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Quantitative Methods for Business Model Innovation and Valuation

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AFFIDAVIT

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Acknowledgment

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Abstract

The automotive sector is in the midst of radical change. The strong tendency for digitalization changes the processes and activities in the industry massively. The decarbonization of the economy due to climate protection and sustainability results in a move away from combustion engines while accelerating electrification in mobility. (Wittmann 2016)

For these reasons, companies strive to maintain and further expand their competitive advantage. Due to these current trends, AVL List GmbH is dealing with business model innovation. To standardize the group's rough procedure for business model innovation, a process has already been established.

The master thesis at hand aims to extend the established BMI process at AVL by integrating a quantitative framework into the process. This quantitative framework provides a solid basis for decision-making and makes business model alternatives comparable.

The elaboration of the framework takes place by applying the design science research paradigm. The relevance cycle, presenting the requirements of the environment, is elaborated by a non-standardized guided expert interview series. The rigor cycle, which provides the knowledge base from scientific literature, was conducted by updating a systematic literature review on methods for evaluating business models. Subsequently, the framework was built as an artifact in the design cycle.

A first draft of the framework was created by comparing the interviews' requirements with the methods found in the systematic literature review. This first draft was further refined with the experience of a conducted case study. The result is a framework consisting of two methods: First, a table with relevant KPIs and criteria to consider was created. The table is suitable in early phases to analyze a potential existing business model or a newly created one. The table includes four perspectives: The market perspective, the financial perspective, the implementation perspective, and the operational perspective. The second part of the framework is the visualization of financial implications. This method is used for detailed planning of cashflows in a respected period and derived values and is suitable in later phases before implementing the business model.

The combination of these methods forms a framework for business model innovation, which provides important information for decision-making. It also provides structure besides the already implemented qualitative methods so that, at best, nothing important is overlooked.

The added value of the solution presented is that by combining the current state of science with requirements and experiences from practice, a framework is presented that combines the demand for practical applicability and scientific methodology.

Kurzfassung

Die Automobilbranche befindet sich in einem radikalen Wandel. Die starke Tendenz zur Digitalisierung verändert die Prozesse und Aktivitäten in der Branche massiv. Die Dekarbonisierung der Wirtschaft aufgrund von Klimaschutz und Nachhaltigkeit führt zu einer Abkehr vom Verbrennungsmotor und beschleunigt die Elektrifizierung im Automobilsektor. (Wittmann 2016)

Aus diesen Gründen sind die Unternehmen bestrebt, ihre Wettbewerbsvorteile zu erhalten und weiter auszubauen. Aufgrund dieser aktuellen Trends beschäftigt sich das Unternehmen AVL List GmbH mit der Innovation von Geschäftsmodellen. Dazu wurde bereits ein Prozess etabliert, der das Vorgehen innerhalb des Unternehmens in groben Zügen standardisiert.

Die vorliegende Masterarbeit zielt darauf ab, diesen Prozess zu erweitern, indem ein quantitatives Framework in den Prozess integriert wird. Dieses quantitative Framework liefert eine solide Entscheidungsgrundlage und macht Geschäftsmodellalternativen vergleichbar.

Das Entwickeln des Frameworks erfolgt durch Anwendung des Design Science Forschungsparadigmas. Der Relevanz-Zyklus, der die Anforderungen der Umwelt darstellt, wird durch eine Reihe nicht standardisierter, leitfadengestützter Experteninterviews ausgearbeitet. Der Rigor-Zyklus, der die Wissensbasis aus der wissenschaftlichen Literatur liefert, wurde durch das Update einer systematischen Literaturübersicht über Methoden zur Bewertung von Geschäftsmodellen durchgeführt. Anschließend wurde das Framework als Artefakt im Design-Zyklus erstellt.

Ein erster Entwurf des Frameworks wurde erstellt, indem die Anforderungen aus den Interviews mit den Methoden aus der systematischen Literaturrecherche verglichen wurden. Dieser erste Entwurf wurde mit den Erfahrungen aus einer durchgeführten Fallstudie weiter verfeinert. Das Ergebnis ist ein Framework, das aus zwei Methoden besteht: Zunächst wurde eine Tabelle mit relevanten KPIs und zu berücksichtigenden Kriterien erstellt. Die Tabelle eignet sich in frühen Phasen, um ein potenziell bestehendes oder neu zu schaffendes Geschäftsmodell zu analysieren. Die Tabelle enthält vier Perspektiven: Die Marktperspektive, die Finanzperspektive, die Implementierungsperspektive und die operative Perspektive. Den zweiten Teil des Frameworks bildet die Visualisierung der finanziellen Auswirkungen, im Allgemeinen als VOFI oder Vollständige Finanzplanung bekannt. Diese Methode wird zur detaillierten Planung von Cashflows in einem bestimmten Zeitraum und daraus abgeleiteten Größen verwendet und eignet sich für spätere Phasen vor der Umsetzung des Geschäftsmodells.

Die Kombination dieser Methoden bildet einen Rahmen für die Geschäftsmodellinnovation, der wichtige Informationen für die Entscheidungsfindung liefert. Außerdem bietet das Framework neben den bereits implementierten qualitativen Methoden eine durch quantitative Methoden ergänzte Struktur, so dass bestenfalls nichts Wichtiges übersehen wird.

Der Mehrwert der aufgezeigten Lösung besteht darin, dass durch die Verbindung des aktuellen Standes der Wissenschaft und Anforderungen und Erfahrungen aus der Praxis ein Framework präsentiert wird, das die Forderung nach praktischer Anwendbarkeit und wissenschaftlicher Methodik vereint.

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List of Abbreviations

BM	Business Model
BME	Business Model Evaluation
BMI	Business Model Innovation
KPI	Key Performance Indicator
NDA	Non-Disclosure Agreement
NPV	Net Present Value
ROI	Return on Investment
SLR	Systematic Literature Review
VOFI	Visualization of Financial Implications

1 Introduction

"You're always one innovation away from getting wiped out by a new competing innovation that eliminates the need for your product." (Franklin 2005, p. 10) This statement by Brian Nesmith, CEO of a US-based security software firm, relates to the security software business but can be applied to many business areas in today's world. Companies that do not consider changing their business models and miss current trends risk being wiped out of the market. (Franklin 2005, p. 10)

This circumstance can be observed in the automotive sector as well. The strong tendency for digitalization changes the processes and activities in the industry massively. The decarbonization of the economy due to climate protection and sustainability results in a move away from combustion engines while accelerating electrification in the automotive sector. (Wittmann 2016)

Due to these current trends, AVL List GmbH is also dealing with the topic of business model innovation. For this reason, a process has already been established to standardize the group's rough procedure. This process is currently in a very qualitative execution and is mainly based on qualitative methods.

The master thesis comes in this circumstance: This thesis aims to build a framework for quantitative assessment during the business model innovation process, based on the existing guideline. This framework focuses on early innovation phases to evaluate business ideas and make business potential transparent and comparable. The framework should also enable monitoring of the business models after the implementation phase. The framework will be implemented in the existing guideline to carry out quantitative evaluations in the management of business models.

The practical applicability of the developed quantitative framework is a central requirement in this work. A conscious effort is made to combine and harmonize scientific methodology with the practical applicability of the result. Especially in the environment of a company, applicability is essential, so that the result does not gather dust. To this end, the need for quantitative methods is surveyed and critically examined in this thesis.

The approach of how company internal requirements are considered is described in the first chapter. Therefore, the first chapter serves to describe the current status of the business model innovation guideline at AVL. To this end, the process and its contemporary characteristics are briefly described. Subsequently, the research question is formulated based on the requirements formulated by AVL and the scientific literature. After the research question has been formulated, the structure of the thesis is described.

1.1 Current State at AVL and Problem Statement

The current AVL guideline for business model innovation consists of eight phases, which roughly describe the process. This process was developed in advance of this thesis and is recorded in internal documents. (AVL List GmbH 2021)

The process is depicted in Figure 1 and then further described.

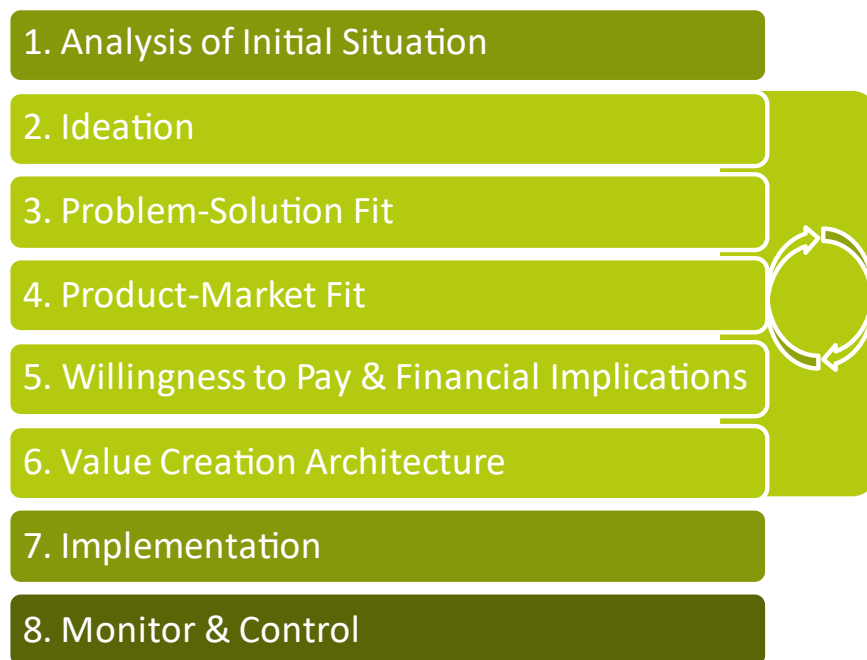


Figure 1: Business Model Innovation Process at AVL (Adapted from: AVL List GmbH 2021)

The analysis of the initial situation sets the following tasks: The understanding of the current business model (if present), the understanding of the business environment, the analysis of the own strengths and weaknesses, and the consideration of the strategy.

After the analysis, the focus is on creativity and collecting ideas. The ideation phase describes potential customer problems and needs and generates new solutions for them. The outcome should be novel ideas that are worth being further developed and fit strategy and trends.

Now that ideas have been described and collected, the next step is to validate them within the business environment. The problem-solution fit phase determines a specific customer group, analyzes the competition, considers a first concept of the internal value creation, and contacts potential customers whether the imagined solution can satisfy their needs or solve their problems.

The product-market fit phase defines products, services and functions, reflects internal value creation, builds and tests a prototype, and evaluates whether potential customers like the solution. The outcoming list of product features facilitates the evaluation of the internal feasibility of an operating model.

The next phase aims to answer whether, how, and how much a customer is willing to pay and for which variant. Accordingly, a revenue model is developed, the feasibility of this model is checked, a business plan is drawn up, and the value distribution across the departments involved is planned. The evaluation of the profitability is essential in this phase.

The value creation architecture phase begins if the planned business model is profitable according to the business plan. In this phase, the plan of the value creation is elaborated in detail. Necessary changes in processes and infrastructures are addressed, the assurance of support and maintenance along the life cycle is discussed, the required resources and partners are listed, and the responsibilities are defined.

An interdisciplinary team establishes the new business model in the implementation phase and ensures visibility on the relevant market.

The monitor and control phase consists of a long-term concept for regular review and health-check of the business model in its environment. The fit between the elements, the fitness of the single model, and the overall harmony and flexibility with strategy, culture, and environment characterize the work in this phase.

It is important to note that this process does not always work straight forward. Especially in phases two to six, iteration loops are desired to refine and improve in detail during further elaboration. The arrow on the right side of Figure 1 represents the need for iteration during these steps.

The challenge the thesis at hand should solve is that the current version of the guideline does not include the use of specific quantitative evaluation methods. Of course, this does not preclude their application. However, a standardized application is desired to support well-founded decisions. A framework consisting of quantitative methods should be developed to quantify the assessment. The main focus is on practical applicability. The concept should also be based on practical cases at AVL. Ultimately, the results should be integrated into the existing guideline.

However, the need to evaluate one's business model does not only arise from the requirements of AVL List GmbH. Scientific literature also addresses the need to do so. Linde et al. (Linde et al. 2021, p. 44) highlight the need to evaluate business models before commercializing them and refer in particular to digital business models. They state that companies "*must take the time to evaluate carefully the business impact and profit potential of new business model opportunities*" (Linde et al. 2021, p. 44). Quantitative methods support the decision-making process by silencing uncertainty and reducing risk while making the decisions more profound (Thompson and MacMillan 2010, p. 293; McGrath 2010, p. 260; Broadbent et al. 2008, p. 40).

Since the initial situation and the goal have to be reflected in the research question, the research question is formulated and explained in the following.

1.2 Research Question

As already mentioned before, the research question to serve as a guide for developing the framework considers the current scientific state and the need for applicability at AVL List GmbH. Therefore, four requirements of the research question were developed, based on the features of a research question formulated by Gläser and Laudel (2010, p. 65). First, the research question starts from existing knowledge. It implies that existing methods and methodologies are taken as a starting point and that the focus is not on developing new methods. The second point established was that answering the research question adds something to the existing knowledge of the scientific community. Third, the research question asks for a context in the immediate setting, and fourth, a general context.

Based on these requirements, the research question is formulated as follows:

How can a framework for quantitative business model evaluation during business model innovation be designed and integrated into a BMI process at an engineering and technology provider?

This research question satisfies the first characteristic because it asks for a framework of quantitative methods rather than the methods per se. It therefore implies that existing approaches are used. The run-up to this thesis investigated whether a framework for business model evaluation in this context already exists, which was not the case. Furthermore, this thesis contributes to a practical examination of existing evaluation methods and a description of the need for evaluation methods in a specific industry. In this way, answering the research question contributes to the current knowledge and fulfills the second characteristic. The third characteristic is met because the research question is centered on BM evaluation during business model innovation in a specific industry. The fourth characteristic is fulfilled because it does not focus on one company only but on engineering and technology providers.

1.3 Structure of the Thesis

The procedure for answering the research question is divided into two overarching blocks, which also build the structure of the thesis. These are the theoretical part and the empirical part.

The first block creates the fundament of the thesis in the form of the theoretical background. Therefore, relevant issues were identified by reading literature on business models, business model innovation, and business model evaluation. Afterward, leading questions were formulated to elaborate the theoretical background systematically. Figure 2 presents the questions and their sequence.

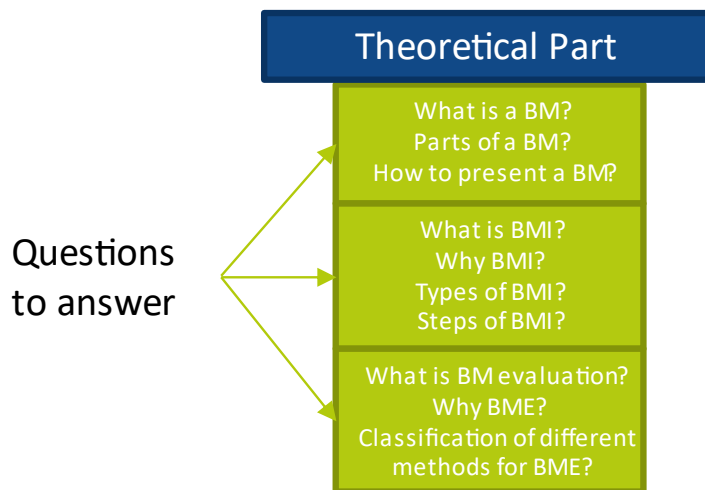


Figure 2: Sequence of the Theoretical Background

The main chapters in the theoretical part are general information on business models (2.1), business model innovation (2.2), and business model evaluation (2.3). The function of this chapter is not only to introduce the topics to the reader. The scientific approach to business models and business model innovation is still emergent and young. Therefore, in many areas, there is still no consensus on definitions and contents. This chapter provides an overview of current contradictions and prevailing currents in the field of business models. Another aspect is, to understand how something can be measured, it has to be clear what is measured. Therefore the definition and elaboration of the terms are of utter importance.

The second overarching block is the elaboration of the framework. The method of choice was the design science research approach by Hevner et al. (2004). At the beginning of chapter 3, the methodology is explained in 3.1. Subsequently, the chapter describes the conduction of the non-standardized expert interview in 3.2, the update of a systematic literature review in 3.3, and the iterative elaboration of the framework itself in 3.4. In chapter 4, the resulting framework in its final version is presented. Chapter 5 closes the thesis with a discussion of the results. The conclusion is presented in chapter 6.

The structure of the empirical part follows the practical elaboration of the framework chronologically. By deriving the approach from the scientific literature and describing how the scientific standards were implemented and complied with, this chapter provides a detailed description of the framework's development. This approach was chosen because the thesis develops a practice-oriented solution with the help of the Design Science Research approach. Thus the procedure is also practice-oriented and in strict compliance with the scientific standards.

2 Theoretical Background

Chapter 2 provides an overview of the necessary theoretical content and essential methods from the literature relevant in this context.

As already mentioned, this thesis deals with the evaluation of business models in the innovation process. Chapter 2.1 deals with what a business model is in the first place. The aim is to understand the different views in the scientific literature on the definition, where the term business model actually comes from, what parts a business model consists of by consensus, and how a business model is frequently presented. This chapter serves as a foundation for further elaboration. The approach was not to depict theory alone but also to reflect contradictions and different approaches of well-known authors in this field of science.

After the principle of the business model has been prepared, an explanation of what business model innovation is follows in chapter 2.2. For this purpose, the chapter presents which definitions prevail in the literature, how BMI can be classified, and the steps of the generic BMI process.

Chapter 2.3 then shows how a business model can be evaluated in principle. For this purpose, the necessity from the literature is highlighted, the application possibilities are established, and a classification of different methodologies is presented. This chapter forms the basis for understanding how a business model can be evaluated. The understanding is needed to integrate the evaluation methods into the step-by-step elaboration of the parts of a business model during the business model innovation process.

2.1 Business Model

Because of the high interest of scientists and practitioners and the different streams of business model research, several terms are occurring in the literature with similar or identical meanings. Especially the three main blocks are often called “dimensions” instead (Spieth and Schneider 2016, p. 671). Various terms also designate them: The value proposition is sometimes called “value offering” (Spieth and Schneider 2016, p. 671; Schrauder et al. 2018, p. 412). A business model’s revenue model is often called the „value capture” (Schrauder et al. 2018, p. 412; Teece 2010, p. 174). The “value creation”, as some papers use it (Teece 2010, p. 172; Chesbrough 2002), is the same as the “value chain”. There are more terms being used differently; this list does not claim to be exhaustive. However, these contexts are essential for the understanding of the further chapters.

Success in today’s competitive markets depends heavily on choosing suitable business models; innovative products alone no longer guarantee triumph. It is assumed that the business model takes into account current circumstances and responds to the permanent emergence of new technologies, changing consumer preferences, and recent social trends. (Chesbrough 2002, p. 529; Gorevaya and Khayrullina 2015, p. 344)

The drive of companies to gain sources of further growth and more substantial competitive positions made the concept an important part of research for both professionals and academic societies (Klimanov and Tretyak 2019, p. 117). The following describes the meaning of the term, the origin, and the parts of a business model.

2.1.1 Origin and Development of the Term Business Model

The term "business model" has become increasingly important in recent decades. Although it entered the scientific literature as early as 1957 (Bellman et al. 1957) and its first use dates back to that year, its popularity increased rapidly in the 1990s (Osterwalder et al. 2005, p. 6). Moreover, the term appears frequently in academic literature since the trend of the NASDAQ index in the early 1990s, during the so-called "dot-com bubble" (DaSilva and Trkman 2014, p. 2; Wirtz et al. 2016, p. 37). Academic research in business models started with Timmers' (1998) contribution, which analyzed and classified business models in electronic businesses (Klimanov and Tretyak 2019, p. 118).

During this time, the novel way of doing business tore a gap between strategy and business processes. Translating the strategy into processes was now a complex task posed by the growing digital business. The business model completed this task and closed the gap. (Al-Debei and Avison 2010, p. 370).

Furthermore, the emerging digital business also increased competition, and sooner rather than later, one had to reckon with competition (Magretta 2002, p. 6). The fundamental change of the markets in the decades before also challenged the companies around the globe. Many markets were saturated, and the structure changed from seller's to buyer's markets. Not everything produced could be sold without complaint, and solutions looking for a problem no longer found a buyer. (Bauernhansl et al. 2014, p. 7)

Since 2004, the concept has received much attention. Practice-oriented and scientific literature gets published increasingly on this topic. Nevertheless, there is still no complete clarity about the central meaning of the term. Despite the many different views, a high value is placed on a business model. (Wirtz et al. 2016, p. 37)

Nowadays, the term business model is widely used among consultants, managers, and scholars. Although the meaning of the word is often not understood, the frequency of its use suggests the importance of the concept. (DaSilva and Trkman 2014, p. 1; Magretta 2002, p. 3)

To ensure a common understanding of the term business model in this thesis, the next chapter describes what is usually understood by a business model in the literature and which contradictions appear.

2.1.2 Definition and Classification of Business Models

Since many definitions with different linkages to the operational and strategic components exist in the literature (Goyal et al. 2017, p. 103), an overview of frequently used definitions is provided subsequently.

A common definition is found in Teece (2010, p. 173), who states: *"A business model articulates the logic and provides data and other evidence that demonstrates how a business creates and delivers value to customers. It also outlines the architecture of revenues, costs, and profits associated with the business enterprise delivering that value."* Also, an often-cited definition is found in Magretta (2002, p. 4): *"...[Business Models] are, at heart, stories – 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?"*

Osterwalder et al. (2005, p. 3) noticed two currents within the general definition among practitioners: A more value/ customer-oriented definition versus an activity/role-oriented one. Based on the definitions already mentioned, it is easy to see that these are value/ customer-oriented. Chesbrough (2006, p. 2), for example, provides a different understanding of the term: He states that a business model *"... creates value by defining a series of activities from raw materials through to the final customer that will yield a new product or service with value being added throughout the various activities "* Chesbrough (2006, p. 2). Chesbrough's understanding of the term is similar to that of Amit and Zott (2015, p. 331), who state that *"The business model describes the system of interdependent activities performed by a focal firm and its partners and the mechanisms that link these activities to each other."* Their activity/role-oriented view suggests that a business model contains more than a proposed value and a customer.

A classification of the scientific approaches of business models was developed by Wirtz (2020, p. 29), who mentions that there are three basic approaches, namely the technology-oriented approach, the organization-oriented approach, and the strategy-oriented approach. The technology-oriented approach is the one to which early concepts of business modeling and electronic business are assigned. For the organization-oriented approach, the focus is on the company's structural components and the company's business architecture. The strategy-oriented approach is the most recent one. This approach focuses on the value creation logic, core competencies, and innovation. (Wirtz 2020, pp. 29–30)

Regardless of the innumerable definitions and contributions to understanding the term, a consensus can be found among the authors. A business model is *"the architecture of relationships between network actors that are used to create and deliver value to the customer and capture profits from these joint activities,"* as Klimanov and Tretyak (2019, p. 118) summarized after reviewing relevant literature.

Commonalities of the definitions are worked out at the beginning of the next chapter. Indirectly, a consensus is also reached on which definition the further work is based, at least regarding what a business model should contain.

2.1.3 Parts of a Business Model

Summarizing the definitions, a business model roughly consists out of

- The Value proposed to the Customer
- The Architecture of the Value Chain and
- The Revenue Model.

Gassmann et al. (2017, pp. 6–7) integrate these parts of a business model in the "magic triangle" structured by four dimensions. Each dimension answers a central question of the business model. The "magic triangle" is presented in Figure 3. The illustration symbolizes the mutual influence of the dimensions and represents their dependence on each other. This type of representation is consistent with the recognition of Doganova and Eyquem-Renault (2009, p. 1560). The three main blocks (value proposition, value chain, revenue model), as they state, can be found in numerous definitions of the business model concept. Spieth and Schneider (2016, p. 675) and Goyal et al. (2017, p. 107) also follow this principle, which they have established by analyzing numerous definitions.

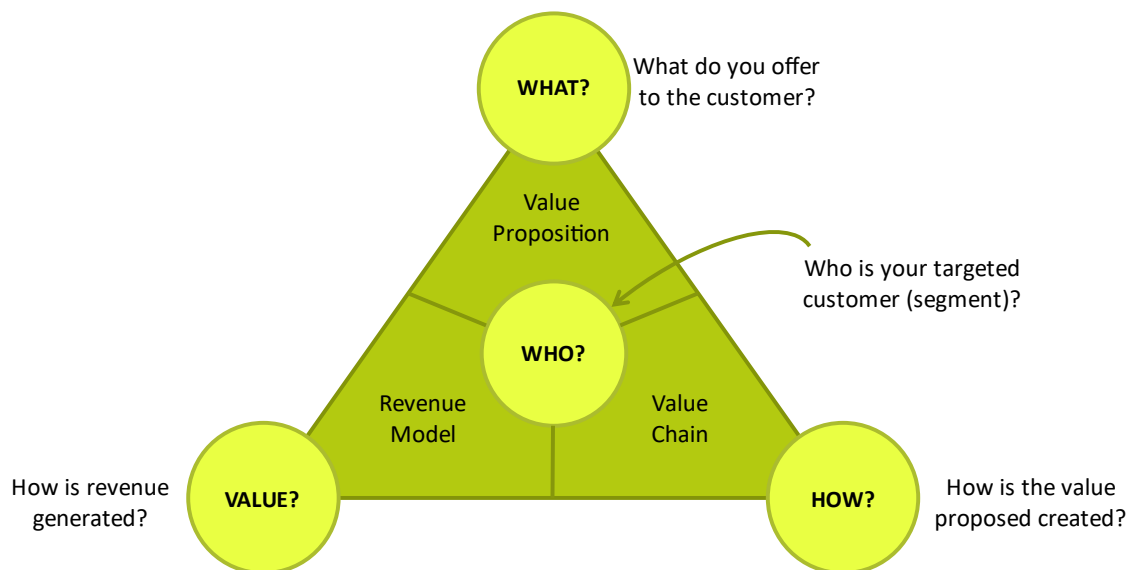


Figure 3: The Magic Triangle – Four Dimensions of a Business Model (Adapted from: Gassmann et al. 2017, p. 7)

The Magic Triangle: WHO? The Customer

Who is your targeted customer segment? This question is not only central to Gassmann et al., but Magretta and Teece also point out the overall importance of this dimension. Without a doubt, it is not by chance that the customer owns the center of the magic triangle. The combination of the customer with the dimensions how, value, and what results in the three main blocks.

Customers form the heart of a business model. For any successful business model, a company needs to understand which are the relevant customer segments to address precisely. To satisfy customer needs in the best possible way, segmentation into a homogeneous group with similar needs is essential. To define small or large customer groups and decide which groups to serve and which not to do is necessary to create a business model. (Osterwalder and Pigneur 2013, p. 20; Gassmann et al. 2017, pp. 6–7)

The task of defining specific customer groups is challenging. Osterwalder et al. (2014, p. 9) provide a description of the customer profile by dividing it into three parts in the "customer map":

- Customer jobs
- Customer gains
- Customer pains

Customer Jobs:

In this context, the word "job" describes a customer's problem in a particular situation that needs a solution. A job is, e.g., a need that the customer wants to satisfy or a task he wants to complete. Without understanding the job in all its dimensions, a satisfactory solution will be difficult to achieve. Thus, the more critical the job is for the customer, the greater the value of the solutions is. (Johnson et al. 2008, p. 60; Osterwalder et al. 2014, p. 12)

Customer Pains:

A customer's "pain" is anything that annoys or prevents him from doing a job. Pain appears as undesired outcomes, obstacles, and risks. Like the importance of a customer's job, the severity of the pain influences the solution's value relieving the pain. (Osterwalder et al. 2014, p. 14)

Customer Gains:

Gains are the outcomes or benefits a customer expects. A gain can be required, desired, or expected by the customer. Even a surprising gain can fulfill the expectations. Osterwalder et al. (2014, p. 16) summarize that "*gains include functional utility, social gains, positive emotions, and cost savings.*" A gain can be "essential" to "nice to have" for the customer, influencing the solution's value. (Osterwalder et al. 2014, p. 16)

Describing these three parts step by step depicts a homogeneous customer group with similar "jobs". Therefore, in the further process of creating the business model, the customers' needs can be adequately addressed.

As already mentioned, the main blocks result from the combination of the customer and the other dimensions. The following combines the "Who?" with the dimensions "What?", "How?" and "Value?" and describes its meaning.

The Magic Triangle: WHO? - WHAT? The Value Proposition

What do you offer to the customer? This block of the magic triangle describes what is provided to the targeted customers to satisfy their needs. The value proposition describes all the benefits of a company that are useful for the customer. (Gassmann et al. 2017, pp. 6–7)

The combination of knowing a customer's job in detail and how it can be done represents the design of the value proposition. Getting done an important job with a lot of pain severity and whose solution adds much value to the customer maximizes the value proposed to the customer. (Johnson et al. 2008, p. 60)

Osterwalder et al. (2014, p. 26) describe the value proposed to the customer with the "value map", which is similar to the customer map. It includes the parts

- Products and Services
- Pain Relievers
- Gain Creators

Products and Services:

The "products and services" part contains a simple list of products and services offered to the customer. The products/ services can be physical/ tangible, intangible, digital, or financial. Acknowledging that a product or service alone is not enough to create a business model is elementary: Added value only comes about in conjunction with customer's jobs, pains, and gains. (Osterwalder et al. 2014, p. 29)

Pain Relievers:

"Pain Relievers" contain a concrete description of how a product or service is going to relieve a customer's pain. They explain exactly how a product or service improves or solves the discouragement of a customer from processing a job or how the processing loses its unpleasant part. The pain relievers focus on the identified customer's pains and explain how to alleviate some of them. (Osterwalder et al. 2014, p. 31)

Gain Creator:

"Gain Creators" explicitly describes how a product or service produces outcomes or benefits that are either expected, desired, or surprise the customer. They target specific gains in the customer profile and focus on those where the product/ service can achieve differentiation. Concentrate on essential gains may result in a more successful business model. (Osterwalder et al. 2014, p. 33)

The value proposition results from the combination of the customer map and the value map. The method by Osterwalder et al. (2014, pp. 8–9) is summarized in the "value proposition canvas", represented in Figure 4. The value map (left) "fits" with the customer map (right).

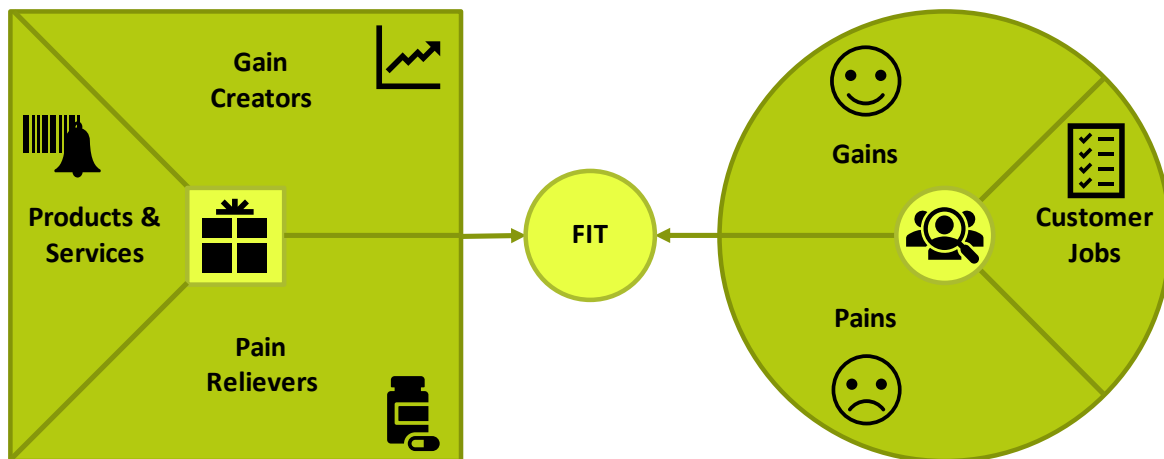


Figure 4: Value Proposition Canvas (Adapted from: Osterwalder et al. 2014, pp. 8–9)

The fit between the value and the customer happens in three stages. First, the problem-solution fit is made by matching the jobs with the offered products/ services, creating the gains, and mitigating the pains. If the customer reacts positively to the value proposition and demand is generated, the second stage is reached - the product-market fit. The "business model fit"-stage is reached as soon as a profitable and scalable business model is found. (Osterwalder et al. 2014, p. 42)

The Magic Triangle: WHO? - HOW? The Value Chain

After formulating the value proposition, a chain of processes and activities must be performed to fulfill it. Combined with the involved resources and capabilities, these processes and activities and their coordination along the value chain form the third block in designing a business model. (Gassmann et al. 2017, pp. 6–7)

Porter (1998, p. 36) mentions that a firm is a "*collection of activities that are performed to design, market, deliver and support its product.*" All these activities are linked to each other and are represented in the value chain. The value is generated along the chain, representing the company's history, strategy, how the strategy is implemented, and the fundamental economics of the activities. Two main parts built up the generic value chain: The primary activities and the support activities. Primary activities are all the processes that contribute to the physical creation, the sale, and the after-sale. Support activities provide purchased inputs, technology, human resources, and various firmwide functions to execute the primary activities. (Porter 1998, pp. 36–39)

Figure 5 represents the value chain as the characteristic arrow with its associated activities.

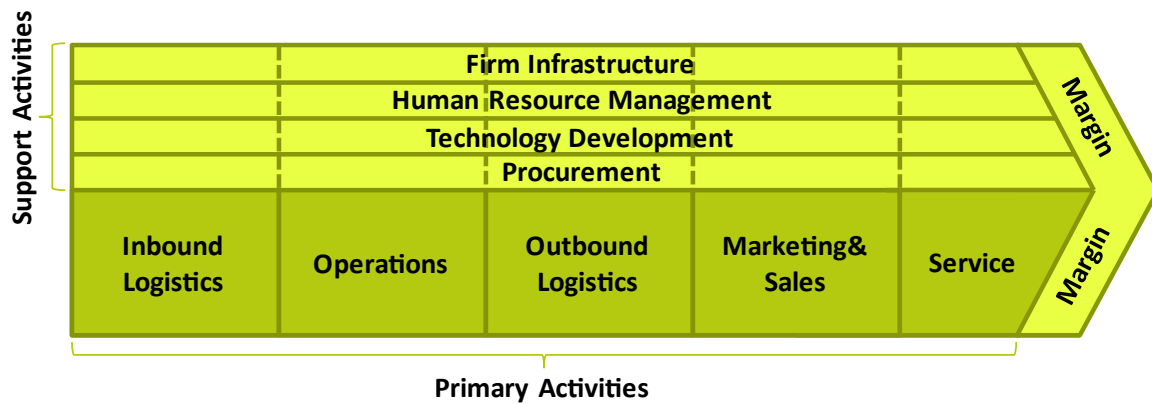


Figure 5: The Value Chain (Adapted from: Porter 1998, p. 37)

As Figure 3 illustrates, all the activities work together towards the common goal of reaching a margin. The margin is the difference between the revenue and the costs incurred during the value chain's activities. The dashed lines imply the assistance of the support activities in each primary activity. Table 1 reflects Porter's descriptions of the various activities to provide a broad conception of the value chain. (Porter 1998, pp. 36–39)

The value chain must be understood as a highly simplified representation of the processes. The specific adaption to each company is necessary. Admittedly, a simple conversion to a service-oriented company does not seem to be possible without problems. The generic value chain was built up for production-oriented companies; e.g., a summary of all production activities does not make sense for service companies. Regardless, it forms an overview of the generic processes. (Wirtz 2019, pp. 80–81)

A different value chain is a crucial source of competitive advantage. Competitors in the same market may seem to have the same value chain, but they differ significantly. While a value chain is company-specific, some stages are specific for certain markets. The creation of new architecture or revising one's value chain can lead to significant cost reductions and therefore increase profits. (Matzler et al. 2013, p. 31; Wirtz 2001, pp. 495–496)

Table 1: Descriptions of Activities in the Value Chain (Composed of Porter 1998, pp. 39–42)

Activity	Description
Inbound Logistics	"Activities associated with receiving, storing, and disseminating inputs to the product, such as material handling, warehousing, inventory control, vehicle scheduling, and returns to suppliers."
Operations	"Activities associated with transforming inputs into the final product form, such as machining, packaging, assembly, equipment maintenance, testing, printing, and facility operations."
Outbound Logistics	"Activities associated with collecting, storing, and physically distributing the product to buyers, such as finished goods warehousing, material handling, delivery vehicle operation, order processing, and scheduling."
Marketing& Sales	"Activities associated with providing a means by which buyers can purchase the product and inducing them to do so, such as advertising, promotion, sales force, quoting, channel selection, channel relations, and pricing."
Service	"Activities associated with providing service to enhance or maintain the value of the product, such as installation, repair, training, parts supply, and product adjustment."
Firm Infrastructure	"Firm infrastructure consists of a number of activities including general management, planning, finance, accounting, legal, government affairs, and quality management."
Human Resource Management	"Human resource management consists of activities involved in the recruiting, hiring, training, development, and compensation of all types of personnel."
Technology Development	"Technology development consists of a range of activities that can be broadly grouped into efforts to improve the product or the process."
Procurement	"Procurement refers to the function of purchasing inputs used in the firm's value chain, not the purchased inputs themselves."

The Magic Triangle: WHO? - VALUE? The Revenue Model

The fourth dimension answers each decision-maker and board member's central question: How is revenue generated?. The dimension contains the cost structure and the revenue mechanisms. By combining these, a profit formula is developed. (Gassmann et al. 2017, pp. 6–7; Teece 2010, p. 173)

It is already mentioned that customers form the "heart" of a business model. Following this metaphor, the revenue model forms the arteries of it. It describes how a company creates revenue through a variety of revenue streams. Through revenue streams, a company conducts value from the customer to itself. There are two categories of revenue streams into which the individual models can be divided. First, there are transaction revenues. In this case, a customer makes a one-time payment. Recurring revenues characterize the second category. Lest a customer makes ongoing payments to receive a value proposition or post-purchase support, recurring revenues occur. (Osterwalder and Pigneur 2013, pp. 30–33; Osterwalder et al. 2005, p. 18)

The cost structure is built of fixed costs and variable costs. Fixed costs are the same no matter how much of a product or service is sold, e.g., salaries or rents. By contrast, variable costs grow or shrink proportionally with the traded volume of goods or services, e.g., raw material or external services. Discussing companies' cost structures, one quickly comes across economies of scale and economies of scope. Economies of scale refer to the effect that large companies achieve price advantages with correspondingly large order volumes. As a result, it significantly reduces the average cost per unit. Economies of scope are the symbiotic use of existing structures within a company. For example, existing marketing activities or distribution channels can be used across product segments and generate a cost advantage. (Osterwalder and Pigneur 2013, pp. 40–41)

2.1.4 Business Model Canvas

After providing a basic overview of a business model and the main parts, the following explains what a framework is, what canvas structures are, and how to develop a business model.

There are many different frameworks to represent a business model. Also, the "magic triangle", according to Gassmann et al., serves as a simplified representation, albeit it explains lucidly what a business model is (Gassmann et al. 2017, p. 6). Over the last two decades, many frameworks have been introduced, as Latora et al. (2018) describe in their review on the topic. They identified 19 different approaches to a business model framework.

One of the most famous and widely used approaches by both academia and industry is the "Business Model Canvas" by Osterwalder and Pigneur (2013) (Linde et al. 2021, p. 44; Steinhöfel et al. 2018, p. 1494). The business model canvas (BMC) is depicted in Figure 6. The BMC consists of four main blocks, which are the customer (top right), the offer (top middle), the infrastructure (top left), and the financial viability (bottom). These four main blocks are further divided into key partners, key activities, key resources, value proposition, customer relationships, customer segments, channels, cost structure, and revenue streams.

Developing a business model is an iterative task that considers multiple influences and uncertainties. The conceptualization of an activity system with many actors and the description of the actor's dependencies on each other takes place. The executing party of each activity is represented and recorded. A development methodology is necessary to take all the crucial influences into account. (Amit and Zott 2015, p. 332)

A framework for business model development proposes such a methodology. The primary purpose is to facilitate the development of a business model and communicate about them in an abstract way (Vorraber and Müller 2019, p. 4). A framework defines which basic building blocks are laid by a business model. (Dijkman et al. 2015, p. 672)

Furthermore, a framework is a tool to describe, analyze and design business models. It provides a shared language that allows to manipulate business models and find strategic alternatives. (Osterwalder and Pigneur 2013, p. 15)

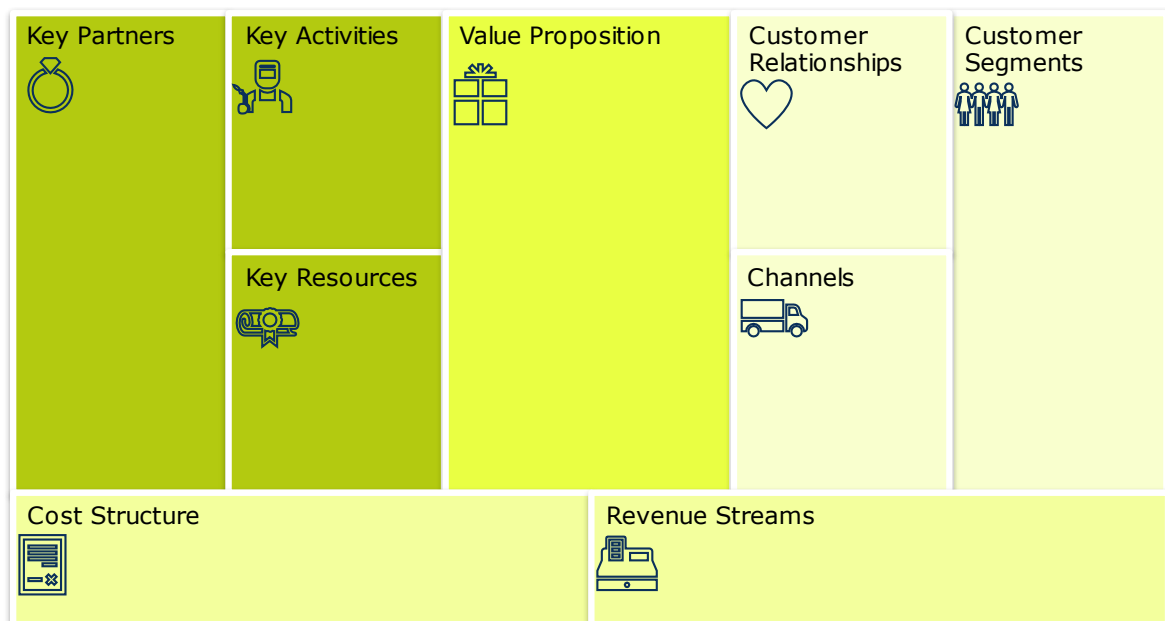


Figure 6: The Business Model Canvas (Adapted from: Osterwalder and Pigneur 2013, p. 18)

Most of the building blocks are already introduced and similar to the "magic triangle" description. In particular, the customer segments, value proposition, cost structure, and revenue streams are already explained in 2.1.3 above. The BMC extends the perception of a business model by the key partners, key activities, key resources, customer relationships, and channels.

However, the extension exists only at first sight. The value chain, as it was introduced in 2.1.3, "*...defines the structure (...) to create and distribute the offering, and determines the complementary assets needed to support the firm's position in this chain*" (Chesbrough 2002, p. 533). Therefore, the mentioned parts of the magic triangle's extension can be understood as fragments of the value chain.

As can be seen from the canvas, it would also have been possible to explain the parts of a BM using this canvas structure. However, Gassmann's approach was deliberately chosen because Osterwalder is often used for this purpose, and thus variety can be brought into the literature.

2.2 Business Model Innovation

After showing which parts a business model consists of and how it is presented, the following explains an essential aspect of Business Models: The Business Model Innovation.

2.2.1 Definition and Importance of Business Model Innovation

Business model innovation (BMI) is a source of competitive advantage and economic success (Massa and Tucci 2014, p. 429). It offers the unique potential to solve the trade-off between innovation costs and innovation benefits (Amit and Zott 2012, p. 37).

Innovations of products and processes are primarily expensive and time-consuming, while returns on investments are uncertain. BMI, in contrast, serves as an alternative to the traditional innovation of processes or products (Amit and Zott 2012, p. 36).

In BMI, the business model serves as the subject for innovation itself (Massa and Tucci 2014, p. 426). The remarkable advantage of BMI is that innovation can occur without technology development (Baden-Fuller and Haefliger 2013, p. 419). BMI is the change of how to do business when creating and capturing value for both company and customers (Bouwman et al. 2018, p. 149).

Due to the fast technological changes and ephemeral markets, innovating the business model is important for companies to ensure survival. (Blank 2013, p. 9; Im et al. 2020, p. 511). Therefore, successful companies innovate their business model before they are forced to by the market and use BMI in the same way they use product innovation: As strategic options and home-grown opportunities (Johnson 2010, p. 7).

Although many describe BMI as a panacea, it is complex, and uncertainty and financial risk remain (Brasseur et al. 2017, p. 7). In contrast, BMI can make the economy more ecological and social (Massa and Tucci 2014, p. 421).

2.2.2 Classification of Business Model Innovation

The following provides an overview of standard classifications of BMI frequently used in scientific literature and the different aspects of a business model which BMI addresses.

Wirtz (2020, p. 170) differentiates BMI into two types. First, the innovation is to find a new market for an existing product to create value, not the other way around (Chesbrough 2010, pp. 354–355; Wirtz 2020, p. 170). The other possibility of innovating the business model is finding a way to exploit new opportunities in already-served markets (Amit and Zott 2012, p. 39; Wirtz 2020, p. 170). Admittedly, there is no overall consensus of how much change has to occur to be called BMI. Thus, a changed value proposition seems to be essential (Wirtz 2020, p. 170).

According to Massa and Tucci (2014, p. 426), BMI “*refers to the design of novel business models for newly formed organizations, or the reconfiguration of existing business models.*” Figure 7 shows the view of Massa and Tucci on BMI summarized.

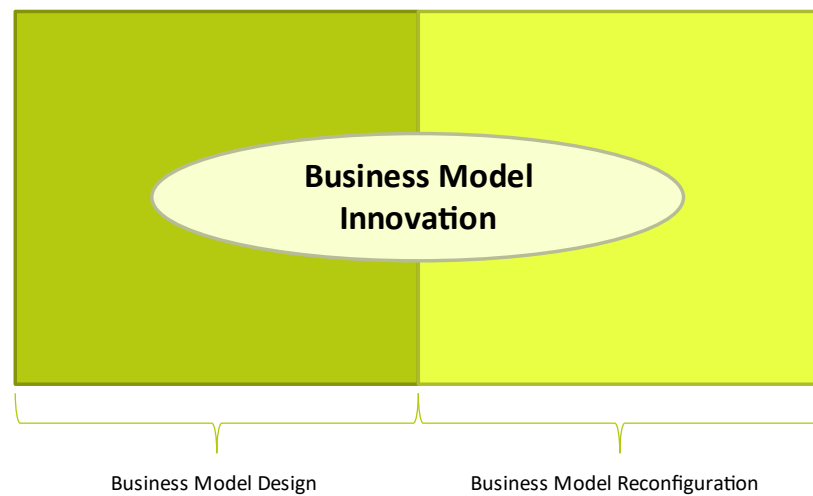


Figure 7: Business Model Innovation as a Subset of Business Model Design and Reconfiguration (Adapted from: Massa and Tucci 2014, p. 426)

Massa and Tucci (2014, pp. 426–429) name the first form of BMI the “Business Model Design” (BMD). BMD includes the entrepreneurial activities of creating, implementing, and validating a business model for a new organization. BMD involves creating a boundary-spanning activity system, including the connection of interdependent activities and the out-carrying party's designation (Amit and Zott 2015, p. 332). It is concerned with typical entrepreneurial choices, such as, e.g., the right product/market mix, organizational design, or control systems. In any case, uncertainty regarding survivability is also an important aspect that must be taken into account. Uncertainty refers to predicting the customer response to the company's offer, the market development, or the future dynamics of the market and the computational and dynamic complexity during the planning of a business model. Computational complexity in this context means the high number of possible logical combinations between the business model's components, activities, and decisions. Dynamic complexity refers to the nonlinear behavior between the mentioned components, activities, and decisions. (Massa and Tucci 2014, pp. 427–428)

The second form, according to Massa and Tucci (2014, pp. 426–429), the “Business Model Reconfiguration” (BMR), is the reconfiguration of organizational resources and the acquirement of new ones. BMR changes the existing business model fundamentally, but the degree of change's radicalism differs. Though the outcome of both processes is BMI, reconfiguration and design are two fundamentally different activities. A significant difference is that BMR assumes an already existing and implemented business model, which comes with organizations' typical challenges. These challenges are, for example, inertia in entrenched organizations, modes of change and organizational learning, management processes, and path-dependent constraints. New firms may not face the same issues. However, they may be challenged by a lack of legitimacy, technological uncertainty, lack of resources, or the liability of newness influencing a new business model. (Massa and Tucci 2014, pp. 426–429)

Chesbrough (2010, p. 358) identifies two different barriers in business model reconfiguration. The first type of barrier is structural; the origin of these barriers is the conflict with existing assets and business models. A cognitive barrier is the second type. It results from the inability of managers to envision how to align value potential and technologies with the existing business model. (Chesbrough 2010, p. 358)

Amit and Zott (2012, p. 39) take a different approach to classify BMI. According to them, BMI occurs in three ways: First by content, second by structure, and third by governance. The first way is associated with adding novel activities through forward or backward integration to a business model. BMI by structure means the linkage of activities in novel ways. According to Amit and Zott, the third form of BMI refers to the change of one or more parties in the activity chain, which can be considered an integral part of the value chain. (Amit and Zott 2012, p. 39)

To summarize the above classifications, it can be concluded that BMI can affect basically any part of a business model. Moreover, depending on the radicality of the change and the nature of the event, it can fundamentally shift the revenue logic.

2.2.3 The Generic BMI Process

The developments and characteristics of process models for BMI are very different due to the high number of scientific contributions in recent years. Because of the many different approaches, Wirtz and Daiser (2018, p. 51) proposed a generic BMI process based on numerous methods considered in a literature review. Due to the similarity of the generic process by Wirtz and Daiser to the process integrated at AVL, the thesis is limited to the presentation of this process from the literature. This similarity is also shown at the beginning of chapter 3.

The generic BMI process is built up of eight phases and the associated process phase activities. The generic BMI process is presented in Figure 8.



Figure 8: Generic BMI Process with Key Activities (Adapted from: Wirtz 2020, p. 178)

The process starts with the analysis phase. During this phase, the initial situation is analyzed by considering the current business model, services, products, market, customer, and competition. A precise description of the strengths, weaknesses, opportunities, and threats is carried out in this phase to deliver a clear picture of the environment. (Wirtz and Daier 2018, pp. 48–51; Wirtz 2020, pp. 177–180)

The focus of the ideation phase is on the determination of the BMI mission and the creation of new ideas. With the help of creativity techniques, different proposals are generated. After finishing a conceptual design of the new business model, the feasibility phase evaluates its practicability and impact to rate the potential realization. Differences and influences between the possible models and existing structures are collected to assess the necessities of internal and external alignments. The conduction of an environment and technology analysis delivers an overview for further proceeding. In contrast to the analysis phase, the focus of this analysis is on the planned business model. (Wirtz and Daier 2018, pp. 48–51; Wirtz 2020, pp. 177–180)

If the feasibility phase results in a justification to pursue the new business model alternatives, the prototyping phase begins. The designs are then further refined until a satisfying status of the prototypes is achieved. During the decision-making phase, the evaluation of the alternatives takes place to prepare the draft for the management's final decision on whether and which of the business models will be implemented or not. (Wirtz and Daier 2018, pp. 48–51; Wirtz 2020, pp. 177–180)

The design-oriented part closes with the decision for the implementation of a specific business model. Subsequently, the operations-oriented part begins. The definition of an implementation plan supports the contracted team in the implementation of the business model. The importance of this phase lies in the fact that success depends not only on the design but also on how it is implemented (Tesch and Brillinger 2017, p. 2252). Once the implementation is complete, the monitoring and control phase begins. Monitoring the achievement of BMI objectives is the focus of activities in this phase. Particular attention should be paid to value proposition and value constellation in this context. In addition, the definition and continuous evaluation and monitoring of key performance indicators (KPI) are carried out. Last but not least, the sustainability phase begins. Necessary adaptations are applied to the business model to ensure sustainability and performance. (Wirtz and Daier 2018, pp. 48–51; Wirtz 2020, pp. 177–180)

Already in the feasibility phase it can be read that the word evaluation is associated with business model innovation. The following chapter describes what this means and why the evaluation of a business model is worthwhile.

2.3 Business Model Evaluation

The evaluation of business models follows the presentation of the business model innovation process. This chapter shows why evaluation is necessary and important, how it is applied, and which methodologies are available.

This chapter contains preliminary theoretical considerations; individual methods are collected in chapter 3.3 in the context of a Systematic Literature Review. The result of this review can be found in chapter 3.3.3, Table 7.

2.3.1 Importance of Business Model Evaluation

In the previous chapter, a generic process for BMI was presented. In the course of the chapter, the word "evaluation" is connected with the business model. Wirtz (2020) repeatedly emphasizes the importance of early evaluation activities. He mentions the need for evaluation in the phases of feasibility, decision-making, and monitoring and control, though an application is conceivable in other phases too. The importance of business model evaluation in BMI is highlighted by numerous authors (McGrath 2010, p. 248; Schrauder et al. 2018, p. 422; Linde et al. 2021, p. 45; D'Souza et al. 2015, p. 22; Brasseur et al. 2017, p. 11).

Evaluation methods, in general, support a key aspect of doing business: The decision-making process. Quantitative methods serve as a silencer of qualitative uncertainties by mitigating them and help quantitatively estimating occurring risks. (Broadbent et al. 2008, p. 40)

Huelsbeck et al. (2011, p. 1636) note that companies that evaluate their business models are more successful in the long run. The fact that intuitive decisions and assessments still play a predominant role in many companies shows the demand to catch up. Intuitive decisions often fail to consider important facts or neglect apparent risks. Accordingly, an essential application scenario of evaluation with great potential is the foundation of decisions in a BMI process. (Mateu and March-Chorda 2016b, pp. 11–12)

Magretta (2002, p. 5) stated that there are two critical tests a business model has to pass. First, the narrative test is failed if the story behind the business model does not make sense (a solution without a problem). A business model fails the second test, namely the numbers test, if the profit and loss calculation does not add up (more losses than profit). These numbers tests are, as the profit and loss annotation suggests, economic and financial calculations, which can be found in Table 2.

Although the benefits of implementing an evaluation concept outweigh the disadvantages, they have still not made their way into all management levels (Huelsbeck et al. 2011, p. 1633). Companies need a systematic process to evaluate the potential of business models before commercialization (Linde et al. 2021, p. 44). But even if many companies did not implement evaluation methods yet, they all search for ways to reduce uncertainty and risk (Thompson and MacMillan 2010, p. 293).

2.3.2 Goals and Application of Business Model Evaluation

The evaluation of business models has three overarching goals, which also summarize the application scenarios: First, evaluating business models can compare the own business model with a competitor's. The focus is not only on the own business model but also on the competitor's one to find sources of competitive advantage or disadvantage. The second case is evaluating business model alternatives to make an informed decision and implement the best one. During the BMI process, it is likely that many ideas for business models pop up, which then need to be evaluated, and the best must be chosen. The evaluation of a business model to assess its viability is the third form of evaluation. Methods of this category focus on one single business model and evaluate different dimensions to make a viability statement. (D'Souza et al. 2015, pp. 4–5)

Schrauder et al. (2018, pp. 413–414) describe the application of the evaluation of business models as a *“conscious evaluation of alternatives regarding all three business model dimensions: Value offering, value capture, and value architecture”*. Evaluating the value offering is assessing alternatives focusing on what the offer to the customer is, how the proposal fits the customer's needs, and the value proposition. The evaluation of the value capture dimension means assessing the coherent costs and benefits and the necessary resources. Finally, evaluating the third dimension, the value architecture, refers to determining the main processes and organizational requirements essential to creating and capturing value.

2.3.3 Classification of Business Model Evaluation Methods

The following introduces approaches for the classification of evaluation methods. This is important for further proceedings, especially concerning the systematic literature review, introducing a concept-centric approach, as described in chapter 3.3.3.

A general distinction between the methods can be made in terms of causal application: The quantitative vs. the qualitative methods. Quantitative methods quantitatively assess the targeted part, as the name already reveals, whereas qualitative methods do not handle any quantifiable fact. (Tesch and Brillinger 2017, p. 2254)

Especially early phases of BMI are characterized by a high degree of uncertainty, which leads to difficulties in assessing the potential risks in numbers- even approximately (Gilsing et al. 2020, p. 429). Therefore, qualitative methods support and evaluate early innovation phases. Nevertheless, a combination of qualitative and quantitative evaluation is also applicable by integrating a quantitative approach in a qualitative framework, e.g., to make a priority ranking of risks. Quantitative methods, on the other hand, serve as reliable information at an advanced stage. (Tesch and Brillinger 2017, p. 2256)

In addition to the aforementioned method of distinguishing between qualitative and quantitative methods, Tesch and Brillinger (2017) also differentiate in a second dimension: Causal and effectual methods. Sarasvathy (2001, p. 245) elaborated the theory for this differentiation, saying that causal methods take particular effects for granted and search for the means creating the effects, whereas effectual methods work vice versa. An example of a causal method is an analytical work; in contrast, a causal method is, e.g., prototype testing.

Business model evaluation methods can also be classified by the typology from Schoormann et al. (2018, p. 65). Their typology intersects the evaluation methods in ten categories by a qualitative-based, conceptual classification. The ten categories are presented in Table 2. Schoorman et al. analyzed relevant literature to identify sustainability-oriented business model evaluation approaches. Though the review focuses on sustainable business models, they stated that all the methods found are suitable for economic evaluation. Thus, the typology provides a logical classification, especially for an economic focused assessment.

Table 2: Typology of Business Model Evaluation Methods (Adapted from: Schoormann et al. 2018, p. 65)

Type	Example
M1. Benchmark-, Comparison-, and Trade Off-oriented Evaluation	Compare/ Identify Alternatives, Benchmark, Qualitative Comparative Analysis, Collect/ Value impacts
M2. Economic-/ Financial-oriented Evaluation and Metrics	Return on Investment, Life Cycle Costing, Net Present Value, Breakeven, Market Share
M3. Mathematical-oriented Evaluation Methods	Analytical Hierarchy Process, Fuzzy Comprehensive Evaluation Method, DEA-Model, Sensitivity Analysis
M4. Survey- and Questionnaire-oriented Evaluation	Questionnaire, Delphi-Technique, Group Decision, Consensual Assessment Technique
M5. Simulation-based Evaluation Modelling Techniques/ Tools	Simulation, System Dynamics, Stress Test, Scenario Planning
M6. Strategy-oriented Evaluation Tools	Balanced Scorecard, PESTEL, PEST, Five Forces Framework
M7. Business Model Ontology-oriented Evaluation	Business Model Canvas, 4C Net Framework, Ballon Framework
M8. Decision Structuring-oriented Evaluation	Decision Matrix, Event-Decision Tree, Morphological Box/ Taxonomy
M9. Pattern- and Key Question-based Evaluation	Pattern-based Analysis, Central/ Key Questions
M10. Value Proposition-oriented Evaluation Tools	Value Mapping Tool, Value Proposition Traceability Diagram

Table 2 closes the part of the theoretical background. Subsequently, the methodology and procedure of the empirical part are further explained, and the results are presented.

3 Empirical Part: Design Science Research Approach

Chapter three describes the development of the framework using the design science research approach. Step by step, a solution is developed and then evaluated. This step-by-step approach is also described in chapter 1.3. The framework with the included quantitative methods aims to align practices from the literature with stakeholder requirements from practice at AVL. To bring the foundations and influences together, the methodology chosen was the Design Science Research approach according to Hevner et al. (2004), which is explained in chapter 3.1

Due to the difference between the generic BMI process, introduced in 2.2.3, and the implemented process at AVL, introduced in 1.1, preliminary considerations must be made. Since the result of the empirical part is to be integrated into the BMI process of AVL, it is briefly described at the beginning of this chapter where the BMI process, which was presented from the literature, shows similarities to that of AVL List GmbH and where differences exist.

The generic business model innovation process shows differences to the presented process in the chapter “Current State” (1.1). Phases one and two are similar, whereas three to eight differ in content, name, and sequence. Phase three differs in the title, while the scope of “Problem-Solution Fit” and “Feasibility” is similar. This similarity can also be found in phase four, the “Product-Market Fit” and “Prototyping”. Phase five and six of the current state can be summarized to phase five in the generic model. The financial implications and the value creation architecture are part of the decision-making phase. The “implementation” and the “monitor and control” show similarities again. The generic model has an additional step called “Sustainability Securing”. This step thus is included in the “Monitor and Control” Phase of the initial situation process. These connections between the two presented processes are illustrated in Figure 9.

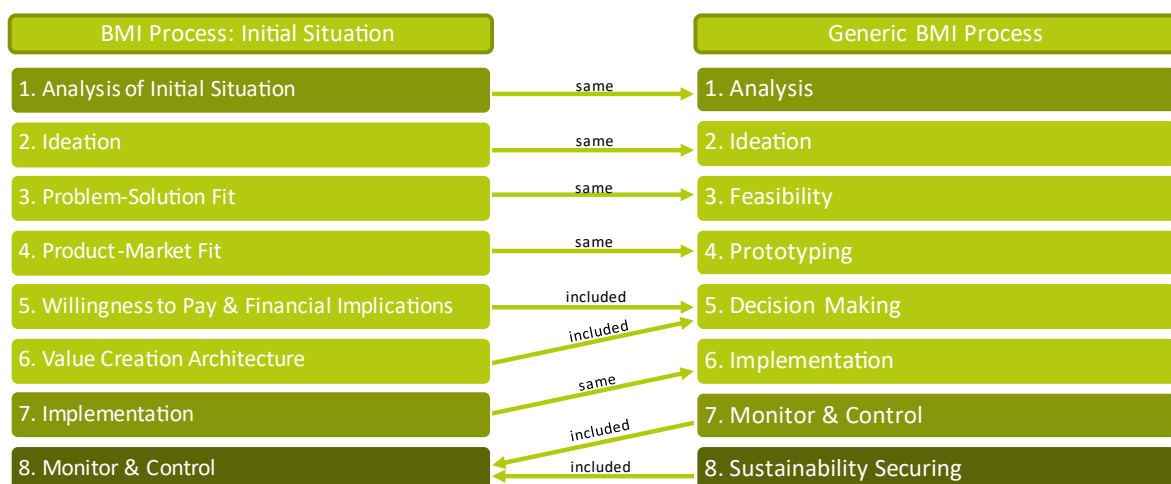


Figure 9: Comparison of BMI Processes: Initial Situation at AVL and the Generic BMI Process by Wirtz et al. (2018)

3.1 Methodology and Procedure of the Empirical Part

In the Design Science Research approach by Hevner et al. (2004), the focus is on knowledge and understanding of a problem. It not only describes and explains, but also changes, improves, and creates something new based on existing knowledge. For this reason, this method was chosen. According to the research question, new approaches with practical relevance should be generated starting from existing knowledge. By taking into account the environment and the state of science, this methodology is particularly suitable.

According to Hevner (2007, pp. 87–92), the design science research methodology aims to create artifacts that solve a specific problem and evaluate these artifacts' performance. Hevner separates the approach into three cycles. Figure 10 presents the design of Hevner's design science research approach in a simplified manner. The cycles are then further described.

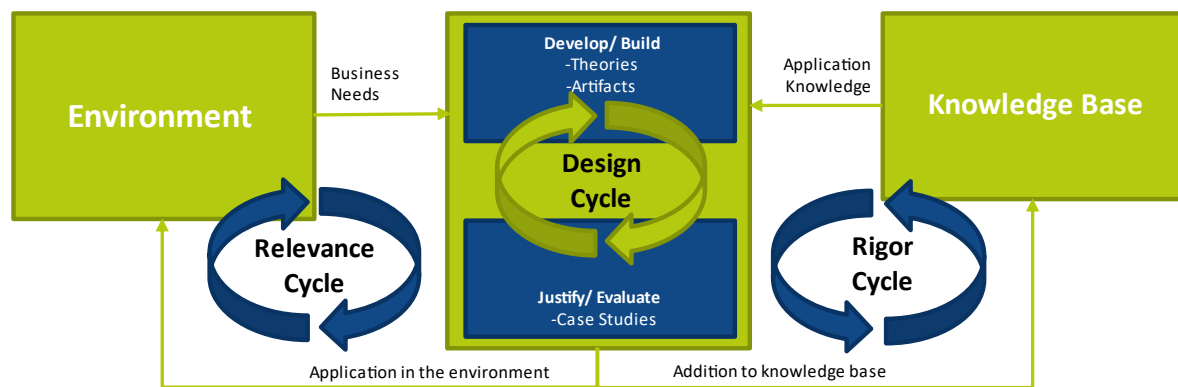


Figure 10: Design Science Research Approach (Adapted from: Hevner 2007, p. 88)

The first cycle is the relevance cycle, which defines the problem's environment. The definition of the problem's environment includes describing the involved actors, organizational structures, technological structures, and problems and possibilities. The cycle aims to set the application context, determines the requirements for the artifact and defines the criteria, which are essential for the artifact's success. (Hevner 2007, pp. 88–89)

The method for the processing of this cycle was the non-standardized guided interview of experts. The procedure and the results of the interviews are described in chapter 3.2.

The rigor cycle is the second one. This cycle ensures that the generic solving of a problem differs from design science research. The results of the process should be able to be abstracted theoretically, and principles or theoretical conclusions should be drawn. Therefore, the process includes existing theories, knowledge, and artifacts. The knowledge base is the fundament of the rigor cycle and influences the solution. (Hevner 2007, pp. 89–90)

A systematic literature review processed the rigor cycle. For this purpose, an existing literature review was consulted, updated, and further processed. Chapter 3.3 describes the procedure and the results of the review.

Following the rigor cycle, the design cycle is the third one. In this cycle, the artifacts are designed, created, and evaluated. (Hevner 2007, pp. 90–91)

The observational evaluation technique was chosen to evaluate and further refine the artifacts during a case study. Chapter 3.4 discusses the creation and evaluation of the artifacts.

3.2 Relevance Cycle: Interview Series

Because the design science research approach is a methodology, not a method, the user can choose his preferred methods to apply the methodology. (Hevner 2007, p. 88)

The method of choice was the non-standardized guided expert interview for the relevance cycle. Accordingly, the interview series establishes the context of use, determines requirements for the artifact, and establishes criteria that characterize the artifact as successful.

The interviews form the basis according to which criteria quantitative methods for evaluating business models are selected. Since the requirements of relevant stakeholders are essential for practical applicability, this also ensures practicability.

The methodical procedure of the interview series was conducted with the method of Gläser and Laudel (2010). Their work on expert interviews provides a step-by-step guide to enable the preparation of the interviews.

3.2.1 Preparation of the Interviews

The preparation of the interviews is essential to gain usable information and satisfyingly answer the research question. Common mistakes concerning the preparation and conduction of interviews can be avoided or reduced when following a profound guide.

Gläser and Laudel (2010, pp. 61–109) provide the mentioned guide with a description of the necessary steps. Because their explanation is very detailed, the conducted process is described in a simplified and shortened manner, and only the practical steps are explained. Background information, further descriptions, and the entire process of elaboration can be found in the authors' work.

The practical steps of the preparation are depicted in Figure 11, which is based on the work of Gläser and Laudel (2010, pp. 61–109). The steps are then further explained.

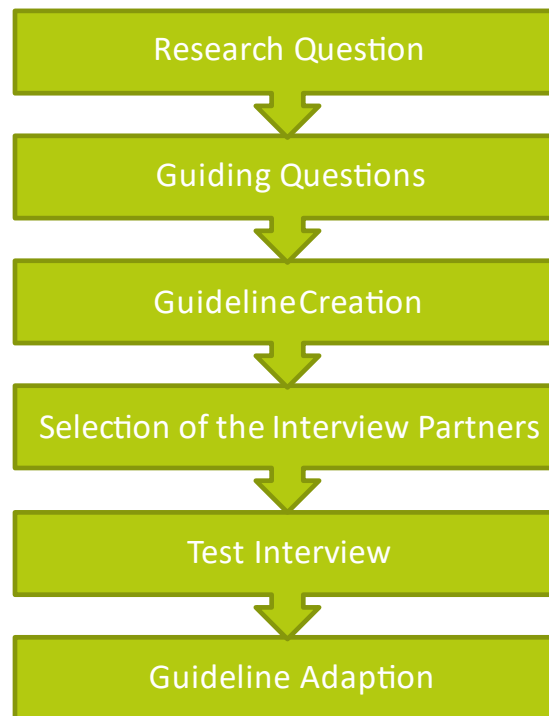


Figure 11: Preparation Steps for the Conduction of an Interview Series based on Gläser and Laudel's (2010, p. 61-109) Approach

- Research Question

According to Gläser and Laudel (2010, p. 62), the first step should always be formulating a research question. Since the research question was already formulated in advance in chapter 1.2, the first step was to develop guiding questions.

- Guiding Questions

As mentioned, the interview series fits into the Design Science Research Methodology as a method. Gläser and Laudel (2010, pp. 90–91) recommend that the research question should be translated into guiding questions in the first step. These define what the interview series contributes to answering the research question. Gläser and Laudel (2010, pp. 90–91) recommend this step because guiding questions serve as a link between the research question and the questions in the guideline.

In formulating the guiding questions, consideration was given to what the goal of the interview series was. The guiding questions thus directly influence the data collected in the interview to answer the research question. The focus was primarily on the environment, which had to be described by the interviews. The guiding questions were:

Q1: Which roles are involved in the business model innovation process, when should they be involved, and what is their focus?

Q2: What should be considered in terms of approaches to evaluation?

These questions also built two of the four main theme blocks in the interview guideline.

- Guideline Creation

According to Gläser and Laudel (2010, p. 111), the next step was translating the guiding questions into questions for the interview guideline, which can be found in the appendix.

The guideline serves in non-standardized interviews merely as a guide to the various topics that need to be covered and the information that needs to be collected in the interview. The order of the questions is not obligatory because the interview should feel like a normal conversation to the interviewee. (Gläser and Laudel 2010, p. 111)

The principle of openness of the questions was always followed in the formulation, as Gläser and Laudel (2010, p. 131) suggest. The questions posed should neither suggest an answer nor be answered with yes or no. Filter questions are an exception: They can be used to classify the expertise of individual interview partners. (Gläser and Laudel 2010, p. 131)

The created interview guideline was divided into four main blocks. The purpose of the first block was to collect demographic data and ask warm-up questions. Talking about the interviewees' favorite topics creates an initial flow of conversation and takes the tension out of the interview.

Gläser and Laudel (2010, p. 170) also suggest a "warm-up" phase in advance of the interview. However, it was refrained from doing this due to time constraints, and the warm-up was made as a casual part of the interview.

The second part deals with the first guiding question. Four questions were formulated for this purpose, with the fourth serving as a transition to the next block. The question about the roles involved and when one's position should be concerned was the first. The interviewee's focus was asked by implementing the Business Model Canvas according to Osterwalder in the guideline and asking about the Canvas area, which was most relevant to the interviewee. The fourth question was if the interviewee's role should be contacted for decisions about these parts of a business model. This way, the decision-making process was addressed.

The third block aimed to answer the second key question. Therefore, it involved asking about criteria for evaluating business models, potential methods, methods in use, and monitored values. In this way, the existing know-how regarding the evaluation of business models was collected.

In the fourth block, single methods were discussed. The question was asked whether these methods had already been used and in what context. Questions regarding the applicability in specific process phases were asked depending on the situation and the answers. This block also implicitly collected the methodological requirements for the framework, as expertise was gathered on the data situation in different phases.

- Selection of the Interview Partners

The basis for selecting the interviewees were the questions from Gläser and Laudel (2010, p. 117) formulated for this purpose. Gläser and Laudel (2010, p. 117) provide four questions in their guide, which are:

"Who has the relevant information?"

"Who is most likely to be able to provide accurate information?"

"Who is most likely to provide information?"

"Which of the informants is available?"

Therefore, it is relevant whether the interview partner has the required knowledge and whether they are willing to share it and take the time to do so. Furthermore, the interview partner has to work at AVL List GmbH. The selection of the interview partners was made in consultation with the supervision at AVL List GmbH. Internal people knowledge ensured that relevant expertise and the willingness to share it were prevalent. This way, seven interview partners were selected. Table 3 shows their sphere of activity and their job rank in the organization. An essential factor in the choice was that experts from different areas of the company were consulted. They all have in common that business model innovation plays a crucial role in their day-to-day work.

Table 3: Interviewpartner's Job Title and Activity Spheres

	Job Title	Sphere of Activity
Interview Partner 1	Team Leader	Partnering
Interview Partner 2	Director International	Business
Interview Partner 3	Global Segment Manager	Business Development/ Innovation
Interview Partner 4	Head of Department	Legal Affairs
Interview Partner 5	Program Manager	Digitilization
Interview Partner 6	Global Program Manager	Business Development
Interview Partner 7	Senior Manager	Innovation Management

- Test Interview

Gläser and Laudel (2010, p. 107) suggest that a preliminary study should be conducted before interviews begin, and the collected data should not be used. Test interviews help improve the interview guide and be aware of problems with the questions early on. They also promote the quality of the data and improve the results. With the experience from the interview, the interview guide can be revised.

A preliminary study was conducted, but not entirely in Gläser and Laudel's (2010, p. 107) mind because of time restraints. It was not possible to conduct a test interview without using the data, as they suggest.

Therefore, it was decided that the first interview partner should be very open to the topic, has interview experience and expertise in the scientific theory of business models. This way, it is hoped to provide a valuable response even if problems arise in the order or nature of the questions.

- Guideline Adaption

Based on the chosen test method, the interview guideline was revised and improved after the first interview. The adaption involved working on the wording of questions and the sequence. The methods in the guideline's fourth part were shortened from 14 to eight.

The next step was the conduction of the interviews.

3.2.2 Conduction of the Interviews

All the interviews were invited a few weeks in advance. The interviewees received the interview guideline a few days before the interview took place. The sending in advance ensured that the interviewees knew which specific topics would be the subject of the interview.

Although this is often discouraged in the literature (Gläser and Laudel 2010, p. 164), it is common practice at AVL List GmbH and did not seem to be an obstacle during conduction.

Because of the pandemic and the general COVID-19 situation, all interviews were held online in a video call. The video call also eases the interview recording, which was directly performed in the same software. All the interviews were held in German to avoid language barriers. The interviews lasted about 45 minutes on average.

The interviews all followed the same procedure: After a short welcome and a casual round of introductions, the topic was briefly introduced. For this purpose, the first page of the guideline served as a reference. The opening was necessary to provide a common understanding of the term business model, business model innovation, and the phases included. Especially the common understanding of the terms is not axiomatic, as differences even between scientists in this field exist, as described in 2.1.2 and 2.2.1. Afterward, the interviewees were asked if the recording of the interview is okay for them. After the general clarification that all interviews would be treated anonymously and no personal data would appear in the thesis or elsewhere, the recording was started. From this point on, the interview followed the prepared guideline without disturbing the natural course of conversation.

Gläser and Laudel (2010, p. 187) expressly warn against "guideline bureaucracy". The guideline should guide freely through the conversation and ensure that all relevant topics are covered, but the sequence of the questions should be allowed to differ, as Gläser and Laudel (2010, p. 187) state.

The best possible attention was paid to this characteristic feature of guided interviews.

3.2.3 Post-Processing of the interviews

After the interviews were conducted, the next phase began immediately: post-processing. The transcription of the interviews was the first step in this process. This elaborate method was chosen to avoid an unreproducible interpretation step, as it would occur if the recordings were protocolized compromised.

This procedure also follows the recommendations of Gläser and Laudel (2010, p. 193). The following of Gläser and Laudel's rules for transcription were applied (Gläser and Laudel 2010, p. 194):

- It is written in standard orthography, and no literary transcription is used.
- Incomprehensible passages are marked.
- Non-verbal utterances are only transcribed if they give a different meaning to a statement.

After transcription, the file was immediately anonymized. Personal data were replaced by codes so that only the author knows about the person.

After the transcripts were processed, the analysis followed.

3.2.4 Analysis of the interviews

The method chosen for this was inductive category formation, according to Mayring (2015), which is a method for summarizing. This method is applicable in this case, as a summary of requirements and existing approaches are sought. Since neither the approaches nor the requirements could be precisely categorized in advance, nor could a scientific article on this topic be found that offers precisely such a categorization, the inductive method was preferred.

The coding process according to Mayring (2015) follows a scheme. The scheme is presented in a simplified manner in Figure 12.

According to Mayring (2015, pp. 69–70), determining an analysis unit is the first step. The answer to a question was set as a unit. However, if several topics were covered in one response, the answer was divided and processed separately.

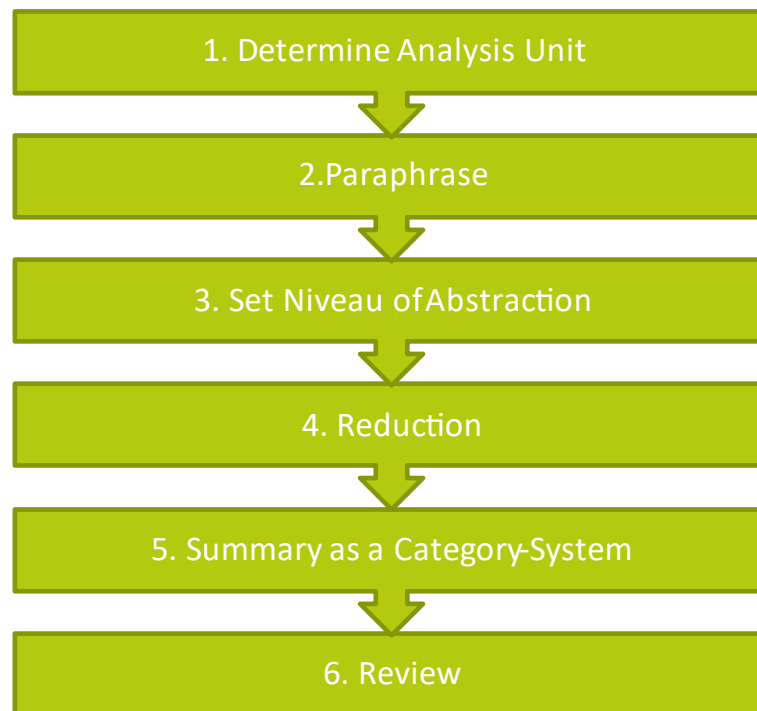


Figure 12: Inductive Formation of Categories (Adapted From: Mayring 2015, pp. 69–70)

Mayring (2015, p. 71) determines paraphrasing as the second step of the analysis. Therefore, the level of abstraction was set so that the essential content was summarized in keywords from a paragraph. These keywords were then generalized and categorized with a label. The reduction steps are from a paragraph to keywords to a category. The categories were summarized in a system.

Mayring (2015, p. 86) suggests revising the formed categories after 10-50% of the material. In this case, the revision reduced the categories from 30 to 16. The 16 categories were then used for coding the rest of the material. During the coding process, it was repeatedly reviewed whether the system of codes reflected the content of the interviews and the key points.

3.2.5 Interim Result: Results of the Interview Series

The result of the interviews is reflected in summary form. According to Mayring (2015, p. 87), there are many ways to analyze the codes. One of these ways is the interpretation by developing main categories, as he mentions. (Mayring 2015, p. 87)

Based on the available data material, the decision was made to project the information of the interviews in the form of the codes onto the guiding questions and compare and reflected points of view. The guiding questions build the main categories in the sense of Mayring. Table 4 presents the formed categories and codes during the coding procedure.

Table 4: Formed Categories and Codes

Category	Code
Aspects of the Roles Involved	A
Market Aspects	B
Aspects Customer and Value Proposition	C
Aspects BMI Process, Phases and Procedure	D
Financial Aspects	E
Strategic Aspects	F
Quantitative Measures for Qualitative Surveys	G
Methods in Use/ Existing Methods	H
Financial/ Economic Methods/ Measures	I
Market Share Considerations, Scalability Considerations	J
Experience Aspects	K
Aspects Properties/ Priorities Methods	L
Strategy Oriented Methods	M
Mathematical/ Simulation- Oriented Methods	N
Questionnaire Oriented Methods	O
Aspects of the used Data	P

Mayring (2015, p. 85) suggests summarizing the interview's information in a generalization process. Therefore, the various viewpoints on each category were summarized, examined for contradictions, and processed so that consensus was discernible and contradictions were comprehensible.

The results are presented centered on the guiding questions presented in 3.2.1.

Q1: Which roles are involved in the business model innovation process, when are they involved, and what is their focus?

Q2: What should be considered in terms of approaches to evaluation?

The correlations were also plotted graphically in Figure 13 to map the simple effect relationship between the codes and the guiding questions.

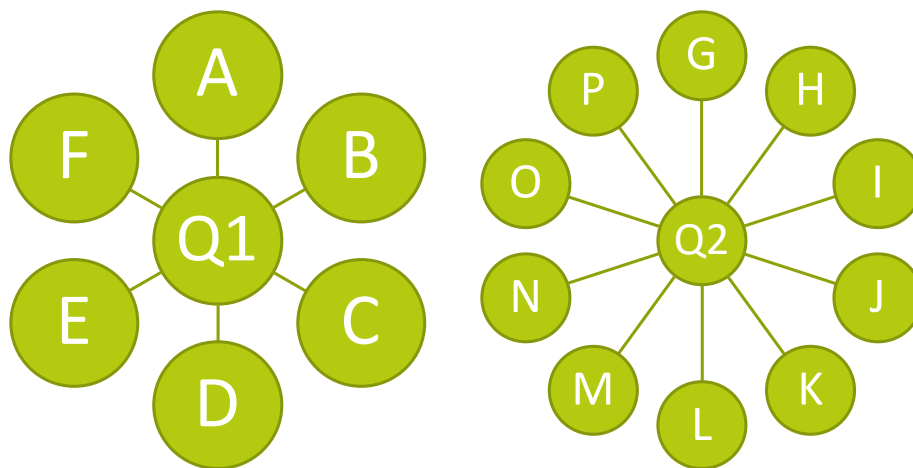


Figure 13: Effect-Relationships between Guiding Questions and Codes

Based on these explanations, further evaluation of the results was carried out. In the following, the interview partners' viewpoints are summarized to answer the guiding questions.

3.2.5.1 Roles in the BMI Process at AVL

Due to the scope of this question, it was divided into three aspects. First, the following aspect was elaborated:

Involved Roles in the BMI Process

In the course of the interview partners' responses, the following aspects came up in this regard:

- Capabilities and Use of In-House Expertise

The statements of the interview partners on this topic were congruent. All of them emphasized the relevance of interdisciplinarity in BMI projects. The specific choice of persons naturally depends on the type of business model being pursued. However, there is agreement that at least one person with the market view, one with technical expertise, and one with methodological expertise regarding business models should be selected. It was also noted that people with experience in other industries should be involved so that their mistakes are not repeated.

Furthermore, one of the involved persons should have good customer relationships and an overview of possible key partners. Remarkably, the involvement also depends on the organizational unit in

which the project is running. As a result, an interviewee also mentioned the danger of the expert next door not being asked because structures hinder it.

The exploitation of the entire in-house expertise across disciplines and structures is described as one of the keys to success. The importance of the “teamwork” ability was also mentioned as being important. To sum up, the success of BMI projects rises and falls with the commitment and skills of the people involved.

- **Backing of Management**

In addition to the skills a team must bring to the table, management backing was a frequently discussed aspect. Support from the management level is just as much a part of this as the team's ability to develop itself and take a certain leap of faith. Within defined limits, the team should be able to develop to its full potential. To be able to pursue the question “Where do I want to go and why”, freedoms are needed. Managers should give this freedom.

- **Early Involvement of Relevant Stakeholders**

In addition to the team's skills and the backing of management, the early involvement of the relevant stakeholders was frequently addressed. The consideration of the local organizations' interests, such as the managing directors, the technical fields, and the business fields, was assessed as essential in this respect. The reconfiguration of business models requires the involvement of those previously responsible. Since there may be different interests involved, moderation of the process is an essential factor in preventing tensions. What was mentioned in addition to the relevant stakeholders was the early consultation of the legal department. In this way, the legal framework can be clarified early, and boundaries can be avoided.

Time of Involvement

The elaboration of this aspect is complicated, mainly because the interviewees could not determine a specific point in time. The general diversity of the projects is a complicating factor. In summary, however, it can be stated that moderating, coordinating, and supporting roles should be involved early in the process. Yet, all interviewees felt that early contact reduced the complexity of introducing the topic, made it easier to identify problems, and contributed to efficiency. What was also mentioned recurrently: The strategic decision of senior management on the handling of specific topics should be clarified in advance of the business model innovation process.

Focus of Involved Roles

The elaboration of this aspect has a time and subject-related dimension. For this reason, the question will be answered related to recurring aspects:

- **Aspects of the Shift in Focus**

These aspects have a time-related dimension. Time-relation refers to the fact that the focus shifts during the business model innovation process. The process of the shift was described similarly by the interviewees. The offer, or rather the value proposition, is the starting point. The customer side follows, then infrastructure aspects are clarified, and finally the financial factors are considered.

- Value Proposition and Customer

As a starting point for consideration, the value proposition is attributed great value by the interview partners. According to the interview partners, understanding the value proposition and the customer is essential for success. For many interviewees, the elaboration of a value proposition is characterized by the formulation and testing of hypotheses. The methods for testing are diverse; customer contact, social media posts, and scholarly articles were mentioned as examples. Although some interviewees have measures concerning the value proposition, it was mentioned several times that the value proposition continues to be assessed qualitatively. The measures, in this case, were quantitative measures for qualitative surveys. An agreement can be found concerning customer contacting: All the interviewees emphasized the importance of early customer involvement, though the way may differ. Those who are primarily concerned with business model design tend to rely on market surveys and various input. In contrast, those who work more on business model reconfiguration seize the friendly customer contact and first-hand and in-house information. One of the interviewees described an interesting aspect in this regard: While affiliates often may not have the right products for the customers, the business units often do not have the market information and access to customers. This circumstance can lead to a discrepancy in the value proposition.

- Market Aspects

A much-discussed point concerning the focus of the interview partners were aspects of the market and competition. An early assessment of the market volume and potential was considered essential. Here, however, differentiation must be made in several dimensions: While known, older markets can be calculated relatively quickly and accurately, this is not true for entirely new markets. In the case of completely new markets, it is often a challenge to get an overview of current participants, let alone potential entrants. Due to the lack of consolidation, an assessment usually involves a great deal of effort. The second dimension to consider is the difference between design and reconfiguration. In reconfiguration, there is often a high level of customer loyalty, and in some business areas, the influence of competition is manageable. This applies, for example, to the digital extension of conventional business models. In contrast, competition often plays a significant role in design. Concerning digital business models, one often encounters large competitors who have already deployed their expertise in the field.

- Financial Aspects

Naturally, financial aspects were of great relevance for all interview partners. In the end, it was explicitly or implicitly stated by all that ultimately, only business models that contribute to economic success are interesting. However, a distinction was made between direct and indirect contributions. For business models with direct contributions, financial success can be calculated directly. In other words, the business model itself generates a profit. An example is a business model based around the sale of a specific product. Business models with indirect contributions, i.e., indirect success, are those in which profitability is achieved in a roundabout way. An example of this would be the opening of a location in a previously unpopular country in the hope of obtaining orders and thus driving other divisions forward. However, both types have in common that they contribute to the company's economic success, but both need to be proved.

A notable finding in the financial area was the massive difference in perception between design and reconfiguration. People who were predominantly involved in business model design found the financial assessment of business models complicated and uncertain at an early stage. At a late stage, calculations are possible but still fraught with uncertainty. This fact applies to costs as well as reve-

nues. Those who mainly deal with reconfiguration find estimating costs to be a straightforward exercise and, from experience, come close to the actual values in the single-digit percentage range. Of course, this is also because they often already know their customers and can estimate the scalability reasonably. In terms of revenues, the situation is somewhat more differentiated: While for some, revenues also seem to be relatively easy to plan in the early phases, others are exposed to greater competition and may miscalculate.

Although some assume a greater degree of imprecision, it was repeatedly emphasized that the financial perspective must be considered from the outset in all ideas and decisions.

- **Strategic Aspects**

In the course of the interview series, strategic aspects regarding the business modeling process were also mentioned. In this regard, some interviewees noted that major strategic decisions must always be made in advance of a business model innovation project. Team members of such a project can accordingly build on these decisions and count on commitment from the management. It was also pointed out that there has been more business model reconfiguration from a strategic point of view so far. In the future, the design will also take place to a greater extent. Accordingly, one interviewee noted that existing business models should continue to be built upon in the future. To this end, consideration must be given to how to make them fit for the future through reconfiguration and at the same time create new business models through design. Ambidexterity was highlighted as very important in this regard. However, it was also mentioned that developing new business models by design is more complex and costly than reconfiguration. At the same time, existing business models also offer excellent innovation potential, especially in combination with the current trend toward digitization.

The information gained with this question was precious. The focus of relevant stakeholders could be set, and topics that should not be part of business model innovation could be defined early, e.g., superordinate strategic decisions.

3.2.5.2 Requirements of Approaches for BM Evaluation at AVL

To answer this question, this part will proceed with the different types of methods. These methods were either mentioned by the interview partners themselves or asked for based on the list in the guideline. The mentioned methods are divided roughly according to the ten types of evaluation methods described above to generalize the results. However, a slightly different classification is used. This results from the coding of the transcripts and provides for a better selectivity in the representation of the result.

- **Financial/ Economic Measures and Methods**

These methods are characterized by the fact that they are derived from financial and economic variables. It includes, e.g., a cost calculation according to the life cycle costing method and the break-even point calculation. Measures of this kind often serve as key performance indicators. Scalability and market considerations are also part of financial and economic measures and methods, as Table 2 suggests.

Because of the consensus that economic success is the primary goal, measures must be implemented. They always form the basis for a decision in management. However, there is a difference concerning usability in design and reconfiguration. As already mentioned in the section “financial aspects”, the uncertainty of the measures is higher in business model design. For this reason, financial and economic measures and methods may be usable at a later stage than in reconfiguration.

Though there is uncertainty, all the interviewees highlighted the importance of early consideration and the repeating calculation. Opposite this, it is precise and informative even in the early stages of reconfiguration.

The interviewees mentioned the following methods and measures as being in use: Net Present Value, Life Cycle Costing, Return on Investment, Break Even Analysis, Pay Back Time, and Discounted Cash Flow.

- Market Share Considerations

The term market share considerations refer both to methods and metrics used to calculate the market volume and potential and methods used to calculate the company's market share.

The interview partners highlighted the importance of early market considerations. The fact that the applicability is different in design and reconfiguration is also given in this case. According to the interviews, this can be attributed to the causality that business model design tends to be practiced where markets are not yet well known and have not existed for long. The lack of consolidation and experience in a market, as described above, makes it challenging to calculate volume or potential. On the other hand, business model reconfiguration tends to serve well-known, older markets, which means that the major players are known and can therefore be used to conclude parameters.

Mentioned methods concerning market considerations are analyzing and discussing a market database, simple calculations from revenue of the most prominent players on the market to conclusions on the volume, and cloud software solutions based on own customer data.

- Scalability Considerations

Scalability considerations were likewise deemed indispensable in the interviews. However, scalability is often misunderstood, but it is one of the keys to success: Microsoft and Amazon are examples of the success of scalability factors. Scalability continues to be viewed on a qualitative level and is fed into an intuitive decision. It was mentioned in the interviews that with experience, it is easy to assess whether and how scalable a business model innovation is. Though, it has already happened that a decision was made contrary to one's own experience.

As mentioned, scalability is assessed qualitatively and intuitively until now. Specific methods are not in use yet.

- Quantitative Measures for Qualitative Surveys

Methods of this type have in common that they are derived from qualitative considerations. They are not part of the ten evaluation types but were mentioned in the interviews. Methods of this type include, for example, metrics, such as a minimum rate of positive feedback from a survey. The evaluation and ranking with the help of a scale (e.g., 1-5) are also summarized as such a method. What they have in common is that the reference values are derived from qualitative considerations only. The example of positive feedback shows that it is debatable what is positive and what is not. Also, the distribution of points may not be precisely reproducible.

The measures have the advantage of making intuitive decisions seem a little more sound. However, it is problematic that methods of this type are reluctantly used according to the interview partners. Many users have the feeling that nothing new is created with it. This is also why some interview partners are aware of these methods but do not use them, especially if it is about spreading points on topics (e.g., one to five points assessment).

- Strategy Oriented Methods

According to the interview partners, strategic thinking is a purely qualitative and intuitive task. As described before, the interview partners see strategic decisions on a higher organizational level. However, individual strategy-oriented methods are instrumental in business model innovation, most notably SWOT analysis, PESTEL analysis, and Five Forces analysis. The interviewees agreed that these methods form a solid basis for starting and analyzing the status quo.

- Mathematically Oriented and Simulation-Based Methods

Mathematically oriented and simulation-based methods were also mentioned during the interviews. In particular, sensitivity and scenario analysis were frequently discussed. However, these methods are mainly used as thought patterns rather than as a mathematical or simulation-oriented approach. One interview partner explicitly mentioned the use of sensitivity analysis in the real sense. There was a consensus that methods of this type are well suited as thought patterns. It was repeatedly mentioned that methods of this kind are helpful and well-applicable if there is a pattern to work with them (e.g., prepared models).

Based on these points, a list of requirements for quantitative methods to implement can be created. Table 5 summarizes the most important requirements.

These requirements and the points discussed form the result of the relevance cycle. In the further course, these are incorporated into the design cycle.

Table 5: Requirements for Evaluation Methods based on Interviews

Requirements	Explanations
Financial/ Economic Aspects	Must be taken into account as early as possible. Are the foundation for decisions. Includes market aspects.
Effort of the methods' use/ Practicability	The methods must be easy to apply. At best, it builds on existing knowledge. Time and resource requirements should be as low as possible.
BM Reconfiguration vs. Design	The differences concerning data availability and uncertainty must be taken into account.
Transparency	Decisions, assumptions, and hypotheses must be explained and transparently documented.
Consideration of the diversity of BMI projects	The framework must take into account the general diversity of BMIs. Innovation is not always straightforward.
Freedom for intuitive decision making	The final decision must be able to be made intuitively. Decision tools should not be mandatory.

3.2.6 Discussion of the Interview Results

During the interviews, a comprehensive insight into the practical approach to the BMI process was gained. As mentioned in chapter 3.1, the interviews' goal was collecting requirements and already used methods at AVL in a structured way. The most important points, which are directly connected to the framework, will be discussed in the following.

- Business Model Reconfiguration vs. Design

Considering the points of view of the interview partners, it became clear that a distinction in the BMI process at AVL between reconfiguration and design is necessary. According to the interviewees, the knowledge of the market, the financial situation, and the customers is very different. Business model reconfiguration is often connected with a deep knowledge of the market, the customers, and financial aspects. Usually, a large amount of data can also be used to estimate markets. On the other hand, business model design involves a high degree of uncertainty. In early phases, even estimating quantitative values is difficult. Due to the different certainty and accuracy of the available data, a differentiation in the evaluation seems appropriate. To date, business model reconfiguration has accounted for a predominant portion of BMI. However, it is expected that the share of business model design will increase in the future.

- Early vs. Advanced Phases of BMI

One aspect that can be observed in summary is that generally, in early phases, qualitative methods are predominately applied in the BMI process. Quantitative methods only come into play as the level of detail progresses in both design and reconfiguration.

- Strategic Decisions

Furthermore, it must be noted that an overriding strategic decision must always be made at a higher organizational level. On the one hand, this ensures the backing of superiors, but on the other hand, it gives the team room to develop creatively with the appropriate freedom in strategy formulation. In this way, the allocation of resources can also be clarified at an early stage.

- Financial and Economic Aspects

Concerning financial and economic aspects, it must be taken into account when working out the artifacts that these will always play a dominant role. Without clarification of these aspects, a business model cannot be fed to a decision on implementation. Significant financial indicators must therefore be implemented as early as possible. Also, other relevant economic aspects, such as market indicators, must be considered. Care must be taken when choosing methods.

- Assumptions and Hypotheses

Incorrect assumptions and hypotheses can lead to misguided decisions and failure. By explaining all assumptions and verifications of hypotheses, transparency and comprehensibility can be achieved.

- Decision Making

Business models are often fraught with uncertainty, predominantly as far as business model design is concerned. In this point, Mateu and March-Chorda (2016b, pp. 11–12) stated that intuitive decisions in business modeling are still common practice. Ultimately, decisions will continue to have an intuitive component. Decision transparency is probably an essential aspect in this respect that must be considered in the framework. The decision between alternatives of business models was not explicitly mentioned in the interviews. This may also be because of a plausible fact: If one remembers the

general statement that economic success is always the top priority, it can be assumed that the business model with the most significant contribution to the success is preferred. In this regard, the respected time must be considered, ultimately leading to a decision based on financial facts.

- Scalability

The scalability of business models must be considered during the innovation process, but, according to the interviews, this is an intuitive task, and there is no need for quantitative methods.

- Value Proposition

The value proposition is of great importance. In this respect, it was pointed out that a qualitative view predominates and is considered sufficient. The question arises as to whether quantification is possible and meaningful.

- The Effort of the Methods

One aspect that must be taken into account is resource pressure. Implemented methods should not require too many detours, should not take too much time, and should always appear useful to the user. Scale ratings (e.g., from one to five), simulation methods, and complicated mathematical approaches can be attributed less importance in the framework due to the statements.

- Benchmarking

Although the literature classifies benchmarking of business models as one of three objectives of evaluation methods, this application was not mentioned. Therefore, benchmarking will not be considered in the further course.

3.3 Rigor Cycle: Update of a Systematic Literature Review

The rigor cycle forms the knowledge base and contains existing theories, knowledge, and artifacts. This cycle ensures that the design science research methodology is different from the practical, straightforward elaboration and provides a scientific basis for the designed artifacts. (Hevner et al. 2004, p. 79)

The systematic literature review was the method of choice to elaborate the rigor cycle. This method was chosen because, if carried out consistently, it provides a reproducible result that offers a comprehensive overview of a topic under investigation while at the same time highlighting relevant streams and also identifying contradictions (Tranfield et al. 2003, p. 209).

Because systematic literature reviews already existed on this topic, it was decided to build on an existing one and update it.

For this purpose, existing approaches for the evaluation of business models were collected and presented. The focus was to develop a summary description of each method to provide an overview of possible ones. Based on a well-considered system for classification, the goal is the possibility to do a subsequent pre-selection of methods.

Although this thesis focuses on implementing quantitative methods or metrics, all kinds of evaluation methods are collected in this step, as announced in chapter 2.3. The selection took place subsequently in the design cycle.

3.3.1 Preparation of the Systematic Literature Review's Update

The preparatory work for conducting the systematic literature review started with reading relevant literature on this specific topic. A foundation for the subject was already laid in chapter 2.3 by showing the fundamental objectives, the relevance, and methods of business model evaluation.

The first step was to define the goal that the systematic literature review should fulfill. The formulated goal was to provide a basis for theory development in the Design Science Research approach by providing relevant business model evaluation methods. For this purpose, existing SLRs were read and selected according to their usability for this goal. The choice ultimately fell on the work of Steinhöfel et al. (2018). This was decided because they provide a short description of each tool, methodology, and approach they found for evaluating business models. Based on their descriptions of methods, it was also considered that this work is best suited as a basis for further use in practical applications outside the design science research.

In principle, this thesis aims to reflect the current state of literature as far as possible. Since Steinhöfel et al.'s (2018) work is from 30th January 2018, it was used as a basis and brought up to date. For this purpose, their approach was analyzed and implemented so that the current status is achieved.

Steinhöfel et al. (2018) derived the relevant search terms that covered the topic of their review in brainstorming sessions. Title and Abstract were considered to identify relevant literature. Their search string was as follows (Steinhöfel et al. 2018, p. 1493):

“business model*” and “analy*” or “assess*” or “compar*” or “control*” or “estimate*” or “evaluat*” or “examin*” or “measur*” or “monitor*” or “test*” or “valuat*”

This search string was used by them to search the scientific literature databases EBSCO, Scopus, Science Direct, and Web of Science. (Steinhöfel et al. 2018, pp. 1492–1493).

Table 6 provides an overview of their results in numbers.

Table 6: Search Results in the Different Scientific Literature Databases by Steinhöfel et al. (2018)

EBSCO	Scopus	Science Direct	Web of Science	Overall
331	3139	174	347	3991

Overall, and before excluding duplicates, 3991 scientific contributions were identified in the databases. With 3139 or 78,8%, the database Scopus delivered the most results. After filtering out irrelevant papers, they identified 34 publications to be covered in the review. 21 of these 34 publications directly focused on tools, methodologies, and approaches for evaluating and analyzing a business model and were also applicable in practice by their opinion. (Steinhöfel et al. 2018, pp. 1492–1493)

3.3.2 Conduction of the Systematic Literature Review's Update

The update of the review was started by searching for publications younger than 1st January 2018, using the same search string as Steinhöfel, Hussinki et al. (2018). Since Scopus was the most promising database due to the most results and the TU Graz offers free access for its students, the search was limited to this database. The search was conducted on 14th April 2021. The search string was:

“business model*” and “analy*” or “assess*” or “compar*” or “control*” or “estimate*” or “evaluat*” or “examin*” or “measur*” or “monitor*” or “test*” or “valuat*” and publicationyear>2017

Running this search in Scopus results in the following search algorithm:

(TITLE (business AND model*) AND TITLE (analy*) OR TITLE (assess*) OR TITLE (compar*) OR TITLE (control*) OR TITLE (estimat*) OR TITLE (evaluat*) OR TITLE (examin*) OR TITLE (measur*) OR TITLE (monitor*) OR TITLE (test*) OR TITLE (valuat*)) AND PUBYEAR > 2017

The process was a sequential search for relevant literature in a manageable quantity. Therefore, only titles were considered in the search string. Steinhöfel et al. (2018) also considered the abstract as relevant in the search string. Due to the limited scope of the thesis, this limitation was chosen. Figure 14 presents the necessary steps to reduce the search results on the relevant literature.

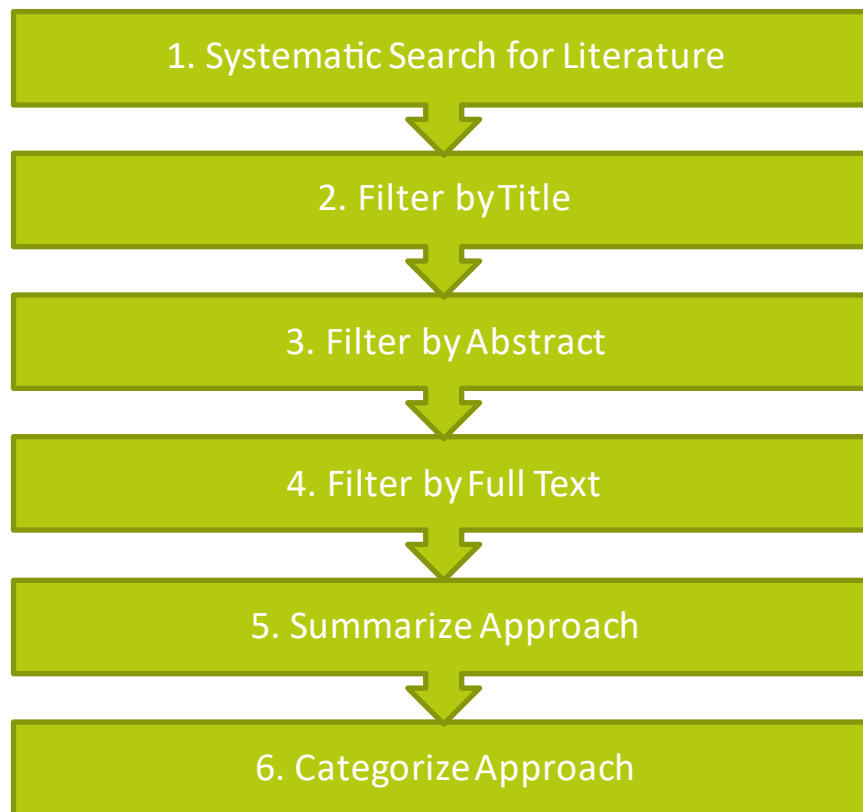


Figure 14: Procedure of the Systematic Literature Review

After the systematic literature search, the results were filtered by title. The search in Scopus resulted in 640 hits. Based on the fact that Steinhöfel et al. (2018) examined the time before January 2018 and got 3991 results with their search, 640 is a satisfying result for the time between January 2018 and April 2021. It can be concluded that the restriction to search by title does not exclude too many contributions.

These 640 scientific contributions were then screened by title. One circumstance that significantly increased the scope of the results was that many titles were found with the topic of business process modeling as well. These had to be sorted out manually in this step.

Furthermore, there were many hits with irrelevant content because the words business, model, and synonyms for evaluation were included only by chance. The filtering by title could factor out 538 unrelated sources. Abstracts of the remaining titles were then read and examined for relevant content. The main focus was on the promise of concrete methods and applications. After reading the abstracts, 25 contributions remained. These 25 were then subjected to full-text analysis. Based on this, 13 titles remained relevant. Figure 15 presents the proceeding of filtering and the results in numbers.

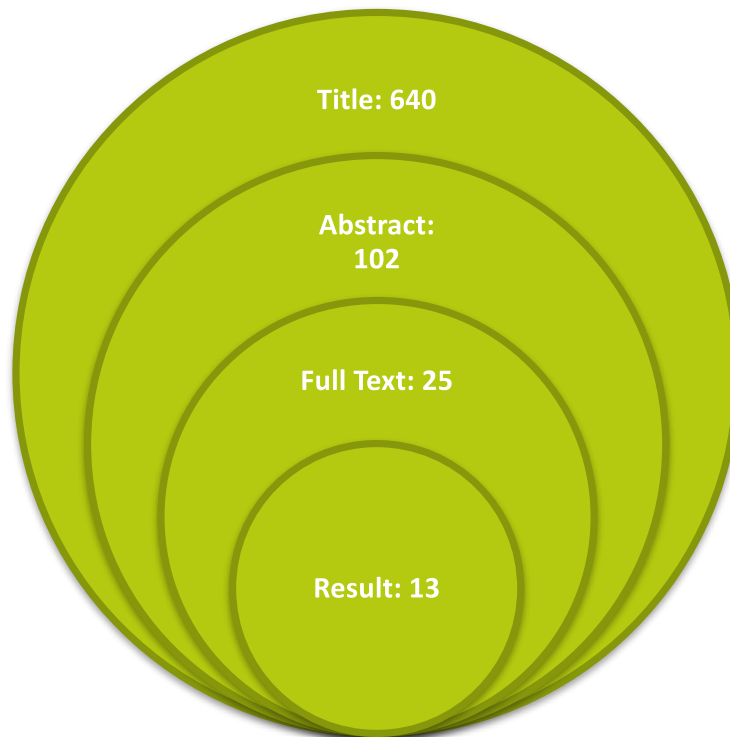


Figure 15: Proceeding of Filtering and Results

The literature found in this way was processed in a next step similarly as Steinhöfel et al. (2018) proceeded. The approach contained in the paper was summarized to the essentials. Subsequently, the results of the own update were collected in Table 7 together with Steinhöfel et al.'s (2018) results. The outcome of this work was a table containing 34 literature sources and 31 different approaches to business model evaluation.

The final step in this process was the categorization of the methods. Two theories were used, which were already presented in chapter 2.3: First, the literature was reviewed in terms of the overall goals of business model evaluation according to D'Souza et al. (2015, p. 4). These are the comparison with a competitor's business model or benchmarking, the evaluation of alternatives for decision making, and the evaluation to assess a business model's viability. After this assignment, the included methods were processed further by classifying them with the ten methods according to Schoormann et al. (2018, p. 65). This approach was chosen because it provides an overview that can find suitable methods depending on the goal of evaluation.

3.3.3 Interim Result: Results of the Systematic Literature Review's Update

As the conduction was explained, the systematic literature review provided three results: The first result is available in Table 7. This table first contains all literature and descriptions performed by Steinhöfel et al. (2018). Subsequently, the 13 sources can be found, originating from the work's update. Which work originates from Steinhöfel et al. (2018) and which from the update is indicated by marking the column with either with the page number for Steinhöfel et al. (2018) or with an "X" for the update. To ensure that the table can be found quickly in practical applications, it is also presented in the appendix as Table 11.

Table 7: Table of Evaluation Methods consisting of Steinhöfel et al.'s (2018) Results and the Own Update's Results

No.	Author	Description	Steinhöfel et al. (2018)	Own Update
C1	Ruseva and Ruskov (2015)	“Develop a framework directed towards technology start-ups and business accelerators for reverse business-modelling. This framework comprises among other steps the testing of the envisioned BM. Prior assumptions regarding the product, technology solution and sales channel of the BM are tested through the creation of a forward-looking financial statement. For this purpose, the production and distribution are quantified in terms of costs and revenues, whereby the return on investment depicts the decisive factor.”	p. 1495	
C2	Tesch (2016)	“Similarly, Tesch (2016) develops an approach to implement scenario planning into a business model innovation (BMI) process for evaluating BMs. In the context of Internet of Things, practitioners face a significantly greater number of uncertainties and higher volatility of driving factors. The approach comprises the elaboration of a reference BM design using the BMC, the investigation of ecosystem changes through the application of a PESTE-analysis, the building of a consistent scenario using influence diagrams to identify scenario dimensions and the identification of alternative BMs that successfully respond to the scenarios on the basis of key success factors for each scenario utilizing stakeholder network diagrams. The usefulness of the approach for the evaluation of the future viability of BMs was validated through interviews with industry experts, BMI experts and senior management.”	p. 1495	

C3	Riordan et al. (2014)	<p>“Propose a three-phase BMI process framework that covers ideation, evaluation, and prioritization with regard to BMs. The ideation identifies potential value activities an organization can provide to the market. The ideas for potential BM value activities are evaluated either through visualization, experimentation, or systematic analysis with regard to the evaluation criteria organizational knowledge, capacity, and network. In the frame of the prioritization, competing options are evaluated with regard to multiple weighted business value-driven criteria. A decision-making matrix serves to compare and select one of the competing options.”</p>	p. 1495	
C4	vom Brocke and Buddendick (2007)	<p>“Outline a systematic approach for the monetary evaluation of BMs in order to choose between different options. By estimating potential cash inflows (market model) and cash outflows (activity model) they determine the cashflow over the period of the planning horizon (capital model). Accounting for uncertainties regarding returns on investment and considering alternatives provides a foundation for decision.”</p>	p. 1496	
C5	Brillinger (2018)	<p>“Develops a methodology for identifying and analyzing BM risk factors within BM value networks from the perspective of the BM owner. In a first step, the value network is mapped covering the end customer, all actors involved in the value creation, all partners involved in the value delivery as well as the value and revenue streams. Building on this visual representation, risks with regard to key resources and key capabilities of the value network, the role of the partners, the role of the focal firm or BM owner, the imbalances, inefficiencies and complexity of the value network as well as critical value streams can be identified and analyzed. This allows the definition of actions to close gaps and achieve an adequate level of maturity before market entry.”</p>	p. 1496	

C6	Kamprath et al. (2014)	“Describe a template that supports the analysis of a BMs environment and the capability of a current or new BM to respond to current and future market conditions. The template is modular and covers the dimensions ecosystem and industry value chain, perception of value and future customers and interest groups, which each contain a subset of 4 components.”	p. 1496	
C7	Batocchio et al. (2017)	“Propose a method to assess the performance of start-ups’ BM by combining the BMC by Osterwalder and Pigneur (2010) and the Balanced Score Card by Kaplan and Norton (1996). Based on the design choices regarding a BM illustrated through the BMC indicators for each component are selected, measured and related target values are set to assess a BMs performance. Where necessary, actions are taken to achieve goals in an on-going process.”	p. 1496	
C8	Abdelkafi and Täuscher (2014)	“Focus on the underlying structure of BM patterns that are related to value generation. They develop a model that contains revenue-model related components that are frequently discussed in the literature and apply the notation of system dynamics to graphically represent these as well as their interrelations in the form of causal loop diagrams. They identify four basic reinforcing loops between these components. Assigning 68 BM patterns from literature that are related to revenue models to the before mentioned basic reinforcing loops, the authors provide practitioners with the ability to generate BMs that focus on strengthening one of the loops. With regard to the analytical aspect, the model enables BM simulations that can be used to compare different BM scenarios as well as the analysis of BMs within the firm’s industry to gain better insights on competitors.”	p. 1496	

C9	Batocchio et al. (2016)	“Focus on BM failure due to poor implementation. They present a method for evaluating the BM implementation process, which essentially involves the development of implementation activities through dedicated implementation team members, the measurement of activity performance through key performance indicators and the comparison of these activities with the objectives in a plan-do-check-act manor.”	p. 1497	
C10	Biloshapka et al. (2016)	“Embrace the question how executives can assess the efficacy and power of a BM for a product or service innovation. They develop the so called Value Matrix. It is defined by two dimensions: business value (the value the company captures) and the customer value (the value the customer is provided), each with a relative scale ranging from low to high forming 4 quadrants (loser, winner, giver, taker) and allows an assessment of a specific BM. Taking into account the lifecycle of a specific BM, the authors provide some general advice on how a BM can be moved into or maintained in the winner quadrant.”	p. 1497	

C11	Bouwman et al. (2012), Haaker et al. (2017)	<p>“Propose and further elaborate Business Model Stress Testing and a BM decision support system for the assessment of BMs. Business Model Stress Testing involves the assessment of BM components with regard to market scenarios, regulatory uncertainties, or technological uncertainties, and aims at making a BM more robust during certain market entry situations. For this purpose, a business is first described and mapped with a selection of relevant uncertainties, before it is assessed with regard to the possible impact of specific outcomes of these uncertainties on the BMs elements. The assessment builds the basis for identifying potential for changing BM elements to make the BM more robust. In contract, the BM decision support system helps companies in choosing the best available BM form a financial point of view of multiple stakeholders and their financial objectives. The use of market data and conjoint results makes it possible to incorporate parameters based on empirical research and making use of the support system a BM that satisfies the requirements of different stakeholders best at the same time can be selected.”</p>	p. 1497	
C12	Lee and Hong (2014)	<p>“A different approach is taken by Lee and Hong (2014) who claim that collecting BM related information is an essential requirement for a company. They propose applying automated text mining techniques to annual reports to gain insights on competitors’ BMs as well as their evolution and provide a detailed methodology.”</p>	p. 1497	

C13	Aversa et al. (2017)	<p>“In contrast to the previous contributions, Aversa et al. (2017) do not focus on a single BM but put the portfolio of several BMs of a company in the center of their attention. According to the authors, most companies show deficiencies regarding tools to assess the value of BMs in their portfolio or their strategic contributions. The authors provide a visualization tool that enables the identification of relationships between resources and capabilities as well as their impact on performance to analyze BMs’ complementarities and to improve them. The tool supports generating new BMs that should be integrated into the existing portfolio.”</p>	p. 1498	
C14	Clark (2009 - 2009)	<p>“Focuses on the assessment of a given BM with regard to the likelihood of it being successful in an overseas market. To this end, he provides a framework that comprises a firm, culture and an economic layer according to which a local BM is described. The economic layer comprises sixteen choices a firm has to make, sell, lease, or broker assets. The culture layer identifies explicit and tacit assumptions of the model specific to national origin that may affect the model’s international portability. The firm layer represents a model’s individual “personality” — specific innovations or “plot twists” designed to overcome competitors and/or meet unserved customer needs. This framework is used in an ex-post evaluation with members of organizations that have gone overseas to identify critical points.”</p>	p. 1498	

C15	Groesser and Jovy (2016)	“Apply computational simulation modeling to test the viability of BM in three different future scenarios, characterized by the introduction of superior competing product, increased contact rate, and tightening supply. The outcome of the study shows that despite some challenges related to model specifications, simulation modeling can provide additional depth to existing BM evaluation methods, in particular when evaluating changes in external factors and possible strategic responses.”	p. 1498	
C16	Im and Cho (2013)	“In their paper on new BM development, Im and Cho (2013) use a systematic approach that helps practitioners to identify and evaluate a BM that meets a firm’s strategic objectives. By utilizing three methods – morphological analysis for the definition and aggregation of BM alternatives, fuzzy analytical hierarchy process to calculate criteria priority weights, and fuzzy technique for order of preference by similarity to the ideal solution to evaluate and select the best BM – the authors provide a practical approach that can be employed in BM development.”	p. 1498	
C17	Moellers et al. (2017)	“Develop a multi-step evaluation method to effectively support decision making in the context of complex dynamics in the course of BMI applying system dynamics. The method includes the specification of a simulation model that represents the BM and relevant cause-effect relationships, the simulation of scenarios and the selection of three to five viable alternatives as well as their preparation in a decision template. The latter comprises all required information for decision making, particularly the main causal loops explaining the BM mechanisms including the model entities with decisive influence on system behaviour, key business metrics, the viable scenarios and underlying hypothesis.”	p. 1498	

C18	Mateu and March-Chorda (2016a)	“Propose a dedicated scale for ex ante BM assessment consisting of eight indicators and considering a wider range of factors than traditional intuitive assessment methods. The proposed scale is compared to a traditional intuitive assessment method in the course of several experiments where the authors provide a set of BMs. They are assessed through the newly developed and a traditional approach by different test persons using multiple linear regression analysis. The proposed scale shows to be more sufficient for the assessment of BMs as the intuitive assessment underrates important factors in comparison to the new scale.”	p. 1499	
C19	Anke (2020)	Proposes a method called "factor refinement" to contribute to the development of business model development tools (software based approach). "Factor refinement" is the extension of the information of each item. An item is a post-it in an area of SBMC (=BMC in 3 levels: Customer, Company, Partner). It is considered that non-quantitative effects must influence the evaluation (not only costs, turnover,...). Using a meta-model, the factors are linked to IEM (impact-effort-matrix) and CBA (cost-benefit-analysis).		X
C20	Bivona and Cosenz (2021)	Propose an assessment framework for multisided platform business models. Their approach is based on the dynamic performance management approach, which makes the net of relationships between external and internal strategic resources, value creation and capture drivers, and the influences of these drivers on the performance. They test their approach by using a successful case (AirBnB) and a failure case (Take Eat Easy).		X

C21	Bouwman et al. (2018)	<p>BM Stress Testing is a method to evaluate BM against regulatory or technological uncertainties and market scenarios which enables the change of the BM to a more robust one. It enhances the responsiveness and agility of the BM to the market situation. Stress Testing is especially helpful if uncertainties regarding government behavior, competitors, or technologies affect a Business Model. BM Stress Testing aims to make explicit in which scenarios the BM components might be at stake. As a result, the 'fit' of a BM with a set of future market conditions, regulatory regimes, and/or technological landscapes can be more precisely determined. The paper provides a 6-step-plan for stress testing a BM:</p> <ol style="list-style-type: none"> 1. Describing BM 2. Selecting Uncertainties 3. Mapping BM to uncertainties 4. Heat Signature 5. Analysis 6. Pattern Analysis <p>The Heat Signature takes the form of a matrix with the BM elements positioned vertically and uncertainties and outcomes placed horizontally.</p> <p>By providing insights into the weaknesses of a BM, it makes the vulnerability of BM visible.</p>		X
C22	Cardeal et al. (2020)	<p>Provide a method to develop and evaluate a sustainable business model. After mapping the BM alternatives by creating a (sustainable) BMC, a preliminary evaluation of BM alternatives is carried out. This is done by VRIO method or by comparing the alternatives to a baseline using ++/+/0/-/-. The second step is the detailed evaluation of the remaining alternatives. Therefore, a LCC is proposed for the economic dimension, Life Cycle Assessment for the environmental dimension and social life cycle assessment for the social dimension. For LCC, the net present value method is suggested.</p>		X

C23	Gilsing et al. (2020)	Provide a method to evaluate business models by linguistic summaries. They state that with the help of linguistic summaries, a "soft key performance indicator" (SKPI) can be derived. These SKPIs are expressed in soft quantitative terms, which makes them suitable to support early business model evaluation when "hard" quantitative data on the business model is not yet available. Linguistic summaries are statements with a specific format used to describe data in brief natural language constructs that can be automatically generated.		X
C24	Havrylenko et al. (2020)	Propose a method to evaluate a business model's financial efficiency in an industrial enterprise. To do so, a system of indicators for the assessment of the financial condition of a company was established. This system contains indicators for the financial stability, business activity and profitability, and liquidity and solvency. The major components to measure the financial performance are then weighted by a mathematical approach. Then, a measure for the financial performance is developed using the fuzzy set method and the taxonomic analysis.		X
C25	Im et al. (2020)	Propose a framework for business model evaluation and deployment by applying the analytical network process, a decision-making method, and portfolio matrix strategy. The design considers both external and internal perspectives. The external perspective is measured through customer survey, the internal by analytical network process through employees. The resulting values are then used to construct a business model portfolio matrix for the continuous management of business models.		X

C26	Klimanov and Tretyak (2019)	Propose a method for business model analysis by providing a literature review on the business model theory and describing a 3 level process divided into eight steps. This network-based approach is formulated based on a conceptual model and is used to determine the directions for BM improvement. The approach is targeted to increase the customer value and revenues of BM participants.		X
C27	Latora et al. (2018)	<p>Present a Business Model Decision Support Tool (BM-DST) based on the Analytic Hierarchy Process (AHP) and on a modified AHP procedure called Value-Analytic Hierarchy Process (V-AHP). The proposed method can be used to decide between business model alternatives. The authors suggest an eight-step process:</p> <ol style="list-style-type: none"> 1. BM framework selection; 2. BM framework criteria identification; 3. AHP rating of BM framework criteria; 4. BM alternatives identification; 5. Quantitative/qualitative criteria discerning; 6. Rating "lean" of BM alternatives under quantitative criteria, 7. AHP rating of BM alternatives under qualitative criteria; 8. V-AHP rating of BM alternatives; <p>The basis of the tool is a framework, the BMC, for example. It consists of nine parts. All of the nine parts of each alternative are then compared to each (7 point scale). The "weight" of the nine parts of the canvas is also assessed by direct comparison."</p>		X

C28	Linde et al. (2021)	<p>The proposed study uses interviews with 14 leading industrial companies (senior managers and executives) who explored digital technologies to offer new innovative services for b2b markets to find the key challenges and traps of digitalization. They are to them:</p> <ol style="list-style-type: none"> 1. Pushing out a digital BM without understanding customer value 2. Promising additional gains without understanding the value delivery process 3. Getting sold on the digital opportunity without understanding the profit formula. <p>Based on the traps and common mistakes, the authors suggest a three-phase assessment method:</p> <p>Phase A: Assessing digital opportunity value</p> <p>Phase B: Managing digital opportunity risks</p> <p>Phase C: Modelling digital opportunity financials.</p> <p>These phases are divided into two steps each and provide questions to consider in the steps. An overview is provided on p.9 of the paper.</p>		X
C29	Ruiz-Ramirez et al. (2019)	Propose a method to assess the categories of the business model canvas by Osterwalder through a failure mode and effect analysis.		X
C30	Shima et al. (2018)	Propose a method for hypothesis verification by converting wants chain analysis (WCA) to a system dynamics model. WCA is an extension of the customer value chain analysis, which is a method for visualizing relationships among stakeholders to analyze existing social systems and design new ones. The wants chain analyses are then converted in a causal loop diagram. The causal loop diagram is then converted into a stock and flow diagram. At this point, a causality analysis is carried out.		X

C31	Zenezini et al. (2019)	Propose a method for city logistics (CL) business model assessment. The methodology follows a 3-step principle: First, the CL systems are interpreted as business ecosystems, characterized by the interplay between stakeholders' activities, decisions, and objectives. Then the CL solution is implemented through a business model configuration. The BM determines the collaboration links between the stakeholders and which stakeholder takes certain decisions and invests in resources. The next step is the assessment of the BM. For the validation of the BM, a Cost-Benefit analysis is suggested.		X
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The first result presented with Table 7 is in the form of an author-centered approach, as Webster and Watson (2002, p. 16) name it. The proposed summary of the articles was considered necessary because, when choosing a method in a practical case, more information seems to be important than is offered by only structuring.

However, since Webster and Watson (2002, p. 16) criticize this approach and strongly advise a concept-centered one, this was also developed. As mentioned above, the three objectives of BM Evaluation according to D'Souza et al. (2015, p. 4) and the ten types of methods according to Schoormann et al. (2018, p. 65) were used for this purpose. The classification of the methods by these approaches builds the second result. This result is presented in the form of figures.

As a first step, the methods presented in the literature were classified according to the ten types of methods by Schoormann et al. (2018). The result is shown in Figure 16. Multiple assignments occur because many articles combine different kinds of methods. For example, Abdelkafi and Täuscher (2014) combine financial and economic variables with mathematical approaches and simulation methods. The "M" combined with the numbers in the second column represents the ten methods of evaluating business models, as shown in 2.3.3 Table 2. Subsequently, the "C" combined with the numbers in the structure represents a scientific contribution, as they are also numbered in Table 7. For example: "M2" are "Economic-/ Financial-oriented Evaluation and Metrics" and can be found in "C1", which is the contribution of Ruseva and Rusokv (2015). As shown in Figure 16, no method could be categorized as type 1.

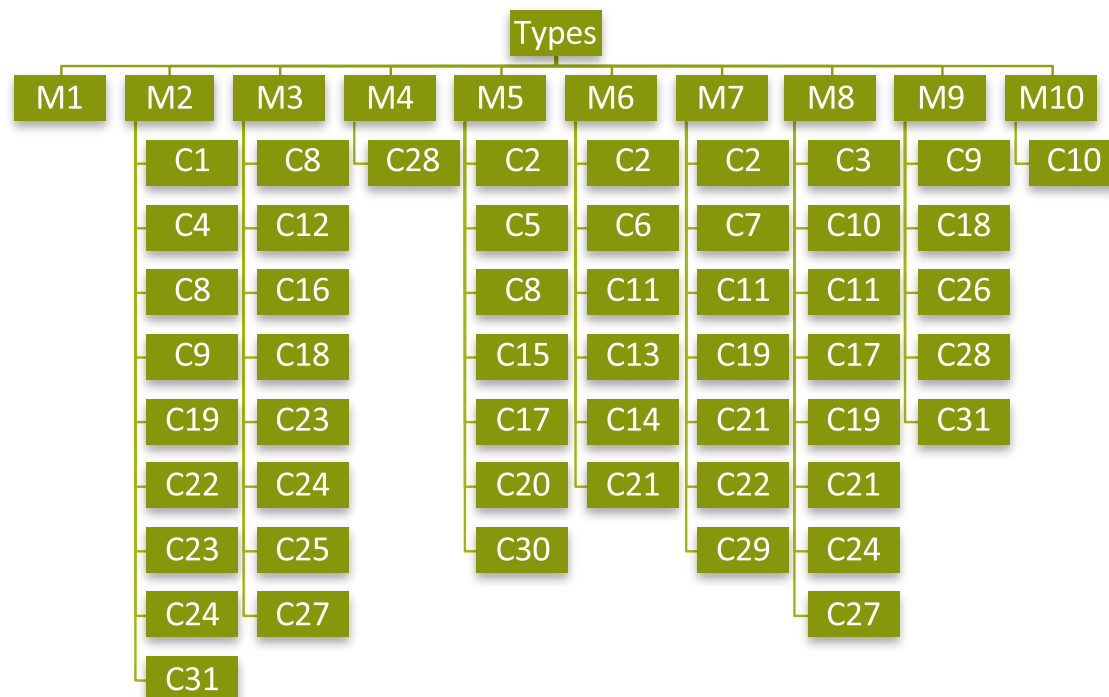


Figure 16: Result SLR 10 Types of Methods

In the next step, the methods presented in the literature were classified according to the three goals of BM evaluation by D'Souza et al. (2015). Figure 17 shows the results of this classification. In this case, too, multiple assignments could occur, albeit rarely. For example, Bouwman et al. (2012) presented a method that evaluates the alternatives and provides decision support in the second step. The letters in the second line stand for "V=Valuation", "D=Decision", "B=Benchmarking", as the goals were described in 2.3.2. The next order again represents a scientific contribution of Table 7 by "C" combined with the numbers.

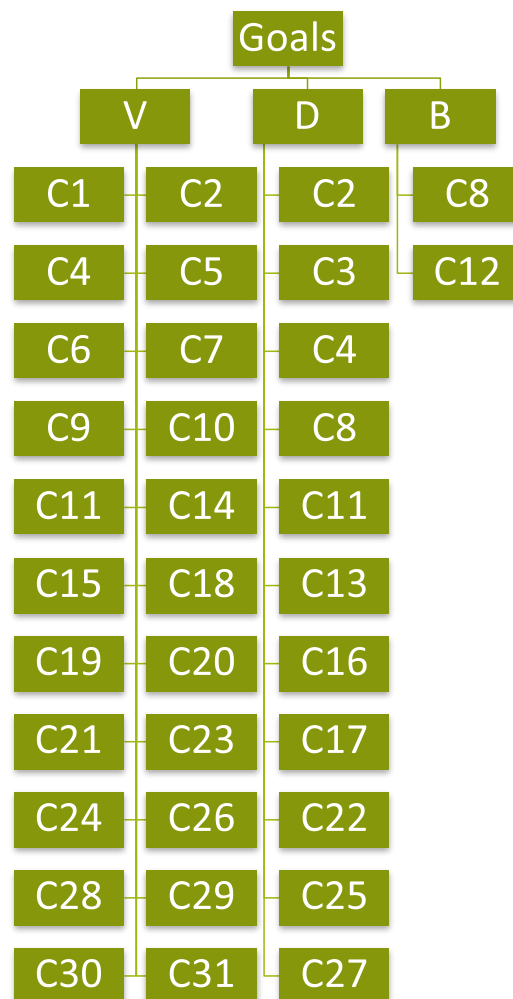


Figure 17: Result SLR 3 Goals of Evaluation

In the final step, these two figures were merged. For this purpose, the scientific contributions were first classified according to the three objectives and then indicated which of the ten types of methods they included. "B, D, and V" in the second line thus again stand for the objectives of the evaluation. Then the "C" combined with the numbers assign the scientific contributions, and in the next level of the structure, the included method types are indicated "M" plus numbers. This overview of the concept-centric approach is presented in Figure 18. The representation combines the advantages of the previous two and is particularly suitable for selecting methods. In the first step, a goal can be set, and the methods' focus can be searched for in the second step.

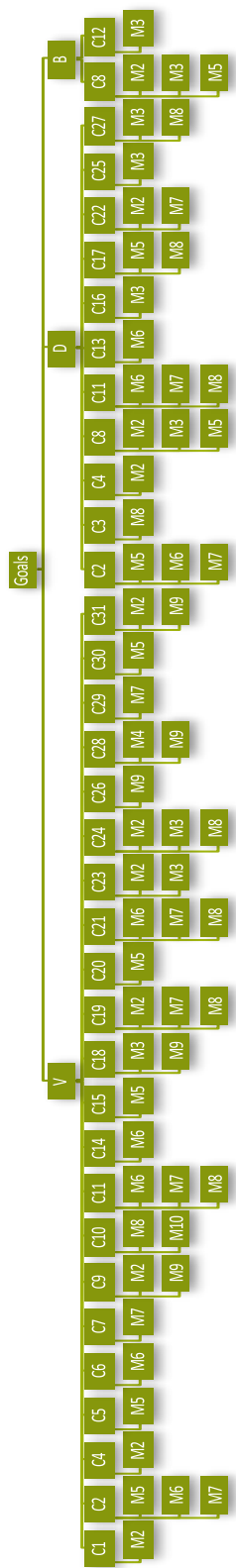


Figure 18: Result of the SLR: Overview of Classification

The numbers of literature found by types of evaluation methods used are presented in Figure 19. Type 2 methods, i.e., financially and economically oriented evaluation, occur most often. This circumstance also reflects the fact from the interviews, namely that these variables are most relevant.

The occasional use of questionnaire-oriented methods (Type 4), and value proposition-oriented methods (Type 10), cannot be justified based on the available data.

No method was assigned to benchmarking (type 1). This is part of the discussion in chapter 3.3.4

The other types of methods are mentioned several times. Because the literature allocation to the types has been consistently feasible, it can be concluded that the choice of the types as an approach to structuring has proven.

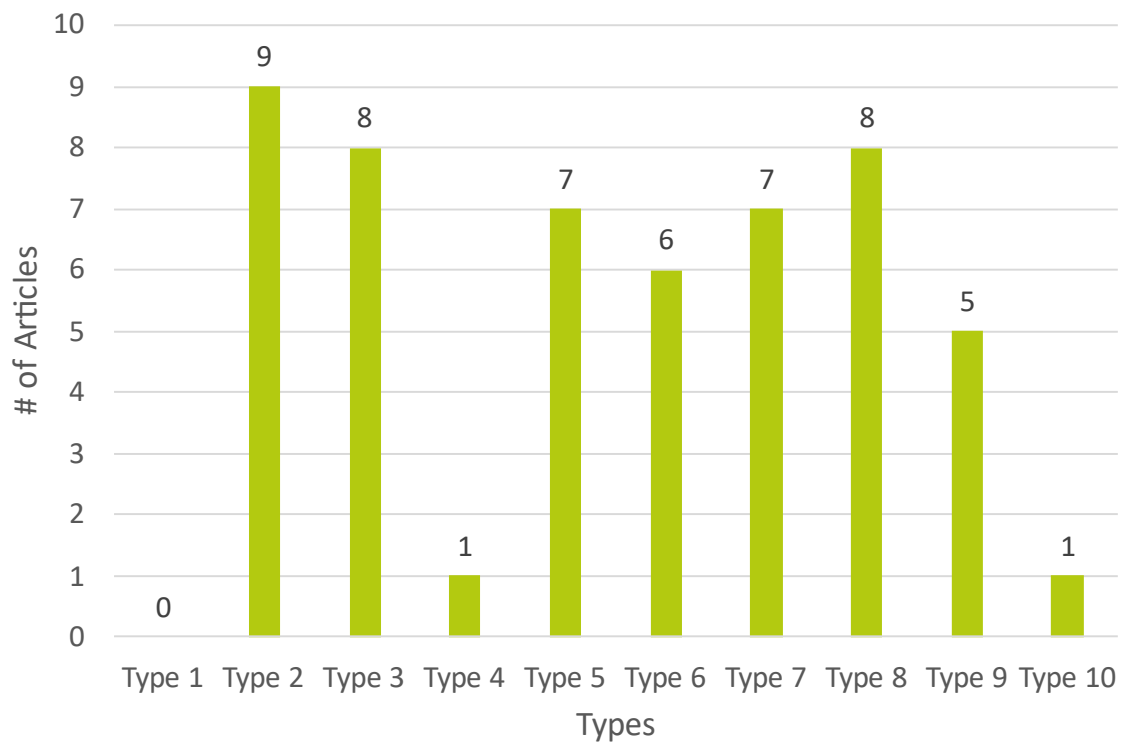


Figure 19: Numbers of Mentions in Articles based on 10 Types presented in Table 2

The current status of publications on the respective evaluation goals can be derived from the data analysis. Accordingly, the focus of scientific contributions to the evaluation of business models is clearly on evaluation. Twenty-one scientific contributions deal with this, while nine contribute to deciding between alternatives and methods for this purpose. Benchmarking as a goal of the assessment was carried out only in two contributions. It can be deduced from this that the state of research on benchmarking as a goal is still relatively undeveloped. The number of contributions is shown graphically in Figure 20.

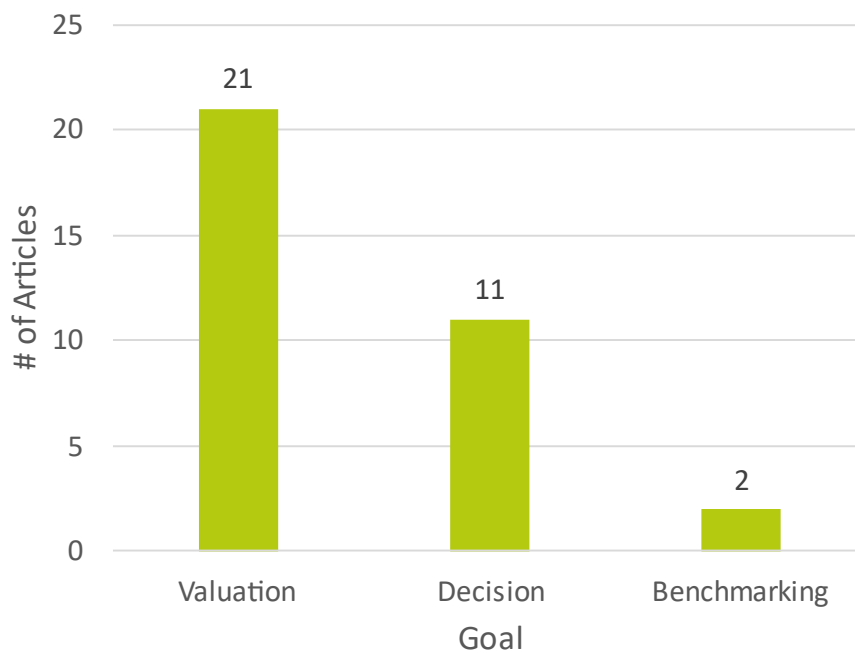


Figure 20: Numbers of Mentions in Articles based on Goals

3.3.4 Discussion of the Systematic Literature Review's Update

The Systematic Literature Review provides a good overview of which methods are available according to the current state of the scientific literature with the two approaches of the results, namely the authors and the concept-oriented approach. Of course, it cannot be excluded that relevant contributions were not found.

Two conclusions can be drawn based on the fact that Steinhöfel et al. (2018) obtained 21 results in their review and the Update obtained 13. Since Steinhöfel et al. (2018) considered the entire period before January 2018 and the update only the last three years, it can be seen that scientific contributions in this field are increasing. While Steinhöfel et al. (2018) found 3139 contributions on Scopus in the entire period under study, the update with search restricted to titles already found 640 in three years. Therefore, a larger number of results must also be expected, which turned out disproportionately high with 13 in the update to 21. One reason for this could be that a better scientific basis has been developed through previous scientific contributions, and thus more relevant literature has been written.

When assigning the literature to the concepts, a weakness of the classification, according to Schoormann et al. (2018), became apparent in retrospect, as shown in this thesis. Benchmarking methods are composed of other types of evaluation according to these results. Thus, they are not a separate type but include them. The weakness is that benchmark and comparative methods (Type 1) cannot be clearly distinguished from decision structuring methods (Type 8). Both use comparisons and the ranking of alternatives. For example, the form of representation alone, the matrix representation or row-by-row evaluation, is not consistent enough as a distinguishing criterion.

The fact that no literature uses methods of type 1, as shown in Figure 16, is due to the circumstances mentioned above that the classification in this regard does not appear to be meaningful. Benchmarking was thus retained as a goal.

The presentation of the results in tables and figures now includes the information which the Rigor Cycle must bring to the Design Science Research approach. The current state of science is thus presented, and different evaluation methods with contained goals and types are prepared in a clear and structured way. With this knowledge and the requirements from the interviews, the next step is to proceed: The development of an artifact.

3.4 Design Cycle: Artifacts

The Design Science Research approach's planned process is recalled for further procedure and the elaboration of the artifacts. For this purpose, the illustration of chapter 3 is shown again in Figure 21.

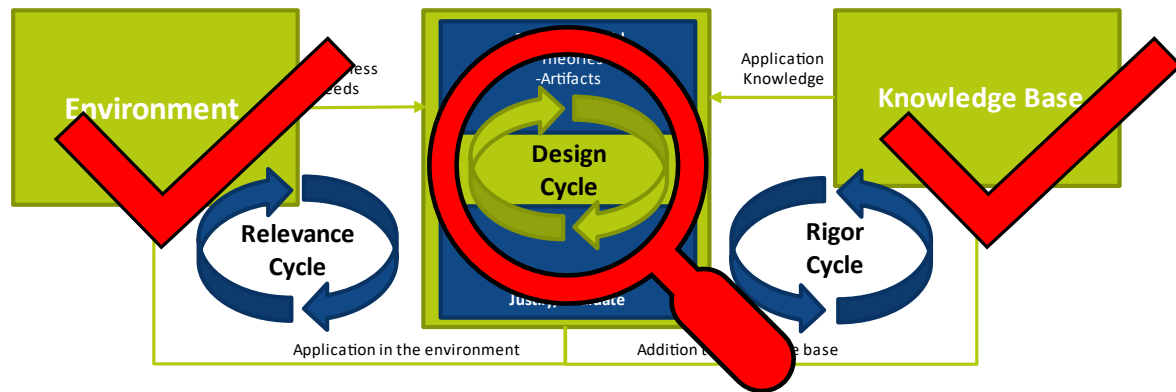


Figure 21: Elaborated Points in the DSR Approach and Focus of the Further Procedure (Adapted from: Hevner 2007, p. 88)

As Figure 21 shows, the last step of the design science research approach is the design cycle. The design cycle's purpose is the elaboration of an artifact (Hevner 2007, p. 88).

In this case, the artifact is the framework for business model assessment focusing on quantitative evaluations. Ultimately, the elaborated artifact should be evaluated and further improved in the design cycle.

3.4.1 Conduction of the Design Cycle

The following approach was chosen to develop the artifacts in the Design Cycle: In a first step, the requirements placed on the artifact by the Relevance Cycle were compared with the results from the Rigor Cycle. In this way, the methods are selected from the Systematic Literature Review that best meet the requirements from the interviews. Subsequently, the chosen method is described in more detail. Later, the framework is subjected to an evaluation.

The conduction of a case study was selected as the design evaluation method, which Hevner et al. (2004, p. 86) cite as an observational method. Through qualitative evaluation with the help of the experience and documentation from the case study, the framework was adapted to the practice's needs at AVL. The iterative improvement through lessons learned from a real-life project at AVL ensures the quality of the framework.

3.4.2 Elaboration of the Framework's First Draft

The initial framework formation was created by comparing the requirements from the interviews with the methods from the Systematic Literature Review. This comparison was executed in a three-step process: First, only methods including financial and economic aspects were taken into account. This process was necessary because financial and economic metrics were designated as essential for further decision-making. In practice, the further development, budgeting, and implementation of a business model are decided based on these metrics. This requirement was realized by further considering only those that contain type two methods. Therefore, as shown in Figure 16, the following sources were considered: 1, 4, 8, 9, 19, 22, 23, 24, 31. Again, the numbers refer to the line number, as found in Table 7, chapter 3.3.3, indicating a literature source.

Secondly, since market considerations are included in the economic measures, a further restriction must be made. For this reason, only 4, 8, and 19 were further considered because they also include a market view.

Finally, the requirement for practicability was included. Because number 8 is based on causal loop diagrams and simulation, it did not seem easily applicable and was therefore excluded. The software-based approach of 19 also has substantial limitations in applicability due to the need for a new software tool and was not further considered.

The remaining requirements could not be evaluated immediately due to the short description of the method. Therefore, these will be considered in discussing the first draft and ascertained whether they are fulfilled.

The leftover approach assists in deciding between alternatives and enables the valuation of a single model.

3.4.3 Interim Result: First Draft of the Framework

In the following, the method is described in more detail. Subsequently, the result is presented by roughly integrating the method in the BMI process introduced in the current state in 1.1.

Vom Brocke and Buddendick (2007), which were mentioned as “4” up to now, provide a systematic approach for evaluating the monetary side of a business model. Therefore, they start with a “market model”. The market model is created by applying different qualitative methods. These methods help to find the right product or service in the right market. From this point on, the quantitative evaluation takes place. As a first step, they suggest forecasting revenues, customer numbers, and market prices based on the market model. This way, the cash inflows are calculated. (vom Brocke and Buddendick 2007, p. 1079)

Next, the activity model is assessed, which forms the cash outflows. Their approach is to use event-driven process chains and to differentiate between usage and consumption factors. (vom Brocke and Buddendick 2007, p. 1079)

As vom Brocke and Buddendick (2007, p. 1079) describe, the activity model shows similarities to the value chain, as described in chapter 2.1.3. In both cases, the focus is on mapping the entire process for generating value. (Porter 1998, pp. 36–39; vom Brocke and Buddendick 2007, p. 1079)

Finally, vom Brocke and Buddendick (2007, p. 1080) combine the cash in- and outflows in a “Visualisation for Financial Implication” (VOFI). This relationship is shown in Figure 22. The VOFI creates a cash flow statement over multiple periods and considers alternative conditions for reinvestments, taxes, and financing. At this point in the method, the return on investment is calculated. Calculating net present value, break-even point, and the amortization period is also possible by planning cash flows with a time perspective. (vom Brocke and Buddendick 2007, p. 1080)

The VOFI method also allows considering the uncertainty regarding financial assumptions. As a further step, a simulation within the spreadsheet is presented. This method can provide comprehensive analysis without additional software, e.g., Excel, through scenario analysis and distribution curves. More details on the method VOFI can be found in the publication of Schulte (1986). According to vom Brocke and Buddendick (2007, p. 1080), a well-founded picture of a business model’s profitability can be generated by following this method. If one carries out the steps with several targeted models, this method also serves as decision support. Based on the return on investment, several business models and different scenarios can be compared. (vom Brocke and Buddendick 2007, p. 1080)

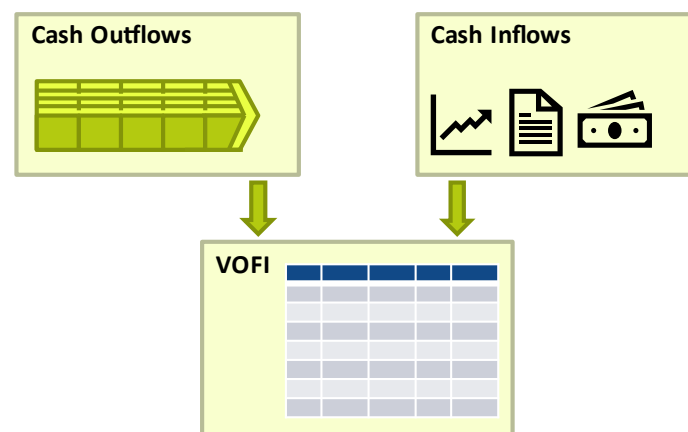


Figure 22: Relationship between Cash Inflows & Outflows and the VOFI based on Vom Brocke and Buddendick (2007) and Schulte (1986)

The quantitative approach of vom Brocke and Buddendick (2007) requires some preliminary work. The "market model", which results from several qualitative methods such as PESTEL and five forces, can also be found in the BMI process. A particular business model must already be established to determine the number of customers, costs, revenues, or cash in- and outflows. This procedure presupposes the approximate knowledge of who the customers are, what is sold, and how. Therefore, an application only makes sense at a stage where financial aspects are already taken into account. In addition to the necessary detailed knowledge, the expense of this method is also a reason for integrating it somewhat later in the process. For this reason, the recommended implementation point is after the “Value Creation Architecture” phase. (vom Brocke and Buddendick 2007, p. 1079)

This method combines the following requirements from the Rigor Cycle: The focus on financial/economic aspects was fulfilled by selecting in the first step. The effort of the method is low because no additional software needs to be learned and obtained. The calculation is possible in Excel and can be further simplified by a template. The distinction between BM Reconfiguration and Design is made because this method also includes simulation and scenario analysis. Through this possibility, a well-founded basis for decision-making can be developed even for design projects fraught with uncertainty. The comparison of different scenarios enables the attenuation of uncertainty.

Furthermore, this method contributes to an increase in transparency. Through a standardized method and recording in a spreadsheet, assumptions can also be checked retrospectively, and decisions can be supported with facts. However, the quality of the documentation is crucial.

The use of a spreadsheet also takes into account that BMI projects are different. The model can be adapted to individual needs. The ability to make decisions based on financial aspects further enables intuitive decision-making. The doubt of assumptions, costs, and revenues can be documented, thus maintaining decision transparency.

Despite the criteria being met, the method seems somewhat one-dimensional. Calculating based on monetary values only runs the risk of neglecting other important aspects. Therefore, a step back was taken, and the literature was searched for an approach extending the presented one.

By making this iteration loop, the approach of Im and Cho (2013) was regarded. They presented a method for deciding between alternatives. A table with three criteria divided into twelve sub-criteria is used. The pairwise comparison and the scale rating form the basis for the Analytical Network Process to define a weighting of each sub-criteria. The alternatives are then evaluated on a one to seven scale and compared in a two-dimensional matrix with the feasibility and attractiveness as axes. The use of the whole approach in practice is limited by the high effort of pairwise comparisons and scale evaluations. However, for decision making in a problem with multiple criteria and alternatives, this method provides an analytical approach. (Im and Cho 2013, pp. 509–514)

Apart from application to decision-making, the table of criteria is interesting. The criteria take the Market Perspective (MP), the Implementation Perspective (IP), and the Operational Perspective (OP) into account. The full list is presented in Table 8.

Table 8: Description and List of Criteria and Sub-Criterion (Im and Cho 2013, p. 514)

Criteria	Sub-Criterion	Definition
MP	Market Size (MKS)	The size of the relevant market
	Profitability (PRO)	The expected profits
	Potential Growth (POG)	The expected level of market growth
	Competition (CPT)	The expected level of competition
	Competitive Advantage (COA)	The level of retaining competitive advantage
IP	Time to Market (TTM)	The expected implementation time
	Implementation Cost (IMC)	The expected cost of implementation
	Resource Availability (REA)	The degree to which the required resources are available
	Technology Availability (TEA)	The degree to which the required technologies are available
OP	Relevant Experience (EXP)	The degree of experience in operating relevant business models
	Operational Cost (OPC)	The expected operation cost
	Facility Availability (FCA)	The degree to which the required facilities are available

Originally, criteria are meant to be weighted and scored from one to seven. This application is adapted to practical needs by the following changes: The market size, implementation cost, and operational cost are assessed monetary. Various KPIs can assess profitability. Their usability will be discussed in the case study. The potential market growth is evaluated in percent, considering the respective period. The time to market is presented in a time range. A scale rating from one to five evaluates the rest of the criteria. This approach was chosen as these criteria require experience and market knowledge to be evaluated. The evaluation types are summarized in Table 9.

Table 9: Criteria and Evaluation Type (Adapted from: Im and Cho 2013, p. 514)

Criteria	Sub-Criterion	Evaluation Type
MP	Market Size (MKS)	€
	Profitability (PRO)	ROI / NPV/ Break Even/ Amortization Period/ Discounted Cash Flow/ Life Cycle Costing
	Potential Growth (POG)	%
	Competition (CPT)	1-5 where one means much competition
	Competitive Advantage (COA)	1-5 where one means no advantage
IP	Time to Market (TTM)	Duration in Months/ Years
	Implementation Cost (IMC)	€
	Resource Availability (REA)	1-5 where one means not available
	Technology Availability (TEA)	1-5 where one means not available
OP	Relevant Experience (EXP)	1-5 where one means no experience
	Operational Cost (OPC)	€
	Facility Availability (FCA)	1-5 where one means not available

The advantage of this table is, that it shares much work with the conduction of the analysis phase and the completion of the Business Model Canvas. This way, no completely new methods need to be introduced, there is no need for many additional work steps, and the elaboration is possible step by step in the process. Phases two to six of the BMI process, i.e., ideation, problem-solution fit, product-market fit, willingness to pay& financial implication, and value creation architecture are chosen as implementation points in the BMI process at AVL. Within these phases, the evaluation of the sub-criteria is applicable.

3.4.4 Discussion of the First Draft

The two methods presented seem to complement each other well in theory. While Table 9 provides an overview of what needs to be calculated and considered and gives structure to early phases, the VOFI method evaluates financial implications in detail later in the process and provides the basis for monitoring and control. Both contribute to decision transparency and seem to be practically applicable. The draft also has some weaknesses: There is no explicit financial perspective in the table, although this was an explicitly important perspective. Furthermore, the term “facility availability” in the table is not precise enough, and the market perspective does not consider the market share. All the measures could also be helpful in the analysis phase to evaluate the current business model, if available. Therefore, it has to be considered that also the current values are surveyed.

The presented version will be evaluated in the next step. As mentioned, an observational evaluation technique was chosen for this purpose, namely the case study. Participating in a BMI project, it was observed step by step when and which methods are applicable and what information is available. In the next section, the case study’s setting is described, the learnings are summarized, and improvements to the framework are suggested.

3.4.5 Basis for Adapting the Framework: Case Study

For confidentiality agreement reasons, the case study that has been run may only be mentioned on a conceptual basis. Names, figures, and results are subject to internal confidentiality. However, this does not prevent the lessons learned from the case study from being used to improve the framework.

3.4.5.1 Description of the Case Study

The case study was run as part of a business model innovation project in a team at AVL List GmbH. The project’s goal was to develop a digital business model for a previously only internally used database. For this reason, short and long-term business models had to be developed, and the customer’s willingness to pay had to be identified. Several approaches were followed, such as selling the database empty as a software solution or offering evaluation charts. In the course of the project, boundary conditions, such as legal aspects as well as the harmony between the organization’s existing BM and the designed BM, had to be considered. This led to iterative adaptations and improvements along the way.

Because the project’s goal was to elaborate entirely new BM alternatives, this project is to be classified as Business Model Design, as described in chapter 2.2.2. In general, there was a strong focus on the analysis phase in the course of the case study because the targeted business concerned new services, and the industry structure analysis was an essential factor. The strengths and weaknesses of the solution were identified. Subsequently, the market was examined, competitors evaluated, and potential customers discussed. The entire process was followed through to the Willingness to Pay & Financial Implications phase, constantly reflecting on when and where something could be quantified.

Due to the Covid-19 pandemic prevalent at the time, all appointments were held online. Meetings were minuted and ideas were recorded. Also, rejected ideas were recorded.

The following section discusses the lessons learned as the results of the case study. Subsequently, necessary adaptations of the framework are addressed.

3.4.5.2 Results of the Case Study

The approach chosen to collect the lessons learned was to reflect on the entire project twice in a discussion and record relevant points of view. The debate took place once after the analysis phase and once at the end of the project. The viewpoints elicited in the process, i.e., the lessons learned were listed unordered through brainstorming. These were then examined for commonalities and summarized.

In the course of working on the project, a high amount of time was spent in the area of customers and value proposition. The question, what customers buy today and how they consume it was recurring to identify pains. The value proposition canvas, which was already described in 2.1.3, was used to provide structure. The value proposition was ultimately evaluated by establishing and evaluating assumptions. The question arose as to whether a quantitative measurement of the value proposition was conceivable. The added value for the customer would have to be quantified, and his willingness to pay estimated on this basis.

Based on the systematic literature review, no method could be identified to quantify the value for the customer. In the course of the interviews, customer feedback was mentioned as the common practice to evaluate the value proposition. The feedbacks can then be divided into negative and positive and be thus quantitatively assessed. However, there is the possibility that more friendly customers are unconsciously interviewed or that customers are more likely not to make negative judgments face to face, as it was mentioned.

A possible approach is the calculation of financial measures from the customer's point of view. However, this presupposes that the customer profits in time, quality, or costs from the product or service sold. In the B2B environment, this will cover many cases. Nevertheless, other advantages are also decisive from the customer's point of view: Comfort, luxury, and status symbols are just some of the potential gains. The Lean Start-Up approach (Blank 2013) is worth mentioning in this context. Through MVPs and early customer contact, it aims to test hypotheses on the value proposition quickly. For qualitative assessment, this approach is, according to Blank (2013), reliable.

Ultimately, the obvious question is whether the value proposition is qualitative per se and does not require any actual quantification. Once again, referring to Magretta's (2002, p. 5) approach, the evaluation of business models is divided into two parts: The narrative test and the numbers test. It is logical to regard the value proposition as part of the narrative test and thus as a story that must make sense. The numbers test is, after all, applicable to many economic aspects, as can be seen in Table 7.

Another aspect was the observation of uncertainty in the early phases of the process. Financial estimations were very difficult until the product-market fit was elaborated. This observation confirmed the assertions of scientific literature. A discussed aspect was if it is useful to start calculating with financial measures too early. This could be an idea-killer by hindering creativity and discarding good ideas. Furthermore, qualitative methods are essential to provide a structured procedure when quantifications are not yet applicable. In the analysis phase, techniques like the PESTEL, 5 Forces, and SWOT analysis were used to lay a solid foundation for developing the business models further.

Furthermore, the necessity to think in scenarios was discussed. It will probably not be possible to do an exact estimation on a quantitative basis. Therefore it seems advantageous to construct a best case, a worst case, and a probable scenario that forms the middle way. The VOFI model already considers this circumstance.

The different planning horizons of business models also change the approach to the process. Mid-term scenarios with a horizon of up to three years are easier to be estimated than long-term ones considering ten years or more.

Risk assessment was also a concurring task in the project from the beginning. The assessment of risks according to the probability and severity of occurrence showed which risks require urgent action. This assessment is also essential for future projects to set priorities in developing measures to minimize risks.

The importance of financial/ economic measures was also part of the discussion. The market volume and potential should always be addressed while creating new business models. These values should be evaluated early and re-evaluated when the model is in a more detailed version. Market considerations are also an essential part of monitoring and control and should be considered over the lifetime.

Also, a need for a set of KPIs to be monitored was detected. These KPIs include the market indicators and should be re-evaluated on an ongoing basis. This set allows weaknesses to be identified early and ideas that do not promise success to be discarded in good time. Defining a set of KPIs and points to consider also provides structure and prevents to miss important perspectives.

Unfortunately, the project's goal did not include elaborating the implementation and monitoring and control phase of the BMI process. The practical applicability of the VOFI model could not be observed for this reason.

3.4.6 Adaptions to the Framework

The first draft requires some adaptations to ensure practical applicability and consider the experience from the case studies in the framework. Especially the more detailed market view and financial perspective have to be integrated into the table, and the criterias' names must be easy to understand.

The sequence of the criteria should reflect the availability of information in the process. This way, the table supports the procedure and provides structure. Table 10 summarizes the necessary adaption to the framework.

Table 10: Adaptions to the Framework

Adaption	Description
Financial Perspective	A detailed financial view has to be integrated.
Market Perspective	The market perspective has to be more detailed.
Comprehensibility	The criteria's name must be easy to comprehend.
Sequence Adaption	The sequence of the criteria has to reflect the information availability in the BMI process at AVL.

The final version of the framework is presented as the overall result of the thesis in chapter 4.

4 Results: Final Version of the Framework

The result of the thesis is a framework for the quantitative evaluation of business models. The framework consists of a table with KPIs and points to rate with 1-5 and the VOFI method.

The table of the first draft was adopted by considering the points discussed in 3.4.6 and summarized in Table 10. The final version is presented in Table 11.

Table 11: Evaluation Criteria, Types, and Definitions

Crite- ria	Sub- Criterion	Evaluation Type	Definition
MP	Market Size	€	The current/expected market size.
	Market Share	%	The current/expected market share.
	Potential Growth	%	The expected market growth in the re- spected period.
	Competition	1-5 where one means much competition	The expected level of competition.
	Competitive Ad- vantage	1-5 where one means no advantage	The level of retaining competitive ad- vantage.
	Scalability	1-5 where one means not scalable	The level of expected scalability.
IP	Time to Market	Duration in Months/ Years	The expected implementation time.
	Resource Availa- bility	1-5 where one means not available	The level to which the required resources are available.
	Technology Avail- ability	1-5 where one means not available	The level to which the required technolo- gies are available.
OP	Relevant Experi- ence	1-5 where one means no experience	The level of experience in operating rele- vant business models.
	Infrastructure Availability	1-5 where one means not available	The level to which the required infrastruc- ture is available.
FP	Revenue	€	The expected revenues in the respected period.
	OPEX	€	The expected operational expenditures in the respected period.
	CAPEX	€	The expected capital expenditures in the respected period.
	Profitability	ROI /NPV/ Break Even Analysis /Payback Pe- riod/ Discounted Cash Flow	The expected profitability based on a key business measure.

The second part of the result is the assignment of the methods to the phases of the BMI process. Table 12 reflects the eight phases of the process at AVL, assigns the methods, and explains the purpose in the specific phase.

Table 12: Assignment of the Methods to the Process Phases at AVL

Phase	Method	Purpose
1. Analysis of the Initial Situation	Table	Analysis of current business model (re-configuration) or market only (design)
2. Ideation	Table	Step by step evaluation of business model alternatives, compare tables and decide on this basis.
3. Problem-Solution Fit		
4. Product-Market Fit		
5. Willingness to Pay & Financial Implications		
6. Value Creation Architecture	At the end of this phase: VOFI	Detailed financial planning of elaborated business model. Provides the basis for the decision to implement.
7. Implementation		
8. Monitor and Control	Table (MP+FP) & VOFI	Re-Evaluate as required

This type of presentation provides clarity as to when which method is applicable. The collection of KPIs and criteria has the advantage that no new method per se needs to be introduced since estimations of the market volume are established in the company, just like profitability figures. Though, the table provides structure and considers the most critical aspects.

5 Discussion of the Framework's Final Version

The discussion is structured to present the answer to the research question, organized by aspects. For this purpose, the research question is recapitulated, and the various aspects are finally discussed with references to the elaborated theory of chapter 2. The research question, as formulated in chapter 1.2, was:

How can a framework for quantitative business model evaluation during business model innovation be designed and integrated into a BMI process at an engineering and technology provider?

The aspects to discuss are the design and the integration of the framework.

Design of the Framework:

The combination of the methods in the framework fulfills the requirements formulated by the interviews and includes methods from the systematic literature review. The practical applicability is ensured by adopting the methods with the experience and lessons learned from a case study. By combining the different perspectives in the table with the VOFI method, the necessary evaluation of the business impact and the profit potential, described by Linde et al. (2021, p. 45) and mentioned in 1.1, are taken into account.

Table 7 supports early phases by providing essential criteria to consider. The financial and market perspective sub-criteria are suitable for analyzing the existing business model in business model reconfiguration. The market perspective alone is helpful by providing clues in the analysis phase in business model design. During the phases from ideation to value creation architecture, Table 7 supports by pointing out factors that need to be considered. Therefore, the framework supports BM design and reconfiguration, as Massa and Tucci (2014, p. 426) distinguish, mentioned in chapter 2.2.2.

The VOFI model, as a detailed financial analysis, considers important aspects before implementation. It urges a user to deal in detail with the financial realities and plannings for a period. The use of this method requires a detailed understanding of the activity model, which is similar to the value chain from Porter (1998, pp. 39–42), presented in chapter 2.1.3. Despite this, it has to be mentioned that it could not be used in the case study because the case study's goal was to elaborate the phases only until the Willingness to Pay & Financial Implications phase, as mentioned in chapter 3.4.5.1. Although, as it was stated in the interviews, detailed financial considerations will always be needed for decision-making on the implementation.

The occasional use of scale valuations takes practical application into account and stimulates discussion of not easily quantifiable aspects. The term "occasional" may seem misleading because seven out of fifteen sub-criteria are rated this way. Nevertheless, this type of evaluation was reduced to a minimum. Scale ratings have the advantage of being easily comparable and ratable without needing quantifiable information, which is the case for some aspects.

The design of the framework for evaluating business models also takes into account a circumstance repeatedly mentioned in the interviews: The methods should be simple and applicable in a generalized way. By focusing on the essentials, the criteria create starting points for more detailed considerations. The generic and condensed presentation of Table 11 makes it possible to evaluate and compare a business model according to its most important perspectives, namely financial, market, implementation, and operational, without much prior knowledge on the method. At the same time, the table's comprehensive criteria allow further questions to be raised, which can then be evaluated in

terms of relevance and answered in the respective BMI team. Thus, detailed aspects of individual projects do not come to the fore within the framework, resulting in a generic method. In the later stages of the BMI process, a detailed and comprehensive evaluation of the financial implications is performed using the VOFI method, preparing a sound basis for management decisions.

An essential feature of the framework in the final version is that no planning horizon is specified. Business models can be subject to long-term planning of ten years or more, but short terms of three years or less are also conceivable. Setting a period would only limit the applicability.

The key figure used to assess profitability was also not specified. This is because different departments and projects rely on different key figures. Therefore, it is up to the project team to decide which key figure is to be used for this purpose. The choice also depends on which decision-making basis the management needs for the respective project.

From a design perspective, the requirements from the interviews have been met, and the quantitative framework is ready for deployment. Aspects that could not be captured quantitatively, such as the scalability and the value proposition, must be subjected to a qualitative evaluation method.

Integration of the Framework:

The integration of the framework into AVL's existing BMI process is ensured by assigning the methods to the respective phases of the process, as presented in Table 12. The table considers the difference between BM design and reconfiguration and formulates the purpose of the application.

Uncertainty in early phases, described by Gilsing et al. (2020, p. 429) and mentioned in 2.3.3, can be addressed in a structured way with the help of these perspectives and the integration into the BMI process. At the same time, creativity and the spirit of innovation are hindered as little as possible. This is taken into account by spreading Table 11 over several phases and allowing new ideas to be evaluated and compared quickly. Mitigating uncertainty in early phases, which Massa and Tucci (2014, p. 426) described, mentioned in chapter 2.2.2, also takes the differentiation of BMI projects into account.

Implementing the VOFI method in late stages of the BMI process ensures that detailed planning takes place. In addition to detailed planning, this method also allows scenarios to be taken into account. Different sales trends, cost structures, or changed legal and political conditions, for example, changed interest or tax rates, can be considered.

The integration of the framework into AVL's existing BMI process enables the evaluation of a single business model and supports the decision between alternatives. These two evaluation goals were also described by D'Souza et al. (2015, p. 4) and mentioned in chapter 2.3.2. Benchmarking as an evaluation goal was discarded because there was no necessity detected in the interviews.

Regarding the integration of the framework into the existing BMI process, the requirements were also met. The assignment to phases considers the iterative nature of the process and does not prevent iteration loops.

The answer to the research question can be described as successful with the help of the separate reflection of the aspects of design and integration. The developed framework provides support, especially in those phases that are particularly affected by uncertainty, and offers structure at the beginning through essential considerations and in later phases through detailed planning.

6 Conclusion

Summary of the Results and Answer to the Research Question

In this Master Thesis, by applying the Design Science Research approach, a framework was developed that combines the current state of the science regarding BM evaluation with the requirements from practice. This provided a comprehensive insight into the requirements for evaluating business models in practice, which would not have been possible from a purely theoretical perspective.

To answer the research question, interim results in the interviews in chapter 3.2 and the systematic literature review in chapter 3.3 were also developed. Through the interviews, characteristics of a framework from the perspective of practice were collected and presented. Updating a systematic literature review provided an overview of the state of research concerning business models' evaluation.

In the course of the thesis, the research question was answered. A framework was built which considers scientific basis and practical requirements, providing decision transparency and detecting weaknesses early by using the table also in early phases.

Generalizability

The development of the framework was guided by the practical applicability in AVL List GmbH. Therefore, it cannot be assumed that the results can be generalized to other companies. The requirement of easy applicability can also be a limitation of the precision of the methods. Nevertheless, it can be assumed that parallels exist with other companies in the same and other industries, as topics as digitalization and decarbonization act as drivers of BMI in many sectors.

Limitations

Since the framework should cover business model design and reconfiguration, a limitation regarding precision in one of them is also conceivable.

Another limitation occurs because the performance of the framework could not be assessed so far. The business model from the case study has not yet been implemented, and weaknesses might only become apparent in the further course of development. However, by taking these criteria into account, a first step has been taken. Viewed retrospectively, the ex-post evaluation of a successful and an unsuccessful business model would have been a more suitable method for evaluating the framework.

A major weakness that must be mentioned is that value proposition and scalability are not analyzed quantitatively. No suitable quantitative methods could be found for this purpose based on the systematic literature review. For further refinement of the framework, these aspects need to be assessed using qualitative methods.

In retrospect, another way of developing the framework would have been possible: First, the focus could have been on success factors in the interviews and the systematic literature reviews. Subsequently, it would have been possible to consider how and whether these success factors could be measured. The case study could then again be used to test and further refine the framework. However, this is contrasted because this is a more hands-on approach and less guided by scientific theory. Therefore, this approach seems less suitable for a thesis but could also provide valuable results.

Outlook

At the end of this thesis, starting points for further research in the area of business model evaluation are provided.

Besides the already discussed aspects concerning business model evaluation in scientific literature, there are more aspects to consider: For example, if the new business model harms an existing one, in which life cycle phase is the specific market, if one is known in the industry he wants to get into or if there are any legal constraints. Further research should focus on a holistic approach and provide methods to evaluate the whole picture.

Furthermore, methods developed to date often seem to focus on mapping a case well but are difficult to apply in a generalized way. This is also where future research could come in.

Another point learned in the course of the exercise is that not everything in business modeling is quantifiable. The "Numbers Test," as Magretta (2002, p. 5) called it, is the logical side of quantitative evaluation. The "Narrative Test", on the other hand, obviously needs qualitative evaluation. This seems obvious since the conclusiveness of a "story" is challenging to capture in numbers. Nevertheless, parts of this story are of great relevance, such as the value proposition. Here, quantification could be desirable. Research should focus on these aspects and find methods to quantify them.

A completely different aspect has not been discussed yet, but it contributes immensely to the success and quality of a business model: The human factor. Ultimately, a business model can only be as good or as bad as the people's ideas who work on it. As Steve Jobs once stated: "It doesn't make sense to hire smart people and tell them what to do; we hire smart people to tell us what to do." His quote outlines the importance of a certain degree of freedom and can also be transferred to business model innovation. The backing of the management as well as trust are essential success factors for business model innovation. No matter how many quantitative methods are combined in one tool, a well-known saying of Grady Booch still applies: "A fool with a tool is still a fool!". Future research could focus on the human factor and describe which skills and characteristics are needed for successfully develop business models in business model innovation projects.

Contribution to Science and Practice

The thesis at hand provides valuable contributions to science and practice. The current state of science could be extended by providing a framework for BM evaluation during BM innovation based on scientific knowledge and practical considerations. Practical implications were shown, and the current state of science on BM evaluation methods was updated. Furthermore, a weakness in the classification of BM evaluation methods by Schoormann et al. (2018, p. 65) could be detected, as shown in chapter 3.3.4.

Furthermore, it was confirmed that quantitative evaluation could not assess all relevant aspects of a business model. Qualitative methods must also be taken into account. In this respect, the legal perspective is also imperative.

In summary, quantitative methods in the form of measurements and metrics are considered important and necessary, both by the literature and in practice. Decisions between business models and implementation decisions are made based on these metrics. A decision support method was not considered necessary at AVL, although those are often elaborated in the literature. A discrepancy between theory and practice can be seen here. In any case, the application of the developed framework will contribute to the successful development of future BMs.

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Appendix

Interview Guideline

INTRODUCTION

Current trends such as digitalization, connectivity and the growing amount of data open new opportunities for business model innovation.

In short, a business model describes how a company works and how it generates profits.

To secure a high standard in business model innovation across AVL, a guideline has been developed which is iteratively optimized now.

The following picture roughly describes the main phases of business model innovation:

Analyze	Innovate	Implement	Monitor & Control
<ul style="list-style-type: none"> – Analysis of the current business model and its business environment – Arguments/ motivation for change – Coordination with strategy 	<ul style="list-style-type: none"> – Iterative development of new business models or change of an existing one – Market analysis – Customer feedback – Elaboration of all parts of a business model e.g. value proposition, operating model, revenue model etc. – Prototyping 	<ul style="list-style-type: none"> – Implementation project for the new business model – Go-to-market – Contracting with partners – Regular consultation of relevant stakeholders 	<ul style="list-style-type: none"> – Long-term concept for regular review and health-check of the business model in its environment – Step-by-step improvement if needed

To secure informed decision-making during this process, quantitative methods are important to compare concepts and evaluate the business potential.

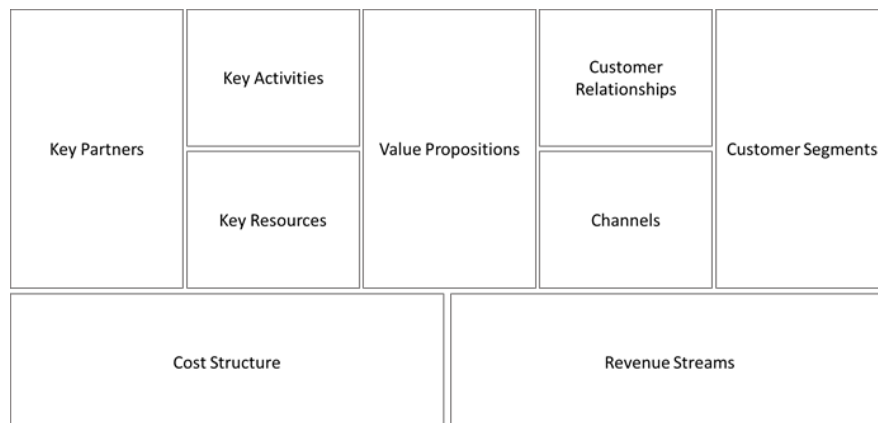
This interview series aims to analyze existing quantitative approaches for decision making in AVL and to collect requirements from relevant roles concerning the innovation process.

DEMOGRAPHIC DATA

- What is your current role and your main responsibility in AVL?
- How relevant is the topic of business model innovation in your current position?

BUSINESS MODEL INNOVATION

- Which roles should be involved in the process of business model innovation in AVL?
- When should your role be engaged in the innovation of new business models in AVL?
- Which parts of a business model are especially relevant for your area and role?



- Should your role be contacted for development or decisions about these parts?
- Which criteria are relevant to decide for or against a specific business model?
- Which quantitative methods could be used to evaluate a new business idea or concept?

- Which quantitative methods for evaluation and decision-making do you use in your job?
- Are there any quantitative methods which are used several times during the development of a new business? E.g. KPIs which are tracked along the process?

Do you know the following methods/ tools and have you worked with them?

No.	Method/Tool	Have you worked with it?	When? In which context?	Positive/negative experiences
1	Return on Investment			
2	Lifecycle Costing			
3	Market Share Calculation			
4	Scalability Analysis			
5	Scenario Analysis			
6	Questionnaire			
7	Balanced Scorecard			
8	SWOT-Analysis			

- Are there relevant issues from your perspective that we have not touched upon so far? If yes, which?

OUTLOOK

The results of this interview series will be processed as follows:

1. Analysis of mentioned established methods and best practices in AVL
2. Reflection on decision points and relevant stakeholders in the business model innovation process
3. Improvement of the business modeling guideline to secure reliable and efficient decision-making with quantitative methods

The anonymized summary of the results will be published in the master thesis “quantitative methods for business model innovation and valuation”.

CONTACT

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THANK YOU FOR YOUR TIME!