A Generic Approach for Dynamic Business Model Evaluation

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Abstract

The term *business model* has gained tremendous attention in the recent years. However, the consensus over concrete description of the term is still awaited. Diverse and unsharp descriptions of this term complicate *business model evaluation*, especially when diverse granularities are to be considered. Both concepts (business model and business model evaluation) have caught relatively lesser attention of the research community. Although the stakeholders of business models have different interpretations of it, which is strictly driven by their positions in the business landscape, all of the stakeholders have mutual agreement on the fact that the business model evaluation should be realistic and accurate.

Common business models are based on approximations of existing templates and structures provided commercially or freely available in the state of the art. However, many of the proposed business models were developed on the basis of specific situations. Hence, business model structures hinder the flexibility and compatibility to vast variety of businesses. In order not to develop a distinct evaluation concept for each business model, the challenge is to create a universal business model with an appendant evaluation concept.

In this study, we addressed the aforementioned issues and proposed a more dynamic, modular, and richer business model evaluation framework. This hierarchical framework deviates from the commonly used block structures. On the one hand, it helps avoiding the complexity of evaluation (especially when the business model blocks are dynamic), and, on the other hand, provides a transparent and easy way of interactions among evaluation functions residing at different hierarchical levels. With the view to attaining the objective of accuracy in evaluation, in this work, we proposed various concepts, namely, criticalness/non-criticalness of the evaluation parameters, interdependencies among the blocks of the business, etc. Our experiments and validations advocate that the proposed approach exhibits

more realistic evaluation outcomes. We also extended the evaluation approach by incorporating the recommender component, which suggests adaptation of activities at different levels in the business model to attain the required evaluation value. The tangible outcome of this research work is a software tool, which implements the proposed framework. It is rich, easy to use, and provides a complete visualization space. We have also implemented the recommender function in the developed evaluation tool.

The experiments carried out on our developed evaluation tool strengthen our confidence that the proposed framework and its implementation address very crucial issues when it comes to business model evaluation. We are also convinced that there is still room for improvement specifically in the recommender component.

Kurzfassung

Der Begriff *Geschäftsmodell* (Englisch: business model) hat in den letzten Jahren enorme Aufmerksamkeit gewonnen. Ein Konsens über eine konkrete Beschreibung des Begriffs steht allerdings noch aus. Sowohl unterschiedliche als auch unscharfe Beschreibungen dieses Begriffs erschweren *Geschäftsmodell-Evaluationen* (Eng.: business model evaluation), insbesondere dann, wenn unterschiedliche Granularitäten berücksichtigt werden. Beide Konzepte, Geschäftsmodell und Geschäftsmodell-Evaluation, wurden bisher in der Forschung kaum beachtet. Obwohl es interessenbedingt unterschiedliche Auffassungen von Geschäftsmodellen gibt, besteht Konsens darüber, dass die Geschäftsmodell-Evaluation realistisch und akkurat sein soll.

Übliche Geschäftsmodelle basieren auf Annäherungen der bestehenden Vorlagen und Strukturen, die im Stand der Technik kommerziell zur Verfügung stehen oder frei erhältlich sind. Jedoch wurden viele der vorgeschlagenen Geschäftsmodelle in Anlehnung an spezielle Situationen entwickelt. Deswegen erschwert die Struktur der Geschäftsmodelle eine flexible Handhabung und ist oftmals inkompatibel für allgemeinere Fälle. Um nicht für jedes Geschäftsmodell ein eigenes Konzept für die Evaluation zu entwickeln, besteht die Herausforderung darin, ein universelles Geschäftsmodell mit zugehörigem Evaluationskonzept zu entwerfen.

Diese Arbeit adressiert die oben genannten Probleme. Es wurde ein hierarchisches, dynamisches, modulares, ausdrucksstarkes und erweiterbares Rahmenkonzept für die Geschäftsmodell-Evaluation entwickelt. Das in dieser Arbeit vorgeschlagene hierarchische Rahmenkonzept weicht von den üblich angewandten Geschäftsmodellstrukturen ab. Auf der einen Seite werden komplexe Evaluationen vermieden (insbesondere wenn die Blöcke des Geschäftsmodells dynamisch sind). Auf der anderen Seite liefert es einen wohl-definierten, transparenten und einfachen Weg der Interaktionen zwischen Evaluationsfunktionen, die an verschiedenen hierarchischen Stufen liegen. Um eine möglichst realitätsnahe Auswertung

zu erhalten, werden verschiedene Konzepte wie z.B. kritische und nicht kritische Evaluationsparameter sowie Abhängigkeitsverhältnisse zwischen Businessblöcken vorgeschlagen. Der Evaluationsansatz wurde um eine Empfehlungskomponente erweitert, die auf verschiedenen Ebenen im Geschäftsmodell eine Anpassung von Maßnahmen vorschlägt, um den erwünschten Evaluationswert zu erreichen. Experimentelle Untersuchungen und Validierungen anhand eines in der Arbeit entwickelten Softwaretools zeigen, dass der vorgeschlagene Ansatz realistische Evaluationsergebnisse aufweist.

Die Resultate der mit Hilfe des Evaluationstools durchgeführten Experimente demonstrieren, dass das vorgeschlagene Rahmenkonzept und seine Implementation geeignet sind, um beliebige Geschäftsmodelle realitätsnah, flexibel und detailliert zu evaluieren.

To my parents

To my beloved country

To Galatasaray

Acknowledgements

After investing so much time and effort in this work, I have finally come to the most meaningful part of it. First of all, I am grateful to Prof. Dr. Şahin Albayrak, who gave me the opportunity to work at DAI-Labor under his supervision and carry out the research required for this dissertation, which I highly appreciate. His guidance, efficacious and constructive critiques throughout my dissertation impelled me to work more focused and efficiently. I would extend my heartiest gratitude to my supervisor Prof. Dr. Frank Straube, without whose support I could not have completed this study successfully. His support at a very decisive phase during this work helped converting it into a dissertation.

My unpretentious friend Dr. Manzoor Ahmed Khan has striven with me at every stage. Each line in this work has traces of not only mine but also his endeavour. My vocabulary does not suffice to express my gratitude to him. Thanks to his guidance, I have ameliorated in scientific way of working and conducting research. It is a happiness for me to see that I am now at the stage of writing these words after having so many fruitful discussions throughout the years. I am very pleased to see the harvest of that effort now.

I have to admit that the road to this moment has been very flexuous. My esteemed friend Dr. Fikret Sivrikaya was the determinant person, who changed my mind and encouraged me to continue at the point of giving up. He acted like an alembic by refining numerous parts of the thesis. His inestimable recommendations led solving problems apace, which I had contemplated for days. His thoughts were like a chisel, which gave the thesis a profluent structure.

Lastly, I would also thank to my friend Dr. Brijnesh Johannes Jain for his continuous support. He was always ready to answer my questions that were beyond my ken.

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Introduction

"Science is the most genuine guide in life." - Atatürk

The development in the global economy caused changes in the traditional balance between customers and suppliers. Changing trading regimes and introducing state of the art computing and communication technologies are motivational forces for revisiting business models. The envisioned new and dynamic environment has amplified the need to keep evaluating business models to cope up with market dynamics. This drives new discussion of understanding business model. This term has been widely used in research literature, by business managers, consultants, etc. We believe that business model may not merely be taken as the process of aggregation of business procedures that enable categorization (via taxonomies), but rather, business models play a vital role as "laboratories", where, academics explore how they work and managers carry out experiments with destiny of their companies (Baden-Fuller & Morgan 2010, pp. 156). Business ventures use business model to understand the customers' needs and describe the architecture of its value creation.

In practice, many people interpret often only a part of a business model as the business model itself. This leads to a misunderstanding of how the business functions. Consequently, the measures taken are also not relevant. As Eltrun, the eBusiness Center at Athens University of Economics & Business, pointed out rightly (Pateli & Giaglis 2002, p. 44), "The research work made in the aspect of business models evaluation and assessment is not mature enough, since it includes few and recently made efforts for defining: purposes of evaluation, dimensions of Business Model that can be assessed, and factors that can be used as evaluation criteria." This

statement is still valid 10 years after it was made. The area needs more scientific work so that an evaluation framework and methodology are developed, which take the interdependencies between factors of different components of a business model into consideration.

1.1 Why Evaluate a Business Model?

We believe that people may have different ideas. They also have plans how to convert these ideas into a good working and consistent business. However, they do not know whether their plan will function. Hence, the natural questions are as follows:

- Is there a tool that informs me whether I can be successful with my model that I will use when I start the business?
- How do I keep evaluating my business?
- What should be done to improve the business?

With the view to finding the answers to the aforementioned questions, we reinforce the fact that key beneficiaries of business model evaluation approach are business owners, managers, and entrepreneurs. Business owners need to evaluate their business in order to: i) know their strengths and weaknesses, ii) evaluate their teams' performance, iii) develop measurable goals and implement cost controls, iv) train their managers at different levels, v) motivate and empower the team, vi) define their businesses for increased profitability and success, vii) attack challenges with suitable and optimal strategies.

1.2 Research Objective and Methodology

In this thesis, we try to address the research question: "*how to realistically evaluate a business model?*" Considering that business model evaluation does not only reflect the current standing of the business but also serves as predicting the outcome of a business, researches on business model evaluation and their accuracy become crucial for the success of new and ongoing business establishments. In addition, the business model evaluation should be flexible enough to fit to different business structures, i.e., it must be able to evaluate business models of different types. However, aiming a very generic and still very accurate evaluation framework seems unrealistic to achieve.

In this work, we make an attempt to stay closer to each dimension of the aforementioned targets. When it comes to having a more generic evaluation framework, in our approach, we enable the business owners to define and configure the proposed framework in such a way that fits to their businesses. For accuracy and realistic evaluation, in the proposed framework, we contribute with several concepts like critical/non-critical evaluation parameters, evaluation functions at different hierarchical levels with various controlling parameters, which provide the evaluator with greater control over the evaluation behavior (refer to Chapter 3).

Our research methodology consists of the following steps: firstly, we provide the background for *business model* by going into details for the most accepted definitions and approaches. Secondly, we give an overview about essential terms like *strategy* and *business plan*. Thus we disambiguate business model and related terms. Thirdly, we analyze the existing *business model evaluation* approaches and determine their shortcomings. Based on these, we introduce our evaluation concept. We give the reasons and justification to deviate from the commonly used models, the need for the proposed evaluation model, and the evaluation/translation functions therein. As proof-of-concept, we use a case study and test our approach, also by making use of questionnaires. Following this, we show the technical implementation of the developed tool. Lastly, we introduce the *business model recommendation* based on the previous evaluation outcome.

1.3 Expected Outcomes of Business Model Evaluation

On an abstract level, the expectation from an evaluation framework may be translated into "getting near to desired goals (e.g., profit, planning)". We strengthen the preceding claim by the following sentence, i.e., "when managers operate consciously from a model of how the entire business system will work, every decision, initiative, and measurement provides valuable feedback" (Magretta 2002). Evaluation metric profits are of vital importance as these advocate the proper functionality of business procedures, i.e., if the business lags behind in achieving the targeted results (desired profit), the business owner is forced to revisit the decision taken and actions executed. To address dichotomies of such nature, we believe that there should be mechanism(s) in place, which cope up with realistic evaluation requirements of business, scalable to any business size, and recommend the adaptation in current state of business model to attain business goals. We envision such a mechanism in Figure 1.1. The figure may be seen as a justification for deviating from the commonly used fixed block evaluation model concepts.

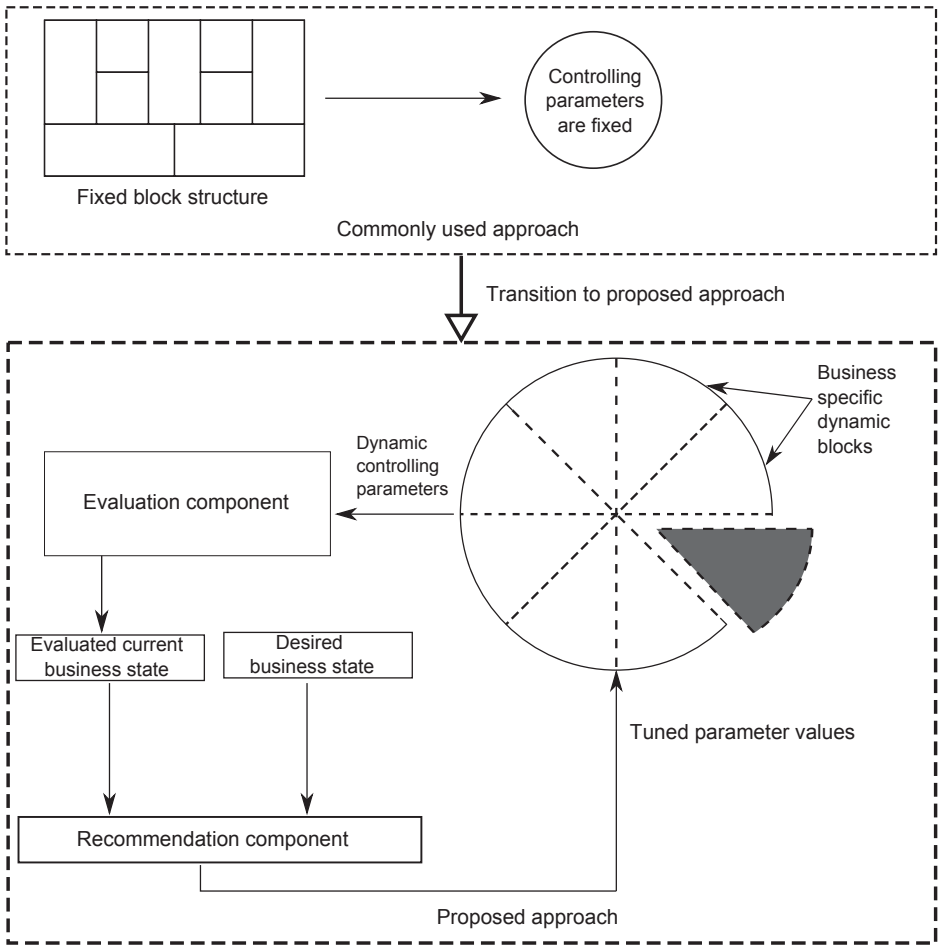


Figure 1.1: Envisioned business model evaluation approach - This figure illustrates the big picture of envisioned business model evaluation approach. The figure develops a feedback loop like process for evaluation and recommendation. The deviation from fixed block structure to dynamic blocks is also discussed. One may interpret it as the motivational block diagram for this research work.

There are two dashed boxes in the figure; the upper one corresponds to the existing approach, whereas the lower one highlights the envisioned procedures for the business model evaluation. The concept of dynamic block structure is represented by the round wheel like structure, which means that the evaluation model should be flexible enough to encamp any number of evaluation blocks and it should not be confined to fixed (nine) block structure, which is detailed in Chapter 2. Having defined the business specific blocks, these are then evaluated by identifying the controlling/evaluation parameters (this is shown by the arrow pointing towards the evaluation component block). These block-specific evaluation criteria should then be evaluated, which are then translated into business model's current evaluation. Due to the fact that the current business evaluation does not finish the job, we believe that the mechanism should not only compute the current status of business, rather it should propose solutions that help business owners to attain the desired business goals. This leads us to propose the recommendation component, which executes some recommendation approaches to compute the optimal solution and adaptation of the operations in the current model to reach the desired business goals. With these brief comments and abstract block diagram, we make a point that a transition to the envisioned business model evaluation is imperative. And to execute such transition, we have to contribute various functionalities and concepts, which are detailed in Chapter 3.

On an abstract level, in the following, we summarize the expectations from the proposed approach.

1. It should support dynamic definition of business blocks or components.

2. It should be modular and provide ways for mapping different business levels and their relationships.

3. It should enable evaluator of the business model and the owner of the business to define the evaluation parameters, their units, scale, and configure the controlling parameters of the evaluation function.

4. The behavior of the critical parameters' evaluation should be different than that of non-critical for the same score values given that controlling parameters of the involved evaluation function remain the same.

5. It should enable the evaluator to assign evaluation scores for the evaluation parameters belonging to any business segment (i.e., corresponding to any hierarchical level in our approach).

6. It should be able to recommend changes in the business processes based on the current evaluation and target evaluation (defined by business owner).

7. The recommendations provided by the recommendation component should be cost efficient.

1.4 Contribution

This section focuses on briefly describing the main contribution of this work, which may be summarized as follows:

1.4.1 Hierarchical Evaluation Model

With the view to concretely defining the evaluation granularities and define their relationship(s), we propose a hierarchical evaluation model. Each level of the model corresponds to a different evaluation granularity level of the business. As will be detailed later in Chapter 3, these levels are arranged hierarchically from top to bottom as business, business block, block criterion, criterion unit, and unit dimension. The evaluation function at each level is strictly influenced by the evaluation parameters at that level. We also concretely define the relationships between the business model components sitting at different levels. The proposed hierarchical model provides the evaluator with the flexibility of choosing the evaluation granularity. We also discuss the evaluation function for each level and justify their difference.

1.4.2 Deviation from the Commonly Used Fixed Block Structure

We deviate from the commonly used fixed block structure and propose the dynamic block structure for business model evaluation. The dynamic number of blocks is strictly driven by the type of business to be evaluated. We believe that such dynamic block structure represents a more generic evaluation model that provides us with the flexibility to be used for almost all types of business models.

In the proposed hierarchical evaluation model, adding the evaluation blocks is possible at block hierarchical level. It is intuitive that contents (block internal lower hierarchical levels) are

block-specific. Thus we believe that the proposed dynamic block structure is generic enough to be suited for evaluating many types of businesses and at the same time scalable.

1.4.3 Integrated Concept of Critical and Non-Critical Parameters

In this work, we capture the sensitivity of evaluation parameters via different approaches at different levels. At dimension level, we propose the concept of critical and non-critical parameters. We claim that at the dimension level, the evaluation parameters may be categorized into very sensitive (critical) and less sensitive (non-critical), which may be interpreted as follows: the overall evaluation at the dimension level is immensely influenced by the evaluation score of critical parameters when compared with non-critical ones. For the proffered categories, we propose different evaluation functions that realistically capture the aforementioned sensitivity.

1.4.4 Introducing the Novel Concept of Platform Blocks and Capturing Block Dependencies

In this work, we identify some evaluation blocks that may be graded as the imperative blocks in any business model. We term such blocks as *platform blocks*. We justify the selection of platform blocks by undergoing extensive research literature.

As the proposed evaluation framework is based on fully dynamic block structure, intuitively, various blocks are inter-dependent over one another. Such dependency may exist at different lower hierarchical levels in a block. We propose that block dependencies may be captured at the criterion level. We capture such dependencies by introducing additional indices in the evaluation function at criterion level.

1.4.5 Heterogeneous and Hybrid Evaluation Functions

Owing to the fact that the proposed model is hierarchical and we categorized the parameters in various categories on these hierarchical levels, there is a need to have different evaluation functions at different levels. Thus in this work, we propose heterogeneous evaluation functions. Since we suggest critical and non-critical concept (at dimension level), we propose a hybrid additive and multiplicative evaluation function.

We also propose a cost component and associate it to all evaluation functions at all levels. The proposed cost component decomposes the cost evaluation to a more granular level, on the one hand, and helps in finding out the (sub)optimal activity adaptation for recommender, on the other.

1.4.6 Extending the Evaluation Model to a Recommendation Model

In this work, we not only propose an evaluation model, but also a recommender model. The business owners/managers may have set targets for their businesses and they need to meet the desired evaluation optimally by adapting their activities/actions and executing them in different segments of the business. Thus we also offer a recommender function, which, when fed with current business model evaluation, provides recommendations for activity adaptation, e.g., highlighting which block, criterion, or unit level parameter should be addressed to reach the target evaluation.

1.4.7 A Software Tool to Realize the Proposed Concepts

In this work, we extensively develop a Java-based evaluation and recommendation tool, which is easy to use for the business owners and the evaluators. It enables the business owner to define business blocks and configure various parameters for business evaluation at different levels. When used by the evaluator, the tool provides "easy to use" options and graphical user interface to enter the parameter score values. The developed tool also serves as a visualization tool when it comes to presenting the evaluation results at different levels. Last but not the least, the tool integrates the recommendation functionality. When business owners define their desired evaluation value, the tool recommends most optimal (suitable) adaptation activities/operations in the business that will lead towards attaining the desired business model evaluation.

1.5 Thesis Structure

In this section, we present the structure of the thesis. Table 1.1 summarizes the chapters, the contributions therein, and provides brief descriptions of each chapter.

Table 1.1: Thesis Structure

Contribution	Chapter		Contents
	No	Title	
Overview and points of interest of the thesis	1	Introduction	In this chapter, we discuss the big picture representing the basic idea of this work, briefly discuss the contributions, and the structure of thesis.
Backgrounding the proposed approach by studying the relevant approaches	2	Business Model and Relevant Concepts	This chapter focuses on elaborating the relevant approaches. We provide the background, summarize the contributions therein, and study their suitability to the requirements of envisioned business evaluation model.
Hierarchical evaluation model, deviation from the commonly used fixed block structure, integrated concept of critical and non-critical parameters, introducing the novel concept of platform blocks, dependency concept, heterogeneous and hybrid evaluation function	3	A New Business Model Evaluation Framework	This is one of the core chapters. This chapter encamps most of the contributed concepts, the need for the hierarchical business evaluation model, and the proposed evaluation function at all of the hierarchical levels. The discussion over the performance evaluation of the proposed model, evaluation of a case study (i.e., DAI business model), and comparison of business evaluation with commonly used evaluation approaches are the contents of this chapter.
A Java-based business model evaluation and recommendation tool	4	Interactive Business Model Evaluation Tool	The focus of this chapter is confined to discussion over the Java-based business evaluation tool that is developed as a part of this thesis work. The chapter discusses various options of tool usage, such as registration, inputting evaluation questions, evaluating the business, and visualizing the evaluation outcome.
Recommendation approach for attaining the desired business model evaluation	5	Recommendation based on Business Model Evaluation	In this chapter, we discuss the proposed approach for the recommendation in the business models. The chapter also discusses the integration of the recommender approach to the Java-based evaluation tool. The chapter closes with discussion over implementation of the recommendation approach to business model evaluation.
Summary of the thesis and an outlook for future work	6	Conclusion	This chapter summarizes the work of this thesis. We also provide the discussion section in this chapter, where we discuss the issues and future prospects of the work.

2

Business Model and Relevant Concepts

"The value of science is similar to the energy source from which other candles get light." - Nizamülmülk

2.1 Introduction

In current world of business, people are aware of the opportunities to earn money by executing various ideas in different areas. However, many failures on markets have shown that good ideas in singularity are not sufficient to attain the objectives. Inferring from the fact presented in the preceding sentence, one may also claim that using the most developed technology, partnering the most reputable partners, or employing the most skilled staff alone do not determine the success of a company in advance unless correct business model has been selected. To support the claim, we consider the use case of Google. We believe, Google did not make money until it started auctioning ads that appear alongside the search results. Thus the decisive action undertaken by Google was to change the business model, which led Google to the current status and earned it the position of market leader. On the similar lines, the dot-com boom in the second half of 90s gave rise to new opportunities in business. Many new entrants entered the markets (and hence evolving the current markets into new markets), where they might have little or no experience at all. This trend provisions new methods, new approaches, and above all

new models (i.e., business models) with objectives to make more money and have sustainable positions. Many of them used either old business models or business models that do not suit the new businesses at all, which resulted in their failure, e.g., XFL, NBC's experimental mixture of sex and violence packaged as football (Fatsis & Flint 2001). Another example took place many years before the dot-com boom, in the late 70s and early 80s. This can be observed in the so called Videotape format war. Sony's Betamax and JVC's VHS battled for a decade for dominance. The winner was VHS at the end. VHS's victory was not due to any technical superiority (Owen, 2005). There were numerous factors that led to the failure of Betamax, e.g., license problems, consumer preferences. A more recent format war was between the Blu-ray Disc and HD DVD optical disc. Blu-ray managed to become the victor of this in February 2008. There were the following two decisive factors: shifting business alliances (including decisions by major film studios and retail distributors) and Sony's decision to make Blu-ray players a part of the Sony PlayStation3 video game console (Kageyama 2008). As we see, being good only in one part of the business is not the only important aspect, but the whole model should also function very well.

In this chapter, we introduce various relevant concepts, terminologies, the related research work, and conclude the chapter by highlighting white spots and defining the motivation to carry out this research work.

One may infer the growing research dimensions and contributions in business model by simply studying the following statistics. The keyword "business model" when searched in an Internet search engine in 2002 produced around 107,000 results, which tremendously increased to 2,130,000, when the same keyword was searched using Google search engine in June 2004 (Chesbrough & Rosenbloom 2002; List 2006). Impressed by the statistical variance in the mentioned results, we also searched the same key word using Google search engines in July 2012, what else one could expect, a massive increase when compared to the earlier discussed amount of search results, i.e, 32,900,000. The motivation to discuss the number of search results for the keyword "business model" comes from the fact that we are interested in knowing the evolution and popularity of the term. The presented number of search results strengthens the claim that business model will be playing a key role in the years to come.

2.2 Background and Essential Concepts

In this section, we discuss the basic ingredients needed for this research work. This section also makes an attempt to clarify different concepts and terminologies, which may potentially be misunderstood or cause confusion. The motivation to include this section comes from the fact that, on the one hand, we are enabled to clearly define the research problem, and on the other hand, readers are provided with clear definitions and our understanding of the relevant concepts and terminologies.

This section is confined to discussing the basic relevant concepts and we make an attempt to highlight the silver lining between them. It should be noted that the focus of this section is converged to some very relevant concepts.

2.2.1 Business Model

As Sosna & Trevinyo-Rodriguez & Velamuri (2010, p. 383) point out, "business models have always existed, but have been of increased interest to practitioners and academics in recent years". However, one obvious issue with defining the term *business model* is that it lacks consistency and clarity (Stähler 2002; Schweizer 2005; Wang & Jaring & Wallin 2009; Dahan et al. 2010; Zott & Amit & Massa 2010). Zott & Amit & Massa also strengthen this claim by stating that "this represents a potential source of confusion, promoting dispersion rather than convergence of perspectives, and obscuring cumulative research progress on business models." Likewise, there has been no established theoretical grounding in economics or in business studies (Teece 2010, p. 175). Lambert (2008, p. 278) also points out that there is a lack of consensus regarding definitions and constructs of business models. In agreement with Zott & Amit & Massa, we are convinced that with the tremendous increase in the number of papers, conference sessions and workshops on the subject of business models, a common and widely accepted business language is still to be developed that would allow researchers, who examine business model, construct through different lenses to draw effectively on each others' work. We observe that the academic literature on this topic is fragmented and confounded by inconsistent definitions and construct boundaries (George & Bock 2010, pp. 83). The scholars frequently adopt these distinctive and personal definitions to fit the purposes of their studies. As Zott & Amit & Massa (2010, p. 10) admit, this hampers a cumulative progress. Before we present our understanding of the term business model (which we present in Chapter 3), let us try to read

the minds of various researchers and discuss their understandings of the term in the following section.

Diverging and converging understandings of business model

The term business model appeared for the first time in 1957 in the article "On the Construction of a Multi-Stage, Multi-Person Business Game" in the journal *Operations Research* (Bellman et al. 1957), and in the title and abstract of a paper in 1960, "Educators, Electrons and Business Models: A Problem in Synthesis" (Jones 1960). Konczal (1975) provided the first indication on the business model concept. Dottore (1977) talks about an information model that is used as an aid in business decision making. Konczal and Dottore "can be referred to as pioneers of the business model concept due to their thematic proximity to today's understanding of the term" (Wirtz 2011, p. 30). For more details about historical development of the term business model readers are encouraged to refer to Wirtz, especially Part A (2011).

Accepting the abstract-level definition of business model as "methodology of how to make money" (Baatz 1996), we start providing a more detailed description of the term from Timmers (1998), which is then followed by the different understandings of the term business model by various researchers.

Definition of Timmers is a pioneering, and a very often cited one. His article is perhaps "the earliest attempt to construct taxonomy of e-commerce business models" (Gaile-Sarkane 2006, p. 45). He describes and shows the benefits for the businesses, customers, and suppliers. After providing the definition of business model, he claims that a business model alone is not sufficient to make clear how it contributes to the business mission of the company within the model. Hence, the marketing strategy should also be known in order to assess the commercial viability. So, he puts the business model under the definition of a marketing model. A business model and the marketing strategy together build the marketing model. He states clearly that product, service, and information flows belong to a business model. They are offered by an actor and received by another actor. He defines the role of an actor and the potential benefits expected from him as well, and also the potential revenue sources as parts of a business model.

The critique to Timmers' work is that the question whether a value creation occurs is still open although he provides the revenue source in his definition (Scheer & Deelmann & Loos 2003, p. 9). Moreover, we see "no interaction between the different elements of a business model since no specific components of a business model are considered." (Wirtz 2011, p. 35). He does not necessarily evaluate the viability of the resulting value chain models, but rather

differentiates these models by examining the degree of innovation and the functional integration (Petrovic & Kittl & Teksten 2001). He offers a classification scheme for business models for e-commerce along two dimensions. The first one is the *degree of innovation* - ranging from essentially an electronic version of a traditional way of doing business to more innovative ways, for example by externalizing via the Internet functions that were previously performed within a company or by offering functions that did not exist before - and the second one is the *functional integration* - beginning from single function, e.g., e-shops providing the marketing function over the Internet, to fully integrated functionality, e.g., value chain integration. This classification was provided by 11 (Internet) business models. These models can be seen in Figure 2.1.

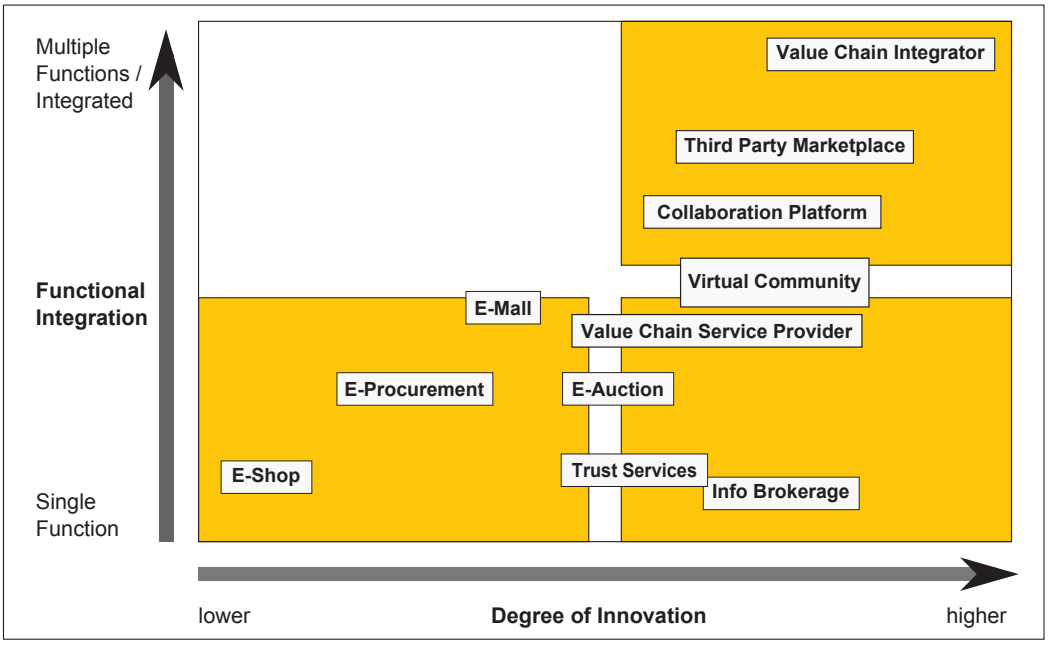


Figure 2.1: Classification of Internet business models according to Timmers - The figure represents 11 (Internet) business models according to Timmers "some of which are nothing but an electronic re-implementation of traditional forms of doing business, such as e-shops. But many other go beyond traditional businesses such as value chain integration and seek innovative ways to add value through information management and a rich functionality".

Based on the definition of Timmers, new definitions have been derived (e.g., Weill & Vitale 2001, p. 34) defining the term business model as "a description of the roles and relationships among a firm's consumers, customers, allies, and suppliers that identifies the major flows of product, information, and money, and the major benefits to participants." Similarly, according

to Rappa (2000, 2007, p. 1), business models are "the methods of doing business, by which a company can sustain itself, i.e., generate revenue." Afuah & Tucci's (2001) business model definition lies near to Rappa's: "...that allows firm to make money..." Linder & Cantrell (2000, p. 13) define business model as the "core logic that enables the firms to create value for their stakeholders." For Magretta (2002, p. 4) a business model is "a story that explains how enterprises work." Zott & Amit (2002, 2004, 2005, 2007, 2008, 2010) emphasize value creation in their definition: "A business model depicts the content (exchanged goods and information), structure (the link between transaction stakeholders), and governance of transactions designed (the control and management of the flows of goods, information and resources) so as to create value through the exploitation of business opportunities." According to Petrovic & Kittl & Teksten (2001) "a business model describes the logic of a business system for creating value that lies behind the actual process." Auer & Follack (2002, p. 768) share the same view. Haaker & Faber & Bouwman (2006, p. 646) stress the aspect of network of firms, i.e., "A blueprint collaborative effort of multiple companies to offer a joint proposition to their consumers." Andersson et al. (pp. 1-2) point out the value exchange aspect in their definition with the exact statement that "Relations in a business model are formulated in terms of values exchanged between the actors." Recently, Casadesus-Masanel & Ricart (2010, p. 195) define the business model as "... a reflection of the firm's realized strategy". Teece (2010, p. 179) claims that "a business model articulates the logic, the data and other evidence that support a value proposition for the customer, and a viable structure of revenues and costs for the enterprise delivering that value." Another value creation and capture view comes from Smith & Binns & Tushman (2010, p. 450): "...the design by which an organization converts a given set of strategic choices - about markets, customers, value propositions – into value, and uses particular organizational architecture – of people, competencies, processes, culture and measurement systems - in order to create and capture this value."

On more concrete grounds and with the view to presenting the well known definitions of the term business model, in Table 2.1, we present the various definitions of the mentioned term.

Table 2.1: Definitions of Business Model

Author(s), Year	Definition
Timmers, 1998	The business model is "an architecture of the product, service and information flows, including description of the various business actors and their roles; a description of the potential benefits for the various business actors; a description of the sources of revenues" (p. 2).
Amit & Zott, 2001	The business model depicts "the content, structure, and governance of transactions designed so as to create value through the exploitation of business opportunities" (p. 511).
Weill & Vitale, 2001	"A description of the roles and relationships among a firm's consumers, customers, allies, and suppliers that identifies the major flows of product, information, and money, and the major benefits to participants" (p. 34).
Chesbrough & Rosenbloom, 2002	The business model is "the heuristic logic that connects technical potential with the realization of economic value" (p. 529).
Magretta, 2002	Business models are "stories that explain how enterprises work. A good business model answers Peter Drucker's age old questions: Who is the customer? And what does the customer value? It also answers the fundamental questions every manager must ask: How do we make money in this business? What is the underlying economic logic that explains how we can deliver value to customers at an appropriate cost?" (p. 4).
Campanovo & Pigneur, 2003	"A detailed conceptualization of an enterprise's strategy at an abstract level, which serves as a base for the implementation of business processes." (p. 4).
Morris et al., 2005	A business model is a "concise representation of how an interrelated set of decision variables in the areas of venture strategy, architecture, and economics are addressed to create sustainable competitive advantage in defined markets" (p. 727). It has six fundamental components: i) value proposition, ii) customer, iii) internal processes/competencies, iv) external positioning, v) economic model, and vi) personal/investor factors.
Rappa, 2007	Business models are "the methods of doing business, by which a company can sustain itself, i.e., generate revenue" (p. 1).

Author(s), Year	Definition
Johnson et al., 2008	Business models "consist of four interlocking elements that, taken together, create and deliver value" (p. 52). These are: customer, value proposition, profit formula, key resources, and key processes.
Baden-Fuller & Morgan, 2010	"One role of business model is to provide a set of generic level descriptors of how a firm organizes itself to create and distribute value in a profitable manner" (p. 157).
Casadesus-Masanell & Ricart, 2010	"A business model is a reflection of the firm's realized strategy" (p. 195).
Teece, 2010	"A business model articulates the logic, the data and other evidence that support a value proposition for the customer, and a viable structure of revenues and costs for the enterprise delivering that value" (p. 179).
Osterwalder & Pigneur, 2010	"A business model describes the rationale of how an organization creates, delivers, and captures value" (p. 14).

For ready reference, some similar tables may also be found in the research literature, e.g., Zott & Amit & Massa (2010, p.15), Baden-Fuller & Morgan (2010, p. 158), Al-Debei & Avison (2010, pp. 362-363), and Wirtz (2011, pp. 60-63). Having detailed very relevant visions of the business model, it is now the time to confine the discussion and focus on forming our understanding of the aforementioned term.

Essential terminologies used in definitions of business model

After observing these varied definitions, one can identify many different terms used as the main building block in constructing the definition of business model. These terms reflect the different interpretations of what a business model is or should be, e.g., plan, statement, method, architecture. We now provide an overview of such essential terms, together with the context they appear in different studies. This section also serves the purpose of eradicating the confusion of terminology usage (specifically in case of multiple terminologies pointing towards the same concept).

- **Plan:** Venkatraman & Henderson (1998) define business model as a coordinated *plan*

to design strategy along three vectors: customer interaction, asset configuration, and knowledge leverage.

- **Statement:** A business model is a *statement* of how a firm will make money and sustain its profit stream over time (Stewart & Zhao 2000).

- **Description:** "A business model is a *description* of a complex business that enables study of its structure, the relationship among structural elements, and how it will respond in the real world" (Applegate 2001). "A *description* of the roles and relationships among a firm's consumers, customers, allies, and suppliers that identifies the major flows of product, information, and money, and the major benefits to participants" (Weill & Vitale 2001). "A description of roles and relationships of a company, its customers, partners and suppliers, as well as the flows of goods, information and money between these parties and the main benefits for those involved, in particular, but not exclusively the customer" (Bouwman 2002, p. 3).

- **Structure:** "A business model depicts the content, *structure*, and governance of transactions." (Amit & Zott 2001, p. 511).

- **Method:** The authors in (Afuah & Tucci 2001) use the term *method*, that stands for a system made up of components, linkages between the resources to offer the customers better value than competitors.

- **Representation:** "A business model is a concise *representation* of how an interrelated set of decision variables in the areas of venture strategy, architecture, and economics are addressed to create sustainable competitive advantage in defined markets" (Morris & Schindehutte & Allen 2005, p. 727). On the similar lines (Shafer & Smith & Linder 2005, pp. 200) define business model as "*representation* of a firm's underlying core logic and strategic choices for creating and capturing value within a value network". For (Johnson 2010, p. 22) business model is "*representation* of how a business creates and delivers value."

- **Architecture:** "A business model is nothing else than the *architecture* of a firm and its network of partners for creating, marketing and delivering value and relationship capital to one or several segments of customers in order to generate profitable and sustainable revenue streams" (Dubosson-Torbay & Osterwalder & Pigneur 2002, p. 8). Timmers

(1998, p. 4), on the other hand, defines the business model as "an *architecture* for the product, service and information flows, including a description of the various business actors and their roles."

- **Conceptual tool:** "A business model is a *conceptual tool* that contains a set of elements and their relationships and allows expressing a company's logic of earning money" (Osterwalder 2004, p. 15), whereas (Osterwalder & Pigneur & Tucci 2005, p. 17) take the business model as a *conceptual tool* that allows expressing the business logic of a specific firm. A somewhat similar terminology to defining the business model is used by (Teece 2010, p. 173), where the notion of conceptual tool refers in the first instance to a *conceptual*, rather than a financial, model of a business.

- **Pattern:** When defining the Business Model in terms of a *pattern*, (Brousseau & Penard 2006, p. 82) have conceptually used the term *pattern* as that of organizing exchanges and allocating various costs and revenue streams so that the production and exchange of goods or services becomes viable, in the sense of being self-sustainable on the basis of the income it generates.

- **Set:** For the authors of (Seelos & Mair 2007, pp. 56-57), "Business model is a *set* of activities, like collaboration with strategic partners, building a quality-focused culture from the beginning, etc." Likewise, Laudon & Traver (2008, p. 66) state "a business model is a set of planned activities (sometimes referred to as business processes) designed to result in a profit in a marketplace." Leem & Suh & Kim (2004, p. 78) use the term *set*, too: "set of strategies for corporate establishment and management including a revenue model, high-level business processes, and alliances."

- **System:** Amit & Zott (2012, p. 42) define a company's business model as "a *system* of interconnected and interdependent activities that determines the way the company does business with its customers, partners and vendors."

Point of interest for this research work in the perspective of business model

Business model description in the context of this research work is basically based on the variant of business model concept given in the book *Business Model Generation* written by Osterwalder & Pigneur in 2010. Before we detail the proposed variation to the definition of business

model, we briefly discuss the perception of business model by Osterwalder & Pigneur, who define the term business model as follows (p. 14):

Definition 1. *A business model describes the rationale of how an organization creates, delivers, and captures value.*

The motivation to focus on the above definition of business model comes from the fact that it falls very near to the definition of business model that we propose. A closer look at the mentioned definition results in the following remark, which, we believe, will help the readers to grab the crux of our perception.

Remark 1. *Osterwalder & Pigneur (2010, p. 15) perceive business model like "a blueprint for a strategy to be implemented through organizational structures, processes, and systems." From their previous works, e.g., Osterwalder & Pigneur (2002), we know that they understand business models as "the missing link between strategy and business processes." According to them, the concept of business model could serve as federator. This is shown in Figure 2.2. Osterwalder, later in his dissertation, amplifies this statement as follows, "it can function as a conceptual link, forming a triangle between strategy, business organization and ICT." (Osterwalder 2004, p. 16).*

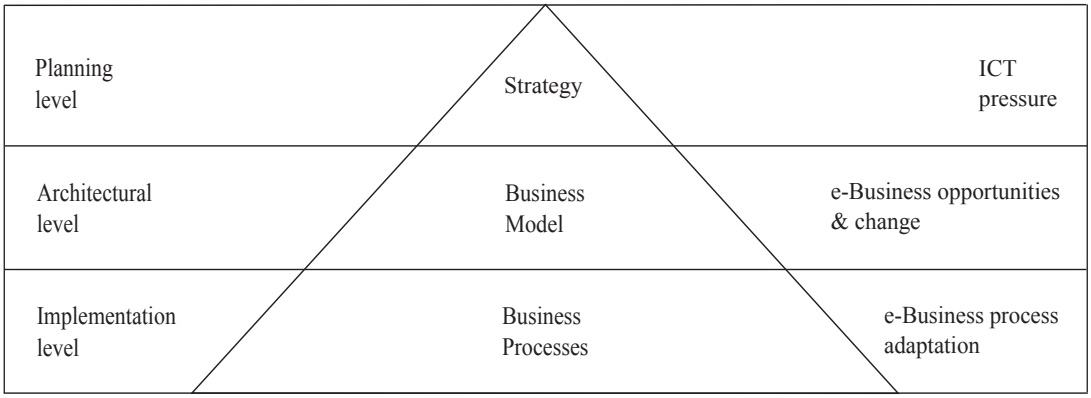


Figure 2.2: Business model as federator - Business model serving as federator between strategy and business processes.

They believe "a business model can be described through nine basic building blocks that show the logic of how a company intends to make money." The nine blocks cover the four main areas of a business.

1. *Customers (who?)*
2. *Offer (what?)*

3. *Infrastructure (how?)*

4. *Financial viability (how much?)*

The first three areas are adapted from Hagel & Singer (1999) and Markides (1999). These four areas can be compared to four perspectives of Kaplan and Norton's works on Balanced Scorecard *(Kaplan & Norton 1996). Table 2.2 presents this relation.*

Table 2.2: Four Business Model Areas vs Balanced Scorecard

Business Model	**Balanced Scorecard**
Customers	Customer Perspective
Offer	Innovation and Learning Perspective
Infrastructure	Internal Business Perspective
Financial Viability	Financial Perspective

Why the proposed Business Model? A few intuitive questions

We now ask ourselves the following basic questions:

- Why does the mentioned concept lie near to our approach?
- Where do we deviate from the concepts detailed in the mentioned work?
- What are the reasons for deviation?
- What gain do we attain with the proposed deviation?
- How generic is the proposed model?
- How can the performance of the proposed model be evaluated?

These questions form the basis for this research work, the answers to which will be discussed over the length of the thesis. However, in this chapter, we elaborate on the most relevant work to the proposed business model in Table 2.3.

Let us consider Table 2.3, which presents an overview about the nine basic building blocks proposed by the Osterwalder & Pigneur in 2010. One will agree to the fact that the nine basic building blocks are a synthesis about the different business model definitions (provided above also by us) and may consist of the following blocks.

Table 2.3: Nine Basic Building Blocks

Business Area	Building Block	Description
Offer	Value Propositions	The Value Propositions Building Block describes the bundle of products and services that create value for a specific Customer Segment.
Customers	Customer Segments	The Customers Segments Building Block defines the different groups of people or organizations an enterprize aims to reach or serve.
	Channels	The Channels Building Block describes how a company communicates with and reaches its Customer Segments to deliver a Value Proposition.
	Customer Relationships	The Customer Relationships Building Block describes the types of relationships a company establishes with specific Customer Segments.
Infrastructure	Key Resources	The Key Resources Building Block describes the most important assets required to make a business model work.
	Key Activities	The Key Activities Building Block describes the most important things a company must do to make its business model work.
	Key Partnerships	The Key Partnerships Building Block describes the network of suppliers and partners that make the business model work.
Financial Viability	Cost Structure	The Cost Structure describes all costs incurred to operate a business model.
	Revenue Streams	The Revenue Streams Building Block represents the cash a company generates from each Customer Segment (costs must be subtracted from revenues to create earnings).

In this section, we provided a detailed discussion over diverging and converging understanding of business model. We also identified essential terminologies used in definitions of business model. We concluded this section by highlighting the need for improvements, which forms the basis for our research work.

2.2.2 Strategy

Strategy states how business should be conducted to achieve the desired goals. It is assumed that without strategy the business management has no roadmap for guidance. Thus it may be taken as core business management function. For successful business management, strategy needs to be frequently reviewed. With the view to elaborating on this important concept, we refer to a well written document by Fred Nickols (2011) on the definition of strategy.

Definition 2. *Strategy comes from the Greek strategia, meaning "generalship" (A Greek-English Lexicon 1940, p. 600). It refers to the art of distributing and applying means to fulfill the end of policy.*

The research literature contains various definitions of the term strategy. In the following, we present a few established of them.

According to Hart (1967), strategy is "the art of distributing and applying military means to fulfill the ends of policy." In this definition, we can easily observe the term "war". The reason for this is that the concept strategy has been borrowed from the military. Hence, Hart discusses wars and battles throughout history in his work. It would be better to delete the term "war" from his definition in order to use the strategy concept for our purpose.

Steiner (1979) stresses the following points for the definition of the concept:

- Strategy is that which top management does that is of great importance to the organization.
- Strategy refers to basic directional decisions, that is, to purposes and missions.
- Strategy consists of the important actions necessary to realize these directions.
- Strategy answers the question: What should the organization be doing?
- Strategy answers the question: What are the ends we seek and how should we achieve them?

Mintzberg (1994a, p. 111) points out that a strategy can be deliberate but also be emergent, i.e., "strategies can develop inadvertently, without the conscious intention of management, often thorough a process of learning." He defines strategy as follows (1994b):

- A plan, a how, a means of getting from here to there.
- A pattern in actions over time, e.g., a company that regularly markets very expensive products is using a high end strategy.
- A position, i.e., it reflects decisions to offer particular products or services in particular markets.
- Perspective, i.e., vision and direction.

Andrews (1997, p. 52), like Mintzberg, emphasizes the terms pattern, plan, and perspective in his definition as follows: *Corporate strategy is the pattern of decisions in a company that determines and reveals its objectives, purposes, or goals, produces the principal policies, and plans for achieving those goals, and defines the range of business the company is to pursue, the kind of economic and human organization it is or intends to be, and the nature of the economic and noneconomic contribution it intends to make to its shareholders, employees, customers. and communities.* He also shows the difference between "corporate strategy" and "business strategy".

Like Seddon et al. (2004, p. 433), we would also like to give seven quotations from Porter (1996, 2001) capturing the gist of the Harvard Business School's thinking on strategy.

1. "Competitive strategy is about being different." (Porter 1996, p. 64)
2. "Strategy is the creation of a unique and valuable position, involving a different set of activities ... different from rivals." (Porter 1996, p. 68)
3. "Strategy is making tradeoffs in competing." (Porter 1996, p. 70)
4. "Strategy defines how all the elements of what a company does fit together." (Porter 2001, p. 71)
5. "Operational effectiveness and strategy are both essential to superior performance, which, after all, is the primary goal of any enterprise. But they work in different ways." (Porter 1996, p. 61)

6. "Operational effectiveness means performing similar activities better than rivals perform them." (Porter 1996, p. 62)

7. "Strategy involves continuity of direction." (Porter 2001, p. 71)

One may clearly conclude that it may potentially be a challenging job to provide clear differentiation between the terms *strategy* and *business model*. This can also be seen in the observable grey areas in provided definitions of these terms. Thus in the following section, we make an effort to differentiate between the two.

For more on the definition of strategy, readers are encouraged to refer to Nickols (2011).

2.2.3 Business Model vs Strategy

Magretta (2002, p. 6) points out the fact that "A business model isn't the same thing as a strategy, even though many people use the terms interchangeably today." To show the problematic distinction between *business model* and *strategy*, Magretta (2002, p. 8) states, "Today, 'business model' and 'strategy' are among the most sloppily used terms in business; they are often stretched to mean everything - and end up meaning nothing."

Besides his various managerial approaches, Porter (2001, p. 73) points out also this vague and confused issue: *The definition of business model is murky at best. Most often, it seems to refer to a loose conception of how a company does business and generates revenue. Yet simply having a business model is an exceedingly low bar to set for building a company. Generating revenue is a far cry from creating economic value, and no business model can be evaluated independently of industry structure.*

Seddon et al. (2004, p. 428) ask the question, which is pictorially given in Figure 2.3, i.e., "In terms of the Venn diagrams in the figure below, which is more correct: A, B, C, D or E?"

They cannot come up with a unique diagram as an answer to their question. The answer depends more on the sets of concepts discussed by the experts on business models and the experts on strategy. Depending on the expert whose concept is used, the answer can be either A or B or C, etc.

A short review of the literature and examining leading authors' definitions of both terms show a lot of overlaps between these two terms. Indeed, "They talk about similar issues, but on a different business layer." (Osterwalder 2004, p. 17).

As the terms are commonly used, strategy seems more concerned with competitive positioning, whereas business models are more concerned with the "core logic" (Linder & Cantrell

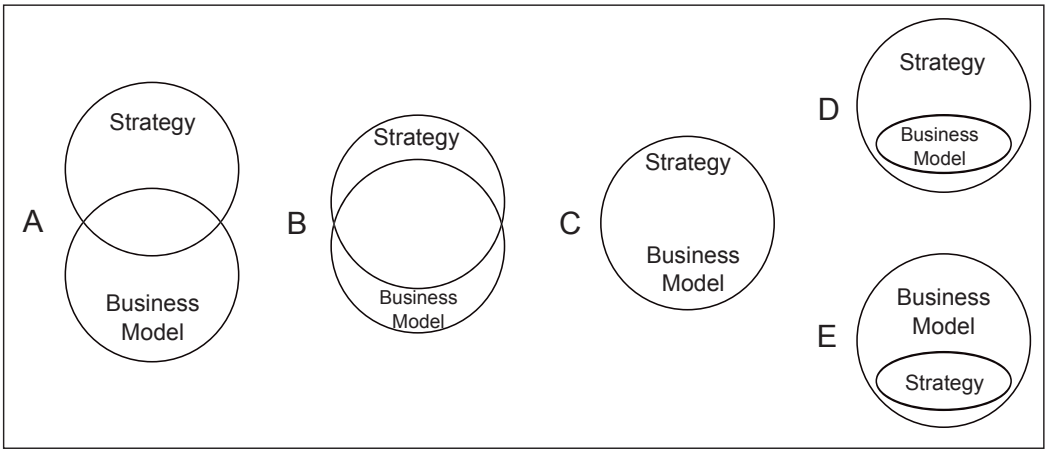


Figure 2.3: Possible overlaps between *strategy* and *business model* - The figure represents different possibilities of overlapping in defining *strategy* and *business model*. As can be seen, there are many answers to the question asked by Seddon et al.

2000) that enables the firms to create value for their stakeholders. It may be the case that people from an information technology background tend to use the term business model more often than those from a management background, who use strategy (Seddon et al., 2004 p. 428).

If we have a look at the definitions of "strategy" given in the earlier section and literature, e.g., Chandler (1962, p. 13), Andrews (1971), Itami (1987), we can easily see that these definitions have much in common. Phrases such as "long-term goals" and "major policies" suggest that strategy has to do with the big decision a business organization faces, the decisions that ultimately determine its success or failure. The idea that strategy "defines ... what kind of company it is or should be" suggests that strategic decisions shape firm's competitive persona, its collective understanding of how it is going to succeed within its competitive environment (Besanko & Dranove & Shanley 2000, pp. 1-2).

Seddon et al. (2004) compared these two terms by choosing Magretta (2002), Weill & Vitale (2001), Applegate (2001), Linder & Cantrell (2000), which were also given by us and are broadly representative of much of the literature on business models, to decide if business models are different from Porter's strategy. At the end of their study, they conclude that viewing the business model as abstract representations of some aspects of various firms' strategy results that a firm's strategy is unique to that firm because it is always firmly anchored in its own particular competitive environment. "A business model can be conceived as an abstraction of a firm's strategy that applies to more than one firm." (Seddon et al. 2004, p. 440). This is

consistent with Magretta (2002).

Magretta's statement (2002, p. 6), "Business models don't factor in one critical dimension of performance: competition. Sooner or later - and it is usually sooner - every enterprise runs into competitors. Dealing with that reality is strategy's job.", combined with Magretta's definition of business model given also in our work results that the diagram D would appear to be the best description of Magretta's view of business models: a business model is a subset of Porter's conceptualization of strategy.

Summing up the above arguments Seddon et al. (2004, p. 440) give the following definition: *A business model outlines the essential details of a firm's value proposition for its various stakeholders and the activity system the firm uses to create and deliver value to its customers. If Porter (1996, 2001) is used to define strategy, a business model may be defined as an abstract representation of some aspect of a firm's strategy. However, unlike strategy, business models do not consider a firm's competitive strategy.*

The view of Tikkanen et al. (2005, pp. 793-794) is like Linder & Cantrell's (2001, p. 13-14) state. According to them, "The function of the strategy is to give meaning and direction to the development of the company's business model." Hence, they see strategy "as the comprehensive pattern of a company's actions and intents, binding together all the components of the business model."

According to Shafer & Smith & Linder (2005, p. 203) one can consider something that a business model is not: a strategy. To illustrate the difference between a strategy and a business model, they use the metaphor of a construction of a custom home. At the beginning, the architect consults with the future homeowners to understand how they envision their home finished and creates a design to fulfill their vision. The claim here is that this corresponds to the strategy. Subsequently, the architect prepares a detailed floor plan based on the choices made during the design process, and this corresponds to a business model. So, a business model can be used to help analyze and communicate strategic choices.

Richardson (2008), like Shafer & Smith & Linder (2005, p. 203), claims that a business model is not a strategy. Moreover, it helps to "simplify and clarify the fit between the elements of execution and the strategy." Business model explains how the activities of the firm work together to execute the strategy.

According to Teece (2010, p. 172), a business model defines how a firm delivers value to customers, entices customers to make payments, and converts customers payments to prof-

its, and is more generic than a strategy (2010, p 179). This means a business model can be associated with several strategies.

Recently, Casadesus-Masanell & Ricart (2010) argue that a firm's business model is a reflection of its realized strategy. Little is gained from separating the concepts when strategy maps one-to-one onto business model, which is observed in simple competitive situations. The substantive difference arises when the firm's contingent strategy calls for business model modification. They distinguish and relate the concepts strategy, business model and tactics as follows:

- Business model refers to the logic of the firm, the way it operates and how it creates value for its stakeholders.
- Strategy refers to the choice of business model, through which the firm will compete in the marketplace.
- Tactics refers to the residual choices open to a firm by virtue of the business model it chooses to employ.

They developed a generic two-stage process framework, which integrates these three concepts as depicted in Figure 2.4. They give the analogy of a car to make their concept to be understood easier, i.e., the design and the building of the car as representing strategy; the car itself as the business model; and the driving of the car as the available set of tactics.

Figure 2.4: Generic two-stage competitive process framework - The figure represents that the object of strategy is the choice of business model, and the business model employed determines the tactics available to the firm to compete against, or cooperate with, other firms in the marketplace.

Also Dahan et al. (2010, p. 328) distinguish a business model from a strategy. According to them, "a strategy can broadly be understood as a description, plan or process for how to move from the current situation to a desired future state." In contrast to that, "a business model is a description of a state."

George & Bock (2011, p. 102) compare the two concepts as depicted in Table 2.4. According to them, "implementing a business model may generate organizational change, but the business model itself is not a description or recipe for change".

Table 2.4: Business Model - Strategy Comparison according to George & Bock, 2011

Business Model	**Strategy**
Static configuration of organizational elements and activity characteristics	Dynamic set of initiatives, activities, and processes
Inherently nonreflexive	May be reflexive, initiating change within the organization that impacts the emergent strategy
Opportunity centric	Competitor or environment centric
Organization's configurational enactment of a specific opportunity	Process of optimizing the effectiveness of that configuration against the external environment, including the potential to change the configuration, alter the underlying opportunity, or seek out new opportunities

Rosenberg et al. (2011) point out that a business model is not a strategy. They believe that the separation of model from strategy is the strength and weakness of the business model concept. Because of the reason that "the business model is the product of the strategy, a business model can only be as strong as your strategic business objectives, critical success factors, and key performance indicators. They refer to Porter's influential strategic framework and value chain framework for the primacy of how the strategy does and should interlink the business model (Porter 1979, 1980, 1985, 1996, 2001; Porter & Kramer 2006).

2.2.4 Business Plan

Business plan is a decision tool. It has become a must for every enterprise planning to apply financial support by banks or investors. Honig & Karlsson (2004, p. 29) define a business

plan as "a written document that describes the current state and the presupposed future of an organization." Without a well prepared business plan, it is almost impossible to convince the financial institutions or venture capitalist for strategic business partners. As Rich & Gumpert (1985, p. 156) state, "without a plan furnished in advance, many investor groups won't even grant an interview." According to Robert Krummer Jr. (n.d.), "the business plan is a necessity. If the person who wants to start a small business can't put a business plan together, he or she is in trouble." However, we should not forget that "writing business plans are not a necessary condition for starting up a business. Businesses were successfully starting up before business planning first became popular to new businesses in the 1970s... Famous start-up entrepreneurs who did not write a business plan before starting their businesses include Bill Gates, Steve Jobs, and Michael Dell." (Karlsson & Honig 2009, p. 28)

As Timmons (1980, p. 28) admits, "The development of a business plan is neither quick nor easy. Properly preparing a business plan can easily take several hundreds of hours. Squeezing that amount of time into evenings and weekends can make the process stretch out between 6 to 12 months."

There is no fixed content for a business plan. The content and format of the business plan are mostly structured by the institutions to whom the business plan will be submitted. The business planner adapts the business plan according to this template. According to Harvard Business School (HBS Press-Pocket Mentor, 2007), a business plan has the following typical structure: i) Cover Page and Table of Contents, ii) Executive Summary, iii) Business Description, iv) Business Environment Analysis, v) Industry Background, vi) Competitive Analysis, vii) Market Analysis, viii) Marketing Plan, ix) Operations Plan, x) Management Summary, xi) Financial Plan, xii) Attachments and Milestone.

The U.S. Small Business Administration (SBA) recommends a business plan template including the following components: i) Table of Contents, ii) Executive Summary, iii) Business Description and Vision, iv) Definition of the Market, v) Description of Products and Services, vi) Organization and Management, vii) Marketing and Sales Strategy, viii) Financial Management, ix) Appendices.

The components given by HBS and SBA may be extended or detailed by the following items and some more, which can be found in many resources that are easily accessible on the Internet: i) Management Team, ii) Personal Financial Statement, iii) Implementation Plan.

Let us now take the readers through an interesting journey of briefly comparing the business plan and earlier discussed business model. It is important to highlight the gains expected by

the cohesive impact of these two (i.e., business model and business plan) in a decision support tool.

On the contrary to the business plan discussed above, the business model is a simplified description of how a company does business and makes money without having to go into the complex details of all its strategy, processes, units, rules, hierarchies, workflows, and systems, while business plan provides very detailed data. In Table 2.5, we summarize the distinctive parameters of business model and business plan.

Sections like Executive Summary and Appendix are not a part of a business model. Nevertheless, an executive summary would be given when someone explains her/his business model. An appendix would also be useful for a business model. An important remark is the Competitive Analysis, which is part of Business Plan but is not an element of business model. This should be analyzed very carefully, because it plays a very decisive role in the success of a product at the market.

Blank (2010) emphasizes the static property of a plan and the dynamic property of a model, "a business model describes how your company creates, delivers and captures value. It's best understood as a diagram that shows all the flows between the different parts of your company. A business model is designed to be changed rapidly." A startup has to draw and test the business model first, the business plan then follows. According to Mühlhausen (2010), if the business model is outstanding you do not need a business plan, "all the planning in the world cannot fix a flawed model."

Osterwalder (2009) explores the close relationship between business model and business plan. "When you have designed and thought through your business model, you have the perfect basis for writing a good business plan." He suggests structuring the business plan into following sections: i) the team, ii) the business model, iii) financial analysis, iv) external analysis, v) implementation roadmap, vi) risk analysis. For Osterwalder, business model itself is also a separate part of the business plan. Other parts of the business plan can be structured around the business model section.

We believe, business models can be used as a control mechanism for business plans. As Sahlman (1997, pp. 98) claimed in his paper about writing a great business plan, most business plans "waste too much ink on numbers and devote too little to the information that really matters to intelligent investors." Business plans should include some numbers. However "those numbers should appear mainly in the form of business model that shows the entrepreneurial team has thought through the key drivers of venture's success or failure."

Table 2.5: Business Model vs Business Plan

Business Model (Business Model Canvas simplified)	**Business Plan**
Value Proposition	Product / Service Line
	Business description
Customer Segment	Market Analysis
	Marketing and Sales Strategy
Channels	Market Analysis
	Marketing and Sales Strategy
Customer Relationship	Market Analysis
	Marketing and Sales Strategy
Key Resources	Company Description
	Management
Key Activities	Operations Plan
	Marketing and Sales Strategy
	Product / Service Line
	Management
Key Partners	Business Environment Analysis
	Operations Plan
Revenue Streams	Financials
	Market Analysis
	Marketing and Sales Strategy
Cost Structure	Financials
	Market Analysis

As we have shown above, both concepts have many common elements. Based on these similarities, a tool can be developed that tells automatically whether a business plan is structured truly and vice versa. There is a reciprocal relationship between business model and business plan. If we have a complete business plan, we can derive the related business model. That way, we can also check the business model's correctness. After giving the business plan, the respective business model can be derived based on any business model framework. Thus it can be analyzed whether the business model is correct. If not, the required modifications should be carried out and the results should be reflected into the business plan.

The objective would then be, given a business idea, finding out if a business model would work properly. For this purpose, following steps should be taken:

1. Reflect the business idea into a business model framework.
2. Develop and sketch out the business model using the framework.
3. Determine the parts of the business plan. This should be done in accordance with the business model of your business.
4. Run a check from business model to business plan and vice versa.

Interpretation of the results depends on the stage of the service life cycle, in which the system is employed. Before service development, results from the tool may indicate a *Go* or *Not Go* decision to proceed with or stall investment in a potential service. During service development, results may influence design decisions. Even after development and marketing, the system may be used to continually improve a mobile service or to plan a smooth withdrawal. We will not go into further details about business model - business plan relation and regarding research possibilities in this work. Nevertheless, we have to stress that this relationship is worth analyzing and has not been investigated sufficiently.

2.2.5 Dynamic Aspects in Business Models

The current era where business environment is changing extremely fast, which can hardly be followed by static business models, motivates us to consider the dynamic aspects of business model.

As Linder & Cantrell (2000, p. 10) point out, most firms' business models are under constant pressure to change. Innovations in technology, changes in the law, competitive moves,

or shifts in consumer tastes can affect an operating model's profitability. In response, firms tweak, twist, and totally revamp their business models in a wide variety of ways.

MacInnes (2005) and Bouwman & MacInnes (2006) examine business model dynamics to determine how technological, regulatory, and market changes affect transition in business models. Their framework can be seen in Figure 2.5. They ask the following question: "how do companies adapt their business models when they no longer adequate?"

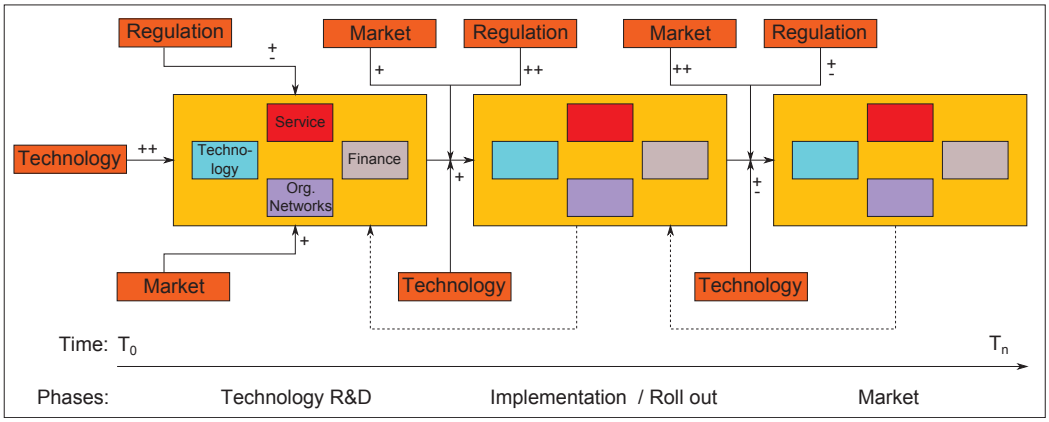


Figure 2.5: Dynamic business model framework for value webs - The figure depicts Bouwman & MacInnes' framework for business models that identifies different phases. The phases seem to be linear. Nevertheless, it is clear that the feedback loops, represented with dotted lines, play an important rule. These feedbacks are crucial if the business models do not function as planned. Furthermore, the dynamics play an important role not only between the different phases, whilst transiting from one to another, but also between and within four domains that constitute a business model.

The first phase of the framework is dominated by R&D and technology. In the second phase roll-out technology becomes more relevant. In the third phase, market adaptation gradually spreads and day-to-day exploitation, operations, and maintenance are key activities.

For the authors, at first technology is the most important driver for the development of the business models. However, technology development alone is not expected to drive changes. In general, there are correlations between technology developments, market response, and regulatory regimes. Both market developments and regulation can also trigger opportunities for the development of new product and services. Changes in market conditions or regulation enable opportunities of defining new product and services. These new products and service definitions must fulfill new customer needs as well as underlying business models. The basic questions concerning technology are as follows:

- How do technical systems support the service?
- How does it make the service available?
- What is the basic architecture?

Organizational issues deal more with strategy, giving raise to the following questions:

- How does the service fit within existing strategies?
- Are the selected providers of technology really adding value?

On the similar lines the investment relevant questions include:

- Are partners prepared to invest or should outside funding being sought?
- What are the expectations about revenues and how to share these among the involved partners?

These decisions are based on more than costs and benefits as calculated through net present value, or internal rate of return. Intangible and strategic benefits also have to be considered. In the roll out phase, the service the product or service complies with regulation with regard to issues such as fair competition, telecommunication regulation, privacy, intellectual property rights, and content regulation. The transition from the roll out to the exploitation phase will be decided upon market acceptance.

In the mature phase of service and a business model question with regard to the value being delivered, customer satisfaction and retention of customers become relevant. The issues in the technology domain are update of software, applications, operations, and maintenance. Organizational issues deal with process optimization, and on operational management. The relevant issues in finance domain are revenue generation on basis of commercial exploitation, maintenance, and operation costs, and orientation to effectiveness and cost reduction. de Revuer & Haaker & Bouwman (2007) summarize the above approach:

- Technology drivers are most relevant in the Technology / R&D phase, decreasing to medium in the second and low in the third phase.
- Market drivers are most relevant in the Market phase and less in phase 2 and 1.
- Regulation drivers are most important in the Implementation & Roll-out phase, and less in the first and third phase.

After demonstrating that "instead of killing themselves over the killer application, executives should be looking for proper business models that address the specific needs of various markets", Soudoplatoff (2003) describes how the business models should be designed dynamically and changed. The process consists of the three steps given in Figure 2.6.

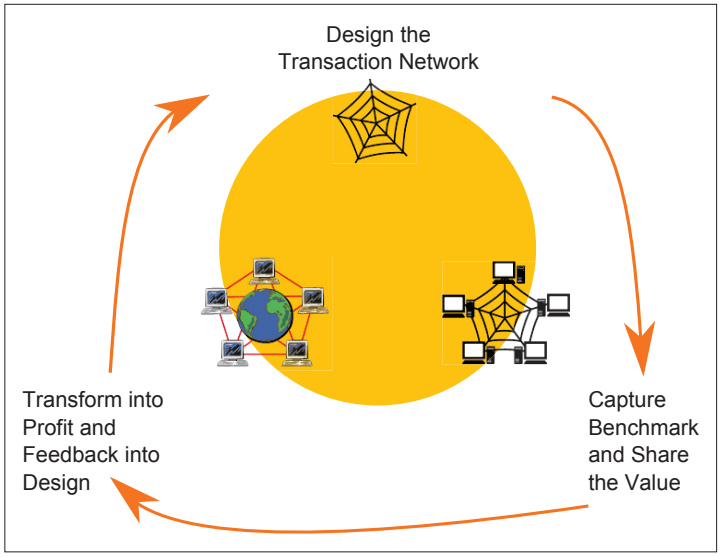


Figure 2.6: Dynamic Transaction Network - The figure shows that, according to Soudoplatoff (2003, p. 5), the process of designing business models and changing them requires three steps, i.e., i) designing the transaction network: identifying groups of people with common needs (the communities of interest), ii) capturing, benchmarking and sharing the value, iii) transforming into profit and feedback redesign.

Soudoplatoff (2003) claims that success is the combination of a good understanding of the business model, i.e., "with whom to partner in order to quickly deliver the proper services to a community or an enterprise and the proper pricing and rewarding, and the use of proper tools to manage this new economy."

Dawson (2007) points out the dynamism in business; with his *R5 Business Model*, "every phase of the business cycle begins with the letter R", i.e., i) research, ii) release, iii) reward, iv) reinvest, iv) review.

In addition to aforementioned scholars, Winter & Szulanski (2001) have also included dynamism in their analysis. They identified the need for the business model to change at different phases of the replication strategy's life cycle and internationalization. "Business model is typically a complex set of interdependent routines that is discovered, adjusted, and fine-tuned by doing." (Winter & Szulanski 2001, p. 731).

2.3 The Need for a New Business Model Evaluation - A Summary

In this section, we summarize the facts, claims, and motivational drivers of this work.

Business model evaluation domain has not been investigated sufficiently. Although there have been many research on business models, e.g., defining business model, taxonomy of business models, decomposing business models into its constituents, ontology, design tools; the evaluation of business models, especially before they are introduced to the market, is still an area that has not been sufficiently investigated (as advocated from the background present in earlier sections).

Let us strengthen our earlier comment by quoting the failure cases in the IT domain, which resulted due to dot com (.com) boom in the beginning of 2000. The market of Information and Communication Technologies is already flooded with unsuccessful services, with only a few successful offerings standing out from the mass of competition. This imbalance is largely due to the "trial and error" approach to business testing employed by the majority of market participants. Unfortunately, the luxury of failure has now become a thing of the past. A more scientific approach to evaluating businesses must be utilized if costly failures are to be avoided. This requires a methodology for describing and evaluating business models. This methodology and its associated processes should be detailed enough to give sufficient confidence in the results of the approach, yet general enough to be applied to many types of businesses.

It is of vital importance to know if money can be earned by using a business model. Only by knowing this, a business can survive. Using a tool for evaluating a business model introduces a new level of detail and accountability to the process of developing and introducing new businesses, which has thus far been dictated by a trial and error approach, which we stated above. Threats should be identified and systematically addressed before, during, and after the deployment of new businesses to turn them into opportunities. This in turn forces the decision maker to recognize problems and risks early, as well as unexploited advantages in the business model. An automatic and intelligent framework will allow people to minimize misguided decisions, develop successful businesses and introduce them to the market and ultimately recover the investments done.

In the coming parts of our work, we are going to describe a business model evaluation framework that serves as the basis for evaluating the feasibility of a business model, and if required, recommends modifications in the business model that is used. Hence, our business

model evaluation framework will function not only as an evaluation framework but also as a decision support framework.

2.4 Business Model Evaluation Concepts

To attain the quantifiable perception of a given business model, one has to undergo the business model evaluation process. In general, for evaluation, it is necessary to conduct a systematic and structured process. Such evaluation process starts with the determination of evaluation objectives. Based on the objective(s), a suitable evaluation approach and suitable evaluation methods have to be chosen. One may discern two abstract consequences of the evaluation process: i) evaluation process is necessary prior to the realization of a particular business model vision. This allows comparing various business model alternatives with respect to their effectiveness and efficiency. ii) having already realized business model evaluated, one may know the pitfalls and adapt the approaches to improve the business.

In this section, we focus on illustrating some evaluation concepts for evaluating business models. Having extensively analyzed the research literature, we believe that *business model evaluation* domain has not been investigated sufficiently. Although the literature advocates appreciable amount of research work carried out in defining business model, identifying its components, and classifying them, the business model evaluation research dimension still lags behind. By the business model evaluation concept, we mean proposing the generic evaluation function and extensively developing the easy to use software tool based on the proposed evaluation function. Our proposed function is multi-dimensional, and indices of critical/non-critical parameter categories and inter-block dependencies differentiate it from the other evaluation approaches that are discussed later in this chapter. More details on this concept may be found in Section 3.6.

2.4.1 Evaluating Business Models using SWOT

Osterwalder & Pigneur (2010, pp. 212) outline two types of assessments. Firstly, they provide a big picture assessment using their Business Model Canvas. Secondly, they use a set of checklist for assessing a business model's strengths, weaknesses, opportunities, and threats (SWOT) and to help evaluate each Building Block. They point out that "assessing a business model from a big picture perspective and assessing it from a Building Block perspective are complementary activities."

As an example, we provide the Value Proposition Assessment in Table 2.6 to give an idea how the tool looks like. The table depicts the assessment of an individual block, in this case Value Proposition. As can be seen, the block is evaluated from different aspects and can get values between +5 and -5. The importance of the specific block to the business model and certainty of evaluation are also taken into account.

Table 2.6: Detailed SWOT Assessment of Value Proposition

Value Proposition Assesment		+	—		
Importance to my B.M. 1-10	Our Value Propositions are well aligned with customer needs.	5 4 3 2 1	1 2 3 4 5	Our Value Propositions and customer needs are misaligned.	Certainity of evaluation 1-10
	Our Value Propositions have strong network effects.	5 4 3 2 1	1 2 3 4 5	Our Value Propositions have no network effects.	
	There are strong synergies between our products and services	5 4 3 2 1	1 2 3 4 5	There are no synergies between our products and services.	
	Our customers are very satisfied.	5 4 3 2 1	1 2 3 4 5	We have frequent complaints.	

2.4.2 Evaluation Tool for e-Business Models

Horsti (2007) presents an evaluation tool for e-business models based on critical success factors gathered from a literature review on management research and an empirical study on five e-business models from different industries. The management research consists of business model framework, critical success factors, and life cycle model literature.

In his tool, Horsti adopts the categorization of Hedman & Kalling's framework as a basis. Hedman & Kalling (2003) propose a generic business model, which includes seven components that are causally related: customers, competitors, offering, activities and organization, resources, supply of factor and production input, and management scope. The first six components are cross-sectional and can be studied at a given point in time. The management scope is included to cover the dynamics of the business model over time, and the cognitive and cultural constraints that managers have to cope with.

His literature review resulted 188 critical success factors from 48 references of academics. Additionally, 70 factors were obtained from interview with 17 interviewees. Subsequently, by synchronizing all gathered factors the number of factors was reduced to 57. 42 of them were

accepted to be prerequisites of success and the rest 15 measures of success. The prerequisites of success were categorized under seven e-business model components given above. This design can be seen in Figure 2.7.

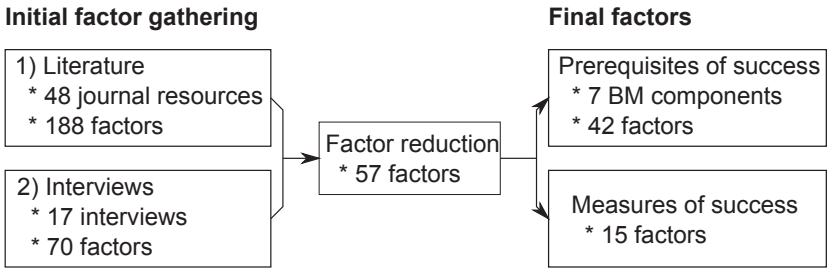


Figure 2.7: Study design - As can be seen, 57 factors are gathered from literature and interviews, which are then grouped as prerequisites and measures of success.

After the design is complete, each success factor gets a quantitative value, after having been prioritized and put in an order according to its importance. If a success factor is bigger than a pre-determined threshold value, then this business model is good regarding that specific success factor. By using the tool regularly, it is possible to follow up the development of business model after a defined period. Likewise, a comparison can be made to competitor's business model. Readers may find the evaluation tool and an illustration of its usage in Table 2.7. The table illustrates 57 factors, defines their states on numeric scale from -3 to $+3$. The business is evaluated, target business evaluation is highlighted, and the competitor's business model evaluation is shown.

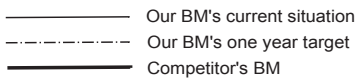
2.4.3 Scoring System

Wohltorf's tool (2005) "Scoring-Model for Success Evaluation of Ubiquitous Services" is also an evaluation tool for services, which functions using the same logic as Horsti's tool given above. In his work, Wohltorf considers three domains, to which the success factors can be allocated: user, competition, and technology. He names this basis as "Mobile Innovations Triangle". As proof-of-concept for his model, an experimental mobile service for the entertainment domain, BerlinTainment, was introduced and evaluated using the tool.

As can be seen in Figure 2.8, each of the three success dimensions forks again in three subcategories. In the figure, we have merely shown the first two layers of the Mobile Innovations Triangle. Nevertheless, the sub-categories can also be refined further, e.g., the category segmentation can be forked in age, gender, nationality, occupation, education, household income,

Table 2.7: Evaluation Tool for E-Business Models

		State of the factor						
A) Prerequisites of Success Factors								
1) Customer Component		-3	-2	-1	0	+1	+2	+3
A1	E-business related customers are recognized							
A2	E-business related customers have an ability for increased independence							
…	…							
A12	IT security is guaranteed for the e-business model related customer							
2) Competition Component		-3	-2	-1	0	+1	+2	+3
A13	Decisions regarding the competitive strategy of e-business model are evident being either cost leadership or differentiation strategy							
3) Offering Component		-3	-2	-1	0	+1	+2	+3
A14	E-business model related offering is easily and geographically widely accessible							
…	…							
A22	The range of e-business model related offering is large							
4) Activities and Organization Component		-3	-2	-1	0	+1	+2	+3
A23	E-business model and its offering has a strong brand							
…	…							
A32	E-business model related organization has an ability to solve e-business model related problems efficiently							
5) Resources Component		-3	-2	-1	0	+1	+2	+3
A33	E-business model related personnel is highly experienced and possesses good capabilities and skills							
…	…							
A35	E-business model related software and hardware are stabile							
6) Suppliers Component		-3	-2	-1	0	+1	+2	+3
A36	E-business model related management accomplishes well networking and partnering relations							
A37	E-business model related operations achieve trust among its business partners							
7) Scope of Management Component		-3	-2	-1	0	+1	+2	+3
A38	E-business model related management handles the multi-channel environment including both the traditional and electronic channels							
…	…							
A42	E-business model related management acknowledges both cultural and generational differences when developing its e-business							
B) Measures of Success Factors		-3	-2	-1	0	+1	+2	+3
B1	E-business model related customers are satisfied							
B2	E-business model related customers are loyal							
…	…							
B15	E-business model related business has good return on investment							



marital status. We will not go into these details because this would go beyond the scope of this work.

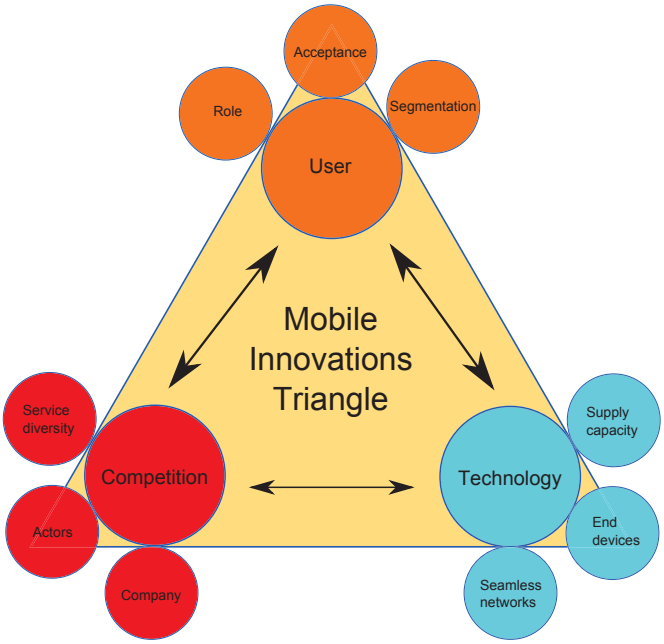


Figure 2.8: Mobile Innovations Triangle - The figure highlights the decomposition of three domains into sub-categories. However, the approach claims further decomposition into many other sub-layers.

After determining the adequate success factors, Wohltorf's tool gives quantitative values to these factors and weights them according to their importance. If the overall value is bigger than a threshold, then the business model is deemed successful. It is an MS-Excel based tool. Table 2.8 exemplifies his evaluation tool filled with points and weights. As can be seen, the factor User is evaluated with 1.94, Competition with 2.21, and Technology with 1.31. Since these three factors are weighted equally, i.e., $1/3$, the overall weighted value is 1.82, which is the arithmetic mean of the three points. The examined business is evaluated as good because this value is between 1 and 2.

2.4.4 Profit Sheets and What-if Scenarios

This evaluation approach from Gordijn & Akkermans (2001a, pp. 16) takes the net in and out flows of value objects into account. It consists of the following steps.

1. Creating profit sheets based on either actor or activity level,

Table 2.8: Scoring Model

Scoring Model for BerlinTainment						
Success Factor	***Good 1-2***	***Middle 3-4***	***Bad 5-6***	***Point***	***Weight factor***	Check
User	User requirements fulfilled	User requirements partially fulfilled	User requirements barely fulfilled	**1,94**	0,33	1,00
Acceptance	High user acceptance expected	Satisfactory user acceptance expected	User acceptance barely expected	**1,85**	0,40	1,00
Incentive	Satisfaction of new needs	Clear enhancement of satisfaction of existing needs	Slight enhancement of satisfaction of existing needs	**2**	0,50	1,00
Mobility	Strong delivery of movement freedom, ubiquitous service experience	Partial movement freedom and ubiquitousness fulfilled	Slight delivery of movement freedom and little ubiquitousness	2	0,20	
Efficiency	Usual tasks can be carried out very faster and cheaper	Usual tasks can be carried out a little bit faster and cheaper	Usual tasks can be carried out barely faster and cheaper	1	0,15	
Spontaneity	High level of spontaneity, open communication	Partial enhancement of spontaneity and open communication	Barely influence of spontaneity and open communication	1	0,05	
…	…	…	…	3	0,05	
…	…	…	…	3	0,15	
…	…	…	…	1	0,20	
…	…	…	…	4	0,10	
…	…	…	…	2	0,10	
Requirements	Using requirements fulfilled	Using requirements limited fulfilled	Using requirements barely fulfilled	**1,7**	0,50	1,00
Usability	Expected functionalities in retrievable from available	Expected functionalities in retrievable form limited available	Functionalities are unexpected	1	0,20	
Privacy	No storage of user data and strong protect and control mechanism	Slight storage of user data and strong protect and some control mechanism	Exact user profiling and little protect and control mechanism	2	0,05	
…	…	…	…	3	0,15	
…	…	…	…	2	0,15	
…	…	…	…	1	0,10	
…	…	…	…	2	0,20	
…	…	…	…	1	0,15	
Segmentation	Very detailed segmentation possibilities, homogene user groups	Little segmentation possibilities, differentiable user groups	No segmentaion possibilities, heterogene user groups	2	0,30	
Role	Basically everybody is potential user	Specific sub-group	Only very special user roles	2	0,30	
Competition	Competition requirements fulfilled	Competition requirements partially fulfilled	Requirements barely fulfilled	**2,21**	0,33	1,00
Service diversity	Very interesting market	Interesting market with some limitations	Not interesting market	**2,33**	0,40	1,00
Market entry barriers	Exclusivity of contents, network access, or customer relations	High market entry barriers	Low market entry barriers	2	0,33	
Unique selling prop.	Complementary to competitors' services	Better than competitors' service	Substitutes exist	2	0,33	
Segmentation	Covering many service segments and international usage	Covering some segments, and regional and national usage	Small special market	3	0,33	
Actors	Important part of value creation	Significant own part in value creation	Barely own part in value creation, reselling of existing services	1	0,30	
Company	Prerequisites are ready	Prerequisites are partially ready	Prerequisites are barely ready	**3,25**	0,30	1,00
Product portfolio	Complimentary of existing services, all necessary components available, new configuration of an existing system	Independent from existing services, partially new creation or change of components, similarity zu existing systems	Cannibalization of existing services, tedious new creation of components necessary, new system concept necessary	1	0,25	
Market leader bonus	Market leader, wide customer source	Well-known brand, existing customer source	Not-known brand, small customer source	5	0,25	
…	…	…	…	3	0,25	
…	…	…	…	4	0,25	
Technology	Technology requirements fulfilled	Technology requirements partially fulfilled	Technology requirements barely fulfilled	**1,31**	0,33	1,00
Seamless networks	All necessary networks available, network independent provision possible	Necessary networks limited available, network independent provision limited possible	New network necessary, network independent provision impossible	**1**	0,40	1,00
WLAN	Not necessary for service functionality	Not directly necessary for service functionality	Necessary for service functionality	1	0,20	
UMTS	Not necessary for service functionality	Not directly necessary for service functionality	Necessary for service functionality	1	0,20	
…	…	…	…	1	0,20	
…	…	…	…	1	0,20	
…	…	…	…	1	0,20	
End devices	No device limitation exists, full device independent provision	Small device limitation exists, partial device independent provision	Device limitation exists, no device independent provision	**1,45**	0,40	1,00
Screen size	Not critical for service usage	Better service via bigger screen	Usable only from a certain size	2	0,10	
Screen colour	Not critical for service usage	Better service via wider colours	Usable only from a certain colour range	2	0,10	
…	…	…	…	2	0,10	
…	…	…	…	1	0,05	
…	…	…	…	1	0,05	
…	…	…	…	1	0,10	
…	…	…	…	1	0,10	
…	…	…	…	1	0,05	
…	…	…	…	1	0,10	
…	…	…	…	1	0,10	
…	…	…	…	2	0,15	
Supply capacity	Supply capacities available	Suply capacities partially available	Suply capacities barely available	**1,67**	0,20	1,00
Storage capacity	Not critical processor performance of supply server, equal usage	Processor performance of supply server is partially available, foreseeable volatilities	Processor performance of supply server barely fulfilled, not equal edges	3	0,33	
Channel cap.	…	…	…	1	0,33	
…	…	…	…	1	0,33	
			Weighted point	**1,82**		1,00

2. evaluating the objects in the profit sheet in terms of their cost and benefit to the participating actors, and

3. evaluating what-if scenarios.

They point out that a sensitivity analysis can also be performed for the business idea under consideration by, "Valuing the objects and by making reasonable assumptions." Their evaluation tool is based on the conceptual modeling approach, what they call the e^3-value ontology. The proposed ontology borrows many various business terms, e.g., actors value exchanges, value activities, value objects. Using these notions, the ontology models the networked constellations of enterprizes and end-consumers.

2.4.5 An Example from Practice - Business Model Evaluator

The instrument Business Model Evaluator developed by Business Model Institute (`http://businessmodelinstitute.com/`, retrieved in December 2012) considers eight essential areas to business model. According to them, a business model must have the following properties; i) excellent margins, ii) easiness to sell, iii) the Four Capitals©: Intellectual Capital, Financial Capital, Human Capital, and Brand Capital, iv) ability to maintain ongoing competitive advantage, v) quality customers, vi) longevity of the industry, vii) it must provide for the owner's graceful exit, viii) it must avoid pitfalls. Based on these criteria, questions are asked and the business model is evaluated relying on the score, which is obtained by the answers given. The score ranges from zero to 1040.

2.4.6 Comparison among the Evaluation Systems

In this section, we present the comparison study of the aforementioned evaluation systems and tools. With this comparison, we highlight the shortcomings of the available approaches and set the targets for the proposed evaluation model.

Osterwalder & Pigneur's evaluation is carried out by using SWOT analysis. They ask questions for each building block in Business Model Canvas. They answer the questions by giving quantitative values from +5 to -5 to the individual strength and weakness points. They also quantify their importance to the business model and the certainty of evaluation between 1 and 10. However, they do not show how this should be done. It is also not possible to see how the output of the assessment would look like. Simplicity is an advantage of their

evaluation. Nevertheless, its very openness offers little direction concerning which aspects of an organization to analyze.

Horsti's evaluation method is explained mainly above. A very important feature of his method is that the success factors are analyzed very deeply. It is clear how they are gathered. Like Wohltorf, he also gives quantitative values to individual success factors and uses threshold, but unlike him, he does not give weights to the values. Another difference is that the tool uses no success factor hierarchy but a flat list of success factors that are categorized under business model components. In second part of the tool, measures of success factors are listed, through which a profitability check can be done. His evaluation criterion is comparison of current business model to own target as well as to competitor. The problematic issue of ignoring the relation between success factors is relevant for Horsti's tool. Although the generic business model of Hedman & Kalling (2003) must have causal inter-relations between the elements, which is a characteristic vital to any real model, it cannot be seen in Horsti's evaluation tool. Another weak point is that the evaluation is based on only one business model.

Wohltorf does not base his scoring system on a sound underlying model. He merely comes up with three domains, which include all as relevant considered and unstructured success factors that are extracted from secondary and partially primary analysis. However, the answer to the question, what these secondary and primary analyses are, is not clear. Moreover, an internal survey is taken into account in determining the success factors, which is far from being reliable.

Gordijn & Akkermans base their evaluation of business models on e^3-value ontology, i.e.,"a value model which shows actors who are exchanging things of economic value with each other" (Gordijn & Akkermans, 2003a). A number of concepts, relationships, and rules are identified to express such a model. The model focuses on the analysis of the expenses and benefits of the e-commerce idea to all actors involved. The elements and relationships encompass the actor, value object, value port, value interface, value activity and value exchange of a business model (Gordijn & Osterwalder & Pigneur, 2005). Additionally, the dependency, connection, stimulus, and "and" and "or" connections between the elements are modeled. Their evaluation criterion is economic feasibility of an e-business model, which means that all actors involved can make a profit or increase their economic utility. They consider the net in and out flows of value objects. The difference between them should be sufficient to cover all other expenses. Consequently, a profitability check is possible. Unlike other evaluation tools, Gordijn & Akkermans do not use success factors.

Inspired by the view of Pateli & Giaglis (2003), "the basis for an evaluation can be derived from the e-business model components", Horsti bases his business model evaluation on a generic e-business model framework, i.e., Hedman & Kalling (2003), including seven e-business model components, which were explained before in this work.

The method of Gordjin & Akkermans is realistic because, as given above, the relations and dependencies between components of the e^3-value ontology are taken into account. Their evaluation starts by creating profit sheets. Secondly, the objects in the profit sheets are evaluated in terms of their cost and benefit to the participating actors. Consequently, what-if scenarios can be done. What-if scenarios are used to determine the effects of different costs or investments on profit and other financial indicators. Companies may use what-if scenarios to analyze the financial effects of different pricing models, number of employees, etc. By this scenario-based evaluation a sensitivity analysis can be performed. However, the difficulty of finding a generic scenario for all business models cannot be overseen, which is a problem of this evaluation method.

Wohltorf, in his tool, gives quantitative values from 1 to 6 to success factors. $1-2$ are good, $3-4$ are middle, and $5-6$ are bad. These values are weighted, and the three main domains become the average value of the regarded success factors. The values of three main domains are also weighted and the overall value comes out. If the ultimate value is smaller than the threshold value 2, it is accepted to be good. The problem here is the difficulty of finding proper threshold value that realizes the successful business model. Wohltorf's classification of success factors is hierarchical, e.g., 1^{st} level User, 2^{nd} level Acceptance, 3^{rd} level Incentive, 4^{th} level Mobility... This top-down approach facilitates a structural analysis of the success factor domains. However, this approach ignores the relations and dependencies between success factors. Another weak point is that the determination method of success factors is not clear. Moreover, domains considered are limited. The value constellation is not clear. Profitability check is not possible. Wohltorf's Scoring Model is appropriate especially to evaluating new services, rather than evaluating business models. Many components, e.g., value proposition, given by us earlier in this work, are not considered. He concentrates on three domains, which may be critical to some innovative mobile services.

The practical instrument Business Model Evaluator is a commercial product. We cannot see the scientific idea behind it. For instance, the claim is that the Business Model Institute has found that a score of 750 or more is above average. However, this is not justified. Hence, it is difficult to talk about this tool.

In Table 2.9, we summarize our analysis of the business evaluation approaches. First column encamps the analysis criterion, against which we evaluated the available approaches. As can be seen, in the last column, we discuss the expected outcome of our proposed evaluation tool. One may clearly notice that we aim at addressing some considerable shortcomings of available approaches.

Table 2.9: Comparison among different Business Model Evaluation Approaches

Criterion \ Reference	**Osterwalder & Pigneur**	**Horsti**	**Wohltorf**	**Gordijn & Akkermans**	**Business Model Institute**	**Proposed approach**
Underlying model	Business Model Canvas (BMC) combined with SWOT analysis	Hedman & Kalling's (2003) business model components	No specific underlying model	e^3-value ontology	No specific underlying model	Hierarchical levels evaluation model
Evaluation method	Combining classical SWOT with BMC to evaluate each building block	Quantifying success factors, thresholding, comparison with target as well as the competitor	Quantifying success factors, weighted average, thresholding	Relations and dependencies among business model components, scenario-based evaluation	Asking question stemming from different areas, giving an overall score	Hybrid additive and multiplicative evaluation function, specific evaluation functions for different hierarchical levels, hybrid additive & multiplicative approach for capturing criticalness, relationships among hierarchical evaluation functions defined
Dependability on sound assumptions	Yes	No	No	Yes	Not clear	Yes
Suitableness to business model evaluation	Yes	Yes	No	Yes	Yes	Yes
Success factor hierarchy	Flat	Flat	Hierarchical	Business model component level	Not clear	Hierarchical
Evaluation outcome	Quantitative values from -5 to $+5$ with weights	Comparison to own target and competitor	Thresholding	Profitability	Thresholding	Dynamic
Dynamism	No	No	No	Yes	No	Yes
Criticalness	Yes/No	No	No	No	No	Yes
Modularity	Yes	Yes	No	No	Yes	Yes
Genericalness	Yes	Yes	No	No	Yes	Yes

2.5 Business Model Recommender

In order to understand the proposed terminology, i.e., *Recommender*, we need to discuss the difference between a recommender and a prediction. One may not negate the importance of these mentioned terminologies owing to their core role for the success of a business.

Let us begin with highlighting the importance of a *prediction model*. From the late 1960s to date, failure prediction and financial distress models have been much discussed in the accounting and credit management literature. The topic has developed to a major research domain in corporate finance: since the first failure prediction models of Altman (1968) and Beaver (1967), many studies have been dedicated to the search for the best corporate failure prediction model, based on publicly available data and statistical techniques (Ooghe & Spaenjers & Vandermoere 2009). When it comes to defining the *prediction model*;

Definition 3. *Failure prediction models are defined as models that assign a probability of failure or a credit score to firms over a given time horizon. The development of the Basel II framework has stimulated vendors to offer such models to banks opting to use the internal ratings-based approach for calculating their regulatory capital requirements. Indeed, one of the inputs that banks adopting the internal ratings based approach must provide is an estimate of the probability of default. Failure prediction models developed by vendors are often used by banks as an off-the-shelf product or, alternatively, as a basis for development and benchmarking of their internal rating systems. While there exists a large academic literature on failure prediction models (see, e.g., Balcaen & Ooghe 2006, for a review), much less is known about failure prediction models offered by vendors (Mitchell & Van Roy 2007).*

We now shed some light over the importance of *business model recommender* as follows. Business managers having their business evaluated know their standings in the market, their strengths, their weak windows. Upon knowing that the evaluation did not yield the desired output, it is now the time to take the corrective measurements for attaining the desired results. This clearly provisions a framework/approach (which we term as the business model recommender) that recommends the most suitable tuning points based on the evaluation. We define the business model recommender as follows:

Definition 4. *The business model recommender facilitates the analysis of business models before and during the business adaptation. Moreover, the recommendation model is used for scrutinizing already developed but not successful positioned business models. The results of*

recommendation models are used to formulate a set of actions necessary to successfully establish the businesses. The primary benefit of using such a model is that it compels decision makers to consider all aspects of a business and to identify problems before the company has committed significant resources to the businesses. We also envision that the business model recommender also shows the decision maker variables and risks associated with components of business models for improving the chances of a business's success. It is obvious and accepted fact that threats in business models should be identified and systematically addressed before, during, and after the deployment of business. Therefore a complex array of factors must be considered.

2.6 Conclusion

In this chapter, we discussed the basic concept of business model, variants of it, and how this term is perceived by the research community. We also presented and compared generic business model definitions provided by different researchers, which construct the base of our work. The chapter further explains the reason why business model evaluation is required, highlights the business model evaluation concepts, and briefly describe the business model recommender concept.

3

A New Business Model Evaluation Framework

"Anyone who has never made a mistake has never tried anything new." - Albert Einstein

3.1 Our Perception of Business Model

As covered in the previous chapter, almost all business model definitions in one or the other way make an attempt to capture a business in various blocks, where the blocks may basically be categorized based on the activities therein. The interaction between or among different blocks can also be seen in different definitions, which is intuitive. This urges us to think of modeling more generalizable features of a business. However, we are also convinced that context specific features of a business can be left open to the business owner. Therefore, we stick to a very generalized business model definition; we do not claim it as an extension or contributed definition to the existing business model definitions. However, we provide the following definition owing to the fact that it suits best to our view of the contributed business model.

Definition 5. *We perceive the business model as an integration of disintegrated components in an hierarchical fashion, where each hierarchical level will host different abstractions of the underlying functionalities. Having given this short and sweet perception, we will need to define these levels and the functional blocks therein, inter-functional relationships , etc. To cut*

a long story short, the business model encamps dynamic amount of functional blocks forming relationships of heterogeneous nature.

The proposed hierarchical evaluation requires dealing with evaluation parameters at different levels. We believe that a business encamps some mandatory processes/entities, which are also involved in the evaluation course. We term such processes/entities as *platform business blocks*. In what follows next, we briefly comment on our understanding of the platform blocks; however, the details and motivation for proposing the platform blocks will be detailed later in this chapter (Section 3.4.5).

When it comes to explicitly proposing the platform block terminology, we believe that, when compared against other aspects of a business model, the platform blocks are very vital and mandatory. Having accepted the fact that there may exist multiple criteria within a block, one intuitive observation would be that the impact of all of the involved criteria on the evaluation of a business model is not *homogeneous* or *uniform*. This results in a natural question, *how severely can a platform block affect the business evaluation?* The answer to this question is both straightforward and complex at the same time. The straightforward dimension of the response to the mentioned question is as follows: the severity of a block for an evaluation depends on what percentage of the involved criteria may be graded as most sensitive and evaluation-impacting. When it comes to the complex dimension of the response to the question, we boldly admit the fact, *the devil lies in details*. By devil here, we ask: *how can we associate priorities to the involved criteria within the block?* This necessitates an acceptable and realistic approach for assigning weights to blocks and the criteria therein. We are now faced with the challenges, which we transform into objectives of this work, i.e., the proposed framework should take care of all aforementioned and other alike issues.

3.2 Evaluation Hierarchy and Relevant Terminologies

We start with defining the basic terminologies that are necessary for explaining the proposed model. We will introduce a hierarchical evaluation structure that comprises various levels, where each level is characterized by the evaluation entity. It is intuitive that in hierarchical levels, the scope of operation (in our case the evaluation domain/vision) changes with respect to levels, i.e., the higher level has greater and more abstract vision of the lower and more concrete levels. We propose a five level model, namely, i) business level, ii) business block level, iii) block criterion level, iv) criterion unit level, and v) unit dimension level, as shown in

Figure 3.1. The naming convention of each level is influenced by the evaluation entity residing at each level. It should also be noted that these evaluation entities present the subset, set, and superset like structure. In the following sections, we will define each entity in more detail.

Consider an example of a business model, which has multiple sub-firms/departments. Let us now map this business model over the proposed hierarchical evaluation structure. For such mapping, we should first identify the evaluation entities and then define the relationships between/among them. In Table 3.1 below, we summarize the aforementioned mapping.

Table 3.1: Hierarchical Evaluation Levels

Level	**Evaluation Entity**	**Corresponding entity in the example model**
5	Business	Company
4	Business block	Subsidiary, or department within the company
3	Block criterion	Human resources of the individual department
2	Criterion unit	A group of workers, an individual
1	Unit dimension	Evaluating the manager on his management capabilities

We now comment on the granularity scale of the proposed hierarchical evaluation structure. It is intuitive that aggregation of unit dimensions at the unit dimension level forms a single criterion unit evaluation. Similarly multiple criterion unit evaluations when aggregated result in a single block criterion evaluation, and so on. We represent this pictorially in Figure 3.1.

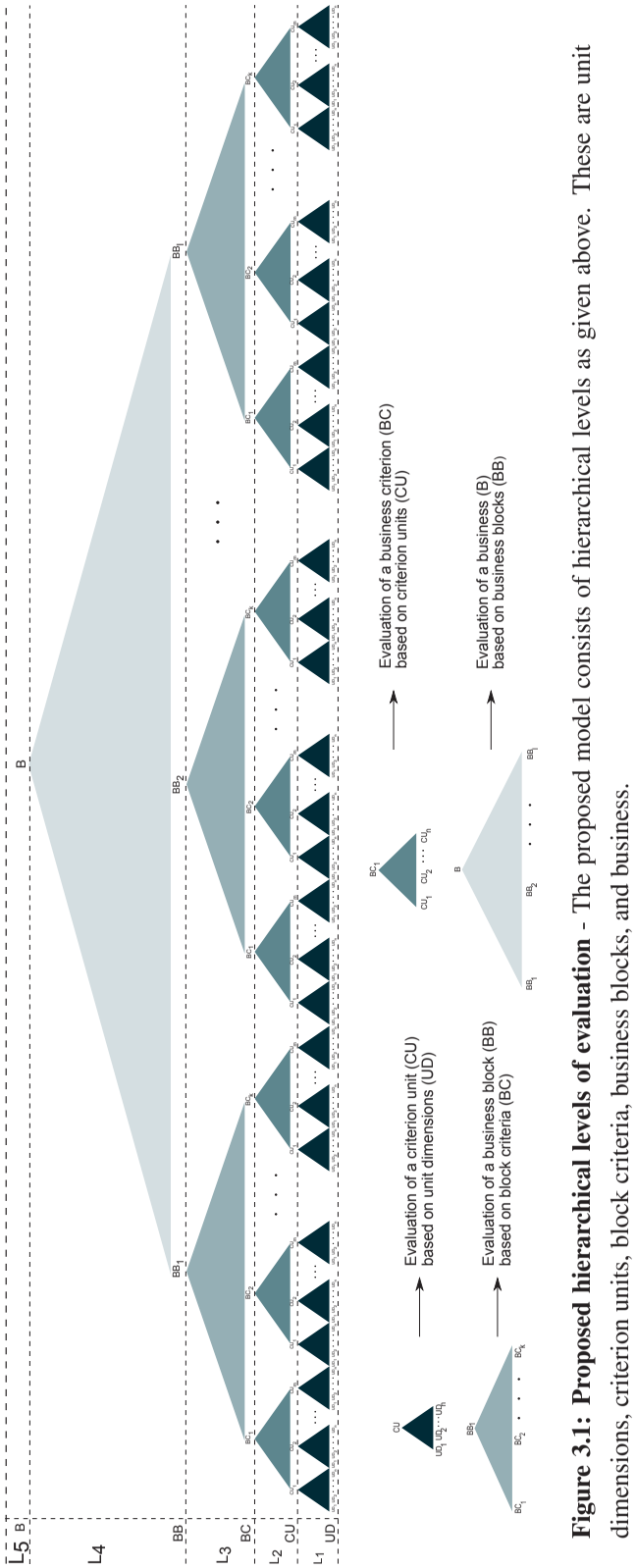


Figure 3.1: Proposed hierarchical levels of evaluation - The proposed model consists of hierarchical levels as given above. These are unit dimensions, criterion units, block criteria, business blocks, and business.

As can be seen, we bifurcate the evaluation process on multiple hierarchical levels. The choice of *triangle* to represent the evaluation process is driven by the fact that it captures our proposed approach very well, i.e., the base represents collection of scores for evaluation parameters, which are then plugged into evaluation function. The output of evaluation function is then considered as the inputs to a higher level. Let us now briefly discuss the proposed evaluation levels.

3.2.1 Unit Dimension Level

In order to understand this level, we should define what is meant by the *unit* and *dimension* in the term *unit dimension*. By *unit*, we mean the basic/atomic building element of any business. When it comes to defining dimension, we take the term as associated attribute of unit. It is intuitive that a unit may be characterized by multiple dimensions. Thus at unit dimension level, the scores for considered dimensions are collected. The evaluation of each dimension may be carried out on different scale, which in turn would mean evaluation scale has to be normalized. The scale normalization requirement is also justified by the fact that evaluation of each dimension has to be aggregated, which then results in single input to a higher level evaluation. This is depicted in Figure 3.1 by the dark green triangles placed at level 1, where the dimension is represented by $D_n, \forall n \in \mathcal{N}$ ($\mathcal{N}$ is infinite set of dimensions). The outcome of evaluation at this level is represented by CU (i.e., criterion unit). More details on criterion unit are provided in later section.

3.2.2 Criterion Unit Level

Similar to the explanation provided in the unit dimension level, in this level, by *criterion*, we mean evaluation aspect that is characterized by one or more unit(s). At this level, the multiple criterion units are assigned evaluation scores, which are then aggregated to attain input to *block* level evaluation. However, it should be noted that the evaluation score at this level or higher levels may not directly be assigned by the evaluator, rather this may be translated as the promoted evaluation that comes from the lower level, where the evaluator directly inputs the evaluation score. This motivates us to introduce the concept of "evaluate anywhere", i.e., we do not strictly confine the input score positions to be at the unit dimension level. Instead, we believe in introducing flexibility when it comes to providing the evaluation score, i.e., evaluators may input score at any level, which would then be plugged into the evaluation function of respective hierarchical level and promoted to higher level(s), if any.

3.2.3 Block Criterion Level

One may now capture the idea that the evaluation process at this level is carried out in the similar fashion as discussed for the earlier evaluation processes. By the *block*, we mean here the entity of business (e.g., subsidiary). It is intuitive that the aggregated evaluation of criterion units corresponds to the block criterion level evaluation.

3.2.4 Business Block Level

This is the second highest level evaluation and corresponds to the overall evaluation of the *business*. For a business with just one setup (i.e., no sub-firm), the block criterion level evaluation may suffice to capture the business evaluation. However, an important aspect to highlight here is that even for such business evaluation, different criteria may be grouped and evaluated separately, in which case the business block level will aggregate the block criterion level evaluation to capture the overall evaluation.

For businesses with multiple blocks, the overall business evaluation is promoted to yet another level, i.e., *business level evaluation*. In the business level evaluation, the evaluations of all business blocks are aggregated.

In general, by *aggregation*, we mean combining the impacts of different evaluation parameters that reside at different levels. The outcome of the aggregation process may be a unified evaluation value/scale. The question is now how to combine the evaluation parameters. The answer to this question is a contribution of this work, which we will elaborate on in the later section. In general, we interpret aggregation as depicted in Figure 3.2.

3.2.5 Parameter Relationships

This may be graded as the integrated process/operation of the *aggregator entity* seen in Figure 3.2. The aggregator entity, based on the relationships between the inputs, aggregates them to have an aggregated input of parameters over the evaluation. Thus defining the relationships between the parameters plays an important role in designing the evaluation framework. As such relationships are greatly driven by the parameters and their levels of existence, functions should be proposed that realistically define these relationships, which in turn will be translated into overall evaluation of the business. We believe that functions defining such relationships are

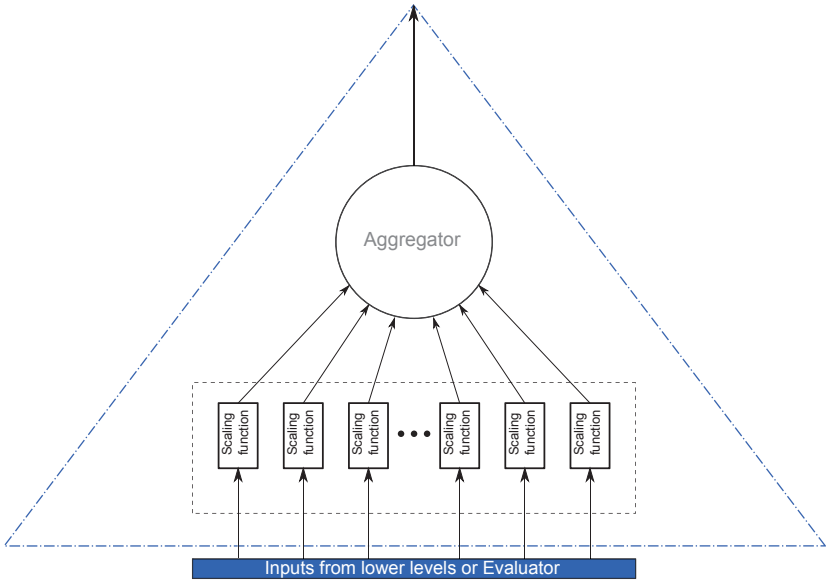


Figure 3.2: Aggregator - Figure representing the aggregation of inputs from lower levels through the aggregator to upper levels.

quasiconcave like functions, which are characterized by *gain and cost components*. In general, we represent the function as

$$U(\cdot) = G(\cdot) - C(\cdot) \tag{3.1}$$

where $G(\cdot)$ represents the *gain component* and $C(\cdot)$ the *cost component*. Both of the components may be functions of multiple parameters depending on their placement in the evaluation hierarchy and involved inputs.

Note: The cost component will be illustrated in detail in Chapter 5, where it is used for recommendation of the activity(ies) adaption in business model.

3.3 Logical Cycle

We believe that to evaluate any business, one has to undergo a series of actions. We term such procedures as *logical cycle*. In what follows next, we briefly discuss the logical cycle that adheres to our perception.

1. Study the evaluation-impacting parameters.

2. Devise methods to collect the required information, i.e., parameter values.
    - Questionnaire.
    - Interview.
3. Collect the parameter information.
    - Distributing the questionnaire to the concerned corners, in case of questionnaire method, or conduct interviews, in case of interview method.
    - Assigning the evaluation score to the evaluation parameter.
4. Process the parameters.
    - Categorize into critical and non-critical categories.
    - Define the cost components of the parameters.
    - Scale/normalize/harmonize the evaluation score(s) of different parameters.
    - Map the parameters to the proposed hierarchical evaluation model.
5. Execute the evaluation function at each level.
6. Visualize/analyze the results.
7. Define the desired evaluation.
8. Read and implement the recommendations to get the required evaluations.

3.4 Contribution

Our contribution in this chapter can be summarized as follows:

- We introduce the *critical* and *non-critical* concepts and categorize all the dimensions within evaluation units in the mentioned categories.
- We deviate from the commonly used fixed (nine-)block structure and propose the *dynamic block structure* for evaluating a business model.
- We propose the basic block structure, namely, *platform blocks*.
- We make use of business specific policies and analytical tools for assignment of weights.

- We propose the aggregator function(s) comprising of gain and cost components at each level of the hierarchy.
- We propose the hybrid additive multiplicative approach based business evaluation model.
- We extensively evaluate a case study business model (i.e., DAI-Labor's business model) using the commonly used *weighted sum* approach and using our proposed evaluation model. We then compare and analyze the evaluations from the two models and provide justification for the existence of different aspects of the proposed model.

In what follows next, we discuss the contributed concepts of this research work.

3.4.1 Critical and Non-critical Concepts

As mentioned in Chapter 1, we propose the concept of critical/non-critical unit dimensions. However, these concepts may exist at all of the proposed hierarchical levels. In this case, it is important to clarify the association of these terms to the evaluation parameters at any level of the proposed hierarchy. In this work, we propose different behaviors of critical and non/critical concepts at different levels, i.e., at dimension level, the zero evaluation score of a critical dimension will result in zero unit level evaluation, whereas at higher levels, the intensity of criticalness is not very high. This now brings us to the point where we concretely set/define these concepts.

A single sentence response to the above question is that "the realistic evaluation may not be obtained without these concepts". To support this response, in the following, we discuss a few use cases.

3.4.1.1 Use cases

With the views to explaining different use cases in Figure 3.3, we present a generic building plan. Four functional areas are identified in the figure, i.e., Conference room (A), Waiting room (B), Kitchen (C), and Internet infrastructure (D). It should be noted that the aforementioned functional areas of the building carry different priorities in different building types, e.g., research lab, trading company. Let us discuss these functional areas in the following building types.

Use case 1 – DAI-Labor: DAI-Labor (Distributed Artificial Intelligence Laboratory) is a computer science research lab at the Techische Universität Berlin headed by Prof. Dr. Dr.

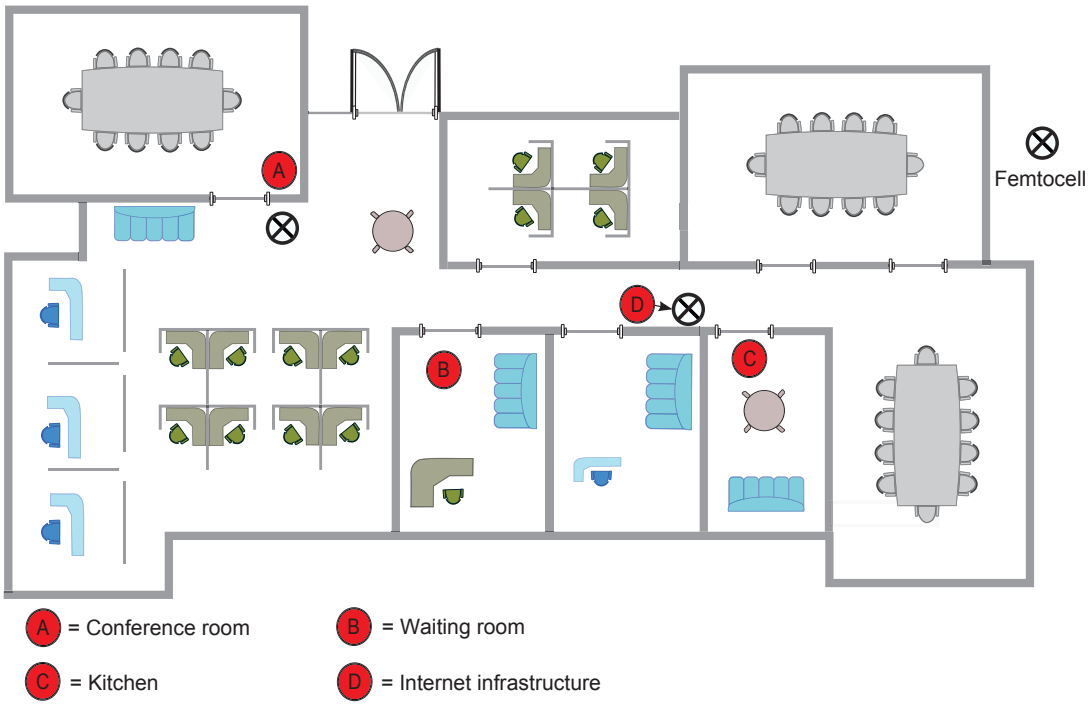


Figure 3.3: Use cases: elaborating the concept of criticalness - Figure representing four different functional areas, namely; i) conference room, ii) waiting room, iii) kitchen, and iv) Internet infrastructure. The functional areas associate different evaluation sensitivity to the same evaluation dimension. This is due the functional importance of the evaluation dimension in the functional area.

h.c. Şahin Albayrak. The researchers at DAI-Labor perform research and development in order to provide solutions for new generation of systems and services in the domains security, energy, health, telecommunication and future Internet, logistics and transportation, etc. More on DAI-Labor and its functionalities is provided later in this chapter. Intuitively, in such an environment, one may define the preferences over the highlighted components of the building (i.e., A, B, C, D in Figure 3.3) in the following fashion:

$$D \succ A \succ C \succ B \tag{3.2}$$

However, one may notice that the preference relationship (which is represented by "$\succ$") does not explain much except that one functional area is more preferred than the other one. For now, let us assume that this relationship is satisfying and we keep the discussion over capturing the properties of preferences for later instances in this research work.

Use case 2 – Doctor's clinic: Let us now assume that the building in Figure 3.3 represents this time a doctor's clinic. On the similar lines that of use case 1, in this use case, one may interpret the building's components' preferences as follows:

$$B \succ A \succ C \succ D \tag{3.3}$$

Use case 3 – Law firm: Now, if the building in Figure 3.3 is a law firm, then the preference over the building's components may be as follows:

$$A \succ D \succ B \succ C \tag{3.4}$$

3.4.1.2 Use cases – A closer look

Let us now have a closer look at the mentioned use cases. While evaluating the business model for use case 1, the evaluator would value D (much) more than B. Thus D and B may not be evaluated on the similar scale. This brings us to the point that heterogeneous scale should be introduced to the business model evaluation. But what if we need to keep the evaluation scale homogeneous? In this case, one would agree to the fact that the evaluation score of D must be valuated as more critical than that of score of B. However, the sensitivity of criticalness is an open question at this point; over this sensitivity, we will detail later in this chapter. Having accepted that using the later idea (i.e., critical concept), we may introduce two terms on the similar scale of evaluation, i.e., *critical* and *non-critical* evaluation scores. This would mean

that when D is declared as critical and B as non-critical function components in the business model evaluation, then the score, e.g., 70%, of D would impact the overall evaluation (much) more than that of 70% of B. However, as already pointed out, the term "(much) more" would then be translated by defined criticalness sensitivity scale.

Let us now analyze the vertical dimension of above defined preference relationships in the use cases. As it can easily be observed from preference relationships given in Equations 3.2, 3.3, and 3.4, the non-critical functional component of use case 1 (i.e., B) is critical functional component of use case 2. Similarly, the non-critical functional component of use case 2 (i.e., D) is critical functional component of use case 3. Thus we conclude that critical and non-critical concepts are strongly driven by the business type. In what follows next, we provide more details on the critical and non-critical evaluation parameters. In this connection, we map the proposed critical and non-critical concepts over the hierarchical evaluation model.

3.4.1.3 Mapping of critical and non-critical concepts to proposed hierarchical evaluation

As we know, the proposed hierarchical evaluation structure comprises five levels with different evaluation parameters. When associating the concept of criticalness to evaluation parameters, we are faced with basic questions such as:

- To evaluation criteria of which level should the proposed concept of criticalness be associated?
- Should the criticalness concept exist on all levels?
- Do the critical and non-critical terms define differently for evaluation parameters at different levels?

In order to answer these questions, let us take the following example. Consider mapping of the DAI business model over the proposed evaluation hierarchy. The mapping is shown in Figure 3.4. As can be seen, the DAI business model is decomposed into the proposed five hierarchical levels. The highest level is the DAI business level, which is then decomposed into six levels corresponding to six competence centers of the DAI-Labor; this level corresponds to the business block level. Each of the competence centers is equipped with hardware, software, and human resources. The functional procedures of the competence centers include development of software, architectural, networking, and hardware solutions. This dictates that profits and

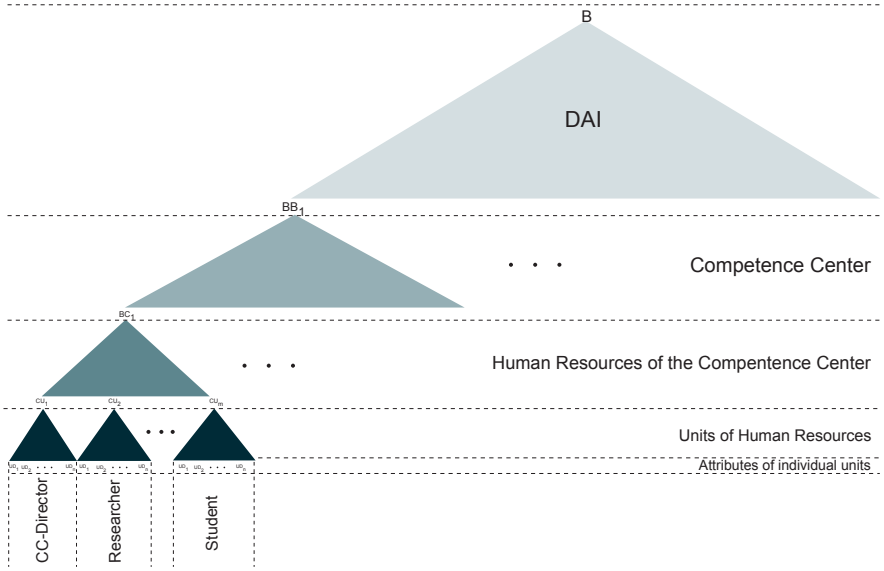


Figure 3.4: Mapping of DAI business model over the proposed hierarchical evaluation - Figure depicts an example of the proposed model mapped over every level in the hierarchy.

costs functions are integrated components of each competence center. Each of these functions may separately be evaluated, e.g., evaluating the human resources of each competence center at this stage results in a lower level (i.e., block criterion level), also highlighted in Figure 3.4. When evaluating the human resource criterion of a competence center, one may think of the human resource as a finite set of researchers, scientists, developers, and students of the respective competence center. An intuitive human resources evaluation approach will be to evaluate the elements of this finite set and aggregate the evaluation. Thus evaluation of the individual set elements forms another level (i.e., criterion unit level). The criterion unit level in the case of DAI model may include evaluating competence center director, evaluation of the researchers, students, etc. This now leads us to the lowest level of the evaluation, i.e., unit dimension level. At the unit dimension level, we evaluate different dimensions of a single criterion unit, e.g., a competence center director may be evaluated on different dimensions including her/his research publication strength, proposal writing experience skills. Having mapped the DAI model over the proposed hierarchical evaluation approach, let us understand what the criticalness of an evaluation parameter is. In this connection, consider the unit dimension level while evaluating the competence center director. Assume that the competence center director is evaluated on the following dimensions: management skills, teaching skills, research publications, language proficiency, personality, etc. It is straightforward which of the dimensions should impact the

evaluation of competence center director more, i.e., management skills are much more critical than the personality dimension. It will not be wrong to say that the overall evaluation of the competence center director should approach zero if the score assigned to management skills dimension is zero. Putting it the other way, one may interpret it as; a competence center director with the best personality and no management skill will have zero evaluation. In the following, we provide more generic and formal understanding of the *strictly critical*, *critical*, and *non-critical* concepts.

Definition 6. *The (non-)critical term corresponds to level of importance of evaluation parameter. In the context of this research work, we take these terms as mandatory association states, meaning thereby that each parameter should belong to non-critical, critical, or strictly critical state. We further define the characteristics of these states as follows:*

- *The overall evaluation of a criterion unit will be zero as long as the evaluation score of the critical unit dimension is zero even if the non-critical unit dimensions are non-zero. However, in case the evaluation unit comprises all non-critical unit dimensions then the evaluation of the unit reaches zero if and only if the evaluation score of all the non-critical evaluation dimensions are zero.*

- *Contrary to the earlier argument, zero evaluation score of the non-critical dimension may not consequence in overall zero evaluation.*

- *The term strictly critical is a special case of* critical. *The difference is that in case of strictly critical parameter, the option of categorizing that specific parameter is not left to the evaluator, it is predetermined. It should also be noted that strictly critical concept exists only at the unit dimension level unless explicitly defined at any higher level(s).*

To illustrate further on the proposed concept of critical and non-critical evaluation dimension, let us consider Figure 3.5, where the overall evaluation feasible area is decomposed into two feasible regions, namely, *critical evaluation region* and *non-critical evaluation region*. The vertical axis represents the evaluation scale and the horizontal axis represents the evaluation dimension. It should be noted that horizontal axis does not represent the number of evaluation dimensions, instead it reflects the valuation of the dimension in the overall evaluation. We assume that in the considered settings, the critical evaluation dimension is more involved than that of non-critical dimension. For simplicity in defining the critical concept, we assume that each involved dimension is evaluated linearly.

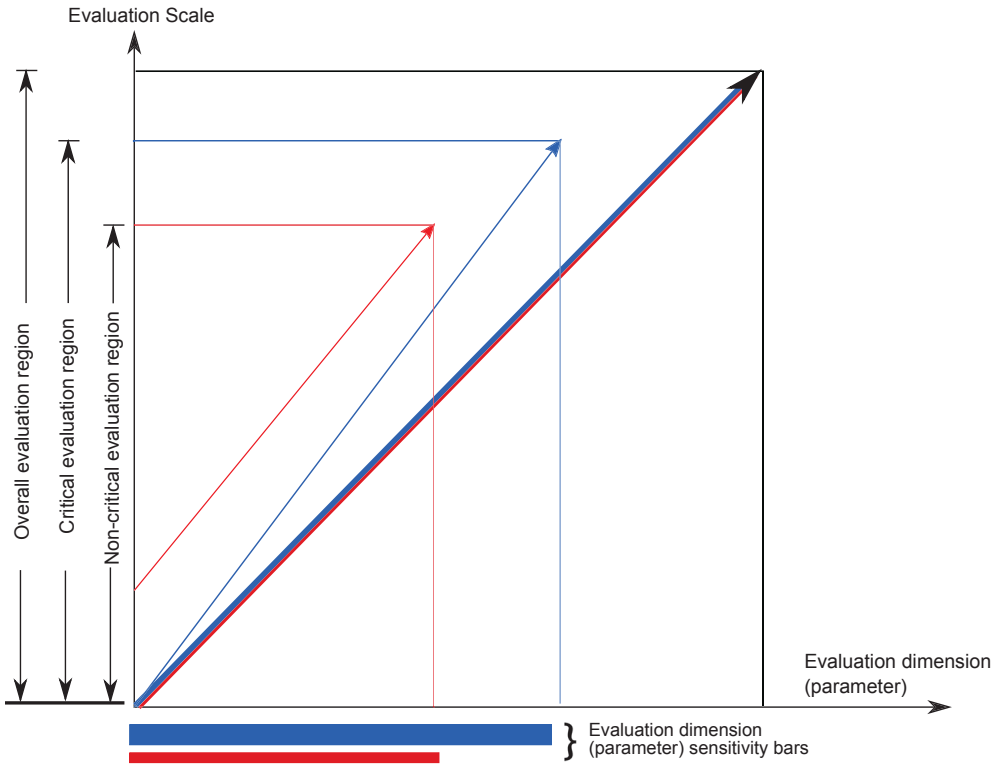


Figure 3.5: Critical and non-critical evaluation regions - As can be seen, the horizontal axis represents evaluation dimensions and vertical the evaluation scale. The evaluation dimension may be characterized by the critical sensitivity value, which in this figure is captured by the "evaluation dimension sensitivity bars", i.e., the thicker the bar is, the more sensitive the dimension is. As can be seen from the evaluation gain (i.e., evaluation scale on vertical axis), the valuation of more sensitive dimension impacts the overall evaluation more when compared with the less sensitive one.

Consider both of the regions (critical and non-critical) discretely; it can be seen in the figure that even if the evaluation of non-critical region is *zero*, the overall evaluation may still be *non-zero*. However, for critical dimensions, the overall evaluation is *zero* as soon as the dimension value approaches *zero*. The contribution of each dimension to the unit level evaluation is strictly driven by the sensitivity (impact) of dimensions. We represent the sensitivity scale of the critical and non-critical dimensions by a sensitivity scale in Figure 3.6 (also explained in Section 3.4.2).

Introducing these concepts, one is faced with a few natural questions, e.g.,

- How to categorize the evaluation dimensions into the proposed critical and non-critical categories?
- How to represent the criticalness scale (i.e., sensitivity) of a critical evaluation dimension?
- Should both the critical and non-critical evaluation dimensions be evaluated using the same evaluation score?

Let us now respond to the above questions with the following arguments:

- We suggest that categorizing the evaluation parameters at different evaluation levels into proposed categories is purely business specific in most of the cases. However, we believe that there are evaluation dimensions, which may be regarded as (strictly) critical for all the business models. The evaluation parameters at different evaluation levels may be categorized into (strictly) critical and non-critical categories by the business owner / managers / evaluators. As already mentioned, in the proposed framework, each evaluation parameter is coupled with (strictly) critical/non-critical indicator. Thus the business owner is the one who selects the right indicator for associating with the evaluation parameter.
- To answer this question, we consider Figure 3.6, where we represent the sensitivity of criticalness of an evaluation parameter by the width of line. As can be viewed, an evaluation parameter, when categorized as non-critical, will be assigned the critical index value as *zero*. Any non-zero value of critical index puts the evaluation parameters into critical category. However, within the critical category, the placement of evaluation dimension is determined by the criticalness sensitivity. An evaluation dimension is strictly critical if critical index values gets the value 1. This definition dictates that the position of critical evaluation parameter floats between critical sensitivity index value 0 and 1. It should further be noted that critical index value is business specific and assigned by the specific business evaluator.

Figure 3.6: Critical sensitivity range - Figure depicting an example of critical sensitivity range, which is linearly increasing.

- The answer to this question is straightforward, i.e., "No". Intuitively, the impact of critical parameters is higher than the non-critical ones, thus any non-critical parameter evaluation score $x \in \mathcal{R}$ may not affect the overall evaluation of the business in the same way as the $y \in \mathcal{R}$ evaluation score of critical parameter even if $x = y$. This provisions a generalized evaluation criterion, which is capable of capturing the impact of both types of evaluation attributes. More on this model is detailed later in this chapter.

3.4.2 Entities Dependency Concept

Another important aspect that remains the focus of this work is to highlight a more realistic concept of *criteria dependencies*. The proposed dependency concept is captured at the criterion level. To illustrate this, consider Figure 3.7, where the inward arrows correspond to the impact extracted by similar criterion of the external business blocks. It should be noted that a criterion may be impacted by single or multiple external blocks. This is also illustrated in Figure 3.8, which is an extended version of Figure 3.7.

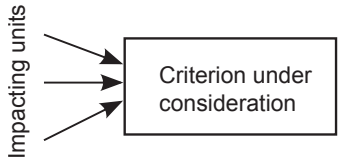


Figure 3.7: Inward impacting factors on a constituent criterion - The criterion is impacted by three different impacting factors, which belong to other blocks.

We also claim that neglecting the dependencies may result in false evaluation of the business models. We now discuss a few of the potential categories that, we believe, may encamp the aforementioned impacting parameters. It should be noted that there may be various such categories specific to different procedures in different businesses. However, the following categories are detected to guide readers through importance of parameter dependency concept.

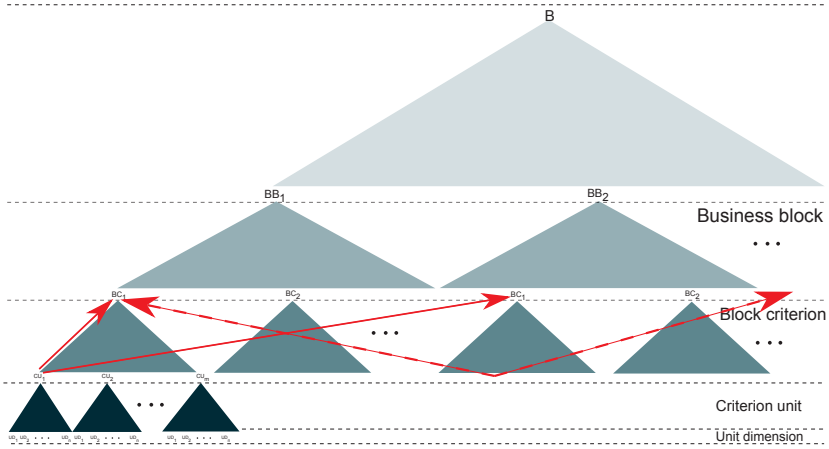


Figure 3.8: Different types of dependency - Figure depicting a criterion unit, i.e., CU1 impacting similar criteria of different blocks, i.e., BC1 of BB1 and BC1 of BB2, and a criterion of a block, i.e., BC1 of BB1, impacted by the different units of different blocks.

1. Knowledge Sharing - The existence of this category is natural in most evaluations, specifically in consortium like firms, which comprise various smaller entities. Thus the knowledge base developed within one entity may have strong impact on the evaluation of the considered business model (see, e.g., Serban & Luan 2002, for more information about knowledge sharing).

2. Physical Resource Sharing - Obviously, in the mentioned business model evaluation, the optimal resource utilization is to share the available resources for activities within different entities. Thus capturing the inter-entities resource sharing dependencies turn out to be a crucial evaluation factor. It should be noted that resources may include skilled personnel, technical equipment, software, test-beds, etc. (see, e.g., Govindarajan & Fisher 1990, for more information about resource sharing).

3. Motivational Competition - The performance of an entity within the firm may create inter-entities competition, which may result in overall better performance of the firm. To capture the performance impact of one entity over the other(s), a functional attribute may be defined. However, modeling such dependency is out of the scope of this work. For an interesting article about this issue, readers are encouraged to refer to Netessine & Yakubovich 2012.

Having explained the need for dependency concept while evaluating the business model, let us now investigate the methods capturing the dependencies among the evaluation criteria of

the business model and their potential impact on the overall evaluation.

As stated earlier, a criterion may be impacted by various other criteria units from external blocks. We recall that according to our definition, the criterion evaluation is specific to a block. However, when it comes to the criterion being impacted by external impacting units, we term this as *aggregation of external and internal parameters* that impact the criterion evaluation as *functional criterion*, which can be seen in Figure 3.9.

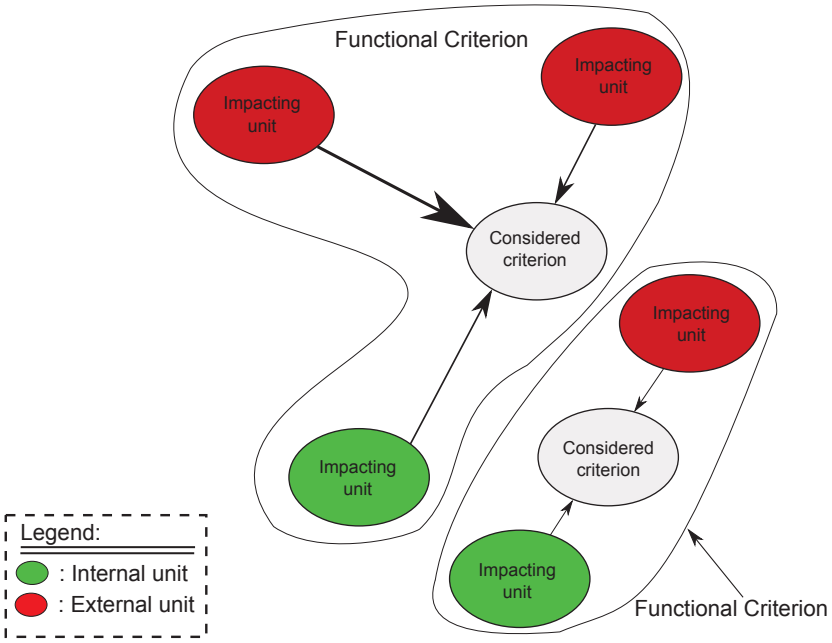


Figure 3.9: Functional criterion concept - There are two functional criteria, where the arrows represent the dependencies, and the measurement of dependencies is depicted by the width of arrow, i.e., the thicker the arrow is the more dependent the considered criterion on the impacting unit is.

The thickness of arrows visually captures the proportion of dependency to the considered evaluation criterion. Such proportion of the impact is captured by associating weight values to the dependency relation. The process of weight assignment in this case is carried out on the similar lines as weight assignment within internal functionalities of the criterion.

Let us now answer the following questions.

- Do the impacting units represent the output of the impacting criterion?
- If the preceding question is not true, then how can we represent the impacting criteria unit(s)?

- Can there be hierarchy of dependencies? If yes, how can they be captured for evaluation of a single criterion?

In the first place, we consider that the impacting criterion unit is the finished product of the other criterion. In this case, the resultant of evaluation is impacted in a boolean fashion, i.e., if the impacting criterion unit is in form of a finished product, then the considered evaluation criterion will be impacted positively (say in this case the impact is represented by 1), otherwise negatively (in which case the impact is represented by 0). However, it should be noted that by the unfinished product here, we confine the scope of the term "unfinished" to the impacting criteria units that are supposed to be finished and input to the considered criterion evaluation. To illustrate this, we recall the aforementioned DAI use case. Consider the two competence centers, namely, i) network and mobility (CC-NEMO): this competence center provides network infrastructure deployment design, configuration, and optimization solution, ii) network and system security solution (CC-SEC): this competence center basically focuses on providing network security, network monitoring, and management solutions. One obvious configuration within this scenario turns out to be that some finished products (e.g., security software) of CC-SEC may be needed/utilized by CC-NEMO. Thus the efficiency evaluation of CC-NEMO is directly dependent on the finished software product from CC-SEC. If CC-SEC provides CC-NEMO with the finished software, a positive increase in CC-NEMO's evaluation is expected, whereas negative in the converse situation.

Let us now consider the case where the impacting units may be input to the considered block (i.e., entity under evaluation process) in the unfinished state. The reader should not confuse the term unfinished used in this paragraph with the one mentioned in the preceding paragraph. In such a case, the impact may not be presented as boolean function, instead as a continuous function, e.g., continuing the previous example of DAI-Labor, consider that CC-SEC provisions the human resource from CC-NEMO. Assume CC-SEC as the considered block for evaluation, the impact of the human resource can be captured by any suitable function that to some extent realistically represents the performance of the human resource.

One natural question that arises here, and is also indicated by one of the questions above, is: to what depth can the dependencies be captured? To illustrate this concern, we go back to our favorite DAI model use case. Assume that the performance of human resources criterion (which is a criterion level evaluation parameter) is impacted by some other criteria units and human resource further has impact on the considered CC-SEC. We suggest that the evaluation

at CC-SEC should just capture the one hop dependencies. Our claim is justified by the fact that evaluation of the human resources can be taken care of by CC-NEMO.

As a note at this stage, we reinforce that capturing the proposed dependency approach remains effective at criterion level (of the proposed hierarchical evaluation). One may argue that such dependency exists at even other levels, too. However, we are convinced that the cost of capturing dependency concept at the other levels is higher (which may be translated into complexity of the evaluation) and impacts the evaluation less.

3.4.3 Cost Association to the Evaluation Parameters

We suggested previously in this chapter that each of the parameters may be evaluated with respect to gain and cost components, i.e., each evaluation parameter may add to the overall evaluation gain of the business model. On the similar lines, each evaluation parameter naturally incurs some costs, which may be interpreted as monetary value, effort, etc. We capture such costs by the cost component. This leads to the conclusion that each evaluation parameter may be characterized by a quasiconcave like function. Having detailed this, we now comment on one of the relevant aspects, i.e., the proposed individual cost elements are different from that of cost structure block, where the cost structure block describes all costs incurred to operate a business model (Osterwalder & Pigneur 2010, p. 40). In cost structure block, we ask questions like, "What are the most important costs inherent in our business model? Which Key Resources are most expensive? Which Key Activities are most expensive?", etc. Osterwalder & Pigneur (2010, p. 41) distinguish between two classes of Cost Structures, i.e., i) cost-driven, ii) value-driven. For more information on the cost classification and characteristics of of cost structure block, readers are encouraged to refer to Osterwalder & Pigneur (2010).

Let us now decide over the placement of gain and cost components of the evaluation function. Framing this the other way, we need to provide the justifications for placing the proposed evaluation function at different hierarchical levels of the proposed evaluation model. In this connection, let us recall the aggregator functional entity, which exists at all levels of the hierarchical model. The aggregator entity takes the input parameter scores at the respective levels and plug them in the evaluation function, which resides in the aggregator entity. As the evaluation function comprises both gain and cost components, the aggregator evaluates the parameter based on the function that maps the domain values (inputs at the respective evaluation level) to the range value, which in this case is the output of the aggregator.

It should be noted that aggregated gain and cost components of the overall business model necessitate the definition of relationships between each individual evaluation parameter. The aggregated cost component of the business model corresponds to the cost structure block. Furthermore, the gain and cost components should be so modeled that realistically captures the evaluation at all of the hierarchical evaluation levels. The aggregator does not only take the inputs from the block under evaluation but also from the impacting unit values from the external blocks (see Section 3.4.2). For instance, a block is dependent on some evaluation parameters and the associated costs to those dependent parameters vary (and may be selectively more than the cost incurred by block internal containers). Thus we believe that the proposed approach will prove to be very helpful when designing the prediction of business model. We will illustrate more on this aspect in the later chapter.

Remark 2. *Each evaluation parameter may have different cost components, which may be represented/captured by various mathematical functions including sigmoid, log-normal, exponential, etc.*

With the view to illustrating more on the concept of inter-block dependencies, we reproduce Figure 3.8 as shown in Figure 3.10. As reinforced from the figure, the dependency concept exists at the block level only, where the dependencies of lower hierarchical level parameters are promoted and captured. As can be seen, a block may exert dependency in uni-direction or the dependencies are bi-directional. The figure also highlights that a block may be dependent on the other block in multiple parameters of various sensitivities.

3.4.4 Dynamic Block Structure Concept

In this work, we deviate from the commonly used "fixed block structure" and propose dynamic block structure for business model evaluation. In the following, we justify the proposed dynamic block structure.

In the first place, the fixed block structure dictates that all the business models must encamp the activities that are then categorized into the fixed blocks of evaluation. Secondly, given the fixed blocks structure, one has to stick to the practice of distributing the evaluation parameters among the available fixed blocks even if the evaluation parameter may not fit to the block. Thirdly, fixed block structure limits us to weighted sum evaluation criteria, i.e., assume that business evaluation attributes fit to 8 of 9 fixed blocks, this would mean that 9^{th} block would have *zero* overall evaluation. Thus multiplicative evaluation criterion is no more a candidate

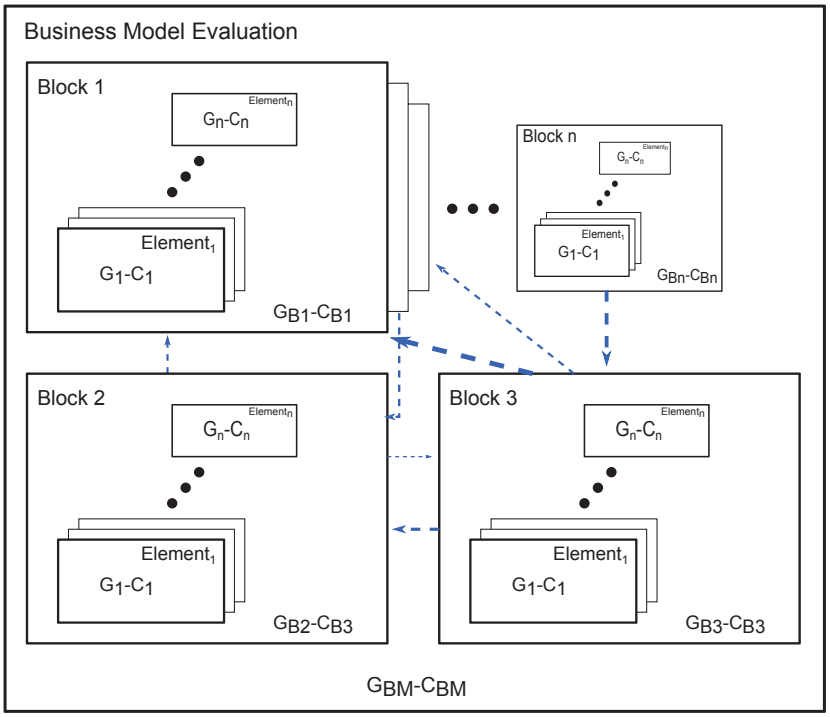


Figure 3.10: Dependency concept in business model evaluation - The figure shows that there exist dependencies between/among entities. The arrows show how strong the dependencies are, i.e., the thicker the arrows, the bigger the dependency.

for business model evaluation. As the basic goal of evaluation models is to carry out a near perfect model evaluation, which we believe cannot be attained with the *one for all* and *fixed* model. The above mentioned claim is further illustrated in Section 3.7, where we extensively evaluate the DAI business model.

Let us now briefly discuss different research works from the perspective dynamics in the business models. As given in Chapter 2, the authors Osterwalder & Pigneur in their work in 2010 define business models in most general form and claim that their proposed nine blocks cover the four main business areas, namely, i) customers, ii) offer, iii) infrastructure, and iv) financial viability, where the earlier three are adopted from Hagel & Singer (1999), and Markides (1999). Authors further decomposed these four areas into a more generic nine block structure. This contribution of authors can also be framed as the ontology based conceptual business model proposal. Although the proposed generic ontology for business is attractive, we raise a few critical questions towards the adaptability to all the business models. The nine block structure is in fact based on some specified business models of the literature, which may not be taken as the generalized business model for all types of businesses. One possible solution can be introducing several other generic blocks in addition to these nine blocks that can capture the services and procedures of the current or envisioned business models, in which case we will have an extended/modified version of static nine block business model structure. However, one cannot negate the fact that the static evaluation model may leg behind in capturing the uncertainties introduced by the dynamics and unpredictability of the businesses, which may result in an increased risk. It should be noted that by the dynamics, we mean the dynamic entities of the business, not the time dynamics.

Most of the literature has taken a static perspective on business model, implicitly assuming them to remain stable over time (de Reuver & Haaker & Bouwman 2007). But in the real life the companies have to reinvent and change their business models continuously to keep them aligned with the very fast-changing environments in many sectors. Thus the situations may occur that the fixed block structure may not be applicable. Recent literature has begun to give clues about the business model dynamics, e.g., Bouwman & MacInnes (2006), de Reuver & Haaker & Bouwman (2007).

On the similar lines (as highlighted in Chapter 2), MacInnes (2005) and Bouwman & MacInnes (2006) examine business model dynamics to determine how technological, regulatory, and market changes affect transition in business models. However, according to them,

the term dynamics capture the shift in time. The focus of their work is on "How do companies adapt their business models when they are no longer adequate?"

Demil & Lecocq (2010) argue that static business model (if not many) brings a few good characteristics, e.g., static business allows one to build typologies and study its relationship with performance. Authors further strengthen their argument that the static models present persistent picture of different involved business model components and their geometry, which is communicable and understandable.

We strongly believe that the dynamics in business activities, new business paradigms, dynamically changing consumer satisfaction patterns, etc., leave us with a single choice, i.e., introducing the dynamics and tying the evaluation to the index of business. To further strengthen our claim, we consider the fixed blocks figure, i.e., Figure 3.11. As can be seen, the evaluation attributes of two business models, i.e., A & B are mapped over the fixed block structure, where the height of colored block (i.e., red or blue) represents the proportion of evaluation attributes within a block. We observe that business A involves only 7 blocks. Given this scenario, we raise the following simple questions:

- Will the model assign *zero* evaluation value to the leftover 2 blocks for business A?
- Will the model assign maximum evaluation value, i.e., 1 to the leftover 2 blocks for business A?

Obviously, the answer to the mentioned questions purely depends on evaluation model, i.e., for weighted sum approach, *zero* value and multiplicative approach value 1 is assigned as the evaluation value of the leftover blocks.

These arguments leave us with an observation, i.e., the leftover blocks in either approaches affect the evaluation model to a great extent. Apparently, sticking to the fixed block structure may seem to be a feasible solution specifically if the evaluation weights of the leftover blocks are distributed [1] over the considered blocks. However, the reader would agree that a careful analysis of the preceding sentence strengthens our claim of dynamic block structure. To illustrate this, we consider a simple example with two configurations, namely, i) in full agreement with fixed block structure, and ii) in partial agreement with fixed block structure. In the earlier configuration, we assume that the considered business model is evaluated exactly within the fixed nine blocks, whereas the later is converse (meaning thereby, the evaluation blocks may be more or less than nine blocks). This situation is pictorially depicted in Figure 3.11.

[1] Any suitable stochastic distribution may be followed.

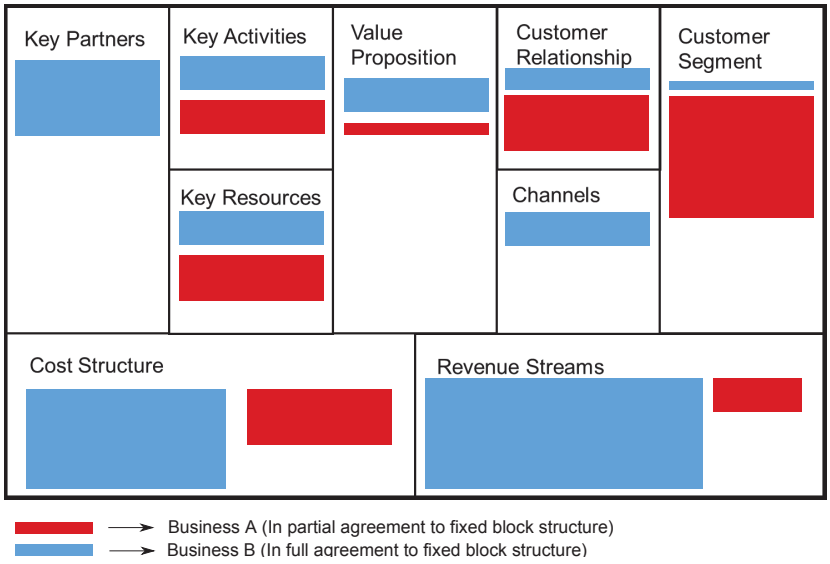


Figure 3.11: Fixed-boxes based business model evaluation structure - Figure represents the involved boxes for evaluation of two different business models.

Now, let us assume that weighted sum approach is used for the evaluation, which would mean that every box would be assigned a weight. Thus for Business B, the evaluation follows the procedure of aggregating the weighted values of each block for computing the overall business model evaluation. However, in case of Business A, if the fixed weight is assigned to the blocks that are not existent, the overall evaluation will not be realistic owing to the fact that $\sum_{i=1}^{7} weights_i < 1$, i.e., the ideal evaluation will always be less than the maximum. A solution to avoid this problem is to assign the weights to the considered blocks only such that $\sum_{i=1}^{N} = 1$, where N is the number of considered blocks; this solution can be regarded as a dynamic solution, hence supporting our claim.

3.4.5 The Platform Blocks Concept

Before we detail the platform blocks, let us understand what we mean by the platform. Inspired by the terms like foundation, base, etc., we define the platform as the foundation and assume that it is a mandatory element in any system. In this work, we select the term platform to highlight the importance and mandatory existence of a few blocks, i.e., the blocks that are of critical importance for almost every business model. This dictates that platform blocks vision should be justified by identifying the mandatory elements/blocks in most (if not all) business

models.

Most of the research literature define business models in terms of blocks, components, entities, building blocks, elements, sub-models, vectors, streams, etc., and hold these as important factors in business model definitions. However, in broader sense, these terms to a greater extent indicate somewhat similar perspective. Similar to the deviation in naming conventions, the researchers also have convergent and divergent views on involved blocks. We now highlight the blocks suggested by various researchers; this exercise will also form basis for justifying the proposed platform blocks.

Table 3.2: Different Approaches in Business Models and heir Constituent Elements

Author	**Year**	**Notation**	**Constituent Elements**
Viscio & Pasternack	1996	Elements	Global core Business units Services Governance Linkages
Alt & Zimmermann	2001	Generic Elements	Mission Structure Process Revenue Technology Legal issues
Afuah & Tucci	2000	Components	Customer value Scope Pricing Revenue source Connected activities Implementation Capabilities Sustainability
Chesbrough & Rosenbloom	2002	Components	Value proposition Market segment Structure of value chain Cost structure of profit potential Position of firm within value network Competitive strategy
Hamel	2000	Components	Customer interface

Author	Year	Notation	Constituent Elements
			Core strategy Strategic resources Value networks
Kraemer et al.	2000	Building blocks	Direct sales Direct customer relationship Customer segmentation for sales and services Build-to-order production
Petrovic et al.	2001	Sub-models (components, entities, elements)	Value model Resource model Production model Customer relation model Revenue model Market model Capital model
Hedmann & Kalling	2003	Components	Customers Competition Offerings Activities and organization Resource Scope of management Suppliers
Stähler	2001	Components	Value proposition Architecture of value creation Revenue model
Mahadevan	2000	Stream	Value stream Revenue stream Logic stream
Weill & Vitale	2001		Value proposition Strategic objectives Channels Core competencies e-business schematic Customer segments
Amit & Zott	2001	Stream	Content Structure Governance of transaction
Gordijn et al.	2001 -		Value offering

Author	Year	Notation	Constituent Elements
	2005		Market segment Actors Value exchange Value configuration
Clarke	2004, 2007		Who pays? For what? To whom? Why?
Shafer & Smith & Linder	2005		Core logic Strategic choice Creating and capturing value
Tikkanen et al.	2005		Material aspects Belief system
KPMG	2006	Component	Value proposition Market segment Cost structure and profit potential Value chain
Johnson & Christensen & Kagermann	2008	Elements	Customer value proposition Profit formula Key resources Key processes
Osterwalder & Pigneur	2010	Building blocks	Value proposition Customer segment Channels Customer relationships Revenue streams Key resources Key activities Key partnerships Cost structure
Demil & Lecocq	2010	Core components	Resources and competences Organizational structure Propositions for value delivery
McGrath	2010	Core components	Unit of business Process or operational advantages
Wirtz & Schilke &	2010	Domains	Sourcing Value generation

Author	Year	Notation	Constituent Elements
Ullrich			Value offering Distribution Revenue
Yunus & Moingeon & Lehmann-Ortega	2010	Components	Value proposition Value constellation Profit equation
Itami & Nishino	2010	Elements	Business system Profit model
Svejenova & Planellas & Vives	2010	Main elements	Activities Organizing Resources
Zolnowski & Böhmann	2011	Elements	Value proposition Value capture Funding and costs Target customers Networks and activities Technology, resources and skills Strategy, scope, sustainability Value flow Legal aspects

Based on the varied approaches in the literature provided also by us in Table 3.2, we believe that the platform blocks may include i) value proposition, ii) revenue, and iii) costs. To justify the nomination of these as the platform blocks, we rely on a thorough research literature review. In Table 3.3, we summarize the selected research articles that quote these blocks as the core blocks while defining the business model.

Tables 3.2 and 3.3 support our claim that the mentioned blocks may be treated as the platform blocks. For the ready reference in Figure 3.12, we present the platform blocks like structure proposed by Alt and Zimmermann (2001).

Note: We also believe that the platform blocks may be specific to business model or specific to sub-firms (in which case, the aggregated impact of various platform blocks may be taken for a business model platform block). However, such aggregation and disintegration of platform blocks are purely driven by business managers. The important point here to note is that the proposed evaluation model should be flexible enough to accept any policy of defining platform

Table 3.3: Platform Blocks and Their References

Platform Block	References
Value Proposition	Stähler 2001, Weill & Vitale 2001, Petrovic & Kittl & Teksten 2001, Gordijn 2002, Afuah & Tucci 2003, Linder & Cantrell 2000, Maitland & Van de Kar 2002, Applegate 2001, Amit & Zott, Magretta 2002, Chesbrough & Rosenbloom 2000, Mahadevan 2000, Hamel 2000, Osterwalder 2010, Hedmann 2003, Weill and Vitale 2001, KPMG 2006, Demil & Lecocq 2010, Wirtz 2010, Yunus et. al. 2010, Alt & Zimmermann 2001
Revenue	Hamel 2000, Mahadevan 2000, Magretta 2002, Applegate 2001, Maitland & Van de Kar 2002, Stähler 2001, Weill & Vitale 2001, Petrovic & Kittl & Teksten 2001, Gordijn 2002, Afuah & Tucci 2003, Linder & Cantrell 2000, Rappa 2001, Osterwalder 2010, Bonaccorsi et al. 2006, Brousseau & Penard 2006, Wirtz 2010, Yunus et al. 2010, Itami 2010
Costs	Chesbrough & Rosenbloom 2000, Magretta 2002, Gordijn 2002, Afuah & Tucci 2003, Linder & Cantrell 2000, Stewart & Zhao 2000, Rappa 2001, Osterwalder 2010, Bonaccorsi et al. 2006, Brousseau & Penard 2006, Itami 2010

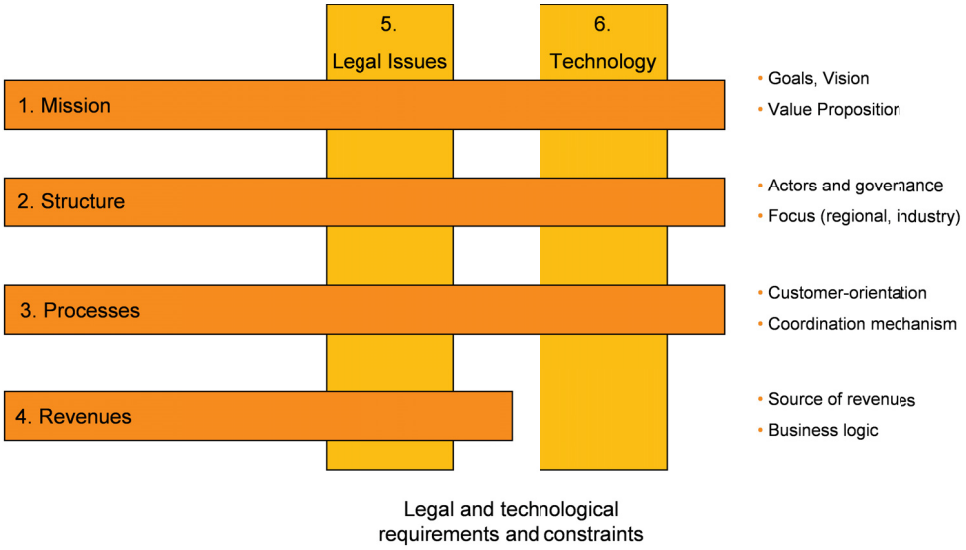


Figure 3.12: Alt and Zimmermann business model components - Authors have one component common for all other components, i.e., legal issues component. According to our definition of business model entities, this block can be termed as platform block, over which all other blocks rest.

blocks by the business manager or owner.

3.5 Basic Requirements of an Evaluator

When it comes to evaluating a business model, we believe that for a realistic evaluation, some basic requirements should be met by the evaluation model. In the following section, we provide details of such requirements. It should be noted that these requirements also form basis for modeling the proposed evaluation framework.

1. It should combine all of the parameters into one measure that evaluates the business model.
2. The importance of each involved parameter in evaluator should be reflected realistically.
3. The characteristic of each involved evaluation parameter should be realistically captured, i.e., for some parameters, a non-linear mapping of values to their quality should be possible.
4. The evaluation score assigned to a critical parameter should impact the unit level evaluation in such a way that a lower score value of a parameter impacts the unit level eval-

uation more when compared with situation where the similar score value is assigned to non-critical dimension parameter. For instance, for evaluation score value equal to "zero/unacceptable", the unit level evaluation should result in minimum. Intuitively, the term criticalness of one parameter over the other dictates that critical criteria influence each other to the great extent, and normally their correlation can be obtained by taking their weighted product. The need to use the weighted product approach is justified and strengthened by the phenomenon mentioned above, i.e, any criterion resulting in zero evaluation reduces the overall business model evaluation.

5. The evaluation model should be flexible enough to include any granule level evaluation parameter. Given the fact that a business model is evaluated on various granule levels, the overall business model evaluation should realistically capture and aggregate these evaluations to a business model evaluation.

6. Since the input to the evaluator may have heterogeneous units, these have to be normalized before the overall evaluation is carried out. The normalization of the parameter values may span between the interval [0,1] or another value range of interest, e.g., Mean Opinion Score value range [0,5] that is commonly used in telecommunications for the quality of service levels.

It should be considered that attaining the normalized values that represent the business evaluation for the considered parameter does not conclude business evaluation modeling. As every involved criterion behaves differently and such behavior may be represented by a mathematical function, modeling evaluation function further provisions defining functions to represent the behavior of each involved parameter. The functions may take different shapes, e.g., monotonically increasing, monotonically decreasing, linear, step, concave, sigmoid, and Cobb-Douglas function. The choice of any of these functions is strictly driven by the parameter under consideration, and its selection is a crucial issue. Furthermore, fairness needs to be ensured when scaling the functions among the scaled context parameters used in the evaluation. However, fairness in this context does not mean that all scaled parameters should have the same distribution within the scaled range. This also implies that a compensation among the parameters is possible if they are equally important (e.g., resource unit vs cost per unit time equally weighted, a doubled resource is supposed to compensate double costs per unit time). This means if the overall evaluation should behave the same for two or more parameters, those parameters must

use the same characteristic scaling function. If the behavior should be inverse for two parameters, inverse scaling functions are to be chosen. To illustrate this, let us consider a DAI-Labor (detailed later in this chapter) like business model. Some of the general scaling functions for generic evaluation parameters within the considered business model are shown below.

Generic Scaling Functions

Criterion	Gain in Business Evaluation
Number of scientific publications	monotonically increasing
Number of acquired projects	monotonically increasing
Technical infrastructure	monotonically increasing
Cost component	monotonically decreasing

Remark 3. *One may agree to the rigid fact that highlighting the potential improvement parameters of an active business turns out to be a vital venture that business owners need to undertake for attaining the desired business evaluation. For such recommendation to be realized, the business evaluation is a priori. Ideally, the business recommender should suggest tuning the parameters that incur the least costs and result in the desired business evaluation. This further necessitates system-wide (business-wide) analysis and one may expect modeling the constraint associated optimization problem. In this research work, we propose business model evaluator and business model recommender. More on the proposed business model evaluator and recommender are given in the later chapters in this thesis.*

3.6 Business Model Evaluation Function

The evaluation process is carried out at all levels of the proposed hierarchical evaluation model. This further dictates that the evaluation function is provisioned at all of the hierarchical levels. Obviously, the evaluation function should realistically capture the evaluation at the respective hierarchical level. Before we discuss the proposed evaluation function, we highlight a few facts that help defining basic building blocks of the function.

Fact 1 Each parameter is evaluated over a defined evaluation scale (e.g., $0 - 100\%$, where 0 represents the worst and 100% represents the best case scenario). Therefore, in such a case, one straightforward solution is that valuation is the linear function of evaluation scale. This would mean that the valuation increase for evaluation scale $20\% - 40\%$ is

exactly similar to that obtained for evaluation scale $40\% - 60\%$. However, we believe that the linear valuation is not realistic for generic evaluation and the valuation may react differently for different evaluation scales. Thus to capture such a realistic behavior in the business model evaluation, the function should capture the realistic valuation reaction for different evaluation scale values.

Fact 2 When it comes to computing the overall evaluation of a business model, the evaluation of each hierarchical level is aggregated. The impact of each level's evaluation should be captured in such a way that the overall evaluation of the business model is realistically grabbed.

Fact 3 The proposed critical and non-critical concepts may exist at all hierarchical evaluation levels. Thus the evaluation function should explicitly capture such critical and non-criticalness in the overall evaluation of the business models.

Fact 4 When it comes to evaluating the business models with at least one critical dimension, the evaluation function should realistically capture its impact on the respective hierarchical level(s) and overall evaluation.

Fact 5 For the overall evaluation of a business model, the proposed evaluation function should also explicitly capture the dependency (as explained in Section 3.4.2) of different criteria and blocks of the business model.

Fact 6 We know that each evaluation parameter adds to the cost structure of the business model. However, the proportion of the cost incurred by a single evaluation parameter is mostly influenced by the evaluation parameter itself and partially by its nature whether it contains the dependency index or not. The question is how to capture the impact of cost of individual evaluation parameter. This brings us to the next natural question, i.e., how is the aggregated cost structure value attained from the components of the individual parameters at different levels?

Fact 7 In order to aggregate the evaluations of multiple evaluation parameters, there should exist a mechanism that realistically creates the relationships among the involved evaluation parameters and achieves a trusted valuation of the aggregated parameters.

Before we go further, we recall the proposed hierarchical evaluation model. In Figure 3.13, we depict the scope of different levels and assign the variables to different evaluation functions. These variables will be used from now on to represent the evaluation functions at corresponding hierarchical levels.

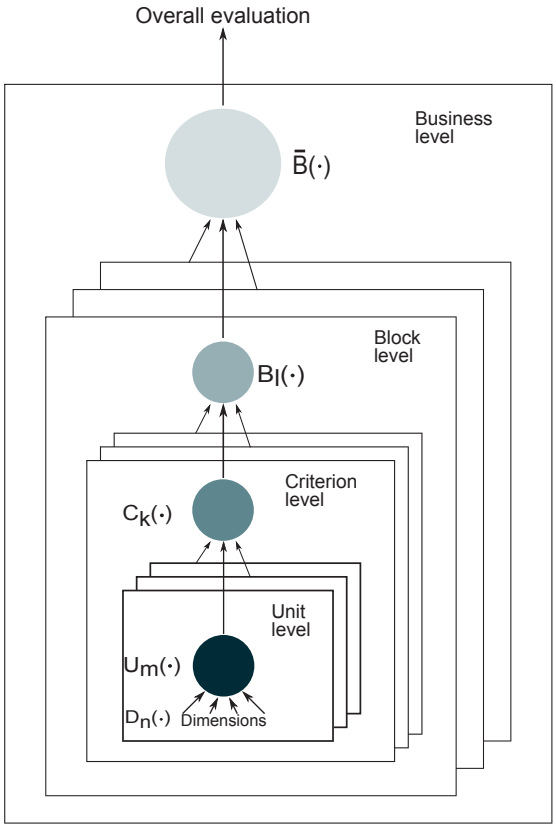


Figure 3.13: Hierarchical evaluation - A recall.

In the following, we elaborate on the proposed evaluation function at all hierarchical levels in terms of the aforementioned facts. We adopt the bottom up approach for such elaboration. We skip the details of dimension level as the explanation over unit level evaluation implicitly captures the details over dimension level.

3.6.1 Unit Level Evaluation Function

At this hierarchical level, the evaluation function relevant contributions may be summarized as:

- **Introducing the evaluation regions** – One may agree to the fact that an individual evaluation unit may react differently to the evaluation values, e.g., the evaluation is zero for and below some evaluation value x_{min} and maximum for some evaluation value x_{max}. This further defines three different regions, which we term as: i) *dead region* - the region for values below x_{min}, ii) *transition region* - the region between x_{min} - x_{max}, and iii) *saturation region* - the region above x_{max}. Capturing the business model evaluation for the (i) and (iii) are straightforward, however, for the transition region, we propose the function given in Equation 3.5. The proposed regions (as a consequence of the proposed function) may be viewed in Figure 3.15 and Figure 3.16.
- **Providing full control over the evaluation function by translating the realistic impacting parameters into variables of the function** – The transition region provides full control over the evaluation curve for a unit. The proposed function for this region is a concave function. It should be noted that behavior of function within the transition region is controlled by the evaluation sensitivity parameter β, which corresponds to the rate of acceleration of evaluation, i.e., the higher the value of β, the greater is the evaluation acceleration rate. To illustrate this, we consider Figure 3.15, where the mentioned three regions are evident and Figures 3.19, 3.20 and 3.21 advocate the impact of β values on the evaluation. Thus with these three regions and the controlling parameters β, we claim that the proposed evaluation function captures very realistic evaluation at the individual unit level.
- **Introducing the threshold achievable evaluation concept** – In general, there may be situations where the evaluation of the business model for a unit gains some positive value soon after some threshold value is attained (i.e., a step function like behavior is observed at some threshold value). In order to capture this behavior, we propose the threshold achievable evaluation concept, this is given by μ_0 in the evaluation function.

- **Introducing the cost component to individual unit evaluation** – As mentioned earlier, the proposed function is a quasiconcave like function, where the cost component may take any shape depending on the evaluation unit. For instance, consider Figure 3.14, which depicts the cost behavior(s) of a unit against the amount of resources. It should be noted that both of these quantities are bounded and hence resulting in a bounded set.

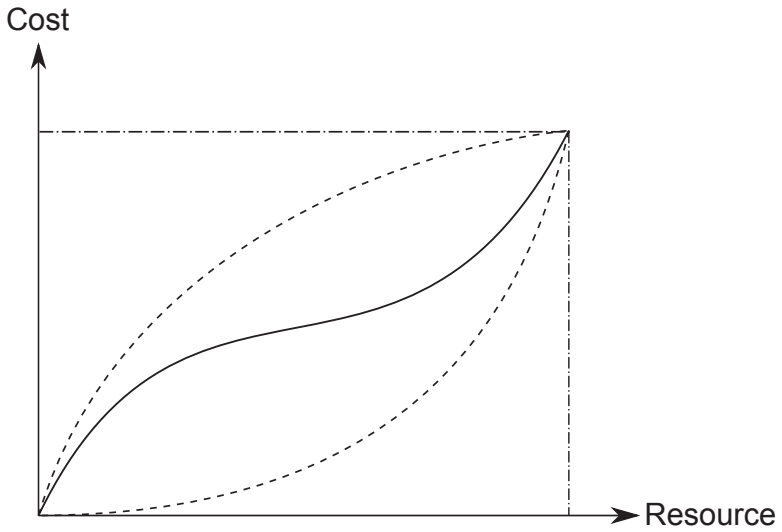


Figure 3.14: Different cost behaviors - The figure depicts three different behaviors of a unit, i.e., sigmoid, convex, concave, against the amount of resources.

We would like to stress here that the proposed cost component (no matter at which level, including individual block or business level) plays vital role in identifying the areas of business, where the improvements may be made and desired business model evaluation may be achieved optimally.

The aforementioned facts (i.e., Fact 1 - Fact 7) set seven basic requirements of the evaluation function (at all levels). A closer look at this stage will highlight that facts $1, 3, 4, 6$ and 7 are specific to the unit level. This further dictates that the proposed evaluation function should have components that satisfy all the requirements mentioned in facts $1, 3, 4, 6$ and 7. Let us now deal with the evaluation function component that meets the first requirement (i.e., highlighted in Fact 1 and Fact 4).

$$D(x) := \begin{cases} 0 & \text{if } x < x_{min} \\ \mu_0 + \mu \cdot \frac{1-e^{-\beta(x-x_{min})}}{1-e^{-\beta(x_{max}-x_{min})}} & \text{if } x_{min} \leq x \leq x_{max} \\ 1 & \text{if } x > x_{max} \end{cases} \tag{3.5}$$

In Equation 3.5, $D(\cdot)$ represents the evaluation function of dimension at the unit level. x is the score variable that may take any discrete value from the evaluation score range, e.g., $x \in [0, 100]$, $x_{min/max}$ is minimum/maximum required dimension score set by the experts / business owner. It is intuitive that this variable is strictly influenced by the nature of unit dimension (i.e., critical/non-critical). μ scales the function, μ_0 takes care of the abrupt gain of the dimension evaluation. As can be seen in the proposed function (i.e., Equation 3.5), it is based on per unit dimension score; curves in Figures 3.15 and 3.16 represent the behavior of these functions for different valuation scores.

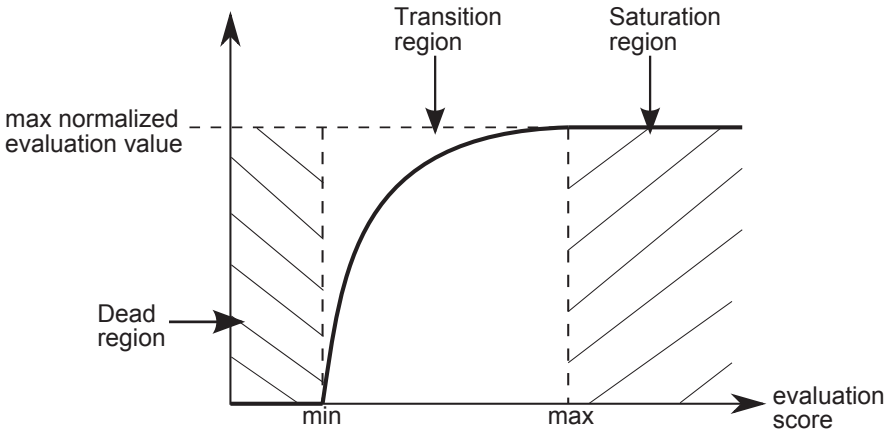


Figure 3.15: Behavior of the curve - The figure depicts the proposed three regions and dynamic transition region.

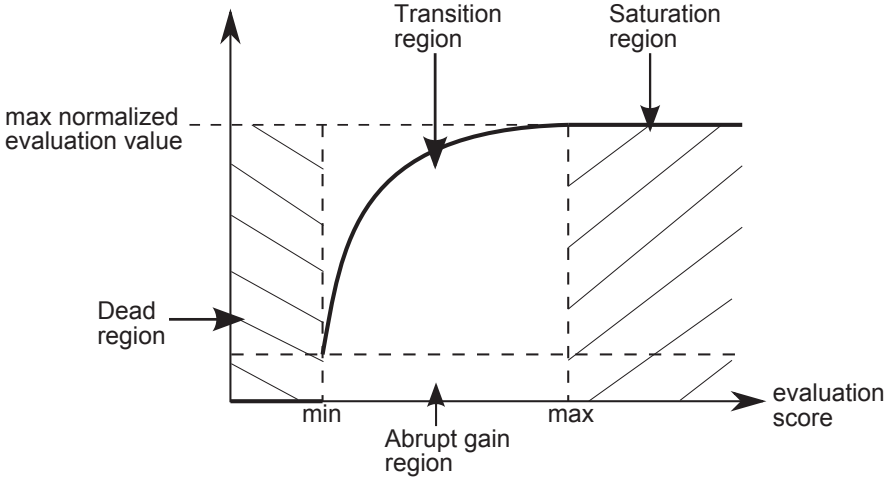


Figure 3.16: Behavior of the curve with abrupt gain - In addition to the three proposed regions, this figure highlights the proposed concept of abrupt gain.

When it comes to satisfying the requirements mentioned in Fact 7, we still stick to the basic structure of proposed function (i.e., Equation 3.5 - which we believe is realistic) and extend it by aggregating the evaluation of individual dimensions to attain the unit level evaluation. By the term *aggregation* in the preceding sentence, we mean the mechanism that captures the combined impact of all individual unit dimension evaluations of a unit. This provisions defining the relationship between/among the unit dimensions. In this work, we make use of the hybrid multiplicative and additive approach, thus the mathematical representation of the unit level evaluation is given in Equation 3.6. However, the decision of using which mathematical relationship is mainly influenced by the nature of the evaluated dimension, i.e., critical or non-critical. We will elaborate more on this later in this chapter.

$$D_1(x) := \begin{cases} 0 & \text{if } x < x_{min} \\ \mu_0 + \mu \cdot \frac{1-e^{-\beta(x-x_{min})}}{1-e^{-\beta(x_{max}-x_{min})}} & \text{if } x_{min} \leq x \leq x_{max} \\ 1 & \text{if } x > x_{max} \end{cases}$$

$$(+)(-)(*) \tag{3.6}$$

$$D_2(x) := \begin{cases} 0 & \text{if } x < x_{min} \\ \mu_0 + \mu \cdot \frac{1-e^{-\beta(x-x_{min})}}{1-e^{-\beta(x_{max}-x_{min})}} & \text{if } x_{min} \leq x \leq x_{max} \\ 1 & \text{if } x > x_{max} \end{cases}$$

An important aspect to highlight is that when normalized, the evaluation of individual dimensions in the preceding equation will be interpreted as having the similar impact in the overall unit evaluation. Such a formulation may not realistically aggregate the impact of individual dimension for the unit level evaluation. Thus if attaining the heterogeneous impact(s) of each individual dimension is the goal, then the relationship should be associated by a weight variable, which we did, and for ready reference, we present the additive relationship and the weight association to dimension values in Equation 3.7.

$$U_m(D_1, \ldots, D_n) := w_1 D_1(x) + w_2 D_2(x) + \cdots + w_n D_n(x) \tag{3.7}$$

where

$$w_1 + w_2 + \cdots + w_n = 1.$$

As highlighted earlier, we are convinced that inter-individual dimensions relationship is strongly influenced by the type of evaluation dimension. Let us now recall our proposed categorization of the evaluation dimensions, i.e., critical and non-critical. However, at this point,

we are interested more in discussing the unit evaluation (i.e., aggregation of the individual dimension evaluation) for different critical and non-critical unit dimensions. To explain things on clearer lines, we discuss the details in the following combinations of unit dimension types.

- Non-critical unit dimension to non-critical unit dimension.
- Critical unit dimension to critical unit dimension.
- Critical unit dimension to non-critical unit dimension.

3.6.1.1 Non-critical — Non-critical

As highlighted earlier (i.e., Fact 1 with per parameter evaluation and concept of value association to each parameter value), different dimensions impact the unit evaluation in different ways. Such heterogeneous like impact of each individual dimension is captured by the associated weight variable w to each dimension. Let us now discuss what the relationship between and among different unit dimensions should be when all of the involved dimensions are non-critical.

In this work, we propose weighted sum approach to capture the overall evaluation of a unit that contains only non-critical dimensions. Let $\mathcal{N}$ represent the finite set of non-critical dimensions of a unit. Then, mathematically, we represent the evaluation function that captures the evaluation of such set as follows:

$$U_m := \sum_{i=1}^{\mathcal{N}} w_i D_i(x) \tag{3.8}$$

where $D_i(x)$ represents the evaluation curve of the individual evaluation dimension. On the similar lines, as mentioned in the preceding section, sum of the associated weight values should be equal to 1. Owing to the additive identity property, one may expect that overall evaluation of such units will only be $zero$ when every dimension has the score $zero$, i.e.,

$$U_m = 0 \iff D_i(x) = 0 \qquad \forall i \in \mathcal{N}.$$

With the view to illustrating this, in Figure 3.17, we draw the curve that captures the evaluation for two dimensions, where both of the considered dimensions are non-critical in nature. Furthermore, we uniformly configure the weight values, i.e., both are assigned 0.5 weight values. Table 3.4 summarizes the configuration of different variables (e.g., weight values, sensitivity variable values) for this setting. As can be seen in the generated curve, keeping the

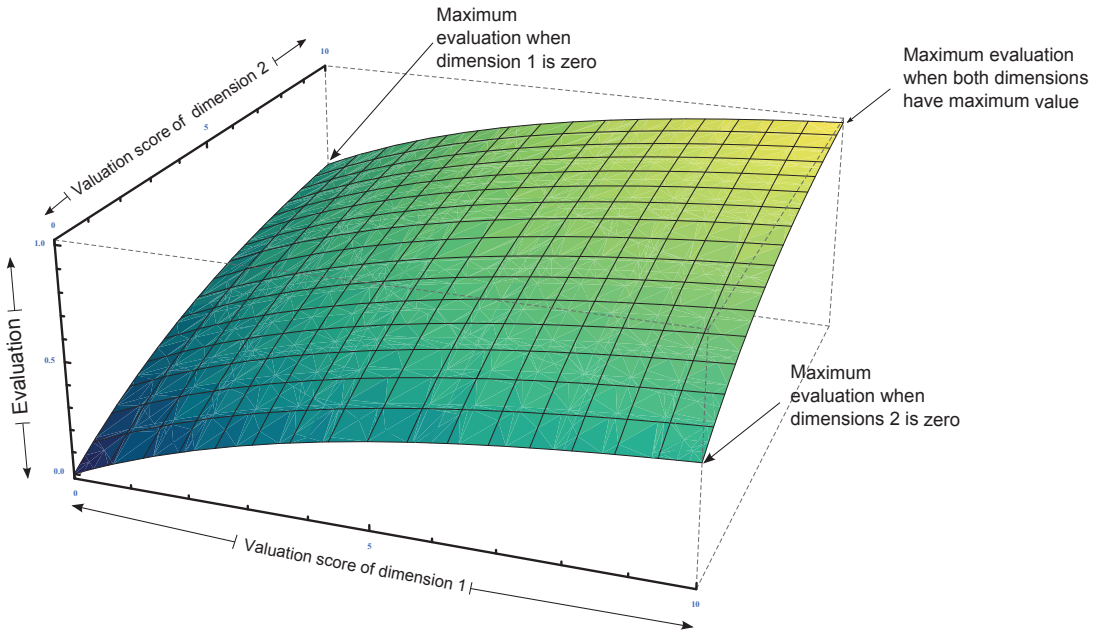


Figure 3.17: Setting 1 - The figure depicts two non-critical dimensions having the same weights, i.e., 0.5, and a β value of 0.2.

valuation score of one of the dimensions $zero$ and changing the valuation score of other, the evaluation varies over the entire valuation score range, i.e., $[0 - 10]$. Maximum evaluation value of 0.5 is attained against the maximum valuation score of one dimension, i.e., 10. This is due to: i) the evaluation dimension is weighted as 0.5 of the overall unit evaluation (thus it is able to reach maximum half of the evaluation scale); ii) minimum and maximum values are configured as 0 and 10 respectively; hence, the curve does not have dead and saturation regions. Surface of the curve represents the behavior of the proposed function for aggregated impact of different score valuation values of both of the evaluation dimensions. One may also observe that overall evaluation approaches $zero$ iff the valuation scores of both of the dimensions are $zero$. With the view to explaining the impact of weight values over the evaluation, we regenerate the results with different weight values and reconfigured the parameters as shown in setting 2 of Table 3.4. The curve is depicted in Figure 3.18.

As can be seen, now, dimension 1 alone may attain the maximum evaluation of 0.8 (i.e., when dimension 2's valuation score is $zero$), meaning thereby that dimension 2's maximum strength is 0.2 in the overall evaluation.

Let us now also observe the behavior of changing β and weight value. In this connection, we configure the variable values of the proposed function as given in setting 3 of Table 3.4. As

Table 3.4: Settings in Evaluation Function

Setting	w_1	w_2	β
Setting 1	0.5	0.5	0.2
Setting 2	0.8	0.2	0.2
Setting 3	0.5	0.5	0.99
Setting 4	0.5	0.5	0.7
Setting 5	0.5	0.5	0.1
Setting 6	0.5	0.5	0.02
Setting 7	0.8	0.2	0.02

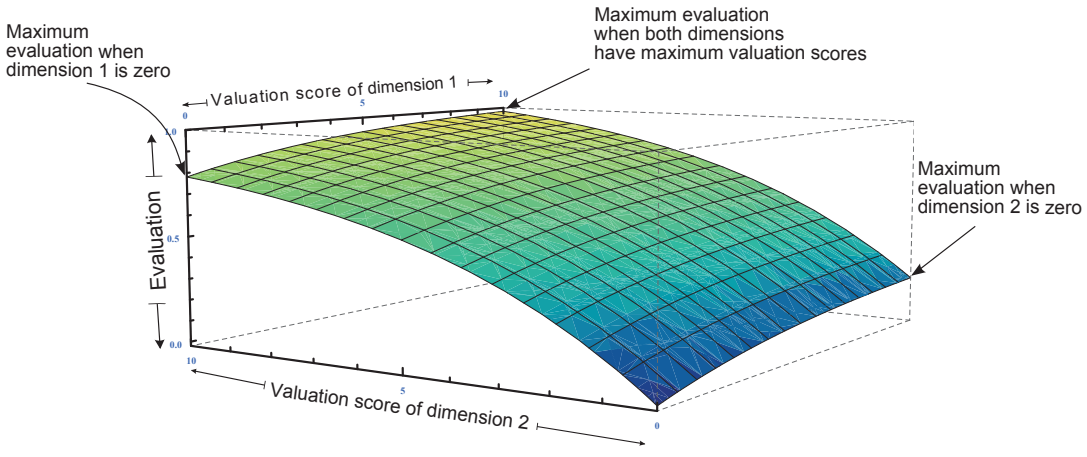


Figure 3.18: Setting 2 - Curve representing the overall evaluation of a unit with two non-critical dimensions for setting 2.

can be seen in curve of Figure 3.19, the transition region is smaller, which is due to higher β value. However, the impact of weight values for extreme results (i.e., 0 and maximum valuation score values) still follows the aforementioned explanations. But when it comes to curve's surface behavior, the impact of β value may be observed. In order to highlight this point, we generated the results shown in Figure 3.20. One may clearly advocate the impact of weight and β values by comparing Figure 3.19 and Figure 3.20. Moreover, one may see the linear like curve in Figure 3.21, when β value is very small.

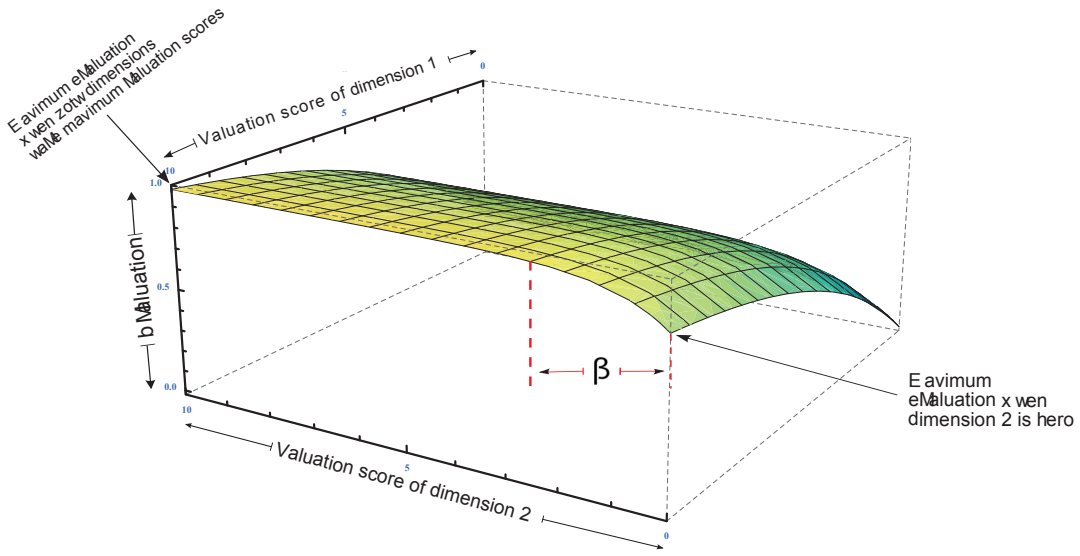


Figure 3.19: Setting 3 - Curve representing the overall evaluation of a unit with two non-critical dimensions for setting 3. We can observe the shrinkage in transition region due to higher β value.

3.6.1.2 Critical — Critical

In this section, we deal with the evaluation of dimension values that are critical in nature. In this work, we proposed weighted product approach to capture the overall evaluation of a unit for critical dimension values. The motivation to propose such an approach comes from the fact that overall evaluation is influenced greatly by the valuation score of the critical evaluation dimension, e.g., the zero valuation of a critical dimension should be realistically reflected in the overall evaluation of the unit. Let $\tilde{\mathcal{N}}$ be the finite set of critical evaluation dimensions of the

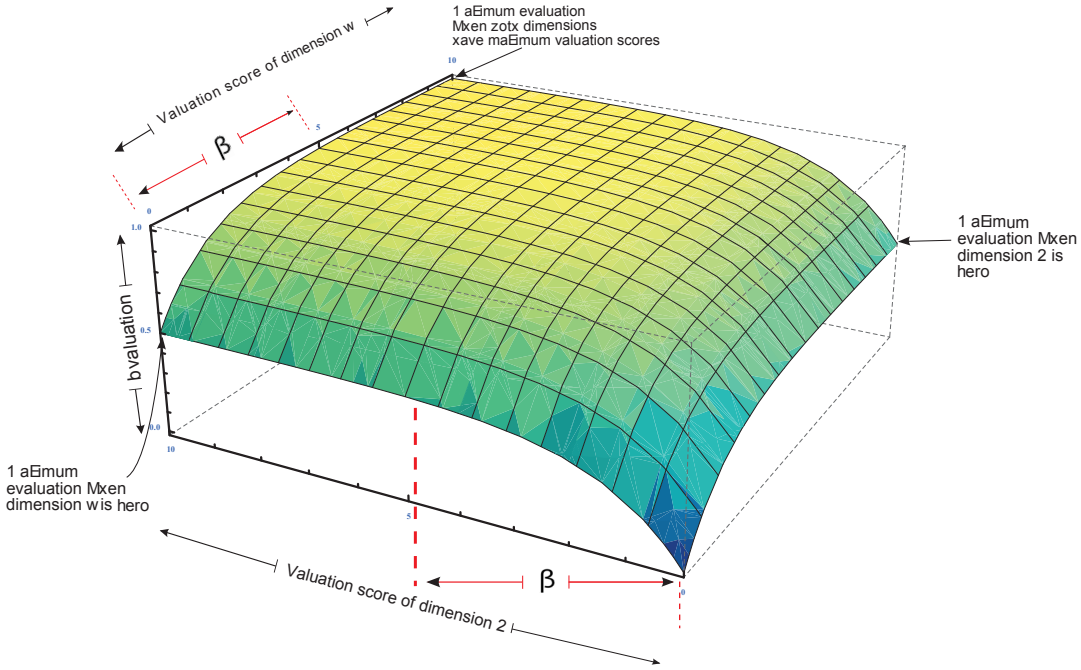


Figure 3.20: Setting 4 - Curve with same weights for both of the dimensions as in Figure 3.19, but a smaller β value, i.e., 0.7.

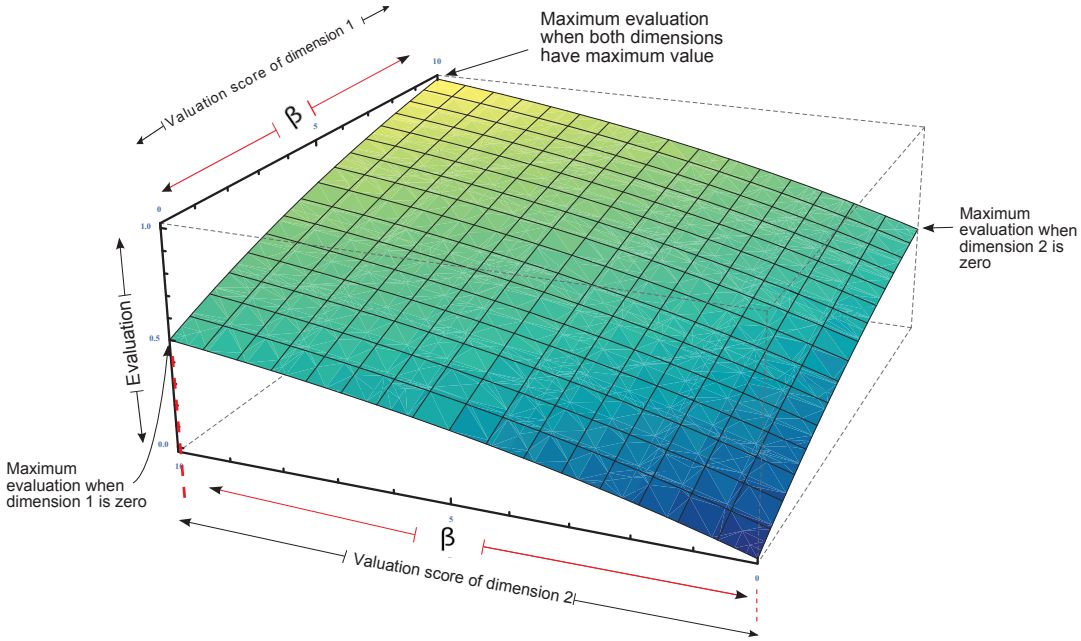


Figure 3.21: Setting 5 - Curve represents two non-critical dimensions having the same weights, i.e., 0.5, as in the previous two curves, but the β value is very small here. We see that the curve gets a linear like shape.

unit.

$$U_m := \prod_{i=1}^{\tilde{\mathcal{N}}} D_i(x)^{w_i}. \tag{3.9}$$

The multiplicative identity dictates that the overall evaluation of the unit will be *zero* as soon as any of the involved dimensions takes *zero* evaluation score.

We generated results for two dimensions (critical – critical) evaluation in different settings. As can be seen in Figure 3.22, both of the unit dimensions contain homogeneous weight value (i.e., 0.5 each) and β value is fixed as 0.02. The curves depicted in Figure 3.22 show that the proposed function meets the requirement highlighted in Fact 4. As evident from Figure 3.22, the evaluation approaches $zero$ as soon as any one of the unit dimensions gets the valuation score $zero$. Curve for heterogeneous weight values (i.e., 0.8 for dimension 1's assigned weight value and 0.2 for dimension 2's weight value) is configured as in Figure 3.23. As can be seen, the valuation score variation of dimension 1 greatly influences the overall evaluation, which is intuitive.

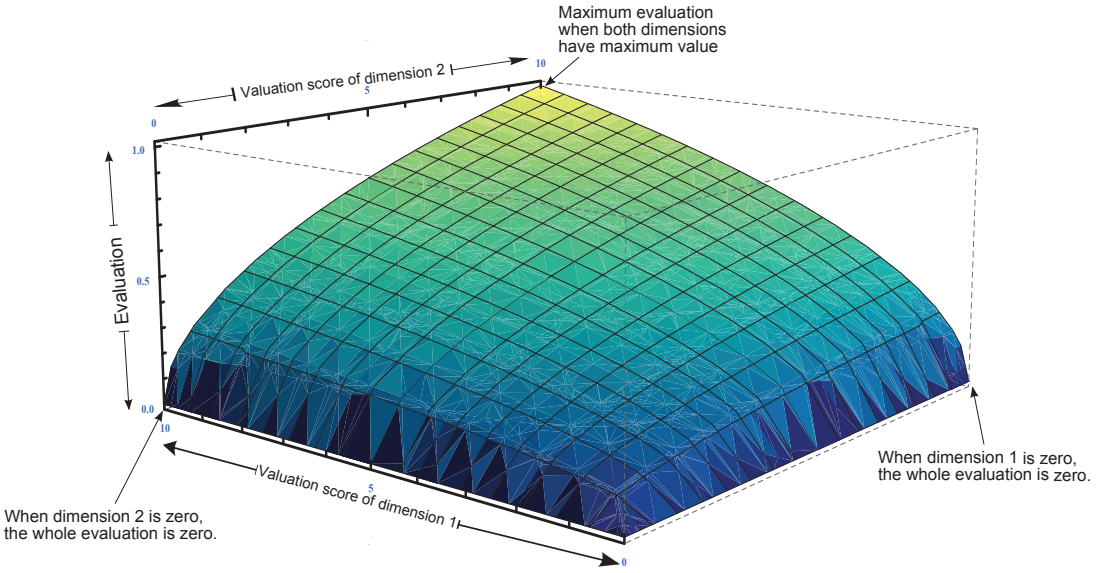


Figure 3.22: Setting 6 - Curve representing the overall evaluation of a unit with two critical dimensions for setting 2 having the same weights, i.e., 0.5, and a β value of 0.02. We can easily observe that the evaluation of the unit gets the value zero when any of the dimensions is assigned the evaluation score zero.

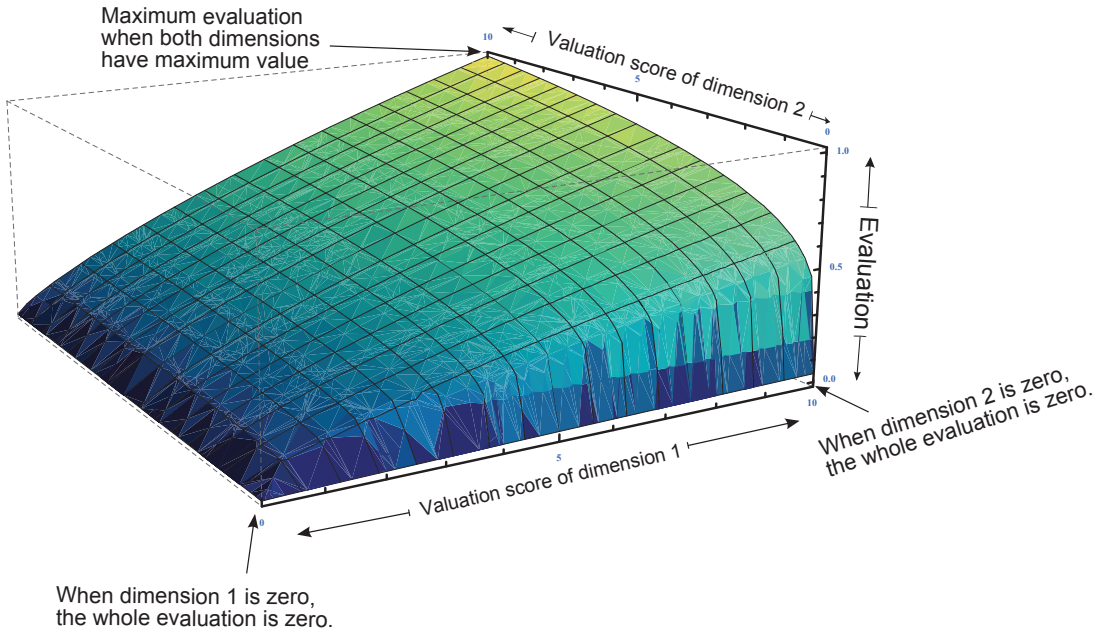


Figure 3.23: Setting 7 - Evaluation curve of a unit comprising two critical dimension with heterogeneous weight values in contrast to Figure 3.22. We can see that the dimension with higher weight, i.e., dimension 1, affects the overall evaluation more strongly.

3.6.1.3 Critical — Non-critical

We now discuss the behavior of proposed evaluation function in cases, where the unit level contains both critical and non-critical unit dimensions.

This requirement further guides us towards completeness of the proposed evaluation function. Thus at this stage the proposed function takes the following shape.

$$U_m := \lambda \sum_{i=1}^{\mathcal{N}} w_i \sigma(.) + \prod_{j=1}^{\tilde{\mathcal{N}}} \tilde{\sigma}^{w_j}(.) \tag{3.10}$$

where

$$\sigma(.) = \tilde{\sigma}(.) = \begin{cases} 0 & \text{if } x < x_{min} \\ \mu_0 + \mu \cdot \frac{1-e^{-\beta(x-x_{min})}}{1-e^{-\beta(x_{max}-x_{min})}} & \text{if } x_{min} \leq x \leq x_{max} \\ 1 & \text{if } x > x_{max} \end{cases}$$

such that $\sum_{i=1}^{N} w_i = 1$ and $\sum_{i=1}^{\tilde{N}} w_j = 1$, where λ is a boolean, which takes the value 1 when evaluation of critical unit dimension values involved in the evaluation is non-zero and zero otherwise.

3.6.2 Criterion Level Evaluation Function

Before we elaborate on the evaluation function at criterion level, we reinforce that the (non-) criticalness is imperative at the dimension level, whereas at any higher level, this concept is optional. Let us now discuss the evaluation function at criterion level. In this connection, we analyze the basic ingredients of the evaluation function at this level. Recall that earlier in this chapter, we highlighted that the proposed dependency concept is specific to criterion level. Thus the evaluation function should capture the evaluation for dependent criteria.

At this level, we propose a very similar evaluation function as that of unit level. This level is fed by the outputs of the immediate lower level, i.e., unit level. Unit level evaluation outputs are processed and fed to the criterion level evaluation function residing in the aggregator. This process is pictorially depicted in Figure 3.24.

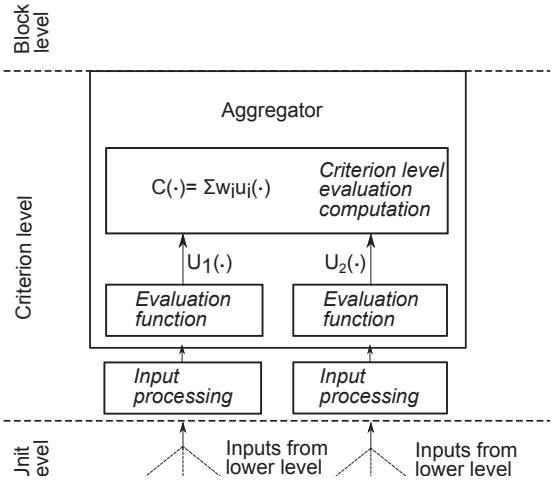


Figure 3.24: Aggregation process - The figure depicts that aggregation comprises process, function, and evaluation computation.

In the *process* block, the scaling will be carried, whereas the *function* block encamps the function very similar to the one presented in Equation 3.5. The proposed function is given by,

$$U(y) := \begin{cases} 0 & \text{if } y < y_{min} \\ \mu_0 + \mu \cdot \frac{1-e^{-\beta(y-y_{min})}}{1-e^{-\beta(y_{max}-y_{min})}} & \text{if } y_{min} \leq y \leq y_{max} \\ 1 & \text{if } y > y_{max} \end{cases} \tag{3.11}$$

where $U(\cdot)$ represents the evaluation function of units at the criterion level. y is the score variable that may take any discrete value from the evaluation score range, e.g., $y \in [0, 100]$, $y_{min/max}$ is minimum/maximum required unit score set. μ scales the function, μ_0 takes care

of the abrupt gain of the unit evaluation. The outputs of the function blocks are fed to the *evaluation computation* block, where we propose to sum the weighted output evaluation values of each unit, on the similar lines as explained in Section 3.6.1.

$$C_k(U_1, \ldots, U_m) := w_1 U_1(y) + w_2 U_2(y) + \cdots + w_m U_m(y) \tag{3.12}$$

where

$$w_1 + w_2 + \cdots + w_m = 1.$$

One may notice that it is still not clear how the proposed criterion level evaluation function captures the *external dependency* of a criterion over different unit evaluations. By the external dependency, we mean that a business model evaluation may take multiple parallel evaluation paths from block level. Such evaluation paths are feasible on those business models, which have more than one block. To elaborate on the parallel evaluation paths, we generate Figure 3.25 as follows:

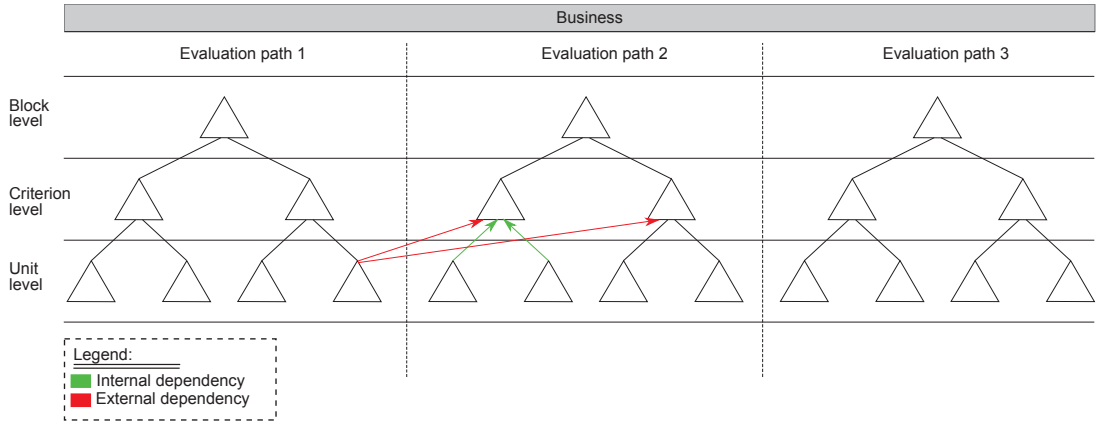


Figure 3.25: Internal and external dependency - Figure depicting both types of dependency, i.e., internal and external.

As can be seen in Figure 3.25 above, both internal and external dependencies are effective at the criterion level. An *internal dependency* concept corresponds to the unit level outputs, which are fed to the criterion level evaluation function of the same block. However, when it comes to defining the external dependency, the unit level outputs belong to different blocks.

The proposed dependency concept may be captured by the function in somewhat the similar way as that discussed for aggregation, i.e., weighted sum approach. The block index is just added to visualize the dependency of one block over another, which would mean that the

block index will have $null$ impact over the business model evaluation. However, what really impacts the business model evaluation is the internal and external units' score values. Thus when capturing the overall evaluation, one may think of two potential approaches, i.e., i) *block neutral*, and ii) *block sensitive* approaches.

Block Neutral Approach - In this approach, the overall evaluation treats score values from all of the units the same, i.e., the evaluation function is indifferent to the index of blocks. This approach assumes that the sub-firms of the business have no specific cost incurrence for the resource sharing in their service level agreements (SLAs).

Block Sensitive Approach - Contrary to the block neutral approach, in this approach, the sub-firms are assumed to have signed SLAs that may result in extra cost value while sharing the unit resource. Thus the overall evaluation should capture the evaluation of units from the external blocks with the mentioned SLA costs.

We now adapt Equation 3.12 to capture the mentioned dependency evaluation as follows:

$$C_k(U_{m,n}) := w_1 U_{1,1}(y) + w_2 U_{2,1}(y) + \cdots + w_m U_{m,n}(y) \qquad \forall k \in \mathcal{K} \tag{3.13}$$

where

$$w_1 + w_2 + \cdots + w_m = 1$$

where $C_k(U_{m,n})$ represents the criterion level evaluation for units m and blocks n of the business, where $\mathcal{K}$ is a set of criteria.

3.6.3 Block Level Evaluation Function

The inputs to the evaluation function at this stage are the outputs from the immediate lower level. On the similar lines as the evaluation at other levels, we make use of the weighted sum approach. However, it should be noted that the output of the lower level evaluation models are not directly aggregated, rather they are input to the block level evaluation function. The block level evaluation function then processes the inputs based on Equation 3.13. The output of the business level evaluation function is aggregation of output values of block level evaluation functions (the equation for this computation is straightforward and similar to the ones discussed earlier).

Remark 4. *It is trivial that business evaluation aggregates the evaluation of the lower levels and such aggregation is carried out on the aforementioned lines. However, the inclusion of*

index for business blocks and sensitivity of evaluation for different business blocks derive the evaluation at this state.

Now that we have discussed the proposed evaluation approach, in the following, we carry out an example business model evaluation (i.e., DAI-Labor, details provided in the following section) to study and validate the performance of the proposed framework.

3.7 Use case: DAI-Labor Business Model Evaluation

To illustrate and capture the basic crux of the proposed ideas, we present the case study of DAI-Labor. The DAI business model was chosen for evaluation of the proposed approach basically for the following major reasons:

- Motivation to explore a business model of different type. DAI-Labor is a non-profit organization. Although most of the research literature evaluate different business models, but to the best author's knowledge, this work may be counted amongst the first ones that addresses the business model evaluation of a non-profit organization.
- The telecommunication sector is quite dynamic, every changing day awaits innovations in services, which in turn provisions adaptive evaluation tool.
- Searching an ideal use case of a mix of research and industry procedures.
- It comprises various competence centers, which could be evaluated on a business block level, and further their dependency over each other can be studied.
- Frequency and relative easiness of the access to the core information and concerned personnel for evaluation of the model. Owing to the fact that this research is carried out at DAI-Labor, and we were able to collect all needed information, the dynamics of business were also observed over the timeline of the research on daily basis. This enables us to claim that DAI-Labor's business model may be the most suitable and realistic one for evaluating the performance of the proposed business model evaluation framework.

We selected DAI-Labor's business model as the use case, which is a non-profit organization but to a great extent involved with industry partners (more details about DAI-Labor are provided below). However, one point worth noticing here is that to what extent can the validation outcome of the above mentioned use case be generalized to other business models? To study this aspect, in Section 3.8, we carry out the mapping of commonly used nine block structure

to the proposed framework. The mapping was exercised to know if the proposed framework is flexible enough.

3.7.1 DAI-Labor - An Introduction

The Distributed Artificial Intelligence Laboratory (DAI-Labor) is a research institute headed by Prof. Dr. Dr. h.c. Şahin Albayrak at the Technische Universität Berlin. The core activities at DAI-Labor can basically be bifurcated into two major dimensions, i.e., Educational dimension and Service dimension. The earlier focuses mainly on carrying out scientific research, offering various courses to the students of Bachelors and Masters through the Agent Oriented Technologies (AOT) chair, whereas the later provides smart solutions and contributes to the industrial and scientific projects. Figure 3.26 shows DAI-Labor's position within Technische Universität Berlin.

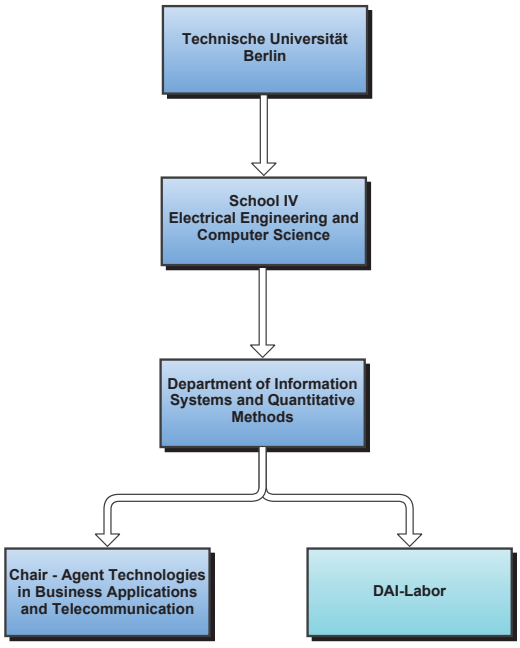


Figure 3.26: DAI-Labor within TU Berlin - The figure represents hierarchical position of DAI-Labor within TU Berlin.

The organization and research structure at DAI-Labor is decomposed into six different sub-entities called competence centers. The competence centers are specialized in different specific scientific areas. Below, we give an overview of these competence centers.

Agent Core Technologies - The Competence Center *Agent Core Technologies* does research and development in the context of agent oriented technologies. In close collaboration with industry, these technologies, methods, and tools are explored and applied to scenarios in areas as diverse as telecommunication, energy, and (electric) mobility. Goal is to quickly and efficiently create scalable systems and smart services, and to master their complex behavior while retaining all possible degrees of freedom, for the participating entities as well as the entire system.

Information Retrieval and Machine Learning - The Competence Center *Information Retrieval & Machine Learning* is working on the semantic collection, intelligent processing, and extensive analysis of data and information.

Next Generation Services - The Competence Center *Next Generation Services* is conducting research in the area of smart (home) environments and future interactive systems. With a focus on model-based approaches, new systems, tools, and development methodologies are developed and evaluated.

Cognitive Architectures - The Competence Center *Cognitive Architectures* deals with open questions in areas such as artificial intelligence, cognitive science, and robotics.

Network and Mobility - The Competence Center *Network and Mobility* conducts research towards the overall vision of shaping the future Internet architecture and services. The research and development activities are performed within 3 main working groups (clusters), supported by inter-connected testbeds. Their innovations contribute to the architecture and services of next generation networks, while the current state of the art is reflected by relevant updates and improvements on the testbeds.

Security - The main focus of the Competence Center *Security* is the research and development of new intelligent security solutions to meet the challenges posed by the increasing complexity of information and telecommunications networks, which are the backbone of our modern society.

These competence centers also provide the researchers with scientific basis. The activities within each competence center, on the one hand, can be graded as the realization of research ideas in terms product, i.e., projects, these activities frame the research work of the researchers therein, on the other hand. More on these competence centers can be found at `http://www.dai-labor.de`.

We now briefly discuss the application centers of DAI-Labor. The application centers provide a platform for the development of interdisciplinary systems solutions that cross the boundaries of single competence center. They combine and focus synergies and generate research

results that directly or indirectly benefit users.There are six application center, namely,

Energy - The application center *Energy* develops ICT and software solutions for efficient and sustainable energy logistics and consumption.

Government - The applications center *Government* is concerned with the implementation of service-centric Government solutions.

Health - The application center *Health* focuses on services that support the users with their health prevention.

Knowledge Services - The application center *Knowledge Services* is concerned with the implementation of service-centric knowledge-oriented solutions.

Security - The application center *Security* focuses on developing security, privacy and safety solutions for protecting critical infrastructures.

Transport and Traffic - The application center *Transport & Traffic* focuses on intelligent solutions for traffic management.

In addition, DAI-Labor offers courses addressing topics such as intelligence, inter-operability, cooperation and coordination within the field of distributed systems. The focus lies on the conception of an agent being a software component featuring autonomous, goal-directed behavior. Putting many agents together leads to highly scalable, fault tolerant Multi-Agent Systems. The chair Agent Technologies in Business Applications and Telecommunication, together with the competence centers of DAI-Labor, offers lectures to instruct basic knowledge in the following fields.

- Multi-Agent Systems
- Information Retrieval and Semantic Search
- Security
- Service Engineering
- Autonomous Communications

As of February 23, 2013, DAI-Labor has 157 employees, comprising:

- 1 Head
- 4 Administrative staff
- 73 Research assistants
- 75 Student co-workers

- 4 System administrators

Projects at DAI-Labor are financed predominantly by third parties, e.g., German ministries, European Union research programs, private companies. Accordingly, most of the staff have limited contracts that depend on the duration of the corresponding project. A small fraction of the staff is financed by the school or the university. These may have permanent contracts.

DAI-Labor does not make profit from the projects it participates in. The financial goal is to cover the costs and realize sustainability in the long run. University has an overhead fraction that is considered while preparing a project budget. This fraction goes directly to the university and DAI-Labor cannot profit from that directly.

3.7.2 Evaluation Approach

With the view to evaluating the business model at DAI-Labor, we adopted the following approach. In the first place, we divided the evaluation process into three phases, namely, i) identification of the relevant information sources, ii) preparation and distribution of the questionnaire to the concerned corners, and iii) evaluation of the gathered information. In the following, we briefly discuss the mentioned phases.

3.7.2.1 Identification of the relevant information sources

As discussed earlier, DAI-Labor focuses on the two dimensions, i.e., education and service, thus dictating that information regarding both of the dimensions is provisioned. In this connection, the most suitable source of information turned out to be the competence center directors or vice directors, as they are the most informed personnel on their respective competence centers both administratively and educationally. We decided to collect information using questionnaire.

3.7.2.2 Preparation and distribution of the questionnaire to the concerned corners

When it comes to the questionnaire preparation, we followed the given steps.

1. Investigating the questionnaires available in the research literature - In this step, we investigated various available questionnaires in the research literature, e.g., (Osterwalder & Pigneur 2010, pp. 216-219), (Horsti 2007, pp. 108-110), (Wohltorf 2005, p. 106), (Weiss 2010, pp. 50). The objective of carrying out this exercise was to extensively study the questionnaire pattern focusing various dimensions.

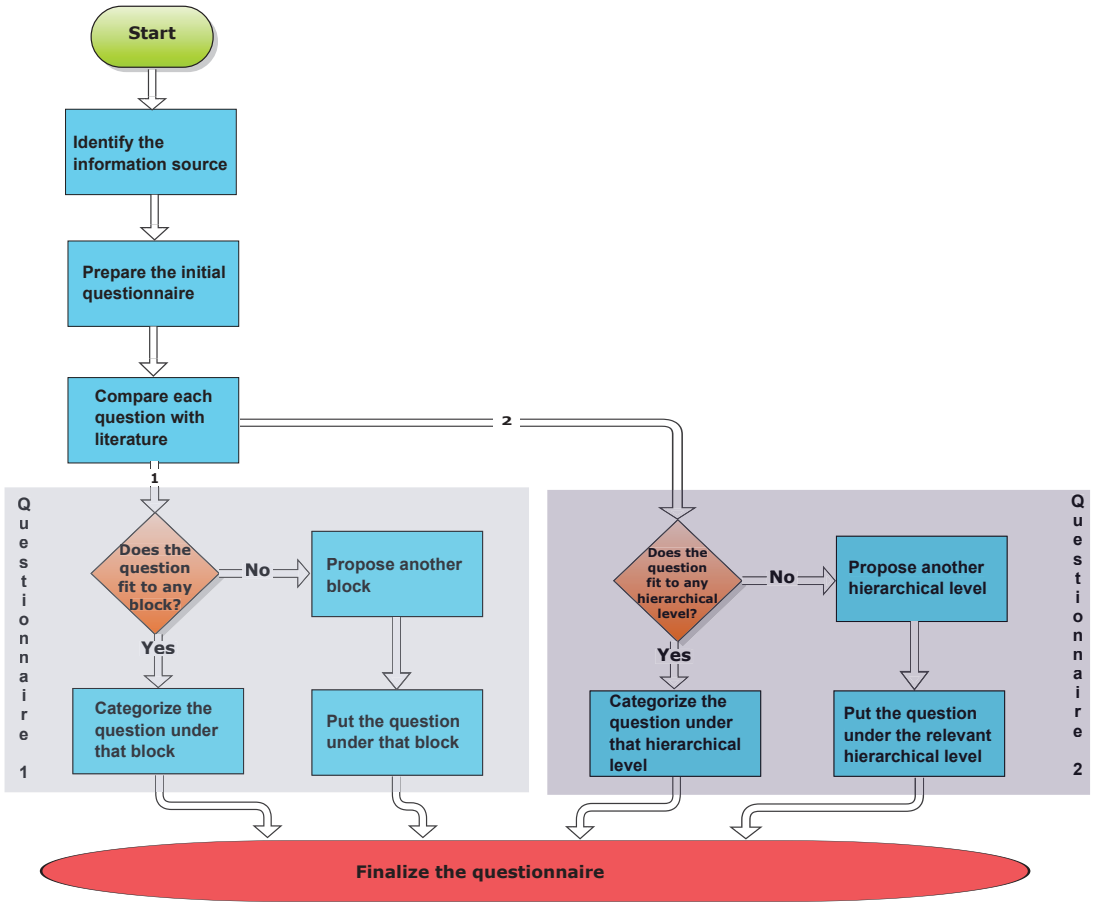


Figure 3.27: The flow diagram of preparation - Flow chart representing the flow of the preparation of DAI Business Model Evaluation Questionnaires.

2. Selecting the most relevant questionnaire for our evaluation - Having studied various questionnaires available in the literature, we chose (Osterwalder & Pigneur 2010, pp. 216-219) as the reference questionnaire for this work. The motivation to select the mentioned questionnaire comes from the following facts: i) it is generic, ii) explicitly following the well-defined 9-blocks structure, iii) outcome of the research literature survey, iv) mostly accepted in the literature and specifically by the practitioners.

3. Preparing the stand-alone questionnaire based on the experienced procedures within DAI-Labor - In the first place, we prepared a questionnaire that we thought should capture the commonly observable procedures within DAI-Labor, e.g., including questions about the technical support, research activities, service partners satisfactions, competence centers integral activities.

4. Comparing the stand-alone questionnaire against the questionnaires in the research literature - We compared the questions within the draft against the questionnaire given in (Osterwalder & Pigneur 2010, pp. 216-219). This comparison had two-fold objectives; on the one hand, we were able to figure out if the DAI questionnaire covers all the blocks within the nine blocks structure. If not, then we had to investigate what blocks were redundant and why. Or what additional blocks were needed and why. On the other hand, this exercise kept the proposed model in line with the framework mostly referred in the literature.

5. Distribution of the questionnaire to the concerned corners - Once the questionnaire was finalized on the mentioned lines, we distributed the questionnaire amongst the competence center directors and competence center co-directors. However, to ensure the realistic evaluation, we adapted the questionnaire collection procedure so that the names of the people filling the questionnaire remained anonymous. One could term the adapted procedure as *blind data collection*. By the realistic evaluation, we mean that the ones filling the forms, who in our case were the competence center directors or competence center co-directors, were responsible for activities within their respective competence centers, thus declaring their names and filling the forms that exhibit the negative impression of their competence centers were unrealistic. Given this fact, one may doubt that the collected information might fall under exaggerated category. However, being sure that the provided information would anonymous, the competence center (co-)directors would truthfully answer the questions within the questionnaire.

Remark 5. *With the view to evaluating the performance of proposed hierarchical model over the legacy approaches, we generated two questionnaires; i) Questionnaire 1, which is not taking hierarchy into account, ii) Questionnaire 2, which takes hierarchy into account. Both of the questionnaires were the consequences of investigation over the relevant approaches. For ready reference, a sample of the questionnaire may be found in Horsti 2007 (pp. 45), and some key questions in Osterwalder 2007. All of the questions in questionnaire 1, and all of the unit dimension level questions in questionnaire 2 are accompanied by the* choice fields *like* critical *and* non-critical. *This helps us categorize the questions in the proposed critical and non-critical categories (more on critical and non-critical categories may be found in Section 3.4) and for mapping of questions over the proposed hierarchical evaluation model (true for questionnaire 2 only). Furthermore, each question had to be evaluated on the discrete eleven instances, i.e., 0 - 100. We summarize this process in the flow chart presented in Figure 3.27*

For ready reference, in what follows next, we present both of the questionnaires.

Questionnaire for Evaluating DAI Business Model

Questionnaire 1

March 27, 2011

Your quick response will be highly appreciated.

Prepared by: Nuri Kayaoğlu.

Note: The terms critical and non-critical are used to scale the importance of the questions.

1. How do you weight the project and research work at your CC, e.g., 50% project work, 50% research, or suggest the percentage break up among different activities?
   Project=.....% and research=.....% ☐ *Critical* ☐ *Non-Critical*
   Remark(if any):
2. Are the personnel highly skilled in their relevant fields?
   .....% ☐ *Critical* ☐ *Non-Critical*
   Remark(if any):
3. How satisfied are the scientists with the project load?
   .....% ☐ *Critical* ☐ *Non-Critical*
   Remark(if any):
4. How satisfied are the scientists with their research progress?
   .....% ☐ *Critical* ☐ *Non-Critical*
   Remark(if any):
5. Are the running projects supporting scientists in their PhD research, scale the relevance in % age?
   .....% ☐ *Critical* ☐ *Non-Critical*
   Remark(if any):
6. How satisfied are you with the organizational structure at DAI-Labor?
   .....% ☐ *Critical* ☐ *Non-Critical*
   Remark(if any):

7. How satisfied are you with project acquisition?
   .....% ☐ *Critical* ☐ *Non-Critical*
   Remark(if any):
8. Scale the synergies among the CCs?
   .....% ☐ *Critical* ☐ *Non-Critical*
   Remark(if any):
9. Are you satisfied with the number of patents being worked on (gained) in the last few years?
   .....% ☐ *Critical* ☐ *Non-Critical*
   Remark(if any):
10. Are you satisfied with the number of PhDs produced per year?
    .....% ☐ *Critical* ☐ *Non-Critical*
    Remark(if any):
11. How satisfied are you with the number of journal publications?
    .....% ☐ *Critical* ☐ *Non-Critical*
    Remark(if any):
12. How satisfied are you with the number of conference publications or book chapters, etc.?
    .....% ☐ *Critical* ☐ *Non-Critical*
    Remark(if any):
13. How satisfied are you with the technical resources, e.g., hardware, software tools, and printers?
    .....% ☐ *Critical* ☐ *Non-Critical*
    Remark(if any):
14. How satisfied are you with room resources, e.g., conference rooms?
    .....% ☐ *Critical* ☐ *Non-Critical*
    Remark(if any):
15. How satisfied are you with WC resources?
    .....% ☐ *Critical* ☐ *Non-Critical*
    Remark(if any):
16. How satisfied are you with the kitchens?
    .....% ☐ *Critical* ☐ *Non-Critical*
    Remark(if any):

17. How satisfied are you with the intra-CC recreational activities?
    .....% ☐ *Critical* ☐ *Non-Critical*
    Remark(if any):

18. How satisfied are you with the inter-CC recreational activities?
    .....% ☐ *Critical* ☐ *Non-Critical*
    Remark(if any):

19. How satisfied are you with administrative procedures, e.g., work related to secretariat?
    .....% ☐ *Critical* ☐ *Non-Critical*
    Remark(if any):

20. How satisfied are you with technical support?
    .....% ☐ *Critical* ☐ *Non-Critical*
    Remark(if any):

21. How satisfied are you with coordination to vertical level partners?
    By vertical level partners, we mean the funding agencies.
    .....% ☐ *Critical* ☐ *Non-Critical*
    Remark(if any):

22. How satisfied are you with coordination to horizontal level partners?
    By horizontal level partners, we mean the partners who share the project work with DAI.
    .....% ☐ *Critical* ☐ *Non-Critical*
    Remark(if any):

23. How satisfied are the vertical level partners (i.e., funding agencies) with our performance?
    I assume that the answer to this question may be based on the feedback received from the partners.
    .....% ☐ *Critical* ☐ *Non-Critical*
    Remark(if any):

24. How satisfied are the horizontal level partners (i.e., partners who share the project work with DAI) with our performance?
    I assume that the answer to this question may be based on the feedback received from the partners.
    .....% ☐ *Critical* ☐ *Non-Critical*
    Remark(if any):

25. How satisfied are you with coordination to partners?
    .....% ☐ *Critical* ☐ *Non-Critical*
    Remark(if any):

26. Does the institute achieve its goals?
    .....% ☐ *Critical* ☐ *Non-Critical*
    Remark(if any):

27. Do revenues cover costs?
    .....% ☐ *Critical* ☐ *Non-Critical*
    Remark(if any):

28. Are your costs predictable?
    .....% ☐ *Critical* ☐ *Non-Critical*
    Remark(if any):

29. Are your revenues predictable?
    .....% ☐ *Critical* ☐ *Non-Critical*
    Remark(if any):

30. Are the revenues sustainable in the long run?
    .....% ☐ *Critical* ☐ *Non-Critical*
    Remark(if any):

31. Are you satisfied with effectiveness of information dissemination of scientific activities by or at DAILabor, e.g., conferences, journals, exhibitions, talks?
    .....% ☐ *Critical* ☐ *Non-Critical*
    Remark(if any):

Questionnaire for Evaluating DAI Business Model

Questionnaire 2

May 17, 2012

Your quick response will be highly appreciated.

Prepared by: Nuri Kayaoğlu.

Note: The terms critical and non-critical are used to scale the importance of the questions.

A. Evaluation of Human Resources

Note: Please select a sample of six personnel for this evaluation.

1. .....

   (i) Assign the performance value to social competence. .....%

   ☐ *Critical* ☐ *Non-Critical*

   (ii) How clear is she/he with research concepts? .....%

   ☐ *Critical* ☐ *Non-Critical*

   (iii) Grade her/him for her/his project contribution. .....%

   ☐ *Critical* ☐ *Non-Critical*

   (iv) Is she/he punctual? .....%

   ☐ *Critical* ☐ *Non-Critical*

   (v) How good is her/his knowledge in the involved project and research area? .....%

   ☐ *Critical* ☐ *Non-Critical*

   (vi) How do you grade her/his communication skills? .....%

   ☐ *Critical* ☐ *Non-Critical*

2. .....

   (i) Assign the performance value to social competence. .....%

   ☐ *Critical* ☐ *Non-Critical*

   (ii) How clear is she/he with research concepts? .....%

   ☐ *Critical* ☐ *Non-Critical*

(iii) Grade her/him for her/his project contribution. .....%

☐ *Critical* ☐ *Non-Critical*

(iv) Is she/he punctual? .....%

☐ *Critical* ☐ *Non-Critical*

(v) How good is her/his knowledge in the involved project and research area? .....%

☐ *Critical* ☐ *Non-Critical*

(vi) How do you grade her/his communication skills? .....%

☐ *Critical* ☐ *Non-Critical*

3. .....

(i) Assign the performance value to social competence. .....%

☐ *Critical* ☐ *Non-Critical*

(ii) How clear is she/he with research concepts? .....%

☐ *Critical* ☐ *Non-Critical*

(iii) Grade her/him for her/his project contribution. .....%

☐ *Critical* ☐ *Non-Critical*

(iv) Is she/he punctual? .....%

☐ *Critical* ☐ *Non-Critical*

(v) How good is her/his knowledge in the involved project and research area? .....%

☐ *Critical* ☐ *Non-Critical*

(vi) How do you grade her/his communication skills? .....%

☐ *Critical* ☐ *Non-Critical*

4. .....

(i) Assign the performance value to social competence. .....%

☐ *Critical* ☐ *Non-Critical*

(ii) How clear is she/he with research concepts? .....%

☐ *Critical* ☐ *Non-Critical*

(iii) Grade her/him for her/his project contribution. .....%

☐ *Critical* ☐ *Non-Critical*

(iv) Is she/he punctual? .....%

☐ *Critical* ☐ *Non-Critical*

(v) How good is her/his knowledge in the involved project and research area? .....%

☐ *Critical* ☐ *Non-Critical*

(vi) How do you grade her/his communication skills? .....%

☐ *Critical* ☐ *Non-Critical*

5. .....

(i) Assign the performance value to social competence. .....%

☐ *Critical* ☐ *Non-Critical*

(ii) How clear is she/he with research concepts? .....%

☐ *Critical* ☐ *Non-Critical*

(iii) Grade her/him for her/his project contribution. .....%

☐ *Critical* ☐ *Non-Critical*

(iv) Is she/he punctual? .....%

☐ *Critical* ☐ *Non-Critical*

(v) How good is her/his knowledge in the involved project and research area? .....%

☐ *Critical* ☐ *Non-Critical*

(vi) How do you grade her/his communication skills? .....%

☐ *Critical* ☐ *Non-Critical*

6. .....

(i) Assign the performance value to social competence. .....%

☐ *Critical* ☐ *Non-Critical*

(ii) How clear is she/he with research concepts? .....%

☐ *Critical* ☐ *Non-Critical*

(iii) Grade her/him for her/his project contribution. .....%

☐ *Critical* ☐ *Non-Critical*

(iv) Is she/he punctual? .....%

☐ *Critical* ☐ *Non-Critical*

(v) How good is her/his knowledge in the involved project and research area? .....%

☐ *Critical* ☐ *Non-Critical*

(vi) How do you grade her/his communication skills? .....%

☐ *Critical* ☐ *Non-Critical*

B. Evaluation of Research Activities

1. Scale your satisfaction with the number of research publications? .....%
2. Scale your satisfaction with the number of Bachelor and Master theses? .....%
3. Are the publications on average in high ranked conferences/journals? .....%
4. Are you satisfied with the number of workshops/conferences arranged by your competence center (CC)? .....%

C. Evaluation of Project Progress

1. To what extent do you think that the number of running projects meet the requirements of CC? .....%
2. How satisfied are you with the progress and meeting the milestones of running projects at your CC? .....%
3. Do the running projects feed to research requirements of PhDs involved? .....%
4. Are the project acquisition activities satisfactory? .....%

D. Evaluation of Knowledge Transfer Activities

1. Do the team members share their knowledge with the team often? .....%
2. Are technical talks arranged by your CC enough? .....%

E. Satisfaction of the Technical Support from the Network Administrators

1. Is the support of the network administrators satisfactory? .....%

F. Evaluation of CC Products

1. Has your CC been converting ideas into products and does it have good amount of products? .....%

2. How satisfied are you with the pace of generation of new ideas for CC assets? .....%

G. Evaluation of Collaboration with other Partners

1. Scale the collaboration activities with research partners.
   (i) Activities with companies. .....%
   ☐ *Critical* ☐ *Non-Critical*
   (ii) Activities with non-profit organizations. .....%
   ☐ *Critical* ☐ *Non-Critical*
2. Scale the collaboration activities with project partners. .....%

H. Evaluation of Marketing Activities

1. Evaluate the marketing activities for your projects, research, and products. .....%

3.7.2.3 Evaluation of the gathered information

In this section, we present the evaluation procedures for the aforementioned two questionnaires. Owing to the scope of each questionnaire, the evaluation procedures are different. The difference in the evaluation of these questionnaires is mainly encamped in the *mapping of questionnaire 2 over the proposed hierarchical level*, which we will detail later in this section.
Evaluation of questionnaire 1 - We now start with detailing the evaluation procedures for questionnaire 1, these procedures may be translated as the subset of evaluation procedures for questionnaire 2. Having collected the filled questionnaires, we first categorize the questions into critical and non-critical categories (this step is common for both of the questionnaires). This is carried out by observing the collected data, where each question is accompanied by an option to declare the question as critical or non-critical. A question is put under the critical category if more than 50% of the collected data points are to be critical and it is put under non-critical category otherwise. Although the mentioned rule was chosen as the default rule for categorizing the questions, to our surprise, most of the collected data did not fall in the vicinity of 50%, hence putting our lives at ease. It should be noted that the proposed concept of strictly critical is treated similar to that of critical question in the evaluation, however, in this case, the evaluator is not given the option to categorize the question. The evaluation procedure was decomposed into the following steps:

1. Classifying the questions into critical and non-critical categories - As can be viewed in the sample questionnaire, every question is accompanied by the option of grading it as critical or non-critical. We enlisted the question in the list of critical question only if the collected data indicated that more than 50% of the competence center (-co)directors have marked the question critical. To further explain this procedure, reader may refer to the flow chart in Figure 3.28.

   Definition 7. *We define the uniform weighing scale as assigning each evaluating criterion exactly the similar weight.*

2. Evaluating on the uniform weighting scale (Questionnaire 1) - In this step, we assign each question exactly the similar weight, i.e., each question from the list of 30 questions gets the weight of 0.03, which scales the overall evaluation between [0-100]. In Table 3.5, we present this step of evaluation. As can be seen, the evaluation outcome is a real number or a percentage value, i.e., 61.71%. One can translate this value on any scale; however, in the proposed configuration, we define three regions of the evaluation,

i.e., *Unacceptable*, *Acceptable*, and *Appreciable*. One can also notice the procedure of classifying the questions into critical and non-critical, which is self-explanatory. In order to investigate the deviation of collected information for each question, we also computed the standard deviation, given in the last column of Table 3.5. As can be observed, most of the questions have standard deviations less than 20%, i.e., 2, 5, 8, 10, 11, 13, 15, 16, 17, 18, 19, 20, 21, 23, 24, 26, 27, 28. However, the standard deviations for almost 40% of the questions fall in the range of $20 - 40\%$. We assume this increase in deviation may be reduced when the survey is conducted on a comparatively larger scale. One interesting fact to notice is that more than 75% of the critical questions were declared critical by almost all the competence center (co-)directors (i.e., 83% of them).

3. Evaluating on the heterogeneous weighing scale (Questionnaire 1) - In this configuration, different questions are weighted differently, whereas the weight associated with each question is driven by its importance in the evaluation process. However, the values of weights associated with each question may be the consequence of firms' policy.
   In the DAI evaluation, to avoid complexity, we randomly assigned different weights to different questions, i.e., the first 10 questions were assigned 0.05 and 0.06, the middle ten questions were assigned for each case 0.03, and the last ten questions were assigned 0.02 and 0.01 weights. With these assigned weights, the model was re-evaluated on the similar lines as in the homogeneous configuration. Table 3.6 presents the evaluation outcome. We carried out evaluation for two sets of weights as depicted in columns 4 and 5 of Table 3.6. One can observe the impact of weights on the overall evaluation from the table, e.g., for the first set of associated weights, the overall evaluation changes from 61.71 (the evaluation with homogeneous weights) to 58.42, whereas for the second sets of weights, the overall evaluation turns out to be 56.45. Though in all the mentioned cases, the mapping results in the "Acceptable Business Model" for this particular case, upon variation in the assigned weights, one can expect the change in the mapping results, e.g., "Acceptable Business Model" may be driven into either "Appreciable Business Model" or "Unacceptable Business Model".

4. Evaluating on the heterogeneous weighing scale without criticalness - In this configuration, we keep all settings similar to the one discussed for the previous configuration except that we replace the evaluation of question number 16 with *zero* and carry out evaluation on exactly similar lines as in the previous configurations. Our goal in this investigation is to study the impact of fully degraded evaluation value of a question on the

overall evaluation. Table 3.7 presents the evaluation outcome. As can be seen with the mentioned settings (i.e., question number $12 = 0$), the overall evaluation turns out to be 59.71%, 56.62%, and 54.65% for equally weighted, first weights set, and second weights set respectively. We further observe a degradation of 2%, 1.80%, and 1.80% in equally weighted, first weights set, and second weights set respectively, when compared with the previous configuration. One intuitive observation is that the overall evaluation is zero if and only if the evaluation of each question is zero; in any other case the overall evaluation is non-zero.

Remark 6. *It should be noted that the evaluation is carried out using weighted sum approach in both the configurations.*

Let us now map the evaluation output on the decision. For such mapping, we use the earlier mentioned three region concept. Thus the consequence of mapping in this configuration is "Acceptable Business Model".

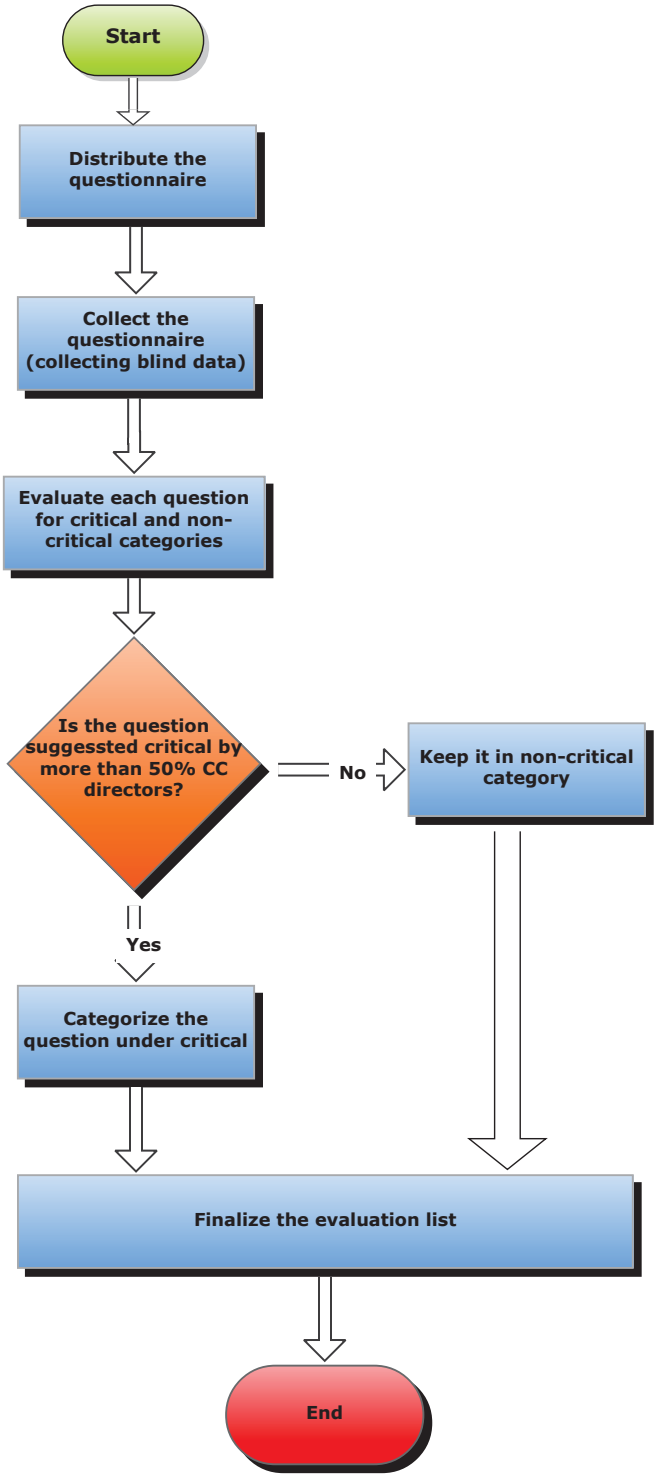


Figure 3.28: The flow diagram of evaluation - Flow chart representing the flow of the evaluation of DAI Business Model Evaluation Questionnaire 1.

Table 3.5: Results of the Questionnaire 1

non-critical 0, critical 1

	1		2		3		4		5		6		Average			
Question	Answer	$0-1$	Answer	$0-1$	Answer	$0-1$	Answer	$0-1$	Answer	$0-1$	Answer	$0-1$	Answer	$0-1$	c-nc	σ
1		1		1		1		0		1		0		0.67	critical	0.52
2	70	1	90	1	90	1	80	1	50	0	90	0	78.33	0.67	critical	16.02
3	40	0	10	1	50	0	42	1	30	1	80	0	42.00	0.50	non-critical	23.15
4	50	1	10	1	50	1	80	0	30	1	20	0	40.00	0.67	critical	25.30
5	60	1	20	1	60	1	48	1	50	1	50	0	48.00	0.83	critical	14.70
6	80	1	50	1	80	1	20	1	50	0	20	1	50.00	0.83	critical	26.83
7	100	1	10	1	90	1	64	1	50	1	70	0	64.00	0.83	critical	32.00
8	25	1	20	1	60	0	20	0	20	1	20	0	27.50	0.50	non-critical	16.05
9	10	1	10	0	20	0	100	0	90	0	70	0	50.00	0.17	non-critical	41.47
10	70	1	50	0	60	1	60	1	70	0	60	0	61.67	0.50	non-critical	7.53
11	10	1	10	0	60	0	30	1	20	1	10	1	23.33	0.67	critical	19.66
12	60	1	50	0	80	0	90	1	50	1	30	0	60.00	0.50	non-critical	21.91
13	90	0	80	1	100	0	100	0	80	0	100	0	91.67	0.17	non-critical	9.83
14	100	1	10	1	90	0	10	1	80	0	60	0	58.33	0.50	non-critical	39.71
15	40	0	30	1	70	0	20	0	40	0	60	0	43.33	0.17	non-critical	18.62
16	100	0	80	0	100	0	100	0	90	0	100	0	95.00	0.00	non-critical	8.37
17	50	0	80	0	60	0	30	0	50	1	80	0	58.33	0.17	non-critical	19.41
18	60	0	20	0	60	0	44	0	50	0	30	0	44.00	0.00	non-critical	16.25
19	75	1	100	1	50	0	70	0	90	0	100	0	80.83	0.33	non-critical	19.60
20	100	1	100	1	70	0	100	0	90	1	100	0	93.33	0.50	non-critical	12.11
21	60	1	50	1	60	1	60	1	50	1	80	0	60.00	0.83	critical	10.95
22	90	1	30	1	80	1	70	1	70	1	80	0	70.00	0.83	critical	20.98
23	80	1	100	1	80	1	88	1	80	1	100	0	88.00	0.83	critical	9.80
24	90	1	100	1	90	1	88	1	70	1	90	0	88.00	0.83	critical	9.80
25	50	1	30	1	80	0	58	1	30	1	100	0	58.00	0.67	critical	27.86
26	30	1	80	1	70	1	60	1	60	1	60	1	60.00	1.00	critical	16.73
27	90	1	100	1	100	1	92	1	70	1	100	0	92.00	0.83	critical	11.66
28	90	1	50	1	80	1	78	1	80	1	90	0	78.00	0.83	critical	14.70
29	75	1	50	1	60	1	63	1	30	1	100	0	63.00	0.83	critical	23.58
30	60	1	10	1	60	1	28	1	10	1	0	0	28.00	0.83	critical	26.38
31	40	1	20	1	60	1	90	0	50	1	80	0	56.67	0.67	critical	25.82
													61.71			

Evaluation of questionnaire 2 - The proposed hierarchical model is flexible enough to enable evaluators to assign the evaluation score at almost all of the hierarchical levels. However, the granularity of evaluation is fully influenced by the choice of hierarchical level, i.e., the higher the level gets, the more abstract the evaluation is. In order to experience the aforementioned flexibility and performance of evaluation model to capture more realistic evaluation, the DAI questionnaire is carefully designed.

In Figure 3.29, we detail the potential evaluation parameters by DAI business model at different hierarchical levels. As can be seen in the figure, the evaluation may be carried out at different granule levels. However, the questionnaire 2 is a subset of the evaluation parameters detailed in Figure 3.29. Having collected the filled questionnaires from the competence center directors, we positioned the questions at different levels of proposed evaluation model. The decision of question placement on the hierarchical level is driven by the nature of questions and their procedural relationships to higher/lower layer procedures of the proposed evaluation model. Table 3.8 summarizes the aforementioned mapping.

Having mapped the questions on the proposed hierarchical evaluation model, we generate the critical/non-critical categories. We also map the questionnaire 2 over the hierarchical evaluation model and the procedure for such mapping is intuitive. We take the competence center for block; each competence center (block) is further decomposed into various evaluation parameters, which are positioned at criterion, unit, and dimension levels.

It should be noted that at dimension level, the categorization of questions into critical and non-critical categories are on the similar lines as discussed in the aforementioned evaluation of questionnaire 1. In this connection, the proposed evaluation tool provides the evaluators with the option to grade a dimension level parameter as critical and non-critical. For ready reference, in the following, we list the dimension level parameters of the questionnaire 2: A1(i), A1(ii), A1(iii), A1(iv), A1(v), A1(vi), A2(i), A2(ii), A2(iii), A2(iv), A2(v), A2(vi), A3(i), A3(ii), A3(iii), A3(iv), A3(v), A3(vi), A4(i), A4(ii), A4(iii), A4(iv), A4(v), A4(vi), A5(i), A5(ii), A5(iii), A5(iv), A5(v), A5(vi), A6(i), A6(ii), A6(iii), A6(iv), A6(v), A6(vi), G1(i), G1(ii). In Table 3.9, we categorize these dimensions into critical and non-critical categories.

Table 3.6: Evaluation of Questionnaire 1 with Different Weights

		Equally weighted 0.033	Questions $2-11:0.05$ Questions $12-21:0.03$ Questions $22-31:0.02$	Questions $2-11:0.06$ Questions $12-21:0.03$ Questions $22-31:0.01$
Question	Average evaluation	0.033	$0.05-0.03-0.02$	$0.06-0.03-0.01$
1		not relevant	not relevant	not relevant
2	78.33	2.61	3.92	4.70
3	42.00	1.40	2.10	2.52
4	40.00	1.33	2.00	2.40
5	48.00	1.60	2.40	2.88
6	50.00	1.67	2.50	3.00
7	64.00	2.13	3.20	3.84
8	27.50	0.92	1.38	1.65
9	50.00	1.67	2.50	3.00
10	61.67	2.06	3.08	3.70
11	23.33	0.78	1.17	1.40
12	60.00	2.00	1.80	1.80
13	91.67	3.06	2.75	2.75
14	58.33	1.94	1.75	1.75
15	43.33	1.44	1.30	1.30
16	95.00	3.17	2.85	2.85
17	58.33	1.94	1.75	1.75
18	44.00	1.47	1.32	1.32
19	80.83	2.69	2.43	2.43
20	93.33	3.11	2.80	2.80
21	60.00	2.00	1.80	1.80
22	70.00	2.33	1.40	0.70
23	88.00	2.93	1.76	0.88
24	88.00	2.93	1.76	0.88
25	58.00	1.93	1.16	0.58
26	60.00	2.00	1.20	0.60
27	92.00	3.07	1.84	0.92
28	78.00	2.60	1.56	0.78
29	63.00	2.10	1.26	0.63
30	28.00	0.93	0.56	0.28
31	56.67	1.89	1.13	0.57
Result		61.71	58.42	56.45

Table 3.7: Evaluation of Questionnaire 1 with Only One Answer Change

Question 12 changed from 60 to 0	Equally weighted 0.033	Questions $2-11:0.05$ Questions $12-21:0.03$ Questions $22-31:0.02$	Questions $2-11:0.06$ Questions $12-21:0.03$ Questions $22-31:0.01$
Average evaluation	0.033	$0.05-0.03-0.02$	$0.06-0.03-0.01$
	not relevant	not relevant	not relevant
78.33	2.61	3.92	4.70
42.00	1.40	2.10	2.52
40.00	1.33	2.00	2.40
48.00	1.60	2.40	2.88
50.00	1.67	2.50	3.00
64.00	2.13	3.20	3.84
27.50	0.92	1.38	1.65
50.00	1.67	2.50	3.00
61.67	2.06	3.08	3.70
23.33	0.78	1.17	1.40
0.00	0.00	0.00	0.00
91.67	3.06	2.75	2.75
58.33	1.94	1.75	1.75
43.33	1.44	1.30	1.30
95.00	3.17	2.85	2.85
58.33	1.94	1.75	1.75
44.00	1.47	1.32	1.32
80.83	2.69	2.43	2.43
93.33	3.11	2.80	2.80
60.00	2.00	1.80	1.80
70.00	2.33	1.40	0.70
88.00	2.93	1.76	0.88
88.00	2.93	1.76	0.88
58.00	1.93	1.16	0.58
60.00	2.00	1.20	0.60
92.00	3.07	1.84	0.92
78.00	2.60	1.56	0.78
63.00	2.10	1.26	0.63
28.00	0.93	0.56	0.28
56.67	1.89	1.13	0.57
	59.71	56.62	54.65

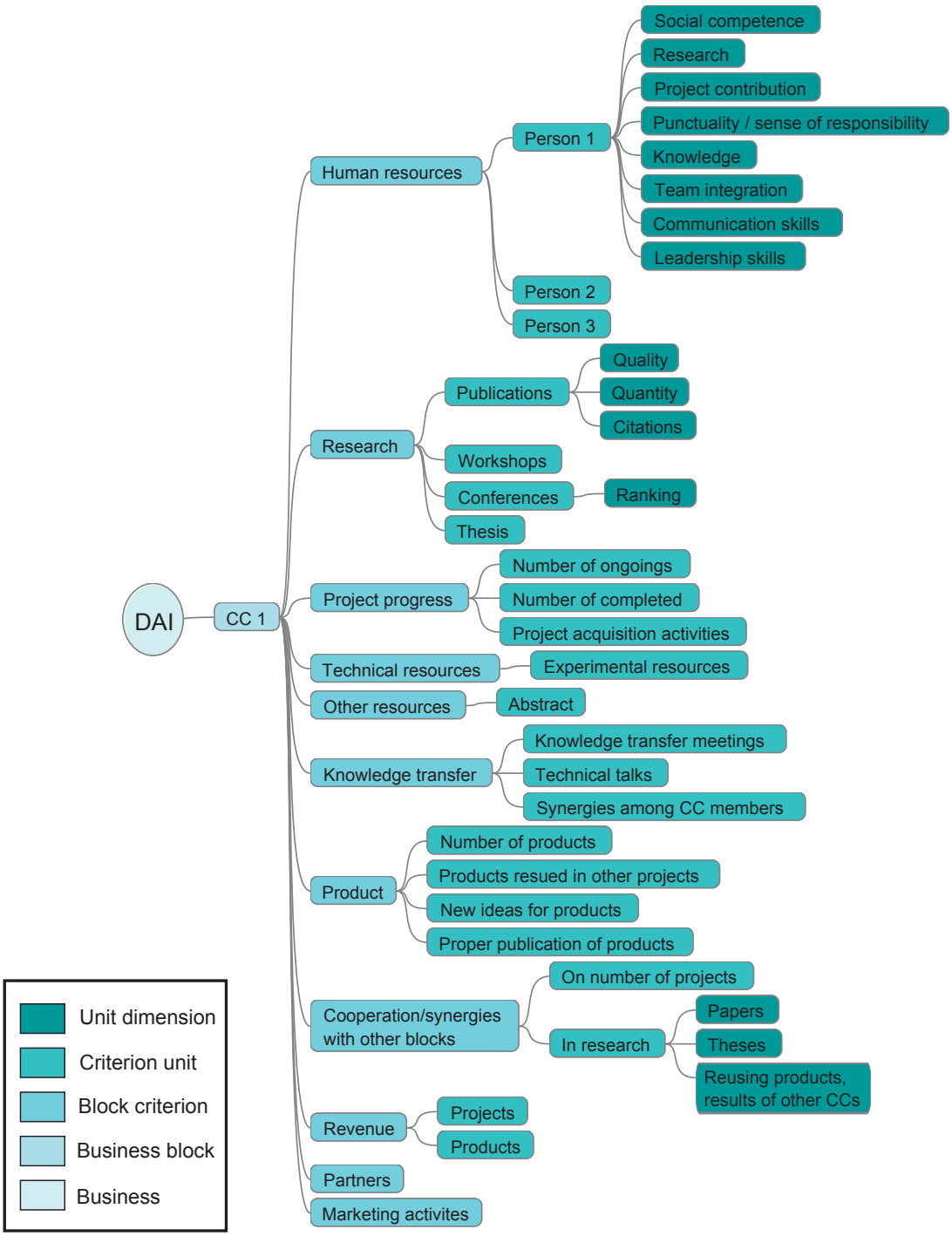


Figure 3.29: Evaluation of DAI-Labor using mind map - The figure represents hierarchical levels of DAI-Labor's business model.

Table 3.8: Mapping of Questionnaire over the Hierarchical Evaluation Model

Levels/Areas	A						B	C	D	E	F	G	H
	P1	P2	P3	P4	P5	P6							
Block													
Criterion													
Unit													
Dimension													

Legend

	→	Business block
	→	Block criterion
	→	Criterion unit
	→	Unit dimension

Table 3.9: Criticalness of Questions

Type of Question	Questions
Critical questions	A1(i), A1(ii) A1(iii), A1(iv), A1(v), A1(vi), A2(i), A2(ii), A2(iii), A2(iv), A2(v), A2(vi), A3(i), A3(ii), A3(iii), A3(iv), A3(v), A3(vi), A4(i), A4(ii), A4(iii), A4(iv), A4(v), A4(vi), A5(i), A5(ii), A5(iii), A5(iv)
Non-critical questions	A5(v), A5(vi), A6(i), A6(ii), A6(iii), A6(iv), A6(v), A6(vi), G1(i), G1(ii)

Note: As we have discussed the evaluation procedure of questionnaire 1 in more details earlier, in the following, we briefly discuss the evaluation procedures for evaluating it (i.e., questionnaire 1) using the proposed evaluation tool. Nevertheless, more details of the evaluation procedures for questionnaire 2 will be provided in the following section with the view to highlighting the different features of the proposed evaluation tool.

3.7.3 DAI-Model Evaluation on the Proposed Evaluation Tool

In this section, we carry out the evaluation of both of the questionnaires on a Java-based evaluation tool. It should be noted that we will illustrate on the evaluation tool in Chapter 4. However, we will briefly introduce the components of the evaluation tool while carrying out the aforementioned DAI-Labor business model evaluations. For every evaluation, one has to register by providing one's credentials to the tool, which is saved in the database.

3.7.3.1 Registering for evaluation

We registered to the DAI-Labor business model evaluation tool, which can be seen in Figure 3.30, by providing the required information. This process basically adds the business to be evaluated and evaluator's information to the database, which enables the evaluator to continue evaluation in multiple periods, i.e., an evaluator may hold the evaluation and resume at any time stamp.

3.7.3.2 Procedures for evaluating the questionnaire 1

In this section, we briefly discuss the evaluation procedure for the questionnaire 1.

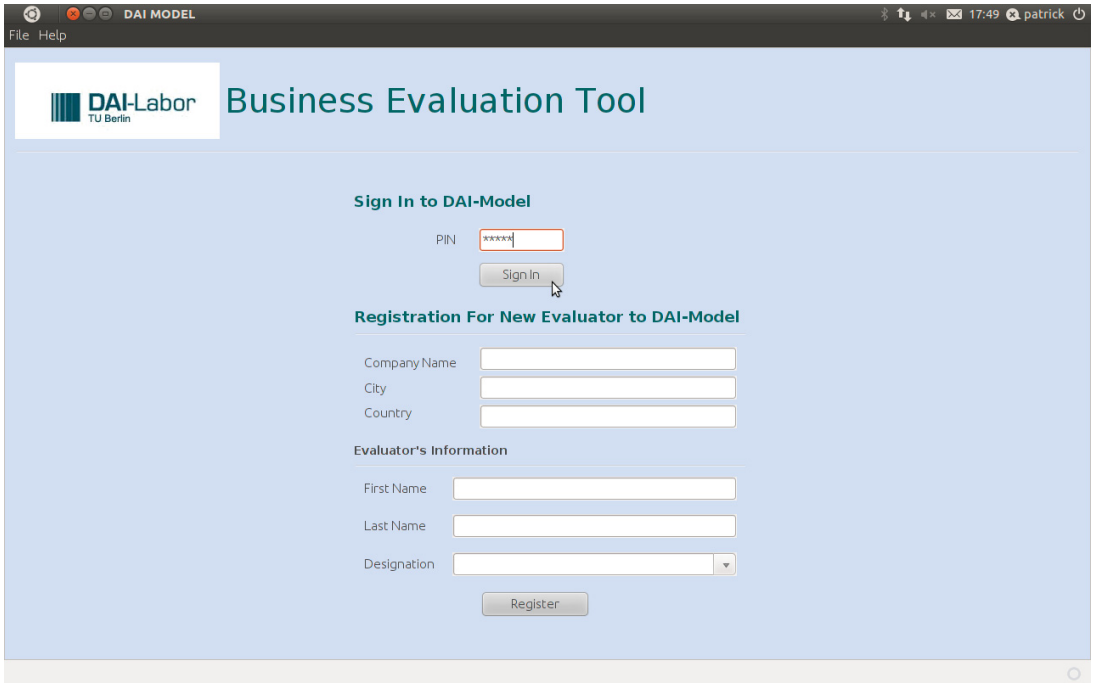


Figure 3.30: Registration to the evaluation tool - Snapshot of the user's registration and sign-in interface.

Selecting the block for evaluation - Clicking over the evaluation block seen in Figure 3.31 leads us to another window (i.e., block evaluation window). Each block may contain various evaluation parameters or questions as illustrated in the section to follow.

Evaluating the blocks - As can be seen in Figure 3.32, there are various questions, their positions at the respective hierarchical level, their scoring options, and categories (critical/non-critical) selection options. Each question is evaluated by selecting the score value from the dropdown menu and categorizing the evaluation question as critical/non-critical by un(checking) the checkbox. Upon providing the score values to all of the questions of the block, the *Done Answering* button is pressed, which results in computing the evaluation of that particular block. This action (pressing *Done Answering* button) also results in closing the block evaluation window. This process is repeated for all of the involved blocks, and questions of the questionnaire.

Having the score values assigned to the questions of different blocks, the tool evaluates the blocks. The evaluation output is visualized on the main screen of the tool for each block and overall business model, as can be seen in Figure 3.33.

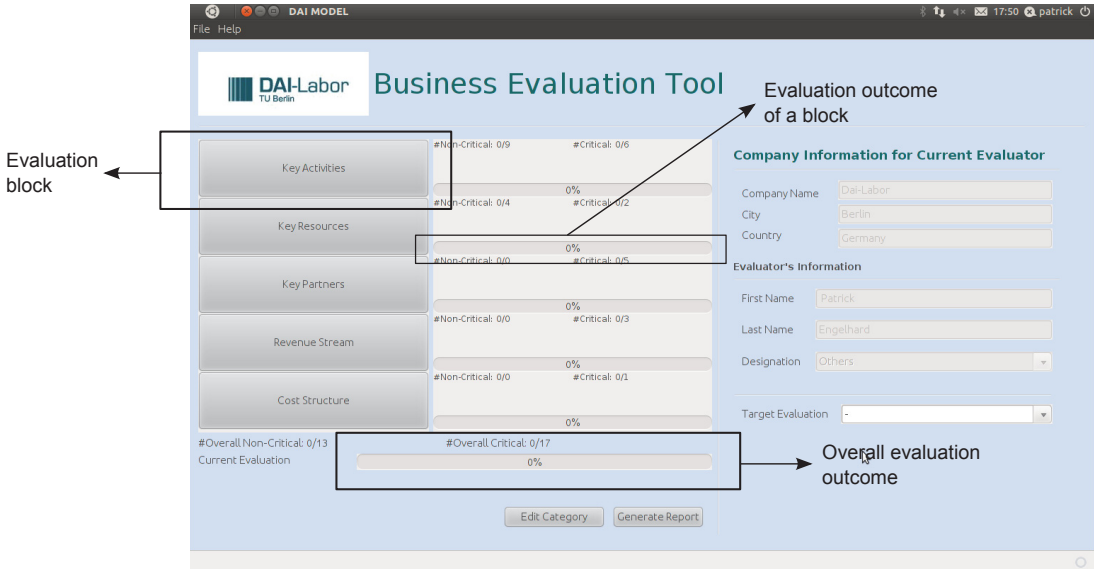


Figure 3.31: Evaluation tool - Block evaluation view - Snapshot of the evaluation blocks, their evaluation outcomes, and the overall evaluation outcome.

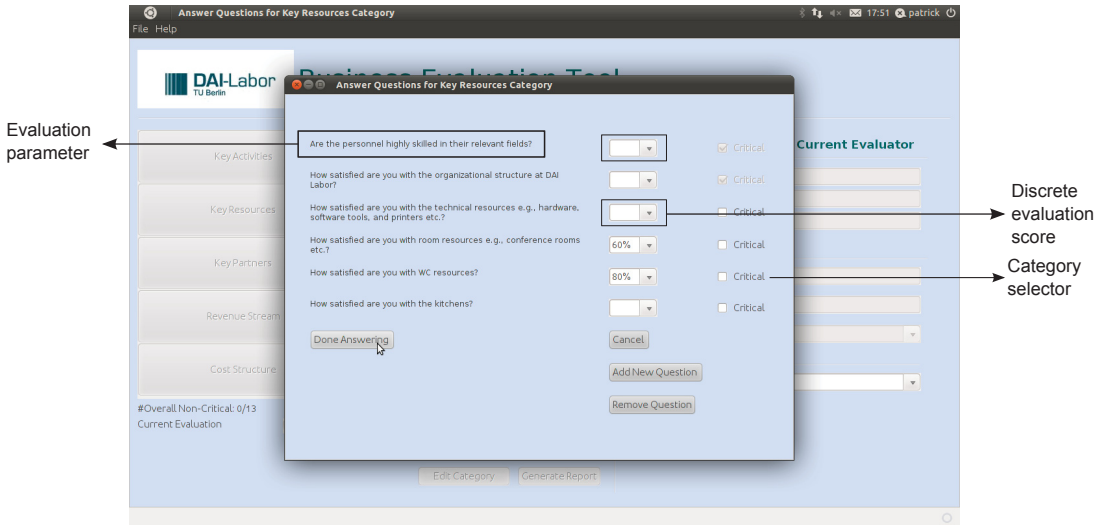


Figure 3.32: Block evaluation window - Snapshot of the evaluation of one block, here Key Resources.

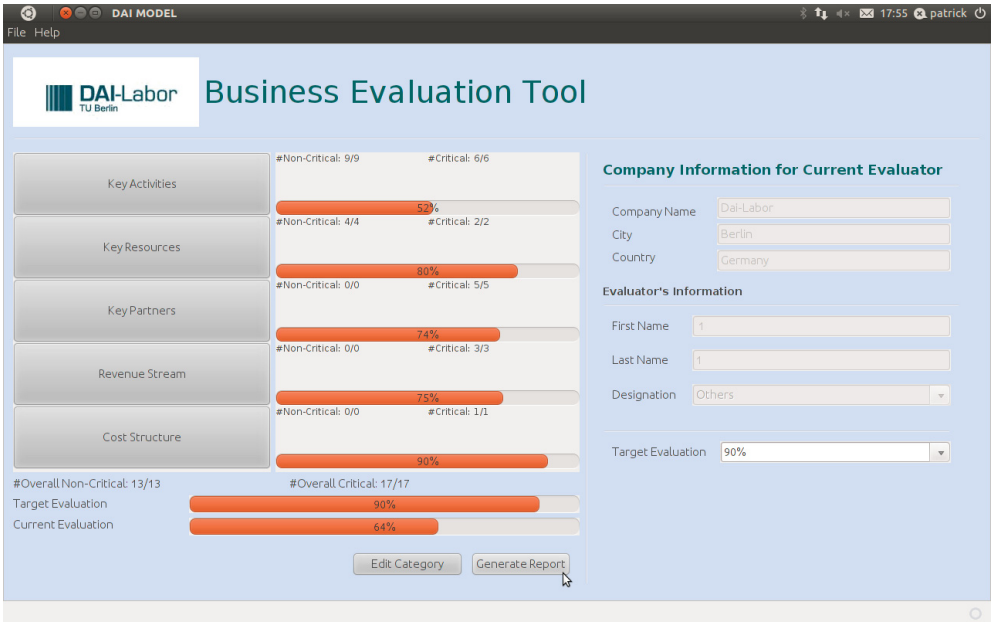


Figure 3.33: View of the result(s) - Snapshot of the result window.

Note: It should be noted that the procedures of entering the questions of questionnaire in the tool will be detailed in the later chapter.

3.7.3.3 Evaluation of questionnaire 2

In order to evaluate the performance of the proposed evaluation tool, we evaluate the DAI business model in the following configurations.

Configuration 1 - In this configuration, we keep the settings relatively simple, i.e., all of the evaluation parameters are non-critical. They are assigned similar score values. The evaluation ranges for all of the involved parameters are set between 0 (min) and 100% (max). We set the value of β to 0.001, which dictates that we decrease the evaluation sensitivity within the defined evaluation range, as given in Table 3.10.

Configuration 2 - This configuration is more complete, realistic, and complicated version of the earlier configuration. In this configuration, we aim at validating the proposed evaluation function with respect to: i) capturing the evaluation sensitivity towards critical evaluation parameters, thus we randomly set a few evaluation parameters as critical (i.e., A2(i), A3(vi), A5(i), A5(vi), A6(ii), A6(iii), A6(iv), A6(v)); ii) capturing the interactions amongst the eval-

Table 3.10: Evaluation of Questionnaire 2 - Configuration 1

QID	Dimension		Unit		Criterion		Block		Overall
	Score	Evaluation	Score	Evaluation	Score	Evaluation	Score	Evaluation	Evaluation
A1(i)	50	0.488							
A1(ii)	50	0.488							
A1(iii)	50	0.488		0.475					
A1(iv)	50	0.488							
A1(v)	50	0.488							
A1(vi)	50	0.488							
A2(i)	50	0.488							
A2(ii)	50	0.488							
A2(iii)	50	0.488		0.475					
A2(iv)	50	0.488							
A2(v)	50	0.488							
A2(vi)	50	0.488							
A3(i)	50	0.488							
A3(ii)	50	0.488							
A3(iii)	50	0.488		0.475					
A3(iv)	50	0.488							
A3(v)	50	0.488							
A3(vi)	50	0.488				0.463			
A4(i)	50	0.488							
A4(ii)	50	0.488							
A4(iii)	50	0.488		0.475					
A4(iv)	50	0.488							
A4(v)	50	0.488							
A4(vi)	50	0.488							
A5(i)	50	0.488							
A5(ii)	50	0.488							
A5(iii)	50	0.488		0.475				0.463	
A5(iv)	50	0.488							
A5(v)	50	0.488							
A5(vi)	50	0.488							0.469
A6(i)	50	0.488							
A6(ii)	50	0.488							
A6(iii)	50	0.488		0.475					
A6(iv)	50	0.488							
A6(v)	50	0.488							
A6(vi)	50	0.488							
B1			50	0.488					
B2			50	0.488		0.475			
B3			50	0.488					
B4			50	0.488					
C1			50	0.488					
C2			50	0.488		0.475			
C3			50	0.488					
C4			50	0.488					
D1			50	0.488		0.475			
D2			50	0.488					
E1					50	0.488			
F1			50	0.488		0.475			
F2			50	0.488					
G1(i)	50	0.488							
G1(ii)	50	0.488				0.469			
G2			50	0.488					
H1					50	0.488			
54	50	0.488		0.475		0.463		0.450	
55					50	0.488		0.475	
56					50	0.488		0.475	
57					50	0.488		0.475	
58					50	0.488		0.475	

uation functions residing at different hierarchical levels. Thus we assign evaluation scores at different levels and observe the evaluation aggregation/translation on higher hierarchical levels. As can be seen in Table 3.11, for block 1, the evaluation scores are assigned at almost all hierarchical layers, i.e., at dimension level (questions A1(i)-A6(vi), and G1(i)-G1(ii)), at unit level (B1-B4, C1-C4, D1-D2, F1-F2, and G2), and at criterion level (E1 and H1). However, for questions 54-58, the evaluation scores are directly assigned at criterion levels belonging to heterogenous blocks.

The evaluation score ranges for dimension level parameters are set between $20\% - 80\%$, for unit level parameters between $30\% - 70\%$, and for criterion level parameters between $50\% - 80\%$. However, it should be noted that these minimum and maximum score values can be explicitly assigned to different evaluation parameters. As opposed to the earlier configuration, with the view to demonstrate the flexibility of the developed tool, evaluation parameters are evaluated at different hierarchical levels.

In what follows next, we analyze the outcome of the aforementioned configurations.

Analysis of Configuration 1 - As can be seen in Table 3.10, all of the involved evaluation parameters are allocated similar score values, i.e., 50% at all of the hierarchical levels. The score values are then fed to the implemented evaluation function at each level. Owing to the simple settings of the configuration, the evaluation outcome is intuitive and similar, i.e., around 47%. The decrease from 50% (the score value) to 47% (the evaluation outcome) is due to β value. The similar behavior is observed at all of the hierarchical levels. The analysis of this configuration advocates that the implementation of the proposed evaluation function is correct.

Analysis Configuration 2 - In this configuration, we carry out the evaluation on two dimensions: i) what is the evaluation outcome when the proposed approach, i.e., defining the score value ranges for the evaluation parameters, setting the sensitivity level of parameter evaluation, and defining μ; we term this setting as *fully operational (FO)*. ii) On the other hand, we analyze the evaluation outcome when proposed approach is partially implemented or not implemented; we term this setting as *partially operational (PO)*.

As can be seen in Table 3.11, unit 2, unit 3, unit 5, and unit 6 contain critical dimensions. One may see that the unit level evaluations (which is the processed evaluation of corresponding dimensions) are somewhat similar for both of the settings (FO and PO). Let us now analyze the evaluation outcome for the unit levels with critical evaluation parameters. The evaluation of unit 2 consequences in 35% for PO and $zero$ for FO settings. As can be seen, the score value

Table 3.11: Evaluation of Questionnaire 2 - Configuration 2

QID	Dimension			Unit			Criterion			Block			Overall	
	Score	Evaluation		Score	Evaluation		Score	Evaluation		Score	Evaluation		Evaluation	
		NC	C		NC	C		NC	C		NC	C	NC	C
A1(i)	15	0.144	0											
A1(ii)	50	0.488	0.493											
A1(iii)	50	0.488	0.493		0.497	0.484								
A1(iv)	50	0.488	0.493											
A1(v)	50	0.488	0.493											
A1(vi)	95	0.948	1											
A2(i)	15(Cr)	0.144	0											
A2(ii)	50	0.488	0.493											
A2(iii)	50	0.488	0.493		0.353	0								
A2(iv)	50	0.488	0.493											
A2(v)	50	0.488	0.493											
A2(vi)	95	0.948	1											
A3(i)	15	0.144	0											
A3(ii)	50	0.488	0.493											
A3(iii)	50	0.488	0.493		0.704	0.691								
A3(iv)	50	0.488	0.493											
A3(v)	50	0.488	0.493											
A3(vi)	100(Cr)	1	1											
A4(i)	25	0.241	0.081					0.541	0.211					
A4(ii)	50	0.488	0.493											
A4(iii)	50	0.488	0.493		0.477	0.484								
A4(iv)	50	0.488	0.493											
A4(v)	50	0.488	0.493											
A4(vi)	75	0.741	0.914											
A5(i)	25(Cr)	0.241	0.081											
A5(ii)	50	0.488	0.493											
A5(iii)	50	0.488	0.493		0.578	0.691					0.525	0.287		
A5(iv)	50	0.488	0.493											
A5(v)	50	0.488	0.493											
A5(vi)	75(Cr)	0.741	0.914										0.649	0.604
A6(i)	25	0.241	0.081											
A6(ii)	50(Cr)	0.488	0.493											
A6(iii)	50(Cr)	0.488	0.493		0.704	0.494								
A6(iv)	50(Cr)	0.488	0.493											
A6(v)	50(Cr)	0.488	0.493											
A6(vi)	75	0.741	0.914											
B1				75	0.731	1								
B2				50	0.475	0.483		0.478	0.25					
B3				50	0.475	0.483								
B4				25	0.232	0								
C1				20	0.184	0								
C2				50	0.475	0.483		0.402	0					
C3				50	0.475	0.483								
C4				50	0.475	0.483								
D1				5	0.045	0		0.096	0					
D2				16	0.147	0								
E1							60	0.588	0.33					
F1				50	0.475	0.483		0.726	0.5					
F2				98	0.978	1								
G1(i)	10(Cr)	0.096	0		0.283	0		0.450	0.5					
G1(ii)	50	0.488	0.493											
G2				65	0.639	0.873								
H1							95	0.948	1					
54	80	0.792	1		0.784	1		0.775	1		0.766	1		
55							75	0.741	0.831		0.731	0.824		
56							60	0.588	0.330		0.576	0.319		
57							70	0.689	0.663		0.679	0.652		
58							65	0.639	0.496		0.627	0.484		

LEGEND: QID: question ID, Cr: critical, NC: no min-max range defined, C: controlled by min-max range

assigned to critical dimension falls below the minimum acceptable score value. Naturally, this should consequence in $zero$ evaluation at the unit level, whereas, in PO settings, the evaluation of unit 2 is still $non - zero$, which is not appropriate. On the similar lines, let us analyze the evaluation of units 3, 5, and 6. As can be seen, the impact of score value for critical evaluation dimensions is realistically captured by the proposed approach. Such behavior in the evaluation computation is observed in the evaluation of unit 5 and unit 6. It should be noted here that for unit level evaluation we have discussed so far, the evaluation score is assigned at the unit dimension level. The proposed approach and the implemented evaluation tool enable the evaluator to assign scores at any hierarchical evaluation level. For the considered use case of DAI business model evaluation, the units B1-B4, C1-C4, D1-D2, F1-F2, and G2 are assigned score values at the unit level.

The unit level evaluations are now attained, and they have to be aggregated and transformed into higher level evaluation. Such aggregation/transformation into higher hierarchical level evaluation is driven by the fact that the proposed approach provides flexibility to configure the controlling parameters of the corresponding level evaluation functions. For the considered use case, to transform the unit level evaluation into criterion level evaluation, we follow the similar settings as earlier, i.e., FO (where we configure the controlling parameters) and PO (where we do not configure the controlling parameters).

As can be seen in Table 3.11, the evaluation of criterion 1 using the proposed approach consequences in the evaluation, which is almost 50% lesser than evaluation carried out PO settings. This is due to the configuration of controlling parameters in the transformation function. We believe that it is very important to provide flexibility in configuring these parameters, i.e., an evaluator is provided with full control over the evaluation translation from one level to other. Intuitively, the criterion level evaluation for the same values of lower level evaluation would be different for different controlling parameter values defined in the translation function. Similar behavior is observed for criterion 2. When it comes to evaluation of criterion 3 and criterion 4, the controlling parameters are so configured (i.e., the minimum required evaluation threshold is set above the current lower level evaluation) that using the proposed evaluation function consequences in $zero$ evaluation, which is realistic. However, for PO settings, the evaluations of criterion 3 and criterion 4 are still $non - zero$ even if the lower level evaluation is below the threshold of criterion level.

In order to attain the block and business level evaluations, the similar procedure of assigning score values to the evaluation parameters at different hierarchical levels and aggre-

gating/translating the lower level evaluations to higher level evaluations is followed. These evaluations are self-explanatory in Table 3.11.

Thus from the above discussion, we conclude that the proposed framework is structured well, provides the business owners with flexibility to evaluate the business model at all of the hierarchical levels, and carries out the evaluation more realistically by providing more room for configuring various controlling parameters.

3.8 Using the Proposed Framework in Combination with Nine Building Blocks

In this section, we make an attempt to combine our proposed hierarchical framework with the nine business model blocks (Osterwalder & Pigneur, 2010) described in detail in Chapter 2. For this, we form a matrix in Table 3.12 by placing the nine *blocks* in rows and our proposed hierarchical levels in columns. Together with each block, we include one sample question that was introduced as part of this model and asked directly to the blocks while making an evaluation using SWOT. As highlighted in the matrix by the shaded cells, each of the nine blocks, and the associated question from the SWOT analysis, corresponds to the business block level in our model. Although we included only one question per block in the table, this actually applies to all questions in the SWOT analysis for each of the nine blocks. In order to perform a more granular evaluation and map those blocks to the lower levels in our hierarchical model, we need to refine those questions. This is demonstrated in the table by introducing new attributes or dimensions for the question asked in the first row under each block, and highlighting the associated cell for the corresponding level in our model.

Let us illustrate this approach by considering the block *Channels* as an example. One of the questions asked in the SWOT analysis was: “Are our channels very efficient?”. In our proposed framework, this question would not be asked directly to a block. The block would have been decomposed into, for instance, *channel types* like fairs, exhibitions, conferences, face-to-face meetings. These would have been the *criteria* in our hierarchy. The intersection cell of channel type and criterion is a degree darker than the intersection of channels and block. Afterwards, criterion would have been also forked; for instance, into *time* of the channel activity like before, during and after purchasing by the customer. This would have been then our *unit*. At the end, our proposed framework would have asked the following question, “Are our channels very

Table 3.12: Mapping of commonly used nine block structure to the proposed framework

	Levels of the proposed hierarchy			
	Business Block	**Block Criterion**	**Criterion Unit**	**Unit Dimension**
Customer Segments				
Are we continuously acquiring new customers?				
Location				
Gender				
Customer acquisition				
Value Propositions				
Do we have satisfied customers?				
Area				
Type				
Satisfaction				
Channels				
Are our channels very efficient?				
Channel type				
Time				
Efficiency				
Customer Relationships				
Do we have strong customer relationships?				
Equity goals				
Retention				
Strength				
Revenue Streams				
Are we continuously acquiring new customers?				
Revenue source				
Gender				
Continuity				
Key Resources				
Do we deploy key resources in the right amount at the right time?				
Human Resources				
Individual members				
Quantity and timing				
Key Activities				
Is execution quality high?				
Projects				
EU-projects				
Execution quality				
Key Partnerships				
Do we enjoy good working relationships with key partners?				
Countrywide/worldwide				
Private partnerships				
Quality				
Cost Structure				
Are operations are cost efficient?				
Cost type				
Responsible cost center				
Efficiency				

efficient?". *Efficiency* would have been equivalent to the *dimension* level in the hierarchy. In order to show the equivalencies, we gave an example scenario for each block in the table.

As can be seen, the proposed evaluation model proves to be flexible enough to be used for business models that are constructed based one the nine block structure. Moreover, from the above mapping, we also observe that the proposed model takes the evaluation parameters at more granule level and hence provides more realistic evaluation (and subsequently recommendation).

3.9 Conclusion

In this chapter, we presented most of the contributions of this research work. We based the proposed contributed concepts and evaluation model on the envisioned requirements of a realistic evaluation model, which we detailed under our perception. Having discussed the aforementioned requirements, we presented our idea of hierarchical evaluation model, where we concretely defined five hierarchical levels, namely, i) dimension level, ii) unit level, iii) criterion level, iv) block level, and v) business level. At each level, we provided the details of the contributed evaluation evaluation functions. We also discussed the flexibility of the proposed evaluation model when it comes to adding new business blocks, assigning the score values at different hierarchical levels, and setting the controlling parameters. At different hierarchical levels, we discussed the various contributed concepts including criticalness/non-criticalness, dependency, etc. With the view to validating the proposed framework, we carried out the evaluation of DAI business model and investigated the gain of the contributed work in terms of its flexibility, practicality, and accuracy. Afterwards, we briefly discusses the procedural implementation of the use case on our developed evaluation tool. We concluded the chapter by mapping of commonly used nine block structure to the proposed framework to see how flexible the proposed tool functions.

4

Interactive Business Model Evaluation Tool

"Societies that do not produce science and its product technology lose their freedom and therefore their happiness." - Cahit Arf

4.1 Introduction

Having explained the motivation for existence of business model evaluation and the proposed evaluation function in the earlier chapters, we now focus on providing the details about the *business model evaluation tool*. Development of the tool is driven by multiple goals: i) providing the business owner(s) or manager(s) with user friendly GUI (graphical user interface) for defining the hierarchical levels of the evaluation and evaluation parameters therein, ii) providing the evaluator(s) with a GUI for inputting the evaluation score against already defined evaluation parameters, iii) providing the business owner(s) or manager(s) with a visualization tool, which reflects the results of evaluation at different hierarchical levels, iv) providing the business owner(s) and manager(s) with an integrated recommender tool that recommends them the potential modifications in business model to attain the target business evaluation.

With the aim to achieving the aforementioned goals, we developed an interactive business model evaluation tool using Java programming language. As the evaluation parameters (e.g., in form of a questionnaire), the evaluation scores, the results of different hierarchical levels

need to be stored in the tool for further process or recommendation, a database connectivity was imperative. We integrated MySQL database with the tool. As we are also integrating the proposed recommender approach in the evaluation tool, the required recommender relevant fields are integrated in the tool. More on these fields will be detailed in Chapter 5. In what follows next, we illustrate different functional components of the evaluation tool.

4.2 Business Model Evaluator - An Illustration

The proposed evaluation tool is decomposed into four major components, namely, i) registration component (can be seen in Figure 4.1, ii) sign in component (can be seen above the registration component in Figure 4.1, iii) evaluation blocks (can be seen on the left hand side in Figure 4.2), and iv) overall evaluation bar (can be seen beneath evaluation blocks in Figure 4.2). These components encamp different functionalities, and in the following, we discuss these functionalities from the perspectives of different stakeholders, i.e., evaluator perspective and business owner perspective.

4.2.1 Evaluator Perspective

As we know, evaluator (i.e., the stakeholder that uses the business model evaluation tool to evaluate the business model) plays a vital role in business model evaluation. Intuitively, evaluators should be provided with various functionalities/options by the tool, so that they may carry out the defined/targeted procedures. We now detail these options.

4.2.1.1 Registration component

This is the first component of the tool to be used by users. It provides the evaluator with the registration form, which is registered in the database and later used for authentication and report(s) generation. During the registration process, the tool requires very basic information of the evaluator, such as, i) company name, ii) city, iii) country, iv) name of the evaluator, and v) evaluator's designation.

Upon inserting the information and pressing the *Register* button, the inserted data is saved in the database and a dynamic PIN for the evaluator is generated. The PIN is important; as each time the already registered user intends to use the tool, the PIN is used as the authentication key. Figure 4.2 depicts the snapshot of the tool after the PIN is generated.

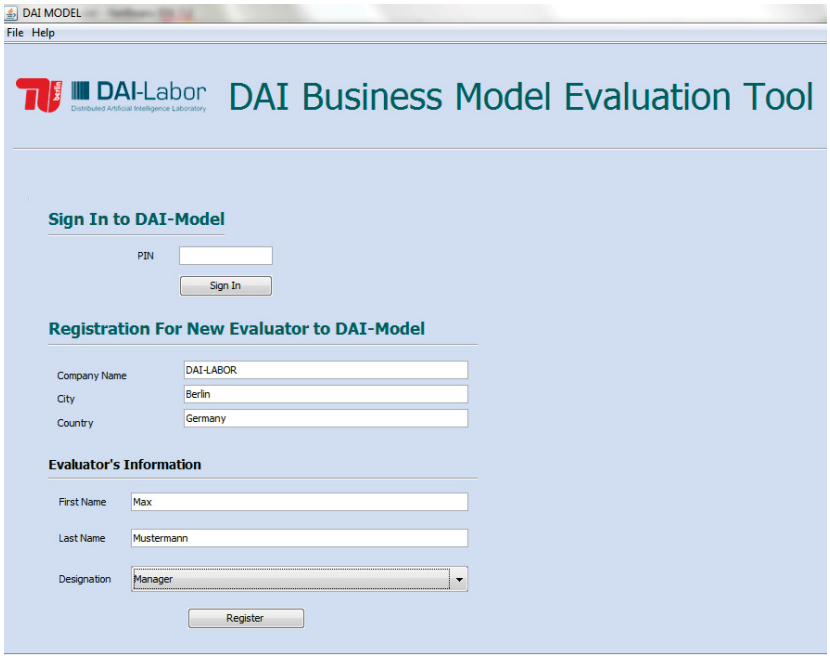


Figure 4.1: First component of the evaluation tool - Figure highlighting the registration/sign-in window of the tool. The users, who will use the system for the first time, must be registered by entering basic information that can be seen in the figure. The users, who have already been registered to the system, log in by entering their PIN in the *PIN* field in the upper part of the window.

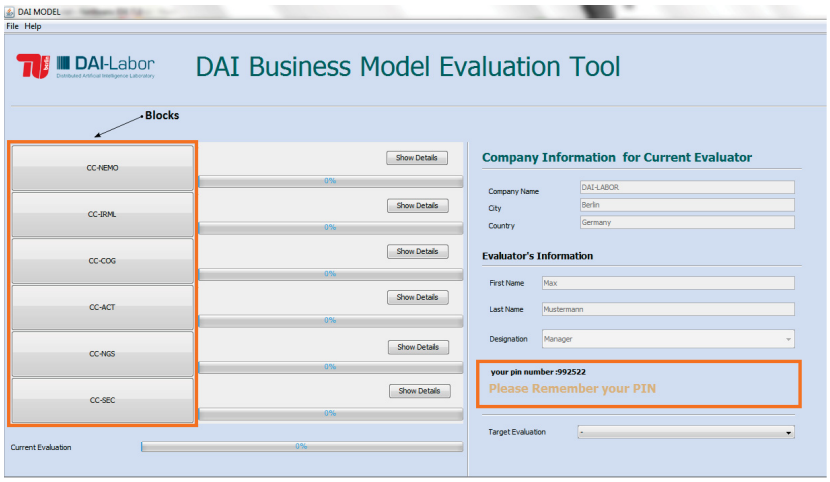


Figure 4.2: Generated evaluator PIN - Figure presenting the registration process and the generated PIN after the registration process is completed. On the left hand side, also the blocks can be seen.

4.2.1.2 Sign in component

This component is only used by the already registered users and it comprises evaluator's name, company name, and the allocated PIN. Upon providing this information, the evaluator is guided to the evaluation window, where the evaluator allocates the evaluation scores to the predefined evaluation parameters.

4.2.1.3 Evaluation component

This component basically corresponds to the evaluation categories of the business model. In Figure 4.2, we depict the evaluation component that comprises six evaluation blocks of DAI-Labor (we have already discussed this evaluation use case in Chapter 3). However, this component is dynamic and may contain any number of evaluation blocks depending on the business model. A simple mouse click on the evaluation block further directs the evaluator through other hierarchical levels specific to the block. This strengthens our claim of flexibility, i.e., the proposed evaluation framework and developed tool are flexible enough to be used for evaluating the most of available business models. Visual placement of evaluation blocks is dynamically adjusted on addition or removal of the block.

One may observe the progress bars for each evaluation category, which visualizes the evaluated score of the corresponding block. Intuitively, the evaluation scores within each block should first be assigned. The *Show details* button guides the evaluator to the screen(s), where the evaluation scores may be assigned. In Figure 4.3, we present the evaluation window, where the evaluation scores are assigned. Such windows are specific to evaluation blocks.

Let us recall the hierarchical evaluation concept of the proposed framework. The block evaluation level sits on the top of other three levels, namely, criterion level, unit level, and dimension level. Intuitively, for each hierarchical level, the manager might put the evaluation parameters as highlighted in Figure 4.3. As can be seen in Figures 4.3 & 4.4, the evaluation parameters of different hierarchical levels may be assigned the score values, and dimension level parameters may be declared as critical or non-critical by simply using the checkbox.

One may also note that in Figure 4.4, there is no checkbox for critical/non-critical categorization. This is because the evaluation parameters $5-8$ and their associated lower hierarchical level parameters do not encamp the dimension level parameters.

Upon assignment of the score values to the evaluation parameters, the corresponding evaluation function (implemented in the tool) computes, aggregates, and produces the block level

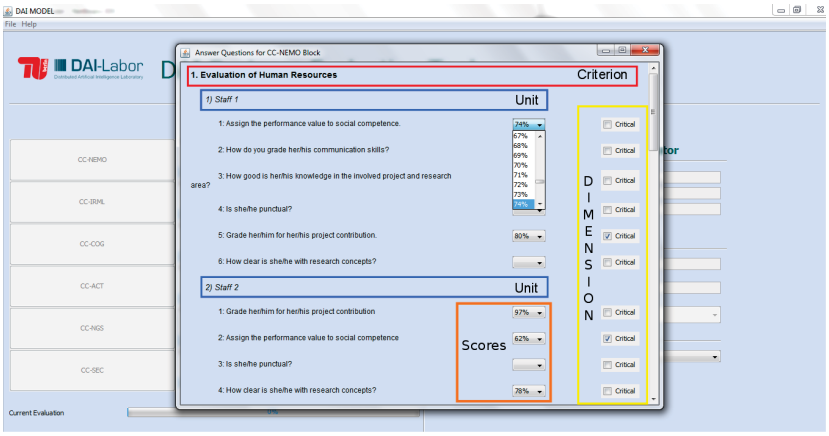


Figure 4.3: Evaluation window - Evaluation parameters specific to a block are allocated the evaluation score values. One may also see the checkbox to declare an evaluation parameter as critical or non-critical.

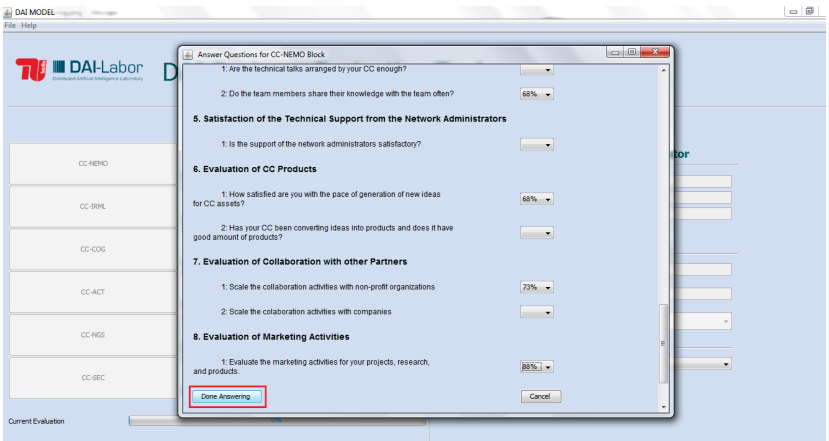


Figure 4.4: Evaluation window (a continuation) - Evaluation parameters specific to a block are allocated the evaluation score values.

evaluation.

4.2.1.4 Visualization output

The block level evaluation is visualized on the main screen of evaluation tool as shown in Figure 4.5. As can be seen, CC-NEMO business block is evaluated (i.e., the score values are assigned to the parameters therein) and CC-NEMO block level evaluation is represented on the scale of $0 - 100\%$ by a progress bar, where the filled (colored) portion of the progress bar represents the current evaluation and 100% corresponds to full or ideal evaluation. On this similar lines, the evaluation of other blocks may be carried out.

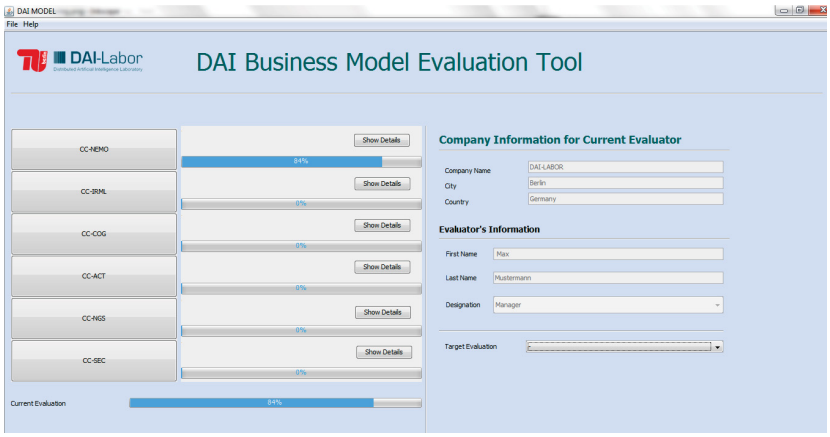


Figure 4.5: Block visualization - Figure highlighting the overall evaluation output of the block.

Once all of the involved business blocks are evaluated, the evaluation tool executes the business level evaluation function. The overall evaluation of business is then visualized by a relatively bigger progress bar below all of the evaluation blocks, which can be seen also in Figure 4.5.

4.2.1.5 Recommendation input

In the earlier sections, we have discussed different options provided by the tool for carrying out the current evaluation of the business. In the proposed evaluation tool, we also implement and integrate the recommendation facilities. The recommendation component of the tool takes the desired evaluation value from the evaluator and recommends tactics to reach the desired/target evaluation. In Figure 4.5, one may also advocate a field, where the evaluator may define the target evaluation values, as can be seen in Figure 4.6. As soon as the target evaluation value

is defined, a progress bar (i.e., target evaluation progress bar) appears above the current evaluation progress bar, which can be seen in Figure 4.7. Thus we provide visualization of current evaluation, target evaluation, and difference of these two.

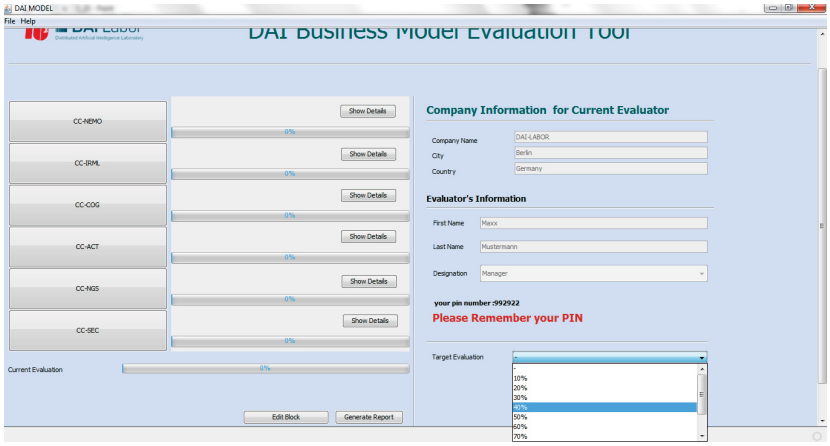


Figure 4.6: Setting the target evaluation - Figure showing how the target evaluation value is determined by the user.

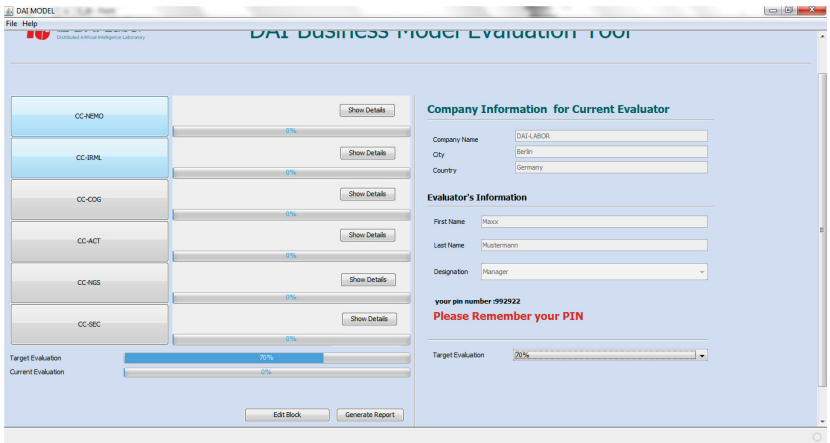


Figure 4.7: Target evaluation progress bar - Figure showing the target evaluation progress bar after selecting the targeted value.

4.2.2 Business Owner Perspective

In this section, we discuss the options and attributes of the evaluation tool specific to business owner. The role of business manager is termed as a *privileged user* of the tool. The privileged

user role may be assigned by the business manager to anyone. Each privileged user may carry out the following activities in the evaluation tool.

- Add/modify blocks.
- Add/remove/modify the hierarchical levels within each defined functional block.
- Add/remove/modify the evaluation parameters in different hierarchical evaluation levels.
- Modify the evaluation function at different levels.
- Set the value of β, x_{max}, x_{min}, μ, and μ_o value for different evaluation functions.

In the following, we detail the procedures for carrying out the aforementioned activities in the capacity of business manager. On the main screen of the visualization tool, one may see *Edit Block* button as shown in Figure 4.8.

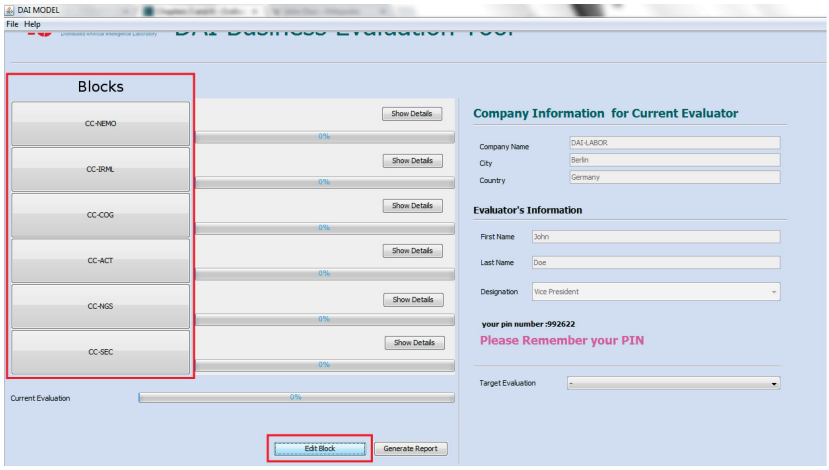


Figure 4.8: Edit block button - Figure highlighting the *Edit Block* button, which guides the privileged users to the editing windows for different evaluation tool attributes and the contents therein.

Upon pressing the *Edit Block* button, the tool will ask for credential of privileged user (i.e., login and password). This is shown in Figure 4.9. Once logged in, the privileged user may edit already defined blocks, add new blocks, or remove (any or all) the already defined blocks.

Let us assume that the privileged user enters a new block as highlighted in Figure 4.10. In this case, the name of the newly added block is ROBO. After naming the block and clicking on the *Add Category* button, the new block is added, which may be visualized on the main screen of the visualization tool as shown in Figure 4.11.

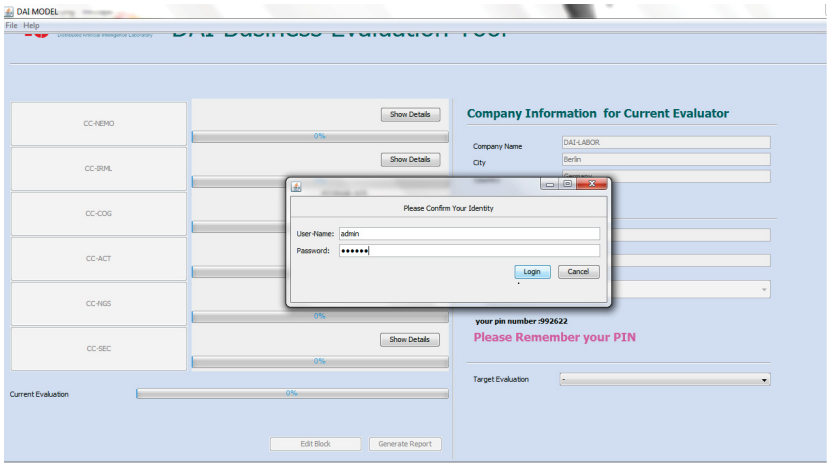


Figure 4.9: Sign in window - Figure highlighting the sign in window, where the privileged users enter their credentials for modifying different tool attributes and contents of the evaluation tool.

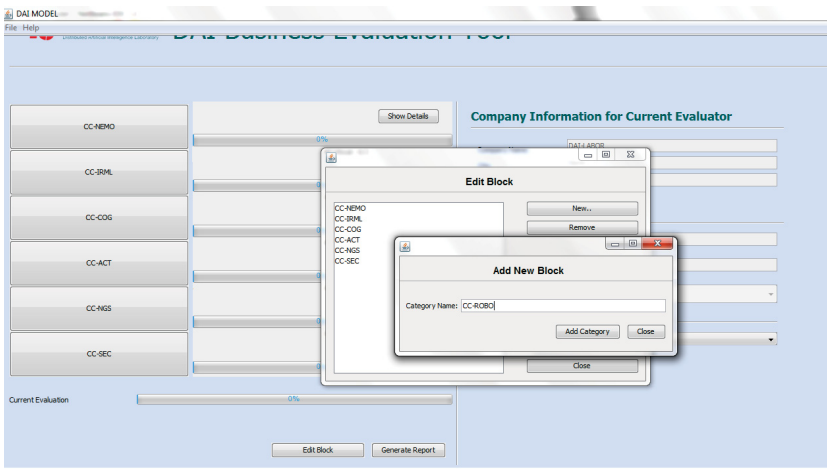


Figure 4.10: Newly added blocks - Figure highlighting the newly added blocks in the tool by the privileged user.

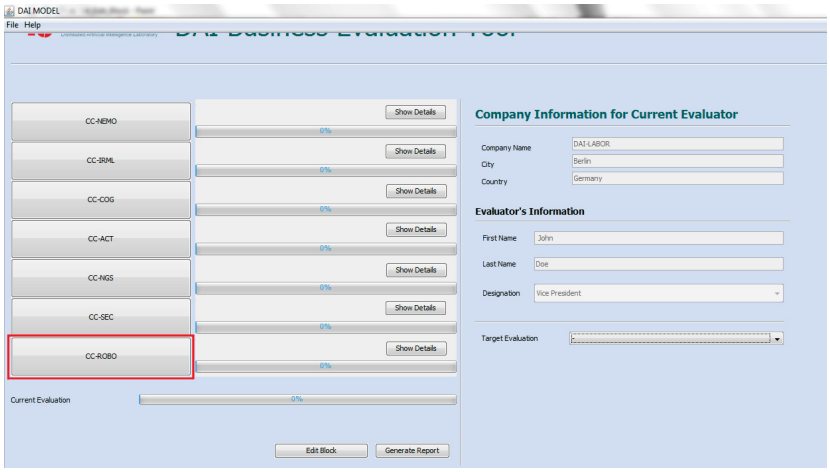


Figure 4.11: Newly added business block - Figure highlighting the newly added business block. As can be seen, the tool dynamically adjusts the available blocks in the given space.

Adding/Editing Block Components - Now that the new block is added, one needs to add the evaluation parameters corresponding to the different hierarchical levels within this block. To do this, by clicking on the block, a pop-up window appears, which requires the credentials. This window provides the privileged user with the options to enter the evaluation parameters (which may be in form of the questions).

Once the evaluation parameter is defined, it needs to be positioned at the right hierarchical level. To do this, users are provided with easy to use *checkbox* options, i.e., selecting the checkbox of any hierarchical level will place the newly defined evaluation parameter on that hierarchical level. Using this window, a user may edit the parameter at any hierarchical evaluation level. This may be seen in Figure 4.12. After the evaluation parameter is defined and *Insert question* button is clicked, the newly added evaluation parameter is added to the database.

Now the evaluation tool with new block and newly added evaluation criteria is ready to be used by the evaluator. This is shown in Figure 4.13.

4.3 Sequence of Operations by the Evaluators (Users) of the Tool

In this section, we detail the sequence of the operations a user follows in the proposed tool.

1. Users must first register. During this process, users' provided credentials are saved in the database and a random PIN is generated. This PIN is unique for each user and enables

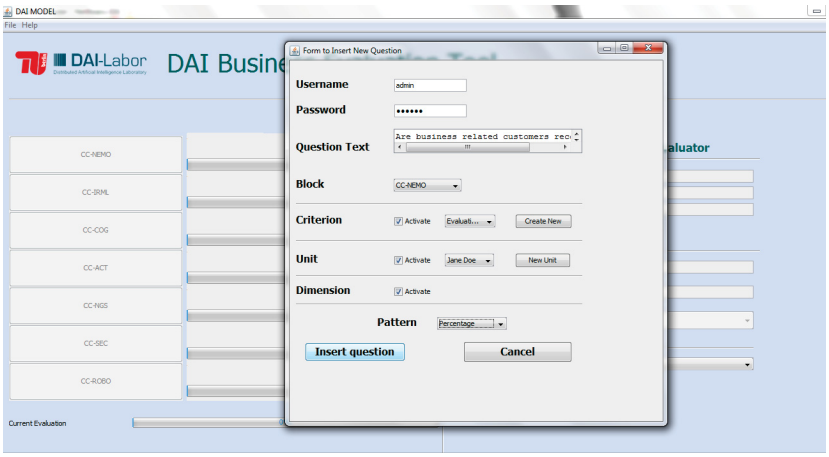


Figure 4.12: Entering the evaluation parameters - Figure highlighting the tool option for entering the evaluation parameter(s).

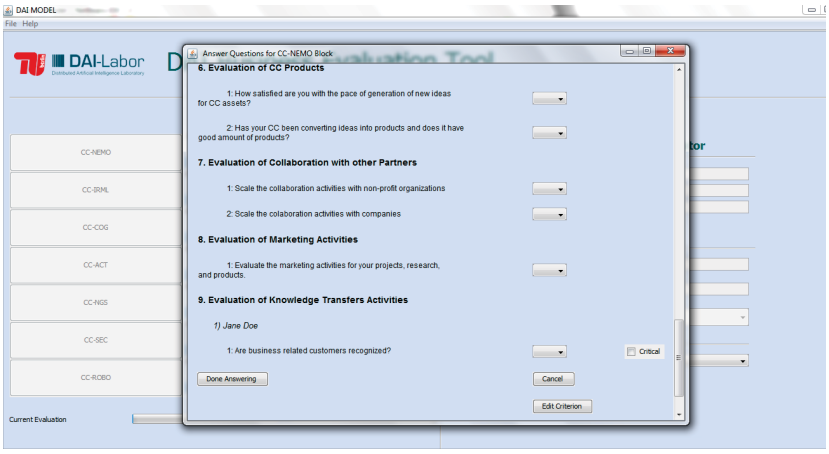


Figure 4.13: Newly added questions - Figure highlighting the newly added questions to the tool.

registered users for signing in. This can be seen in Figure 4.14. It should be noted that unless the registration process is completed, the evaluation block remains inactive.

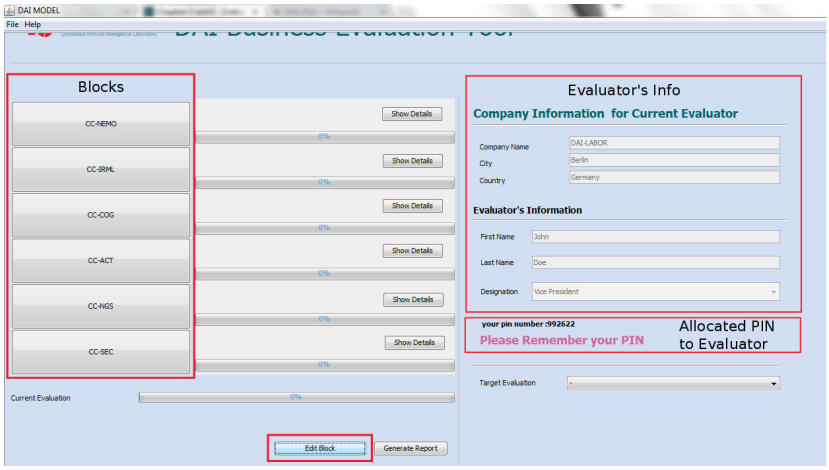


Figure 4.14: User registration and PIN allocation - Figure depicts the user registration and PIN allocation on the tool.

2. Upon the completion of registration, the registered users may now choose any of the available blocks for evaluation (giving responses to the questions therein). For this, the user simply clicks the *answer* button on the business model evaluation block that leads her/him to the questionnaire. The user may respond to all or a few of the questions within the questionnaire. In case the user is unable to submit the responses of all of the questions, she/he may respond the left-over question later. In such a case, the evaluation progress bar of the corresponding business model block will look as shown in Figure 4.15.

   This implies that the tool keeps track of all of the responses of the evaluator and for this purpose, the tool makes use of the PIN of the evaluator. While leaving the questionnaire window, the user must press *Done Answering* button, which is shown in Figure 4.16. As can be seen, upon pressing the *Done Answering* button, the message box pops up to ensure that the user wants to submit the answers and leave.

3. After all of the responses to all of the evaluation blocks are submitted, it is now the time to analyze the overall evaluation (which is reflected by the progress bar on the main window of the tool) and generate the detailed report. For generating the detailed report(s), the *Generate Report* button is to be clicked. More on generating report is given later in this chapter.

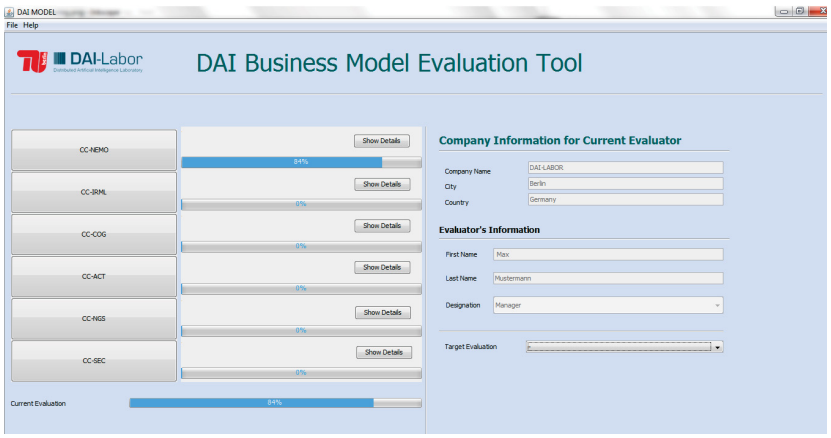


Figure 4.15: Partially answered block - Figure highlighting the partially answered block.

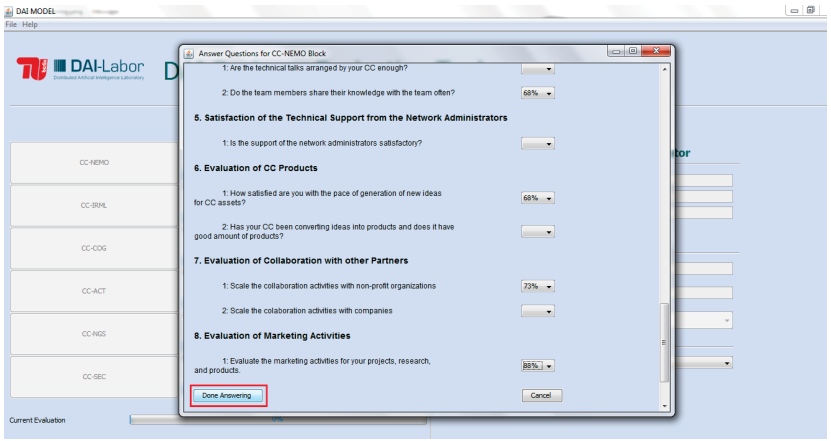


Figure 4.16: Answering the questionnaire - Figure depicting the questionnaire of an evaluation block and saving procedure.

4. Once the evaluation is completed and the progress bar indicates the overall evaluation of the business model, a detailed evaluation report may also be generated. Such reports are generated by clicking the *Generate Pdf* button. The report on granular level contains the evaluation process results, where one may generate the evaluation reports for each single block and multiple combined blocks, etc.

5. User may also make use of the recommendation options provided by the tool. In this connection, user must define target evaluation by adjusting the slider on the main screen of the evaluation tool. Upon defining the target evaluation, the tool executes the recommender algorithm and generates a list of recommendations, following which the estimated business model evaluation would raise to the target value.

4.4 Implementation - A Brief Overview

In this section, we briefly discuss the implementation details, i.e., the software architecture, software packages/classes, and databases.

4.4.1 Database Tables

In Table 4.1, we summarize the tables used in the database of the developed evaluation tool. Currently, we categorize the database into eight tables. However, it should be noted that the tool is modular and enables the administrator to modify/add/remove tables when needed.

4.4.2 Software Components

The evaluation tool is developed by using object oriented programming language Java. The development logic of the tool is summarized through the flow charts given in Figure 4.17 and Figure 4.18. These flow charts are self-explanatory. Thus we avoid giving the details. However, in the following, we discuss a few important Java classes of the tool for ready reference.

4.4.3 Software Classes

Now that the detailed tool using procedure is explained, in the following, we present the most significant implemented classes.

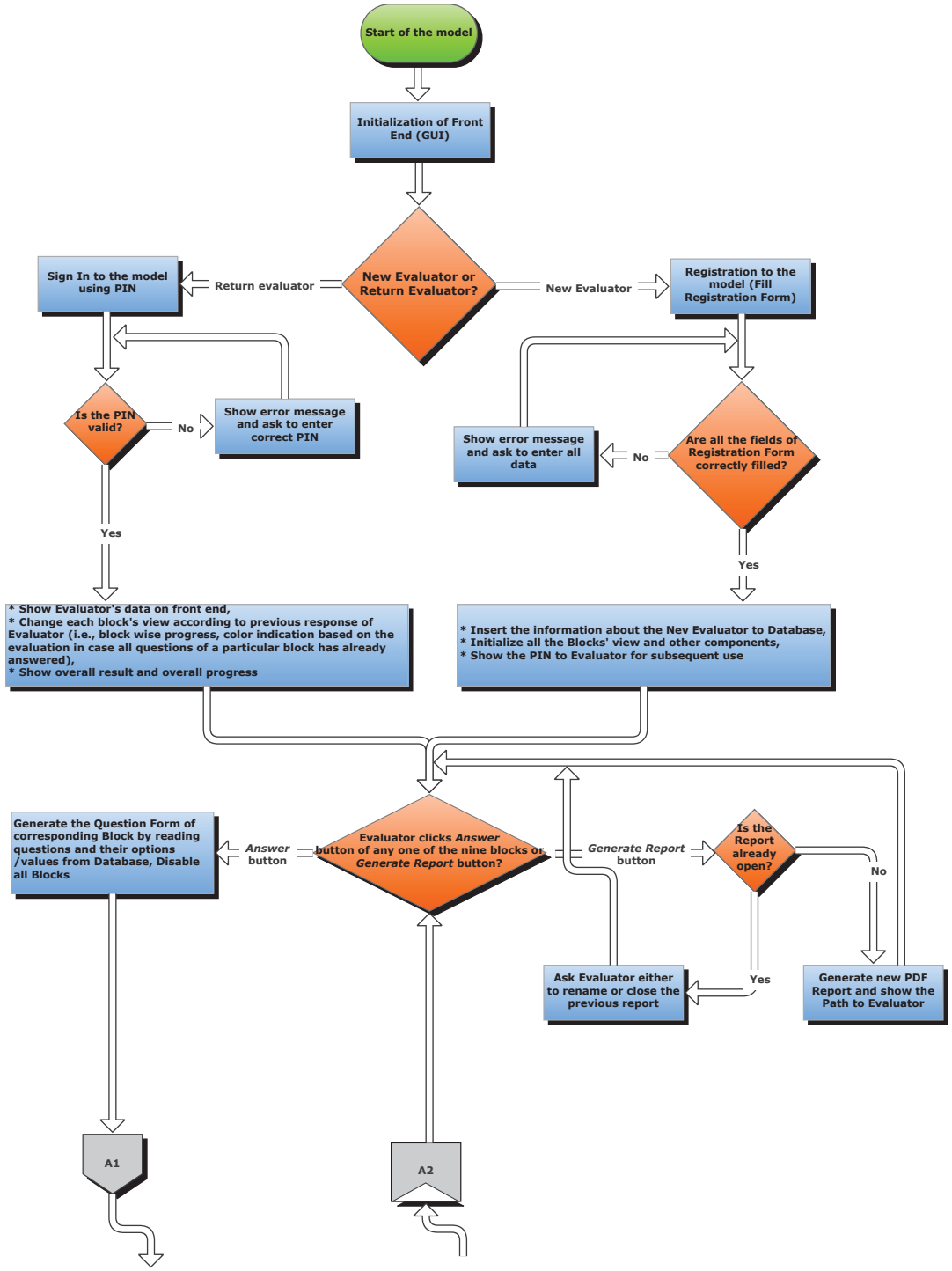


Figure 4.17: Tool procedural view (page 1/2) - Flow chart explaining the sequence of evaluation with and without administrative privilege.

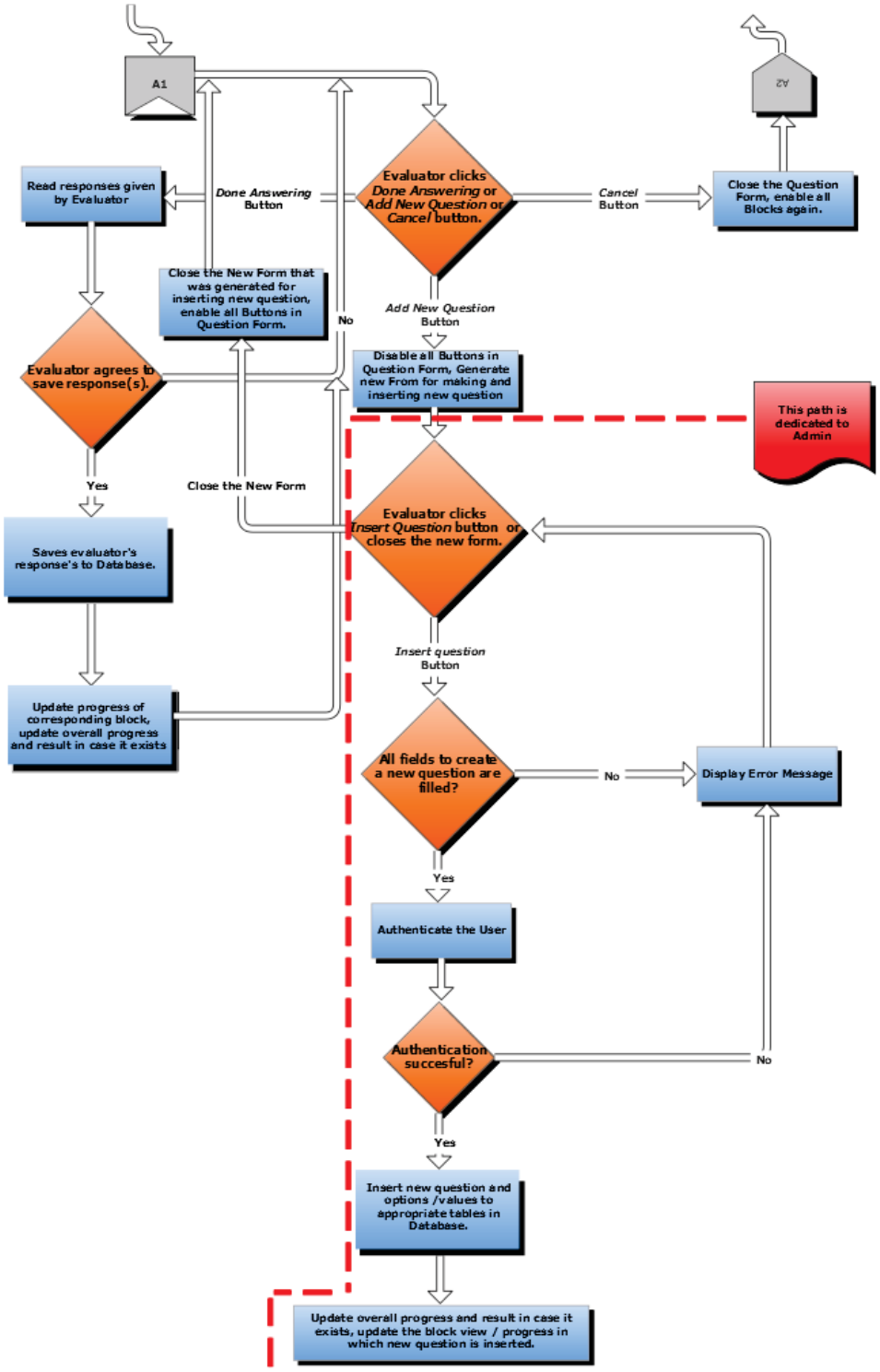


Figure 4.18: Tool procedural view (page 2/2) - Flow chart explaining the sequence of evaluation with and without administrative privilege.

Table 4.1: List of Tables Composing the Database

Table Name	Description
Evaluator	Contains PIN and relevant information of the evaluator
Questions	Contains question ID, question text and information of what hierarchical level the questions belong to
Options_Values	Contains options and values of each question identified by the question ID of the question
User_Response	Contains evaluator responses to questions
Blocks	Contains block ID and block name
Criteria	Contains criterion ID, criterion name and the corresponding block
Unit	Contains unit ID, unit name and the corresponding criterion
User_Pass	Contains user name and password of the admin

`Class SaveUserResponse`

This class provides the method to save evaluator's response to the database. It also provides a protected mapping method named "`all_Responses`", which maintains a mapping from Block ID to a set of questions that have been answered before clicking *Done Answering* button of an evaluation block. Another important method of this class is discussed as follows:

- `void save_toDatabase(int pin,`
  `int category_id,`
  `DatabaseServices databaseServices)`

  This method saves evaluator's response in the database against the unique PIN of the evaluator(s). It is intuitive that `pin` parameter of the method corresponds to the PIN of the current evaluator, `category_id` corresponds to the block under evaluation, and `databaseServices` corresponds to the instance of classes that provide methods for insertion to database.

Class ReportGenerator

This class provides the method for generating PDF reports, which are the consequences of the evaluation procedures at different hierarchical levels. Some of the important methods of this class include:

- `public int createPDF(Evaluator evaluator, java.lang.String data_to_make_report)`

  This method creates a PDF document using library methods. The `evaluator` parameter of this method corresponds to the evaluator's information, `data_to_make_report` corresponds to the text data of block specific results and other necessary information to generate the PDF report. This method has the return type integer, which is used as an indication of error occurrence instances.

Class NewQuestionForm

This class provides the method for generating a valid new question, which may further be inserted into database. A few of the important methods within the class are discussed as follows:

- `public boolean authenticate_user(java.lang.String usr, java.lang.String pass)`

  This method checks whether the user can insert new questions into the database or not. The parameter `usr` represents the user name of the privileged user, who is permitted to insert new questions, and the parameter `pass` corresponds to the password of the privileged user.

- `public void insert_button_actionPerformed (java.awt.event.ActionEvent evt)`

  This method is used to insert a new question (or evaluation parameter) in the database. The method also contains the required information for placing the new question on any of the hierarchical levels. The `evt` parameter corresponds to the action input, which takes place after the *Insert New Question* button.

Class Evaluator

This class mainly deals with the required information of the evaluator. The attributes of this class include xyzxyzxyzxyz.

Class Each_Question

This class deals with the procedures relevant to questions (or evaluation parameters) such as response value, response string; whether they are critical or non-critical, answered or not; and the getter/setter methods of question IDs.

Class DatabaseServices

This class focuses on the database relevant service of the tool. A few of the important methods within the class are discussed as follows:

- `public int insert_delete_or_update_to_Database (java.lang.String query)`

  This method executes the given SQL statement, which may be an INSERT, UPDATE, or DELETE statement. The parameter `query` represents any SQL statement to be read from the database.

- `public java.sql.ResultSet readFromDatabase (java.lang.String query)`

  This method performs read operation from database. The parameter `query` represents any SQL statement to read from the database.

Class Calculation

This class contains methods that perform numerical calculation to get block wise results and reports. A few of the important methods within the class are discussed as follows:

- `public HashMap<String,HashMap<Integer,Double>> Evaluation(int blockID,int pin)`

This method evaluates the responses of the evaluator with corresponding PIN. The evaluation of of different hierarchical levels are executed here. The parameter `blockID` specifies the ID of the block currently being evaluated and the parameter `pin` defines the PIN of the evaluator doing the evaluation.

- `public Map<java.lang.Integer,java.lang.Double> get_results_for_all_blocks(int pin)`

  This method calculates the numeric results for all blocks evaluated by corresponding valuator specified by `pin`. The parameter `pin` represents the PIN of the current evaluator.

- `public double get_Numeric_Result(java.util.ArrayList<Each_Question> responses_of_question, java.lang.Integer block_Number)`

  This method calculates the numeric result of a specific category. The parameter `responses_of_questions` represents an ArrayList of objects of `Each_Question` class where `Each_Question` class contains fields that determine the status of each question (i.e., whether the question is answered or not, whether the question is critical or not), the parameter `block_Number` represents block ID of a block, for which we want to calculate our numeric results. The method returns numeric results of a specific block specified by `block_Number`.

- `public void display_result(int pin)`

  This method displays results (in case all questions of a category/block have already been answered by the current evaluator) and updates corresponding information in front-end GUI. The parameter `pin` represents the PIN of current evaluator logged into the system.

- `public void make_report(int pin)`

  This method creates PDF report containing block wise results (only if all questions of a particular block are already answered by the current evaluator). The parameter `pin` represents the PIN of the current evaluator logged into the system.

Class Business_Model_CanvaView

This class represents the application's main frame, which generates front-end GUI. Some of the important methods within the class are discussed as follows:

- `public void manipulate_question_form (int block_id, javax.swing.JProgressBar progressBar)`

  This method is called to show the question form of a particular category specified by its ID. The parameter `block_id` represents the ID of a block, for which the question form is generated and the parameter `progressBar` corresponds to the reference of the progress bar of a particular block that shows corresponding progress.

- `public static void update_component(int pin)`

  This method updates the GUI components (progress bar / color in panel / overall progress) and displays block wise result (only if all questions of a block have been answered) and relevant information. The parameter `pin` represents the PIN of the current evaluator.

- `private void register_to_DAI_Model (java.awt.event.ActionEvent evt)`

  Action Listener of *Register* button. The parameter `evt` represents the event generated when *Register* button is clicked.

- `private void sign_in_handler (java.awt.event.ActionEvent evt)`

  Action Listener of *SignIn* button. The parameter `evt` represents the event generated when *SignIn* button is clicked.

4.5 Conclusion

In this chapter, we have provided the implementation details of the developed evaluation tool. We have discussed in detail different options of the evaluation tool from the perspective of an evaluator and a business owner (or privileged user). The chapter may serve as a "tool usage manual". We have also discussed a few important software components / Java classes and

methods therein to help readers understand the granular details of implementation. We believe that the self-explanatory flow chart, which explains the procedure flow in software, will help readers understand our contribution better.

5

Recommendation Based on Business Model Evaluation

"The most wonderful discovery ever made by scientists is science itself." - Jacob Bronowski

A business owner would naturally strive to know the optimal adaptation of their business activities/tactics to reach the desired business model evaluation. Such a goal of the business owner is attained with what we may call *business model recommender* or *business model predictor*. With the view to avoiding confusion stemming from terminology, in the following, we briefly highlight the basic difference between the buzz words *recommender* and *predictor*. By definition, *business model predictor* commonly refers to the failure prediction models, whereas the term *business model recommender* is not concretely defined. The earlier concept turned out to be a major research domain in the accounting and credit management (Ooghe & Spaenjers & Vandermoeren 2009). However, when it comes to the latter concept, to the best of our knowledge, very little is carried out in this direction. Thus the research literature does not give a concrete definition of the term *Business Model Recommender*. In the following, we present the definition of business model recommender that adheres to our concept.

Definition 8. *A business model recommender is a component that suggests the modifications/adaptations in the business activities for achieving the target business model evaluation. Ideally, the recommendations should be optimal in terms of costs and gains of the business model under evaluation.*

5.1 Motivation

The idea of proposing a business model recommender stems from the following facts:

1. Having the estimated evaluation value of the business model, the business owner is more confident to adapt the business activities.
2. Since the outcome of the recommender aims at recommending the activity/tactics adaptation that incurs the least cost and attains maximum evaluation value, business owners may estimate the required costs beforehand that help them attain the desired business model evaluation.
3. Having known the variable values of various evaluation controlling parameters and the assigned score values (which we discussed in the earlier chapters), we believe that the recommender component has enough information to make the recommendation for the evaluated business model. In other words, we believe that our evaluation component makes 80% of the complete contribution and the rest 20% is the recommendation component.

5.2 Recommender Requirements

In this section, we highlight some generic requirements of the recommender function.

- The recommender function should take the associated resource costs into account, so that recommendations are cost efficient.
- It should be able to provide recommendations on different hierarchical levels.
- The recommendations should be optimized on the abstract level in terms evaluation gain and resource costs.

In the background discussed in Chapter 2, we see that the business model evaluation models do not explicitly provide the recommender and hence are confined to simple evaluator. They do not explicitly provide the ways to optimally tune different evaluation metrics to attain the desired business goals (which will be translated in the business model evaluation). A recommender is envisioned to assist a business owner in making the optimal decisions over adapting the business model evaluation entities. In this chapter, we deal with finding the (near) optimal solution for adapting the business model to achieve the target evaluation goals.

In this work, we propose a recommender concept that recommends the business activity adaptations, aiming at attaining the target business evaluation score. We also integrate the proposed recommendation concept in the developed business model evaluation tool.

The recommender model is based on the evaluation outcome of the proposed evaluation model, i.e., the recommender model makes use of the variable values that were allocated by the evaluator while evaluating the business model. The target evaluation value, which is defined by the business owner, is set as the objective by the recommender. Let us recall the abstract vision of this work, which we discussed in Chapter 1. Figure 5.1 clearly depicts the inputs to the recommender component and the execution path of the recommender output; the focus of this chapter remains on the recommender component as highlighted in the figure. It should be noted that the contributed recommender takes the evaluated values of a business model into account.

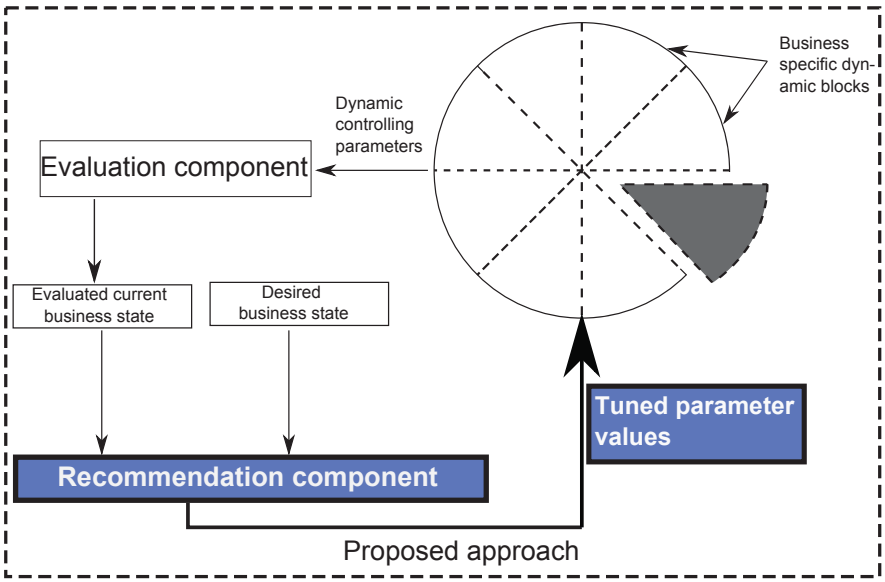


Figure 5.1: Business model recommender vision - Figure explains the block structure vision of the contributed business model recommender. As can be seen, the recommender is fed with the inputs from evaluator and the target evaluation (by the business owner); the recommender then suggests the most optimal recommendations to attain the target evaluation of the business model.

5.3 Recommender

With the view to provide a more concrete depiction of the recommender specific operations, we regenerate Figure 5.1 as Figure 5.2.

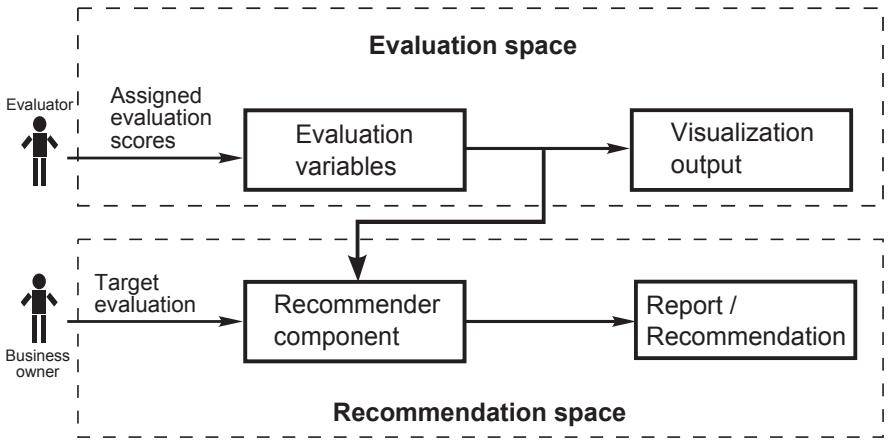


Figure 5.2: Evaluation and recommendation processed - Figure highlighting the interaction in evaluation and recommendation processes, and the role specific procedures of the evaluation tool.

In Figure 5.2, we summarize the placement and relationships of the recommender in a big picture. This corresponds to the contributions of this work. As can be seen, a business owner configures the evaluation function control parameters' values for a business model. The evaluator of the business model then assigns valuation scores to the predefined evaluation parameters, which consequences in the evaluation of the business model. The recommender component takes the current and the desired evaluation values as input. These inputs are fed to the recommender algorithm, which then generates a report that recommends business owners to adapt the current activities.

5.3.1 Cost Function - A Controlling Lever

The proposed recommender model exploits the cost component of the evaluation parameters, i.e., we believe that each evaluation parameter may be categorized by gain and cost components (as already explained in Chapter 3). Cost function is the function of evaluation parameters and may take any shape, which is driven by the type of the evaluation parameter (or resource). It is not practical to model a generic cost function that realistically captures the cost of every involved evaluation parameter. However, at an abstract level, we comment that the cost function

may take the concave, sigmoid, or decaying exponential functions like shapes, as depicted in Figure 5.3.

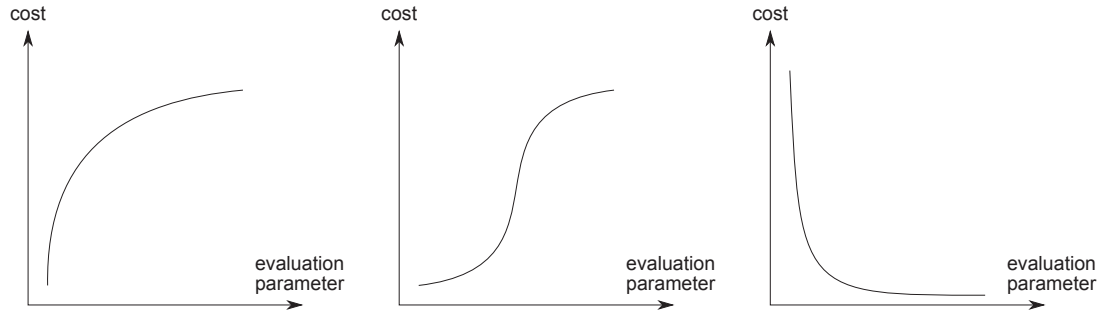


Figure 5.3: Possible cost functions - Figure depicting different cost curves driven by the type of the evaluation parameters.

One intuitive inference is that each evaluation score may be translated into / associated to specific amount of cost. Thus one may estimate the incurring cost for any specific amount of evaluation score. This concept plays an important role in the proposed recommender system. However, the question here is how to estimate the cost per evaluation score? In this connection, we suggest to extract this information from the evaluation already carried out. To shed more light on the proposed approach of extracting the cost from evaluation, in the following, we discuss a very simple use case. Assume that an evaluation parameter is assigned the score value 50% for the current amount of resources. This information is good but not enough.

For the proposed recommendation, we provision various relations, i.e., between resource and evaluation score relationship, cost and resource relationship depending on the block of the business model under evaluation. Business owner has more concrete information about these relationships. However, in this study, we consider simplistic relationships for the aforementioned controlling parameters, i.e., linear mapping of resources to evaluation scores, and linear mapping of costs to resources. Thus knowing the evaluation score for current amount of resources and the incurred costs on the resources, we are in a position to extract the cost per unit resource. This leads us to the solution, which we adopt, i.e., having known the cost-resource relationship, we formulate an optimization problem and solve it for the resource cost. The solution of the problem comprises recommendations such that the desired business model evaluation is attained by adapting the activities that incur the least costs.

5.3.2 Recommendation Problem

We model the recommendation as an optimization problem, where we minimize over the cost component. We know that each evaluation parameter may be characterized by resources and associated costs. For instance, given the evaluation parameter of amount r resources, the current evaluation score $\tilde{e}$, and the associated cost c, what should be the increase in r such that c remains minimum and $\tilde{e}$ increases to desired evaluation $\bar{e}$. Thus to attain the target evaluation of $\bar{e}$, the recommender should select the set of resources that incur the least cost. In this work, we made use of the *Optimization Toolbox*^{TM} of MATLAB to solve this problem. In addition, we also implemented the *brute-force* solution. In the brute-force approach, we iterated over the resources involved in business model evaluation and their associated costs. In pseudocode below, we summarize this procedure.

Algorithm 1: Optimization

get $\tilde{e}$(CurrentEvaluation), $\bar{e}$(DesiredEvaluation), $[R]$ =list of resources, $[c]$ =list of associated costs, e =attained evaluation, $\tilde{c}$ =aggregated attained cost
while $\bar{e} < e$ **do**
    Simulate incrementing all the responses;
    Find entirely in [R] that has lower cost;
    Increase the response of the corresponding resource;
    Update $\tilde{c}$;
    Recalculate e with the updated responses;
end

However, we reiterate here that for such recommendation, relationships between evaluation outcome value and evaluation parameter resources, resources and associated costs, translation of resource adaptation (i.e., for attaining the target evaluation) and the business activities adaptation need to be defined. This may turn out to be cumbersome in various cases and business owners may need to configure many attributes in the developed tool. One may carry out the aforementioned procedures on abstract level, but at the cost of accuracy loss.

5.4 Validation of the Recommender

In order to validate the recommender, we implemented a simplified version of the earlier use case, where the business model consists of one block only. The block is evaluated on different evaluation parameters. The evaluation of this block is shown in *A* of Figure 5.4. The outcome of the evaluation turns out to be 45% as shown in *C* of Figure 5.4. Having known the business

model evaluation, the business owner is willing to attain a target evaluation, and is interested in knowing the activity adaptations that lead to the optimal solution. The business owner desires to attain the business evaluation of 80%. This is depicted in *B* of Figure 5.4. After the target evaluation is defined, the recommender function is executed by pressing the button "Generate Report".

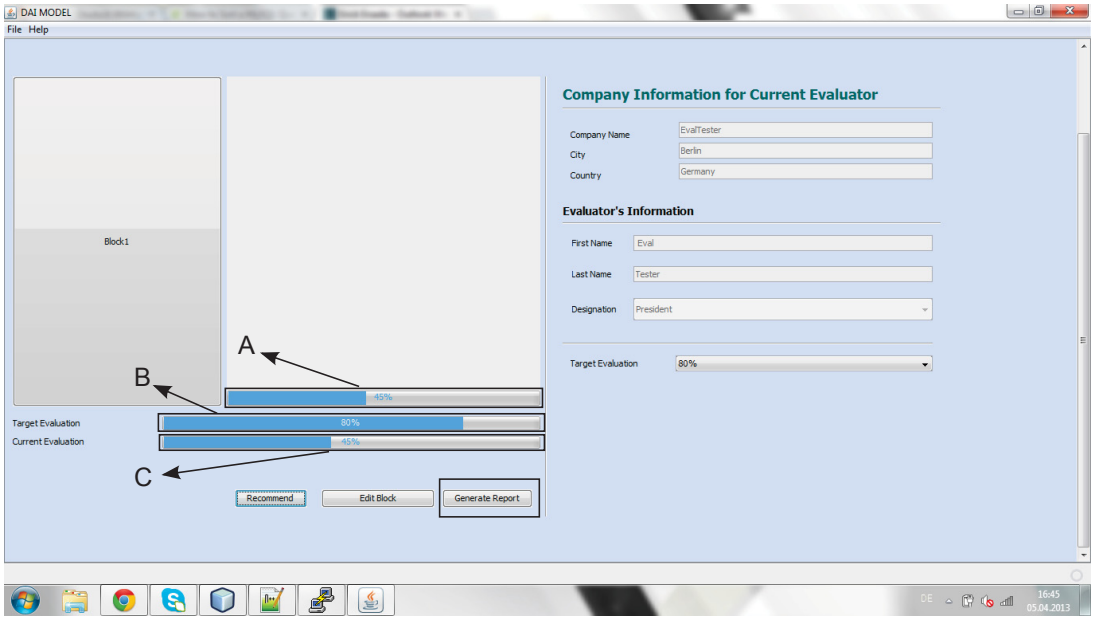


Figure 5.4: Current and target evaluations - Figure highlighting the evaluation tool visualization for per block evaluation (i.e., 45%), current evaluation (i.e., 45%), target evaluation (i.e., 80%), and "Generate Report" button.

The "Generate Report" button executes the recommender function, which results in new score values for specific actions as shown in Figure 5.5.

The new evaluation scores for these actions are then translated into understandable recommendations. In this connection, we developed a mapping function in the tool, which generates the evaluation parameter specific recommendations; this is shown in Figure 5.6.

In order to validate the correct implementation of the mapping function, we also generated the report for a use case, where the evaluation needed to be raised from 45% to 60%. As can be seen also in Figure 5.7, this is a self-explanatory report with clear recommendations for activity adaptations.

To see if the recommended adaptations achieve the desired evaluation, we adapted the activities, allocated recommended evaluation scores as shown in Figure 5.8, and observed that the

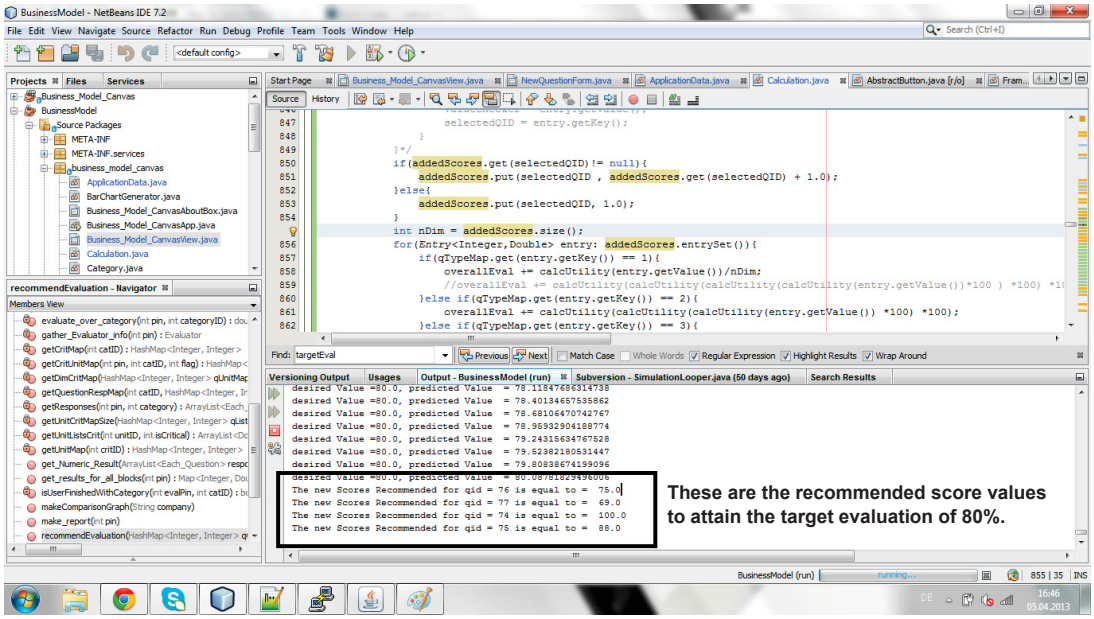


Figure 5.5: Recommended values - A snapshot of the console output of the evaluation tool. As can be seen, the tool selects the parameters for adaptation and also recommends the score values. This adaptation would result in attaining the target 80% evaluation.

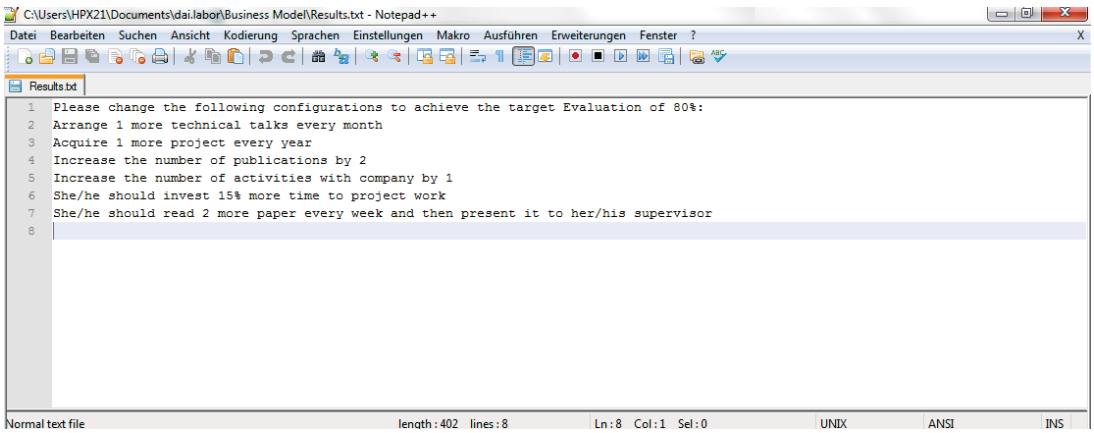


Figure 5.6: Tool recommendations after mapping (45% **to** 80%) - The figure depicts the recommendations (i.e., similar to the ones shown in Figure 5.5) translation into human understandable and evaluation parameters specific recommendation.

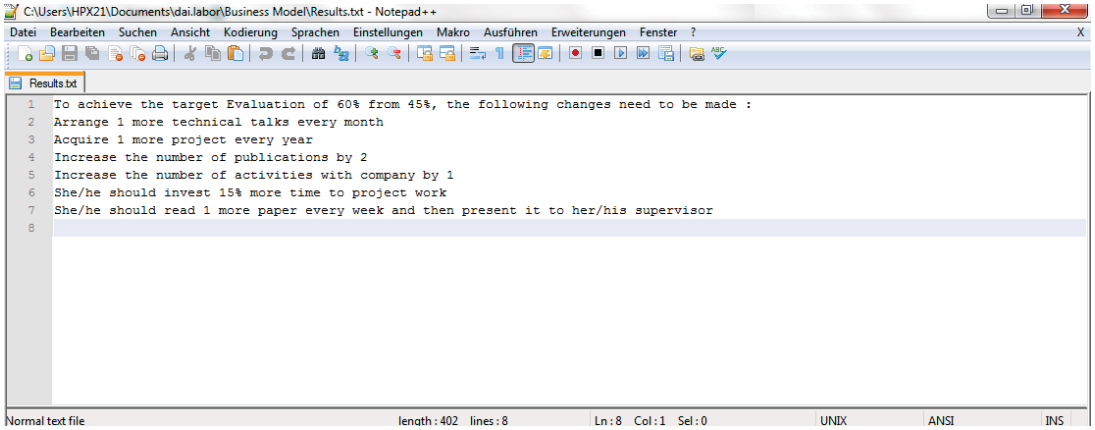


Figure 5.7: Tool recommendations after mapping (45% **to** 60%) - The figure depicts the recommendations (i.e., similar to the ones shown in Figure 5.5) translation into human understandable and evaluation parameters specific recommendation.

business model evaluation increased to 80%, which is depicted in Figure 5.9. This advocates that the proposed recommender component performs as expected.

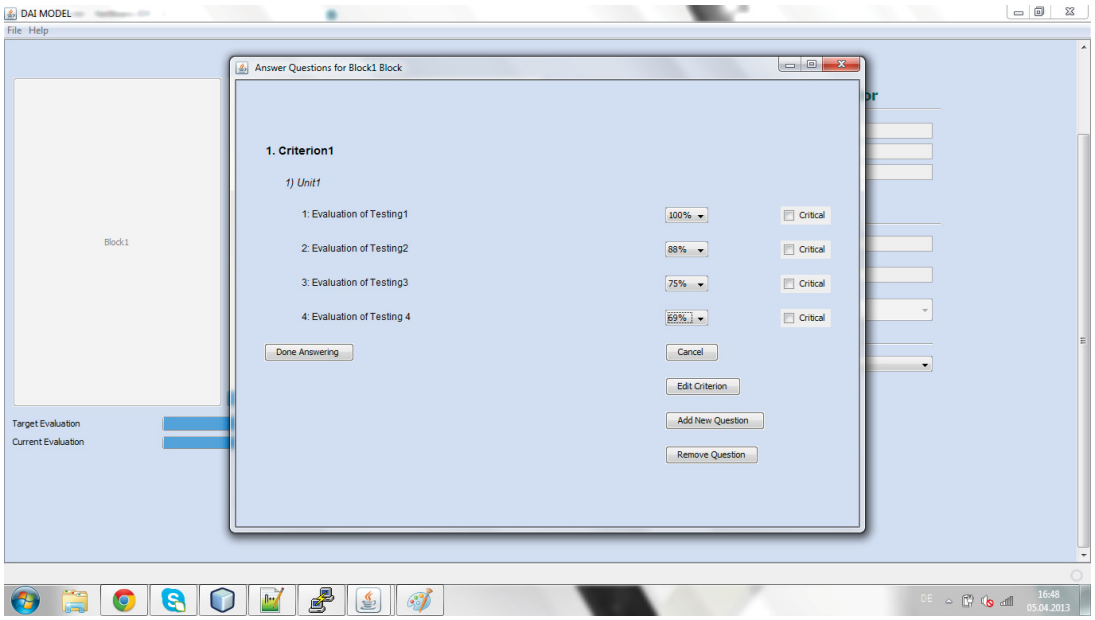


Figure 5.8: Setting the values to the recommended values - Figure shows that the evaluation scores of the parameters are allocated accordingly by the evaluator.

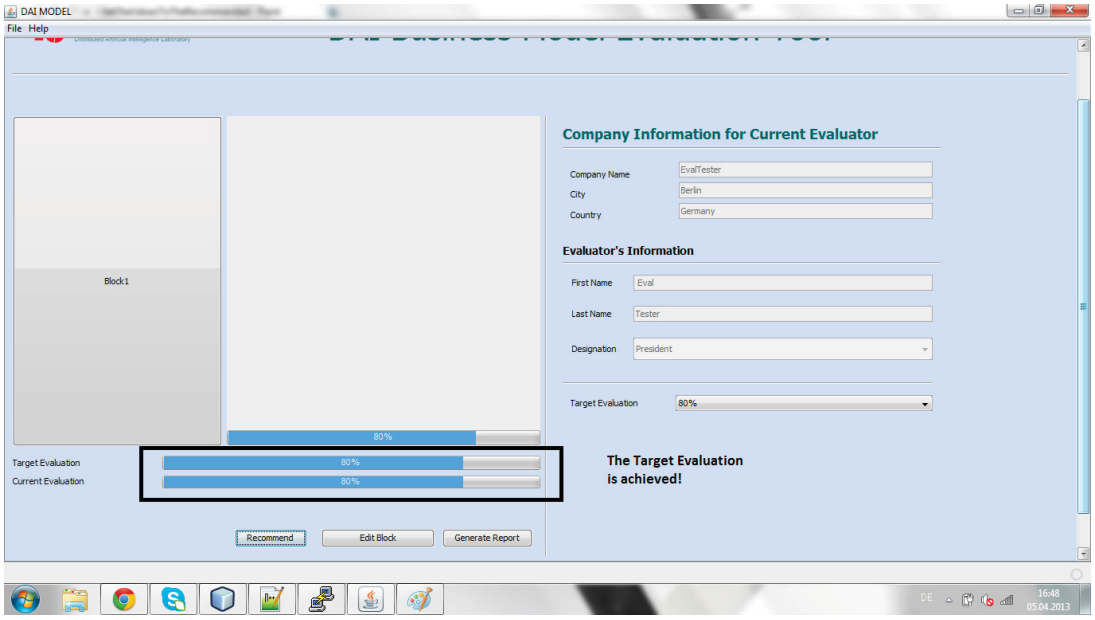


Figure 5.9: Results after insertion of recommended values - After the insertion of the recommended score values, we observe that the target evaluation is attained.

6

Conclusion and Future Prospects

"Arriving at one goal is the starting point to another." - Fjodor Michailowitsch Dostojewski

In this work, we had set the goal of addressing the following research question: "*how to realistically evaluate a business model?*" In terms of major contributions, the thesis models a decision support tool that facilitates scientific analysis of business models. We believe that the proposed hierarchical business model evaluation approach, on the one hand, acts as a skeleton for the businesses by providing a structured way of thinking; it provides a strong foundation for abstract level analysis of relations, gains, and faults that form the core of the businesses, on the other hand. The contributed concepts, evaluation model approach, and the evaluation tool, give us enough confidence to place this work as a contribution under strategic management in the management context. Deviating from the commonly used static methods, in this work, we propose a dynamic solution. Instead of loading a rectangular container with watermelons, which causes not filling the container 100% and leaves vacuum, we offer a solution that does not change the shapes of the watermelons from round to square by modifying them genetically and cause them lose their taste, but constructs an elastic container fitting not only to watermelons but also to bananas.

Instead of striving to solve a big problem, we decompose the problem into constituent parts and then deal with them. After solving the individual problems, we combine/aggregate/translate these solutions using an aggregation/translation function to attain the system-wide solution. In other words, to solve the problem, we follow a divide and conquer strategy by decomposing the problem into parts that are easier to handle.

We started with converging the scope of the problem domain and clearly highlighting the dimensions for research; this may be found in Chapter 1. Having a concrete picture of the problem, we constructed the background of our research work in different relevant dimensions and investigated the strengths/weaknesses of available approaches. A well organized, thoroughly investigated, and easy to follow state of the art analysis constitutes the Chapter 2 of this thesis. Chapter 3 is the rich chapter of the thesis when it comes to size of contribution. The chapter discusses proposed concepts, reasons and justifications to deviate from the commonly used models, the need for hierarchical evaluation model, the evaluation/translation functions, and validation of proposed evaluation framework against the other approaches. Chapter 3 concludes by providing a lengthy discussion over evaluation procedure of DAI-Labor's business model (a use case study), where we discuss the steps for mapping business model dynamics to the proposed approach, selecting and inserting the evaluation parameters in the developed evaluation tool, and visualizing/analyzing the evaluation outcome. This aforementioned discussion also serves to be the proof-of-concept study for the proposed approach. The development details of proposed evaluation tool are provided in Chapter 4, where the discussion focuses on technical details, available functionalities from the perspective of evaluator / business owner, usage of functional options, and software components. This chapter may be taken for a *usage manual* and a *developer instruction manual*. A further valuable contribution of *business model recommendation* constitutes Chapter 5, where we detail the concept of recommendation based on the current evaluation. We extended the developed evaluation model tool by integrated the proposed recommendation component; the details of this integration, usage procedures are then contained in Chapter 5.

As the future perspective of this work, we aim at implementing the advanced version of the evaluation tool. The current version of the recommender component in the evaluation tool provisions that the business model should first be evaluated using the evaluation tool and then the recommender component takes the variable values, which were used for evaluating the business model, into account. Our goal as an extension of this work would be to enable the tool accept some input variables (without carrying out the evaluation) and output the estimated evaluation against different (optimized) adaptation of business operations.

As mentioned earlier, the goal of designing and implementing a very generic and yet accurate business model evaluation tool could be too ambitious and can be achieved hardly within the scope of a dissertation, if at all. For this reason, while we introduced a flexible tool that

can be customized for a wide scope of business domains and scenarios, we have kept our attention on the specific case of a smaller organization for the proof-of-concept in this thesis. The non-profit organization DAI-Labor was chosen for relatively easy access to the information and personnel needed for the questionnaires in the evaluation. However, comprising various departments, the model presented for the use case can be adapted to similar small scale companies. It remains as future work to adapt and test the proposed approach in different business markets and scenarios.

Bibliography

[1] Afuah, A. & Tucci, C. L. 2001, *Internet Business Models and Strategies: Text and Cases*, McGraw-Hill, Boston.

[2] Afuah, A. & Tucci, C. L. 2003, *Internet Business Models and Strategies: Text and Cases*, McGraw-Hill, Boston.

[3] Al-Debei, M. M. & Avison, D. 2010, 'Debeloping a unified framework of the business model concept', *European Journal of Information Systems*, Vol. 19, Issue 3, pp. 359-376.

[4] Alt, R. & Zimmermann, H. D. 2001, 'Preface: Introduction to Special Section - Business Models', *EM - Electronic Markets*, Vol. 11, No. 1, pp. 3-9.

[5] Altman E. I. 1968, 'Financial ratios, discriminant analysis and the prediction of corporate bankruptcy', *The Journal of Finance*, Vol. 23, Nr. 4, p. 589-609.

[6] Amit, R. & Zott, C. 2001, 'Value Creation in E-Business', *Strategic Management Journal*, Vol. 22, pp. 493-520.

[7] Amit, R. & Zott, C. 2012, 'Creating Value Through Business Model Innovation', *MIT Sloan Management Review*, Vol. 53, No. 3, pp. 41-49.

[8] Andersson, B. & Bergholtz, M. & Edirisuriya, A. & Ilayperuma, I. & Johannesson, P. & Gregoire, B. & schmitt, M. & Dubois, E. & Abels, S. & Hahn, A. & Gordijn, J. & Weigand, H. & Wangler B. 2006, 'Towards a Reference Ontology for Business Models', *In Proceedings of the* 25^{th} *International Conference on Conceptual Modeling - ER2006*, Tucson, USA, pp. 1-16.

[9] Andrews, K. R. 1971, *The Concepts of Corporate Strategy*, Irwin, Homewood, IL.

[10] Andrews, K. R. 1997, 'The Concepts of Corporate Strategy', in N. J. Foss (ed.), *Resources, Firms, and Strategies: A Reader in the Resource-Based Perspective*, Oxford University Press, Oxford, pp. 52-59.

[11] Applegate, L. M. 2001, 'E-Business Models: Making Sense of the Internet Business Landscape', in Dickson, G. W. & DeSanctis, G. (eds.), *Information Technology and the Future Enterprise: New Models for Managers*, Prentice-Hall, Upper Saddle River, N. J., pp. 49-94.

[12] Auer, C. & Follack, M. 2002, 'Using Action Research for Gaining Competitive Advantage out of the Internet's Impact on Existing Business Models', *Proceedings of the* 15^{th} *Electronic Commerce Conference – eReality: Constructing the eEconomy*, Bled, pp. 767-784.

[13] Baatz, E. B. 1996, 'Will Your Business Model Float?', *Web Master Magazine*, October Issue. Retrieved June 2007, from `http://www.cio.com/archive/webbusiness/100196_float_content.html`.

[14] Baden-Fuller, C. & Morgan, M. S. 2010, 'Business Models as Models', *Long Range Planning*, Vol. 43, pp. 156-171.

[15] Balcaen, S. & Ooghe, H. 2006, '35 Years of Studies on Business Failure: an Overview of the Classic Statistical Methodologies and Their Related Problems', *British Accounting Review*, Vol. 38, No. 1, pp. 63-93.

[16] Beaver W. 1967, 'Financial ratios predictors of failure', *Empirical Research in Accounting: Selected Studies 1966*, *Journal of Accounting Research*, Supplement to Vol. 4, pp. 71-111.

[17] Bellman, R. & Clark, C. E. & Malcolm, D. G. & Craft, C. J. & Ricciardi, F. M. 1957, 'On the Construction of a Multi-Stage, Multi-Person Business Game', *Operations Research*, Vol. 5, No. 4, pp. 469-503.

[18] Besanko, D. & Dranove, D. & Shanley, M. 2000, *Economics of Strategy*, John Wiley & Sons, New York.

[19] Blank, S. 2010, 'No Plan Survives First Contact with Customer - Business Plans versus Business Models', Steve Blank's web page, April 8. Retrieved January 2011, from `http://steveblank.com/2010/04/08/`.

[20] Bonaccorsi, A. & Giannangeli, S. & Rossi, C. 2006, 'Entry Strategies under Competing Standards: Hybrid Business Models in the Open Source Software Industry', *Management Science*, Vol. 52, No. 7, pp. 1085-1098.

[21] Bouwman, H. 2002, 'The sense and nonsense of Business Models', *International Workshop on Business Models*, Lausanne.

[22] Bouwman, H. & MacInnes, I. 2006, 'Dynamic Business Model Framework for Value Webs', *Proceedings of the* 39^{th} *Hawaii International Conference on System Sciences*, Vol. 2, Hawaii.

[23] Brousseau, E. & Penard, T. 2006, 'The Economics of Digital Business Models: A Framework for Analyzing the Economics of Platforms', *Review of Network Economics*, Vol. 6, No. 2, pp. 81-110.

[24] Campanovo, G. & Pigneur, Y. 2003, 'Business Model Analysis Applied to Mobile Business', *Proceedings of the* 5^{th} *International Conference on Enterprise Information Systems*, Angers, pp. 1-10.

[25] Casadesus-Masanell, R. & Ricart, J. E. 2010, 'From Strategy to Business Models and onto Tactics', *Long Range Planning*, Vol. 43, pp. 195-215.

[26] Chandler, A. 1962, *Strategy and Structure: Chapters in the History of the American Industrial Enterprise*, MIT Press, Cambridge, MA.

[27] Chesbrough, H. & Rosenbloom, R. S. 2002, 'The Role of the Business Model in Capturing Value from Innovation: Evidence from Xerox Corporation's Technology Spinoff Companies', *Industrial and Corporate Change*, Vol. 11, No. 3, pp. 529-555.

[28] Clarke, R. 2004, 'Open Source Software and Open Content As Models for eBusiness', *Proceedings of the* 17^{th} *International eCommerce Conference – eGlobal*, Bled, pp. 1-14.

[29] Clarke, R. 2007, 'Business Models to Support Content Commons', *SCRIPT-ed*, Volume 4, Issue 1, pp. 59-71. Retrieved July 2007, from `http://www.law.ed.ac.uk/ahrc/script-ed/vol4-1/clarke.pdf`.

[30] Dahan, N. A. & Doh, J. P. & Oetzel, J. & Yaziji, M. 2010, 'Corporate-NGO Collaboration: Co-creating New Business Models for Developing Markets', *Long Range Planning*, Vol. 43, pp. 326-342.

[31] Dawson B. 2007, 'The Power of the R5 Business Model', *EC&M*, Vol. 106, No.8, pp.20-26. Retrieved July 2012, from `http://ecmweb.com/content/power-r5-business-model`.

[32] Demil, B. & Lecocq, X. 2010, 'Business Model Evolution: In Search of Dynamic Consistency', *Long Range Planning*, Vol. 43, pp. 227-246.

[33] Dottore, F. A. 1977, 'Database Provides Business Model', *Computerworld Special Report on Database Management Systems*, Vol. 11, No. 44, 18 October, p. S/2.

[34] Dubosson-Torbay, M. & Osterwalder, A. & Pigneur, Y. 2002, 'eBusiness Model Design, Classification and Measurements', *Thunderbird International Business Review*, Vol. 44, Issue 1, pp. 5-23.

[35] Economist Intelligence Unit 2006, *Rethinking the Business Model*, research report, KPMG International. Retrieved March 2007, from `http://www.us.kpmg.com/microsite/FSLibraryDotCom/docs/Rethinking_the_business_model.pdf`.

[36] Fatsis, S. & Flint, J. 2001, 'How the XFL Football League became one of the biggest flops in TV history', *Wall Street Journal*, 23 April. Retrieved May 2007, from `http://www.totalobscurity.com/mind/news/2001/xfl-flop.html`.

[37] Gaile-Sarkane, E. 2006, 'On Evaluation of Information Flow Efficieny in E-Business', *Vadyba/Management*, Nr. 1(10), pp. 39-47. Retrieved July 2012, from `http://www.leidykla.eu/fileadmin/Vadyba/10/Elina_Gaile-Sarkane.pdf`.

[38] George, G. & Bock, A. J. 2010, 'The Business Model in Practice and its Implications for Entrepreneur Research', *Entrepreneurship - Theory & Practice*, Vol. 35, Issue 1, pp. 83-111.

[39] Gordijn, J. & Akkermans, H. & van Vliet, H. 2000, 'What's in an electronic business model?', *Proceedings of the* 12^{th} *European Workshop on Knowledge Acquisition, Modeling and Management*, Lecture Notes in Computer Science, Vol. 1937, Springer Verlag, London, pp. 257-273.

[40] Gordijn, J. & Akkermans, H. 2001a, 'Designing and Evaluating e-Business Models', *IEEE Intelligent Systems*, Special issue on intelligent e-business, Vol. 16, No. 4, pp. 11-17.

[41] Gordijn, J. & Akkermans, H. 2001b, 'Ontology-Based Operators for e-Business Model De- and Re-construction', *Proceedings of the* 1^{st} *International Conference on Knowledge Capture*, ACM Press, Victoria, pp. 60-67.

[42] Gordijn, J. 2002, 'Value Based Requirements Engineering: Exploring Innovative e-Commerce Ideas', Ph.D. Thesis, Vrije Universiteit. Retrieved July 2007, from `http://www.cs.vu.nl/~gordijn/thesis.pdf`.

[43] Gordijn, J. 2003, 'Why visualization of e-business models matters', 16^{th} *Electronic Commerce Conference – eTransformation*, Position paper, Panel *Business Models & the Mobile Industry: Concepts, Metrics, Visualization & Cases*, Bled.

[44] Gordijn, J. & Akkermans, H. 2003a, 'Value Based Requirements Engineering: Exploring Innovative e-Commerce Ideas', *Requirements Engineering Journal*, Vol. 8, No. 2, pp. 114-134.

[45] Gordijn, J. & Akkermans, H. 2003b, 'Does e-Business Modeling Really Help?', *Proceedings of the* 36^{th} *Annual Hawaii International Conference on System Sciences*, IEEE, Hawaii, pp. 1-10.

[46] Gordijn, J. & Wieringa R. 2003, 'A Value-Oriented Approach to E-Business Process Design', in Eder, J. & Missikoff, M. (eds.), *Advanced Information Systems Engineering*, Lecture Notes in Computer Science, Vol. 2681, Springer Verlag, Berlin, Heidelberg, pp. 309-403.

[47] Gordijn, J. 2004, 'e-Business value modeling using the e^3-value ontology', in Currie, W. (ed.), *Value Creation from E-Business Models*, Elsevier, Oxford, pp. 98-127.

[48] Gordijn, J. & Osterwalder, A. & Pigneur, Y. 2005, 'Comparing two Business Model Ontologies for Designing e-Business Models and Value Constellation', *Proceedings of the* 18^{th} *Electronic Commerce Conference - eIntegration in Action*, Bled, pp. 1-17.

[49] Govindarajan, V. & Fisher, J. 1990, 'Strategy, Control Systems, and Resource Sharing: Effects on Business-Unit Performance', *The Academy of Management Journal*, Vol. 33, No. 2, pp. 259-285.

[50] Haaker, T. & Faber, E. & Bouwman, H. 2006, 'Balancing Customer and Network Value in Business Models for Mobile Services', *International Journal of Mobile Communication*, Vol. 4, Issue 6, pp. 645-661.

[51] Hagel, J. & Singer, M. 1999, 'Unbundling the Corporation', *Harvard Business Review*, Vol. 77, Issue 2, pp. 133-141.

[52] Hamel, G. 2000, *Leading the Revolution*, Harvard Business School Press, Boston.

[53] Hart, B. H. L. 1967, *Strategy*, Basic Books, New York.

[54] Hedman, J. & Kalling, T. 2003, 'The business model concept: theoretical underpinnings and empirical illustrations', *European Journal of Information Systems*, Vol. 12, Issue 1, pp. 49-59.

[55] Honig, B. & Karlsson, T. 2004, 'Institutional forces and the written business plan', *Journal of Management*, Vol. 30, Issue 1, pp. 29-48.

[56] Horsti, A. 2007, 'Essays on Electronic Business Models and Their Evaluation', Ph.D. Thesis, Helsinki School of Economics.

[57] Itami, H. & Nishino, K. 2010, 'Killing Two Birds with One Stone: Profit for Now and Learning for the Future', *Long Range Planning*, Vol. 43, pp. 364-369.

[58] Itami, H. 1987, *Mobilizing Invisible Assets*, Harvard University Press, Cambridge, MA.

[59] Johnson, M. W. & Christensen, C. C. & Kagermann, H. 2008, 'Reinventing Your Business Model', *Harvard Business Review*, Vol. 86, pp. 50-59.

[60] Johnson, M. V. & Suskewicz, J. 2009, 'How to Jump-Start the Clean-tech Economy', *Harvard Business Review*, Vol. 87, No. 11, pp. 52-60.

[61] Johnson, M. W. 2010, *Seizing the White Space: Business Model Innovation for Growth and Renewal*, Harvard Business Press.

[62] Jones, G. M. 1960, 'Educators, Electrons, and Business Models: A Problem in Synthesis', *The Accounting Review*, Vol. 35, No: 4, pp. 619-626.

[63] Kageyama, Y. 2008, 'Toshiba Quits HD DVD Business', *abc News*, 19 February. Retrieved November 2008, from `http://abcnews.go.com/Technology/GadgetGuide/wireStory?id=4309219`.

[64] Kaplan, R. S. & Norton, D. S. 1996, *The Balanced Scorecard: Translating Strategy into Action*, Harvard Business School Press, Boston, Massachusetts.

[65] Karlsson, T. & Honig, B. 2009, 'Judging a business by its cover: An institutional perspective on new ventures and the business plan', *Journal of Business Venturing*, Volume 24, Issue 1, pp. 27-45.

[66] Konczal, E. F. 1975, 'Models Are For Managers, Not Mathematicians', *Journal of Systems Management*, Vol. 26, No. 1, pp. 12-15.

[67] Kraemer, K. L. & Dedrick, J. & Yamashiro, S. 2000, 'Refining and Extending the Business Model With Information Technology: Dell Computer Corporation', *The Information Society*, Vol. 16, pp. 5-21.

[68] Krummer, R. Jr. n.d., *Write a Business Plan*. Retrieved July 2012, from `http://www.sbaonline.sba.gov/smallbusinessplanner/plan/writeabusinessplan/SERV_BUSPLANBASICS.html`.

[69] Lambert, A. 2008, 'A Conceptual Framework for Business Model Research', *Proceedings of the* 21^{st} *Bled eConference – eCollaboration: Overcoming Boundaries through Multi-Channel Interaction*, Bled, pp. 277-289.

[70] Laudon, K. C. & Traver, C. G. 2008, *E-commerce - business, technology, society*, Prentice Hall, Upper Saddle River.

[71] Leem, C. S. & Suh, H.S. & Kim, D.S. 2004, 'A Classification of Mobile Business Models and its Applications', *Industrial Management and Data Systems*, Vol. 104, Issue. 1, pp. 7887.

[72] Liddell, H. G. & Scott, R.(ed.) 1940, *A Greek-English Lexicon*, 9^{th} edn, Clarendon, Oxford. Retrieved February 2013, from `http://www.areopage.net/PDF/LSJ.pdf`.

[73] Linder, J. C. & Cantrell, S. 2000, 'Changing Business Models: Surveying the Landscape', Accenture, Institute for Strategic Change. Retrieved April 2007, `http://www.accenture.com/NR/rdonlyres/0DE8F2BE-5522-414C-8E1B-E19CF86D6CBC/0/Surveying_the_Landscape_WP.pdf`.

[74] Linder, J. C. & Cantrell, S. 2001, 'Five business-model myths that hold companies back', *Strategy & Leadership*, June issue, pp. 13-18.

[75] List, D. 2006, 'What is a business model?', *Audience Dialog*. Retrieved February 2013, from `http://www.audiencedialogue.net/busmod.html`.

[76] MacInnes, I. 2005, 'Dynamic business model framework for emerging technologies', *International Journal of Technology and Management*, Vol. 6, No. 1, pp. 3-19.

[77] Magretta, J. 2002, 'Why Business Models Matter', *Harvard Business Review*, Vol. 80, No. 5, pp. 3-8.

[78] Mahadevan, B. 2000, 'Business Models for Internet based E-Commerce – An Anatomy', *California Management Review*, Vol. 42, No. 4, pp. 55-69.

[79] Maitland, C. & Van de Kar, E. 2002, 'First BITA Case Study Experiences with Regard to Complex Value Systems', *BITA-B4U Symposium Business Models for Innovative Mobile Services*, Delft, Netherlands.

[80] Markides, C. 1999, 'A Dynamic View of Strategy', *Sloan Management Review*, Vol. 40, Issue 3, pp. 55-63.

[81] McGrath, R. G. 2010, 'Business Models: A Discovery Driven Approach', *Long Range Planning*, Vol. 43, pp. 247-261.

[82] Mintzberg, H. 1994a, 'The Fall and Rise of Strategic Planning', *Harvard Business Review*, Issue January-February, pp. 107-114.

[83] Mintzberg, H. 1994b, *The Rise and Fall of Strategic Planning*, Free Press, New York.

[84] Mitchell, J. & Van Roy, P. 2007, 'Failure prediction models : performance, disagreements, and internal rating systems', Working Paper Research, National Bank of Belgium, No. 123.

[85] Morris, M. & Schindehutte, M. & Allen, J. 2005, 'The Entrepreneur's Business Model: Toward a Unified Perspective', *Journal of Business Research*, Vol. 58, pp. 726-735.

[86] Mühlhausen, J. 2010, 'Business Model vs Business Plan'. Retrieved January 2011, from http://businessmodelinstitute.com/what-is-a-business-model/business-model-vs-business-plan/.

[87] Netessine, S. & Yakubovich, V. 2012, 'The Darwinian Workplace', *Harvard Business Review*, Vol. 90, Issue 5, pp. 25-28.

[88] Nickols, F. 2011, 'Strategy: Definitions and Meaning'. Retrieved July 2012, from http://www.nickols.us/strategy_definition.htm.

[89] Ooghe, H. & Spaenjers, C. & Vandermoere, P., 'Business Failure Prediction: Simple-Intuitive Models versus Statistical Models', *The IUP Journal of Business Strategy*, Vol. VI, Nos. 3-4, pp. 7-44.

[90] Osterwalder, A. & Pigneur, Y. 2002, 'An e-Business Model Ontology for Modeling e-Business', *Proceedings of the* 15^{th} *Electronic Commerce Conference – eReality: Constructing the eEconomy*, Bled, pp. 75-91.

[91] Osterwalder, A. 2004, 'The Business Model Ontology - a proposition in a design science approach', Ph.D. Thesis 173, University of Lausanne. Retrieved April 2007, from http://www.businessmodeldesign.com/business-model-research.html.

[92] Osterwalder, A. 2007, 'How to Describe and Improve your Business Model to Compete Better', Draft Business Model Innovation Manual (Beta Version), La Trobe University. Retrieved June 2011, from http://www.setoolbelt.org/resources/830.

[93] Osterwalder, A. 2009, 'How Business Models Help generate Business Plans', Osterwalder's web blog, August 6. Retrieved July 2012, from http://www.businessmodelalchemist.com/2009/08.

[94] Osterwalder, A. & Pigneur, Y. 2010, *Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers*, John Wiley & Sons, New Jersey.

[95] Owen, D. 2005, 'The Betamax vs VHS Format War', MediaCollege.com. Retrieved July 2012, from `http://www.mediacollege.com/video/format/compare/betamax-vhs.html`

[96] Österle, H. 1996, 'Business Engineering: Transition to the Networked Enterprise', *Electronic Markets*, Vol. 6, No. 2, pp. 14-16.

[97] Pateli, A. 2002, 'Reviewing and Organising Research on Business Models (BMs)', *The HERMES Newsletter by Eltrun – The eBusiness Center*, Athens University of Economics and Business, Issue 18. Retrieved May 2007, from `http://www.netmode.ntua.gr/courses/postgraduate/edi/material/18thELTRUN-Newsl(BMs).pdf`.

[98] Pateli, A. & Giaglis, G. 2002, 'A Domain Area Report on Business Models', Eltrun – The eBusiness Center, Athens University of Economics and Business, White Paper.

[99] Petrovic, O. & Kittl, C. & Teksten R. D. 2001, 'Developing Business Models for eBusiness', *Proceedings of the International Conference on Electronic Commerce 2001*, Vienna.

[100] Pijpers, V. & Gordijn, J. 2007, 'Does your role in a networked value constellation match your business strategy? - A conceptual model-based approach', *Proceedings of the* 20^{th} *Bled eCommerce Conference - eMergence: Merging and Emerging Technologies, Processes, and Institutions*, Bled, pp. 37-49.

[101] Porter, M. E. 1979, 'How Competitive Forces Shape Strategy', *Harvard Business Review*, Vol. 57, No. 2, pp. 137-145.

[102] Porter, M. E. 1980, *Competitive Strategy*, Free Press, New York.

[103] Porter, M. E. 1985, *Competitive Advantage: Creating and Sustaining Superior Performance*, Free Press, New York.

[104] Porter, M. E. 1996, 'What is Strategy?', *Harvard Business Review*, Vol. 74, No. 6, pp. 61-78.

[105] Porter, M. E. 2001, 'Strategy and the Internet', *Harvard Business Review*, Vol. 79, No. 3, pp. 63-78.

[106] Porter, M. E. & Kramer, M. R. 2006, 'Strategy & Society: The Link Between Competitive Advantage and Corporate Social Responsibility', *Harvard Business Review*, Issue December, pp. 1-14.

[107] Rappa, M. A. 2000, 'Business Models on the Web', *Managing the Digital Enterprise*. Retrieved April 2007, from `http://digitalenterprise.org`.

[108] Rappa, M. A. 2007, 'Business Models on the Web', *Managing the Digital Enterprise*. Retrieved December 2007, from `http://digitalenterprise.org`.

[109] de Reuver, M. & Haaker, T. & Bouwman, H. 2007, 'Business model dynamics: a longitudinal, cross-sectional case survey', *Proceedings of the* 20^{th} *Bled eConference – eMergence: Merging and Emerging Technologies, Processes, and Institutions*, Bled, pp. 429-442.

[110] Rich, S. R. & Gumpert, D. E. 1985, 'How to Write a Winning Business Plan', *Harvard Business Review*, Vol. 63, Issue 3, pp. 156-166.

[111] Richardson, J. 2008, 'The Business Model: An Integrative Framework for Strategy Execution', *Strategic Change*, Vol. 17, Issue 5/6, pp. 133-144.

[112] Rosenberg, A. & Chase, G. & von Rosing, M. & Omar, R. & Taylor, J. & von Scheel, H. 2011, *Applying Real-World BPM in an SAP Environment*, SAP Press, Maryland, US.

[113] Sahlman, W. A. 1997, 'How to Write a Great Business Plan', *Harvard Business Review*, Vol. 75, Issue 4, pp. 98-108.

[114] Sauer, C. & Willcocks, L. 2003, 'Establishing the business of the future: the role of organizational architecture and information technology', *European Management Journal*, Vol. 21, No. 4, pp. 497-508.

[115] Scheer, C. & Deelmann, T. & Loos, P. 2003, 'Geschäftsmodelle und internetbasierte Geschäftsmodelle - Begriffsbestimmung und Teilnehmermodell', Working Papers of the Research Group Information Systems & Management, Johannes Gutenberg Universität, Mainz.

[116] Schweizer, L. 2005, 'Concepts and Evolution of Business Model', *Journal of General Management*, Vol. 31, No. 2, pp. 37-56.

[117] Seddon, P. B. & Lewis, G. P. & Freeman, P. & Shanks, G. 2004, 'The Case for Viewing Business Models as Abstracting of Strategy', *Communications of the Association for Information Systems*, Vol. 13, pp. 427-442.

[118] Seelos, C. & Mair, J. 2007, 'Profitable Business Models and Market Creation in the Context of Deep Poverty: A Strategy View', *Academy of Management Perspectives*, Vol. 21, No. 4, pp. 49-63.

[119] Serban, A. M. & Luan, J. 2002, 'Overview of the Knowledge Management', *New Directions for Instituonal Research (Special Issue: Knowledge Management - Building a Competitive Advantage in Higher Education)*, Vol. 2002, No. 113, pp. 5-16.

[120] Shafer, S. M. & Smith, H.J. & Linder J. C. 2005, 'The power of business models', *Business Horizons*, Vol. 48, Issue 3, pp. 199-207.

[121] Smith, W. K. & Binns, A. & Tushman, M. L. 2010, 'Complex Business Models: Managing Strategic Paradoxes Simultaneously', *Long Range Planning*, Vol. 43, pp. 448-461.

[122] Sosna, M. & Trevinyo-Rodriguez, R. N. & Velamuri, S. R. 2010, 'Business Model Innovation through Trial-and-Error Learning', *Long Range Planning*, Vol. 43, pp. 383-407.

[123] Soudoplatoff, S. 2003, '3G - The Business Model is the Killer Application', *Business Briefing: Wireless Technology 2003*. Retrieved July 2007, from `http://www.touchbriefings.com/pdf/20/wire02_t_Highdeal.pdf`.

[124] Stähler, P. 2001, *Geschäftsmodelle in der Digitalen Ökonomie: Merkmale, Strategien und Auswirkungen*, Josef Eul Verlag, Lohmar, Köln.

[125] Stähler, P. 2002, 'Business Models as a Unit of Analysis for Strategizing', *Proceedings of* 1^{st} *International Workshop on Business Models*, Lausanne. Retrieved July 2012, from `http://www.scribd.com/doc/34770740/Business-Models-as-a-unit-of-Analysis-for-Strategizing`.

[126] Steiner, G. A. 1979, *Strategic Planning - What Every Manager Must Know*, Free Press, New York.

[127] Stewart, D. W. & Zhao, Q. 2000, 'Internet Marketing, Business Models and Public Policy', *Journal of Public Policy and Marketing*, Vol. 19, No. 2, pp. 287-296.

[128] Svejenova, S. & Planellas, M. & Vives, L. 2010, 'An Individual Business Model in the Making: A Chef's Quest for creative Freedom', *Long Range Planning*, Vol. 43, pp. 408-430.

[129] Teece, D. J. 2010, 'Business Models, Business Strategy and Innovation', *Long Range Planning*, Vol. 43, pp. 172-194.

[130] Tikkanen, H. & Lamber, J. A. & Parvinen, P. & Kallunki, J. P. 2005, 'Managerial cognition, action and the business model of the firm', *Management Decision*, Vol. 43, No. 6, pp. 789-809.

[131] Timmers, P. 1998, 'Business Models for Electronic Markets', *Electronic Markets*, Vol. 8, No. 2, pp. 3-8.

[132] Timmons, J. A. 1980, 'A business plan is more than a financing device", *Harvard Business Review*, Vol. 58, Issue 2, pp. 28-34.

[133] Venkatraman, N. & Henderson, J. C. 1998, 'Real Strategies for Virtual Organizing', *Sloan Management Review*, Vol. 40, No. 1, pp. 33-48.

[134] Viscio, A. J. & Pasternack, B. A. 1996, 'Toward a New Business Model', *Strategy & Business*, Issue 3, pp. 125-134.

[135] Wang, L. & Jaring, P. & Wallin, A. 2009, 'Developing a Conceptual Framework for Business Model Innovation in the Context of Open Innovation', *Proceedings of* 3^{rd} *IEEE International Conference on Digital Ecosystems and Technologies*, Espo, pp. 453-458.

[136] Weill, P. & Vitale, M. R. 2001, *Place to Space – Migrating to eBusiness Models*, Harvard Business School Press, Boston, MA.

[137] Weiss, D. M. 2010, 'Business Model Innovation in Venture Capital Investment Funds: Business Model Due Diligence in Venture Appraisal', Master Thesis, Zeppelin University.

[138] Winter, S. G. & Szulanski, G. 2001, 'Replication as Strategy', *Organization Science*, Vol. 12, No. 6, pp. 730-743.

[139] Wirtz, B. W. & Schilke, O. & Ullrich, S. 2010, 'Strategic Development of Business Models – Implications of the Web 2.0 for Creating Value on the Internet', *Long Range Planning*, Vol. 43, pp. 272-290.

[140] Wirtz, B. W. 2011, *Business Model Management: Design - Instruments - Success Factors*, Gabler Verlag, Germany.

[141] Wohltorf, J. 2005, 'Entwicklungsansatz eines Entscheidungsunterstützungssystems zur Evaluierung ubiquitärer Dienste auf der Basis kritischer Erfolgsfaktoren – demonstriert anhand eines geräteunabhängigen, personalisierten und ortsbezogenen Freizeitgestaltungsdienstes', Ph.D. Thesis, Technische Universität Berlin.

[142] Yunus, M. & Moingeon, B. & Lehmann-Ortega, L. 2010, 'Building Social Business Models: Lessons from the Grameen Experience', *Long Range Planning*, Vol. 43, pp. 308-325.

[143] Zolnowski, A. & Böhmann, T. 2011, 'Business modeling for services: Current state and research perspectives', *AMCIS 2011 Proceedings - All Submissions*, Paper 394. Retrieved July 2012, from `http://aisel.aisnet.org/amcis2011_submissions/394/`.

[144] Zott, C. & Amit, R. 2002, 'Measuring the Performance Implications of Business Model Design: Evidence from Emerging Growth Public Firms', *INSEAD Working Paper Series*, 2002-13-ENT-SM.

[145] Zott, C. & Amit, R. 2004, 'Business Model Design and the Performance of Entrepreneurial Firms', *INSEAD Working Paper Series*. Retrieved April 2007, from `http://www-management.wharton.upenn.edu/amitresearch/docs/Business_Model_Design_120504.pdf`.

[146] Zott, C. & Amit, R. 2005, 'Business Model Design and the Performance of Entrepreneurial Firms', *INSEAD Working Paper Series*, 2006-33-EFE ACGRD. Retrieved May 2007, from `http://www.insead.edu/alliance/faculty/documents/christophzott.pdf`.

[147] Zott, C. & Amit, R. 2007, 'Business Model Design and the Performance of Entrepreneurial Firms', *Organization Science*, Vol. 18, No. 2, pp. 181-199.

[148] Zott, C. & Amit, R. 2008, 'The Fit Between Product Market Strategy and Business Model: Implications for Firm Performance', *Strategic Management Journal*, Vol. 29, Issue 1, pp. 1-26.

[149] Zott, C. & Amit, R. 2010, 'Business Model Design: An Activity System Perspective', *Long Range Planning*, Vol. 43, pp. 216-226.

[150] Zott, A. & Amit, R. & Massa, L. 2010, 'The Business Model: Theoretical Roots, Recent Developments, and Future Research', Working paper WP-862, IESE Business School – University of Navarra.