means of IT investments.

#### *Enterprise technology architecting*

A common architecture conception is to build it up by viewpoints. ISO/IEC 42010, 2007 developed a recommendation addressing activities such as the creation, analysis, and sustainment of architectures of systems and software engineering. This recommendation is based on this conception of views and viewpoints.

The Open Group Architecture Framework – TOGAF is a standard for assisting in the acceptance, production, use, and maintenance of enterprise architectures. It is based on an iterative process model supported by best practices and a re-usable set of existing architectural assets. TOGAF is developed and maintained by The Open Group Architecture Forum and its 350 members (The Open Group, 2009).

The TOGAF content meta-model is divided by views such, Business Architecture (motivation, organization, and function); Information Systems Architecture (application and data); and Technology Architecture. TOGAF has a method to be implemented. TOGAF Architecture Development Method (ADM) provides guidance to description of, (a) Architecture Vision, (b) Business Architecture, (c) Information Systems Architecture, (d) Technology Architecture, (e) Opportunities and Solutions, (f) Migration Plan, and (g) Implementation Governance.

The Object Management Group – OMG created a Business Architecture Special Interest Group to promote industry consensus and develop a set of standards to support the concept of building, evolving and aligning business blueprints. The actual work of this group of experts is defining requirements for a business architecture standard (OMG, 2010a). They are working in abstract business views and a business architecture standards ecosystem to represent them.

One Business Architecture viewpoint is the vision and strategies that is planned be represented by Business Motivation Model (OMG, 2008). The Business Motivation Model provides a scheme for developing, communicating, and managing business plans in an organized manner. Specifically, the Business Motivation Model does all of the following, identifies factors that motivate the establishing of business plans; identifies and defines the elements of business plans and indicates how all these factors and elements inter-relate.

#### *Information systems development*

Unlike business models, systems development models are older. Originated in the 70's with flowcharts and entity-relationship models they evolved to the modern Unified Modeling Language – UML (Davies et al., 2005).

The process for software development is also a standard ISO 12207:2008 – Software Life Cycle Processes. The standard comprises management and technical processes. Technical processes include requirements definition, requirements analysis, design, implementation, integration, testing, installation, acceptance, operation, maintenance, and disposal.

Another widely used process reference is the Rational Unified Process – RUP (Jacobson et al., 1999). RUP is currently part of the Eclipse Process Framework an open software development platform. The RUP is divided in two processes type the engineering and support workflows. The engineering workflows are, business modeling, requirements, analysis and design, implementation, test, deployment. The supporting workflows are, project management, configuration and change management, and environment.

### WHY AN INTEGRATED MODEL IS NEEDED?

Most of the existing methodologies and models for business management are not linked to each other. Current business management processes are fragmented, and deal with different elements hindering their integration. Diverse management processes carried out by different units frequently lack guidance from an integrated, consistent view of company's strategy (Kaplan & Norton, 2005).

The Table 1 attempts to summarize the modeling approaches mentioned in this section, presenting the objective of the business development context, the underlying approach (how) and the used conceptual models of frameworks (which tool).

Objective	Approaches	Conceptual models or frameworks	References
Business plan formulation	Strategic planning	SWOT analysis	Andrews (1987);
Business strategy development	Strategic positioning	Generic strategies framework; Competitive forces	Porter (1996); Porter (2008)
	Resource Base View	Physical, human and organizational resources	Barney (1991)
	Business modelling	Model Building Blocks	Osterwalder and Pigneur (2005)
Business operations improvement	Business Process Management – BPM; Re-engineering;	Value Chain BPMN 1.2	Porter (1985) OMG (2009) Hammer (1990)
Quality assurance	ISO 9000 Process Approach	Quality Management System (eight principles within PDCA)	ISO 9001:2008 ISO 9004:2009
Strategy and execution alignment	Closed-loop management system	A Management System Tool Kit	Kaplan and Norton (2008)
Information technology strategy development	Strategic Alignment Model	Two build blocks, strategic fit and functional integration	Henderson and Venkatraman (1993)
Information technology governance	CobiT 4 Generic Process	CobiT Framework	ITGI (2007)
Information technology evaluation	Financial and non-financial approaches	Payback, ROI, IRR, NPV, etc.	Gunasekaran et al. (2006)
	Benefits management process	Benefits Dependency Network	Ward et al. (2007); Peppard et al. (2007)
Business architecture development		Business Architecture Standard;	OMG (2010a)
Enterprise architecture development	TOGAF Architecture Development Method	TOGAF content metamodel and ArchiMate language	The Open Group (2009)
Software development	Rational Unified Process: Two dimension, iterations and process workflows	Unified Modelling Language – UML 2.3	Jacobson et al. (1999); OMG (2010b)

**Table 1. Management approaches and conceptual models**

On technological management side, neither the information technology development methods (e.g. TOGAF-ADM) nor the languages (e.g. UML) are explicitly concerned with business throughput requirements. Companies need to use another approaches to justify their IT projects (Gunasekaran, 2006). It is hard to understand why software engineering practices do not follow other engineering practices that use a set of modeling tools that cover all aspects of the product and can be used along all the design process. This is perhaps the reason why the level of failed software projects is still high (Cerpa, 2009).

Authors that analyzed the most cited architectural frameworks in the literature (e.g. Business Architecture – OMG, The Open Group Architecture Framework – TOGAF 9; and others not cited in this paper) agree that none is complete (Glissmann and Sanz, 2009; Leist and Zellner, 2006; Anaya and Ortiz, 2005). Each framework misses parts from the standpoint of the general model requirements and its components relationship. With these limitations, modeling together business and technology remains difficult.

Business and enterprise architecture frameworks were devised to cover perspectives or viewpoints, according to ISO/IEC 42010:2007. But, the resulting conceptual frameworks do not establish how the perspectives interconnection can be performed and usually do not show what elements or components could make such connection (Winter and Fischer, 2006; Boucke et al., 2008).

The challenge of providing a technological solutions arise from organizational problems, but current Business or Enterprise Architecture methodologies and frameworks are not capable of taking organizational concerns adequately into account. This issue has been pointed out in a recent study by Seppänen et al. (2009), where one of their interviewee states,

*“The EA frameworks by design become marked as IT governance models instead of being generic [governance] models capable of taking into account different organizational structures and factors of production.”*

Kaisler et al. (2005) sustain that critical problems of Enterprise Architecture are rarely technical, but arise from political, project management, and organizational issues.

## PROPOSED MODEL

The goal of the on-going project is to develop a modeling approach that provides an integrated view of business, organization, and technology that is suitable to be used by managers to make decisions regarding the alignment of strategy, operations, and its support technology. Such approach should be applicable to organizations irrespective of their size and economy sector.

The modeling approach should comply with the following requirements,

- To cover aspects related to the structure of business, organization, and technology applications and platforms as well as the interdependences among those aspects;
- To use as few modeling constructs as possible so it is more easily grasped by the different professionals involved in the decision making process.

### Underlying vision

The modeling approach under development is based on the following vision of what a business is,

A business is established by people who believe to have the knowledge to produce goods or provide services that can meet consumer needs.

To set up a business, an entrepreneur needs money (financial resources), people (human resources) and the expertise to design the products or services and to organize the operational processes needed to produce and sell the products or services.

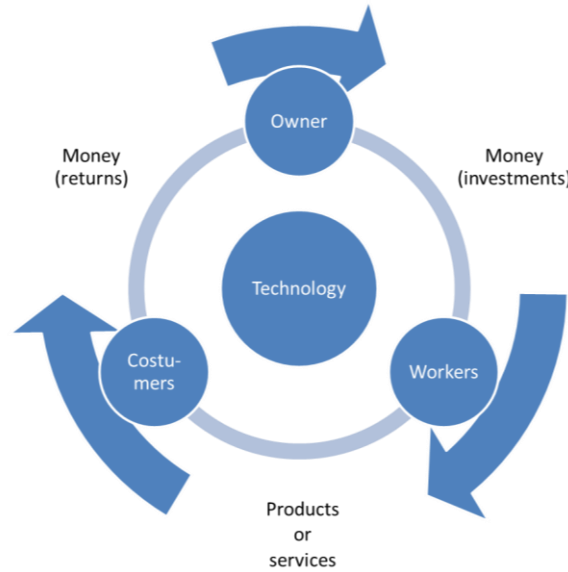
The business converts money into valuable products or services and sell them to receive the money back making a profit.

This vision makes clear that a business is a form of human activity. At a general level, the proposed vision is consistent with the activity theory, a theory developed by Russian psychologists who attempted to deal with the complexity of human activity, and later expanded by Engeström (1987). The theory states that actors use means to do something to an object, in order to achieve some outcome.

Considering the intended use for the modeling approach, a model of a business should encompass three dimensions (Figure 1):

1. The flows of money invested in the organization to produce and sell goods or services and the results revenue flows that provides business sustainability and returns to the invested capital. These flows have some correspondence to what has been called results chain (Boehm, 2003) or outputs chain (Barker, 1994). In this work these flows are named results network;
2. The structure of people – people network – involved in the business results network, owners, workers, customers, and others.
3. The structure of technology – technology network – (herein particularly focused on IT) that interacts with people, supporting them to achieve their target results.

Each node of the people network is involved in some form of value exchange. In a healthy situation, the result of the exchange is recognized as satisfactory for all.



**Figure 1: Three dimensions of modeling approach: results, people and technology network**

Actual values for these flows have to be represented so the impact of adopting/implementing new IT applications can be assessed. The assessment of the adoption/implementation involves comparing the existing scenario with the estimated scenario resulting from the changes introduced in the organization. The scenario characterization is made through the corresponding models (current and future situations) where the results, people and technology networks and the flow values are depicted.

In the table below, the constructs that compose our underlying vision are compared with the constructs proposed by some recently proposed business modeling approaches,

References	Results Network	People Network	Technology network	Complete architecture
Zott and Amit (2010)	Activity system content	Activity system governance		Activity system structure
Al-Debei and Avison (2010)	Value proposition; Value finance.	Value network		Value architecture
Osterwalder and Pigneur (2010)	Value Propositions; Revenue Stream; Cost Structure.	Customer Segments; Customer Relationships; Channels; Key Resources (workers); Key Activities; Key Partnerships.	Key Resources (technology)	The Business Model Canvas
Sultanow et al. (2010)	Value generation; Software development; Revenues; Costs	Markets / Customers Resources; Processes; Distribution.		Business model of an ERP system provider
Andersson et al.(2008)	Goal model layer	Business layer Process layer		
Gordijn (2006)	Value exchange	Actors	e-business technology	Goal and value models

**Table 2. Comparison with related work**

**Model example**

Figure 2 shows the business model corresponding to a furniture manufacturing company. This example is taken from a test case based on a real world situation that involves the acquisition of a computer-controlled panel saw that the company expects will bring several benefits.



Symbols that include human icons correspond to nodes of the people network. Symbols at the bottom that include machine icons correspond to the technology network. Arrows correspond to the outcome chain and have associates actual or estimated values.

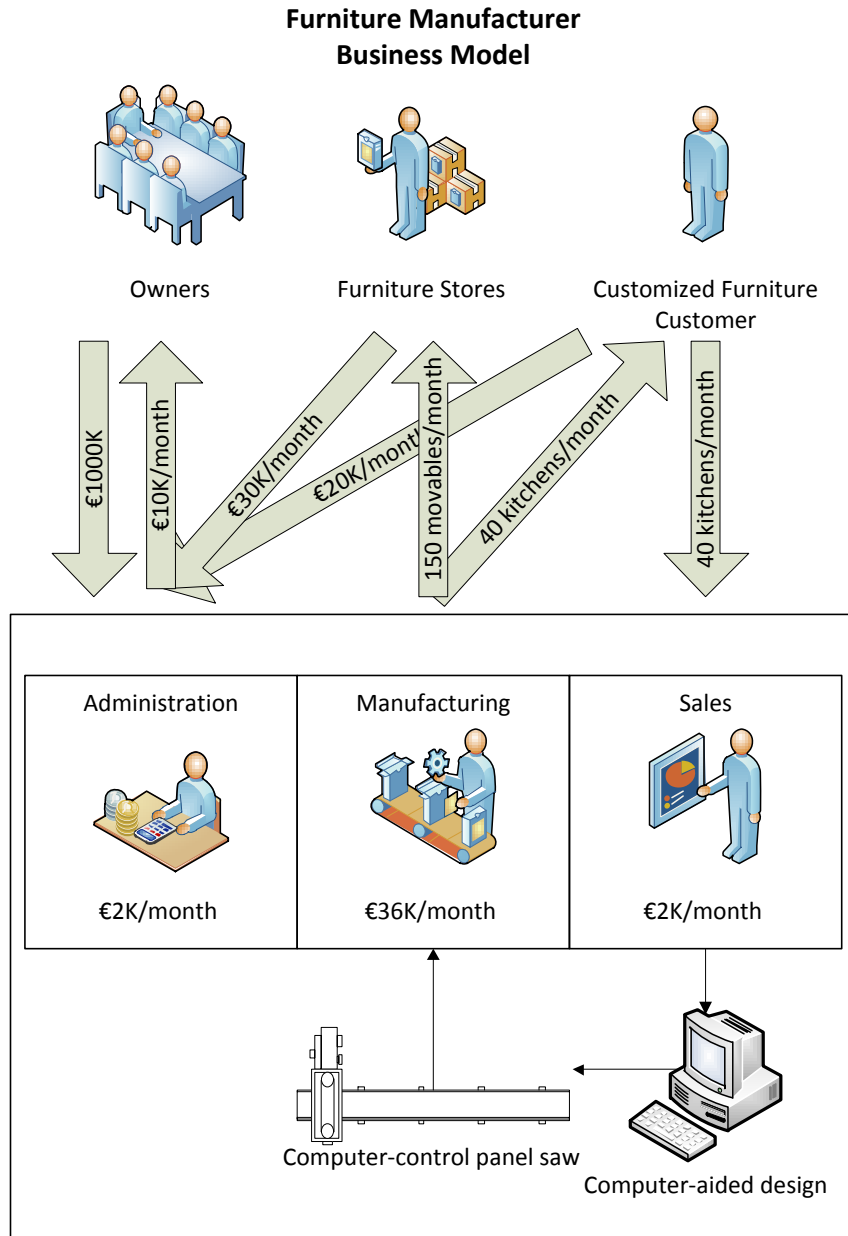


Figure 2. Business model

**CONCLUSIONS**

This paper outline the work-in-progress of development a modeling approach that is capable of assist executives and managers align their business, organization and support technologies.

The development of a modeling approach can be viewed as design science research (Peffer et al., 2007). Its outcome can be described as a design theory. Therefore, when presenting the proposed modeling approach we focused on elements that integrate Gregor and Jones (2007) anatomy of a design theory. This article we focused on the purpose and scope (meta-

requirements), constructs, principles of form and functions (meta-description), artifact mutability (states), testable propositions, justificatory knowledge.

The presented modeling approach is currently being developed. The first phase of the development processes addresses the establishment of the constructs and its representation. Test cases for several situations either from the literature or from real world situations are being used. For later phases of the project, the application of the modeling approach in real world decision-making situations related to the adoption of technology is planned.

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