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How to monitor business model portfolios: A new framework for the automotive industry

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Title:
How to monitor business model portfolios: A new framework for the automotive industry

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Abstract:

Throughout the last decades, incumbents not only needed to innovate their business models, but even established a portfolio of many diverse business models. A higher number of simultaneously operated business models brings a new form of competition to the market and makes the monitoring of the portfolio more complex. Hence, managers are in need for a tool to overview their business model portfolios. This thesis reviews the strengths and weaknesses of existing approaches for monitoring portfolios from the business literature and develops a new framework that aims to give an overview about both, the current and the future perspective of corporate business model portfolios. I use the case of the automotive industry as it is undergoing fundamental changes due to environmental trends and shifting customer demands that forced incumbents to diversify their business model portfolios, especially in digital services. To show the practical fit and to validate the framework, I apply the framework to the business model portfolio of Volkswagen. The framework contributes to explore synergies between business models and helps to identify supply gaps and clusters along the corporate value chain. The results of the thesis are based on scientific knowledge from the literature, as well as conducted interviews with practitioners from the automotive industry.

Keywords: Business model portfolio monitoring, diversification

Título:
Como monitorar portfólios de modelos de negócios: uma nova estrutura para a indústria automóvel

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Resumo:

Durante as últimas décadas, empresas não só necessitaram apenas de inovar os seus modelos de negócio, como também criaram portfolios com variados modelos de negócio. A operação de um elevado número de negócios em simultâneo conduz a uma nova forma de competição ao mercado e faz com que a monotorização de portfolios seja mais complexa. Assim, gestores necessitam de uma nova ferramenta para estudar os portfolios dos seus modelos de negócio. Esta tese revê os pontos fortes e fracos dos métodos existentes de monitorização de portfolios. Usei o caso da indústria automóvel uma vez que este está a passar por mudanças fundamentais devido a uma maior preocupação ambiental e uma descida de procura por parte dos consumidores, razoes que levaram as empresas a diversificar os seus portfolios, particularmente nos serviços digitais. Como tal, para demostrar a relevância pratica e validar o Framework, eu aplico o Framework ao portefólio do modelo de negócio da Volkswagen. O Framework contribui para explorar sinergias entre modelos de negócio e ajuda a identificar falhas nos fornecedores e na rede de distribuição. Os resultados desta tese são baseados em conhecimentos científicos de literatura, assim como entrevistas a trabalhadores da indústria dos automóveis.

Palavras-chave: Monotorização de portfolio de modelo de negócio, diversificação

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BM	Business model
BMI	Business model innovation
OEM	Original equipment manufacturer
NPV	Net present value
VW	Volkswagen

1. Introduction

In the age of digitalization, the practical importance of business model innovation is rising and many researches are trying to find drivers for it. Incumbents and big corporations are approaching new ways for value creation and capturing (Yoo, Henfridsson, & Lyytinen, 2010). They are serving a number of customer segments and their shifting demands, to stay competitive. Therefore, they not only diversified, but also added business models (BM) to their corporate strategy. Incumbents with the core business in manufacturing physical products are more and more integrating digital services into their portfolio (Nambisan, Lyytinen, Majchrzak, & Song, 2017). They not only integrate them but combine their physical products with digital solutions (Yoo et al., 2010). This enhances the product functionality with software-based capabilities (Yoo et al., 2010). As companies turn their products into platforms they change the business strategy towards an ecosystem approach (Yoo et al., 2010), which most likely requires a corporation to operate multiple BMs. However, operating a portfolio of BMs brings new challenges. The more BMs are added to the portfolio, the higher the lack of transparency when managing them. As each BM has its own contribution and importance for the corporation, managers should be able to recognize which BMs are in place, how value is created for the customer, and how the composition of the portfolio will change in the future. As for the business world, there are not many frameworks to map and monitor a BM portfolio, yet. This thesis focuses on the change and diversification of corporate BM portfolios and establishes a framework that allows to monitor and analyze them according to their constellation. Thereby, the goal of the framework is not only to give an overview about the current and future composition of the portfolio, but also to identify blind spots and clusters within the portfolio, as well as synergies between different BMs.

To gain more knowledge in the research field, I use the first part to review the existing literature and elaborate on the relevance of corporate BM portfolios. Furthermore, I shed light on the associated benefits and challenges to manage and monitor a portfolio and evaluate existing approaches. The second part discusses the methodology that was used and introduces the environmental changes of the automotive industry, which serves as an illustrative case for applying the framework.

The third part entails an example to illustrate the practical fit of the framework. I analyze the BM Portfolio of Volkswagen as they face several challenges and needed to redesign the composition of their BM portfolio due to legislative, technological, environmental and demand-sided developments within the last decades. I will show how the tool can be used and which

benefits an OEM might have when using it. In the end, the user of the framework should be able to identify the current and future constellation of the portfolio and get deeper insights into the synergies and similar characteristics between single BMs.

2. Theoretical background

2.1. The relevance of corporate business model portfolios

The notion of a BM became relevant to academic literature only in the past two decades "with the advent of the internet in the mid-1990s" (Zott, Amit, & Massa, 2011). The consensus of most published articles is that a BM describes a company's operational logic on how to capture and create value to the customer and on the market. They reflect the organization's strategy in a way that they formally explain how all independent business activities are linked to each other, to create a sustainable and competitive advantage to the company (Globocnik, Faullant, & Parastuty, 2019; Teece, 2010; Zott et al., 2011). According to Teece (2010, p. 172), "a business model reflects management's hypothesis about what customers want, how they want it and what they will pay, and how an enterprise can organize to best meet customer needs and get paid well for doing so." Being a reflection of the customer's needs, BMs must be inimitable and give the organization a unique competitive advantage, to protect themselves from competition (Teece, 2010). A good BM design, a correct implementation and an intensive strategic analysis are necessary to achieve commercial viability on the market (Teece, 2010). Nevertheless, a company must be careful when it comes to sustain success on established markets. Due to technological development and new entrants with disruptive BMs, customer's needs and expectations can shift drastically over time. This brings companies to the need to innovate their BMs to sustain their competitiveness, because "business model innovation is key to firm performance" (Zott et al., 2011, p. 1033).

Business model innovation (BMI) has equally gained attention in management research and among practitioners over the last 15 years (Foss & Saebi, 2016). It is a form of organizational innovation that takes place on one or more dimensions of the BM, to implement a novel configuration of resources and activities (Geissdoerfer, Vladimirova, & Evans, 2018). The dimensions on which innovation takes place were mentioned by the authors as the product-market combination, the architecture of value creation and the revenue model. As disruptive technologies emerged on the markets, regulatory environments shifted and big data opened new opportunities and widespread throughout the last years, BMI became important for many companies (Broekhuizen, Bakker, & Postma, 2018). This multi-dimensional development

brings new entrants to the markets that challenge existing businesses with innovative products and BMs that offer novel value propositions. Companies are therewith forced to "transform their business models more rapidly, more frequently and more far-reachingly than in the past" (Doz & Kosonen, 2010, p. 370). In practice, BMI is hard to achieve, as the barriers for companies to innovate are high, including not only changes in organizational processes, but also a cultural change, i.e. the adoption of an experimental attitude (Chesbrough, 2010). Companies are pursuing many different strategies when engaging in BMI, such as changing the organizational boundaries, reducing costs, establishing new revenue models, accessing new markets, but also to improve financial performance (Foss & Saebi, 2016; Giesen, Berman, Bell, & Blitz, 2007). However, measuring financial performance is difficult, as there is no generic performance indicator for BMI, which may also be a reason why there is a lack in academic literature that sheds light on the effect of BMI on a firm's performance (Foss & Saebi, 2016). Nevertheless, firms with modified BMs experience a positive effect on venture performance over time (Cucculelli & Bettinelli, 2015). In a different study, Zott and Amit (2008) find that a good fit between the product market strategy and a business model design enhances firm performance.

In order to achieve a transformation of the overarching BM and the underlying strategy, corporations either innovate their original BM by experimenting with new configurations, or they add novel BMs and build a portfolio of multiple BMs. Corporations operate multiple BMs simultaneously to address several customer segments, each according to the respective needs of the target group, seeking to create advantages (Casadesus-Masanell & Tarziján, 2012; Markides & Charitou, 2004; Snihur & Tarzijan, 2018). Engaging in BM diversification means operating a portfolio of BMs that create and capture value in different ways, thereby using different monetization and value creation mechanisms. For example, Netflix offered the same product by operating two distinct BMs simultaneously, i.e. the DVD-by-Mail services and the online streaming service, both as subscription models. As the online streaming service became more successful due to a broader availability of high-speed internet, they were able to refocus their BMs within their portfolio, thus having a competitive advantage.

A BM portfolio is defined as "the range of different ways they (i.e., firms) deliver value to their customers to ensure both their medium term viability and future development" (Sabatier, Mangematin, & Rousselle, 2010, p. 431). The literature provides a set of positive effects that arise through operating a diversified BM portfolio. The first and foremost benefit is that firms can capture value and create value for customers by additional activities and services (Aversa & Haefliger, 2016; Broekhuizen et al., 2018; Casadesus-Masanell & Tarziján, 2012; Globocnik

et al., 2019; Sund, Bogers, Villarroel, & Foss, 2016; Zott et al., 2011). By serving different customer groups with distinct BMs, companies do not only diversify their revenue streams and profits, but also increase their competitiveness by expanding into new markets. Additionally, operating a BM portfolio allows for an optimized use of physical assets and the exploitation of interdependencies (Snihur & Tarzijan, 2018) and other key resources, making the company more competitive on the market, which can potentially crowd out competitors (Casadesus-Masanell & Tarziján, 2012). Globocnik et al. (2019) find that companies can "explore alternatives within the strategic constraints of the firm's current strengths and weaknesses" (p. 3) and that diversification finally influences and supports the business strategy, because multiple BMs may be necessary to execute the business strategy (Globocnik et al., 2019). They further describe a BM portfolio as their market's heterogeneity, adding that it can outperform competitors when it serves several customer segments with "segment-specific business models that consider the differences in need, price elasticity, or geographical location" (p. 6). Either, companies are intrinsically motivated to diversify their BM portfolio as a translation of a new corporate strategy (Globocnik et al., 2019), or they react to disruptive changes within their environment (Sund et al., 2016). Corporate strategy includes the strategic decisions of multi-BM organizations, which "particularly concern the choice of specific BMs to operate and the management of several BMs within the firm's BM portfolio" (Snihur & Tarzijan, 2018, p. 1). The authors follow the finding of Zott & Amit (2010) who describe a BM as an activity system that enables a firm to create value, in collaboration with partners. Activities are described as a set of processes, resources and capabilities that need to be deployed to enact the BM (Aversa & Haefliger, 2016). The idea of such activity systems is coupled with the strategic concept of Porter, who defines that a firm consists of a set of activities that make it competitive (Porter, 1987).

However, the trend of operating multiple BMs also brings another form of competition to the market, that is not only between products and services, but also between BMs (Markides & Charitou, 2004). Therefore, a BM portfolio has to be managed and monitored properly, because multiple BMs can both help the company to grow, but also have the potential to increase conflict between existing BMs, which potentially leads to cannibalization (Aversa & Haefliger, 2016). Aversa and Haefliger (2016) study the diversification of BM portfolios, defining it as "the activity of establishing, expanding, reducing, and eventually terminating business model portfolios" (p. 15) and add, that it is different from traditional corporate strategy diversification. They describe three ways of diversification strategies, i.e. horizontal, vertical and geographical. In addition, Ahuja & Novelli (2016) introduce a fourth dimension, namely the diversification

through different BMs. Aversa and Haefliger (2016) call it BM diversification, that gave Netflix the advantage by using two different monetization strategies (Aversa & Haefliger, 2016). Although Netflix has diversified within the other three dimensions in the meantime, it was the BM diversification that helped them to stay on the market in the first place, which is why this form is suggested to be considered as an independent form of diversification (Ahuja & Novelli, 2016).

2.2. The challenges of a corporate business model portfolio

New BMs bring challenges to the management of an organization, because they can require new value-chain activities that are incompatible to the one that are already in place (Markides, 2013; Porter, 1996). Not only internal stakeholders can get confused by adding BMs to the portfolio, but also existing customers have to adapt to a new environment (Markides, 2013). A good BM portfolio management requires to identify interdependencies between the BMs and other stakeholders, to explore synergies. This avoids capacity shortages and fertilizes knowledge spillover (Globocnik et al., 2019). In addition, it includes the monitoring of threats and opportunities to check both, the market validity of current BMs, and possible opportunities that match internal strengths (Globocnik et al., 2019). Due to market dynamics, i.e. changes in the organization's external environment (Osiyevskyy & Dewald, 2018), BMs need to adapt to maintain competitiveness on the market (Globocnik et al., 2019). Globocnik et al. (2019) mention three different dynamics that may trigger change on the BM level, that need to be managed. These include the dynamics caused by changes in the environment, the organizational growth, as well as the organizational transition processes.

The degree of environmental change determines whether a BM or the corporate strategy either require small modifications, need to be revised or even should be terminated (Cavalcante, Kesting, & Ulhøi, 2011). Changes in the internal environment that provoke reaction include stakeholders and other factors, "such as resources, cost structure, production capacities, intellectual property, knowledge, or management decisions" (Globocnik et al., 2019, p. 8). External changes refer to changes outside the organizational boundaries, "such as technologies, customers, competitors, laws and regulations, society, and the economy" (Globocnik et al., 2019, p. 8).

Organizational growth is mostly expressed by innovative and newly introduced BMs. They are used as a tactical move to enter into different markets with growth and profit potential. Because organizational growth is a process that needs to be planned and monitored carefully, a good BM portfolio management is needed. The management should be able to watch the sequences

of the evolution of the portfolio, to create awareness on the strategic level and translate a new strategy into a set of activities and goals on the BM level (Globocnik et al., 2019).

The third dynamic are organizational transition processes, i.e. dynamics that arise when a BM gets renewed. Triggered by the strategic level, possibly due to technological development, established BMs need to be adapted or instantly replaced. In the case of Netflix, one of their many transition processes is the transition from only distributing content to producing original content themselves.

Companies can achieve economies of scope through the combination and exploitation of their resources and capabilities (Ahuja & Novelli, 2016). On the one hand, when running multiple BMs, companies and especially incumbents have benefits and cost savings from 'resource co-deployment' (Ahuja & Novelli, 2016). On the other hand, when shifting all resources from one BM to a new one, companies have benefits and cost savings from 'resource re-deployment' (Anand & Singh, 1997). It allows the company to faster terminate underperforming BMs, thereby being more flexible and cost efficient than a single-BM firm (Lieberman, Lee, & Folta, 2017).

When engaging in resource co-deployment, companies may build a new BM that shall complement the existing portfolio. This, however, can cause confusion within an established incumbent, because it "requires re-shuffling or recombining the various business activities that compose the model in a novel way" (Ahuja & Novelli, 2016, p. 130). While sharing common activities and partners, some BMs might be mutually reinforcing that help to exploit unviable possibilities and turn them into profitable opportunities (Casadesus-Masanell & Tarziján, 2012). Nevertheless, the old and new BM might conflict with each other in terms of different value chains and resource exploitation (Porter, 1996). It is not as easy as just distributing resources and capabilities between two BMs, because a new BM tackles a completely different market with different requirements, values and customer preferences (Markides & Oyon, 2010). Therefore it is crucial to align and manage the interrelations between the multiple BMs correctly, because this finally determines the success or failure of a company (Globocnik et al., 2019). A company should also focus on the question whether the new BMs are complements or substitutes. The greater the compatibility of resources and capabilities and the greater the extent to which BMs are able to share physical assets, the more likely are the BMs complements (Casadesus-Masanell & Tarziján, 2012).

When managing a multi-BM portfolio, it should be fitted to the organizational set-up, i.e. either a centralized or decentralized management form. On the one hand, a decentralized management allows for more local adaptation and flexibility in terms of decision making due to a

knowledgeable and more dedicated management (Gibbons, Matouschek, & Roberts, 2012), but on the other hand, it decreases knowledge transfer within the organizational boundaries and increases "between complexity" (Snihur & Tarzijan, 2018), due to managers that keep information inside their autonomous BM for protection reasons. That is why a BM portfolio with high "between complexity" and decision making between the separate BMs, need an organizational form that is more biased towards a centralized management structure (Snihur & Tarzijan, 2018). In contrast, the higher the complexity within each individual BM, the more efficient a decentralized management. In different words, when there are serious conflicts between two BMs, separation is the preferred strategy (Markides, 2013).

In addition to the organizational set-up, the type of BM portfolio complexity does also determine the barriers to imitation (Snihur & Tarzijan, 2018). The higher the interdependencies between BMs and single activities, the more effort is needed to imitate (Rivkin, 2000). This reasoning allows the author to conclude, that interdependencies within BMs in a portfolio builds a barrier to imitation (Rivkin, 2000), which further fuels the sustainability of the firm's competitive advantage (Snihur & Tarzijan, 2018). The same authors conclude and advise that managers should carefully balance the degree of interdependences between the BMs in the portfolio and that they have to think about which activities and partners to separate and which to integrate, because these factors determine whether a portfolio should be managed autonomously (i.e. more decentralized), or rather centralized. However, the literature on BM separation within a portfolio also suggests a different approach, namely temporal separation (Markides, 2013). A company would pursue this strategy, if it introduces a new BM with a decentralized organizational structure but would eventually centralize it after some time. This helps to exploit synergies more effectively in different stages of the companies' development (Puranam, Singh, & Zollo, 2016). They add the example, that managing an exploration-intensive stage with autonomy outperforms coordinated structures. This suggestions implicates that managers can start a BM in a separate unit and as development matures, reintegrate it into other existing BMs (Markides, 2013). Finally, Markides (2013) concludes that each company has to decide individually on the level of separation and integration.

2.3. Current approaches to monitoring a portfolio

When having multiple BMs, the question for a company remains how to monitor and analyze the portfolio. BM portfolio is a diversification strategy to increase competitiveness which offers opportunities to reduce risks, firm growth and performance enhancement (Ahuja & Novelli, 2016; Aversa & Haefliger, 2016; Harrison, Hitt, Hoskisson, & Ireland, 2001). Each BM has its

own strategy and value proposition, but the company must ensure to pursue multiple BM within one corporate (Sabatier et al., 2010). For having an overview about all activities in a portfolio to manage it efficiently and sustainably, the monitoring of the portfolio is an indispensable task. Therefore, a company needs to know which BMs are in place, for which strategic reason, how they are interrelated, how they are mutually reinforcing and which individual role they play. Additionally, a manager should be able to see, how the portfolio is about to transform in the near future. Literature has only shed little light on how to monitor a multi-BM portfolio. However, some common approaches are summarized in Table 4.

In the BM literature, only two viable frameworks have been identified, yet. Paolo Aversa tried to answer the questions on what should be considered in a BM portfolio, how the value of an added BM can be assessed and optimized, and how the portfolio should be modified over time. The framework (Figure 8) primarily focuses on the relationship between the BM's resources and capabilities, and how they actively interact to create a certain performance outcome. This framework may allow to show the internal connections for sustainable performance, however, it does not act as an appropriate tool to map and finally monitor BMs according to their role and strategic position within the company, and its' development over time (Aversa, Haefliger, & Reza, 2017).

Osterwalder and Pigneur developed a BM portfolio map (Figure 9). The aim is to "help organizations understand if their business is prepared for the future or risks disruption" (Osterwalder & Pigneur, 2017). Their map is two-folded and analyzes a BM from the invention in the exploration stage towards the improvement in the exploitation stage. In the exploration stage, BMs are analyzed according to their innovation risk and their expected return. In the exploitation stage, they are analyzed by their disruption risk versus the real return. Thereby, they try to integrate the maturity level of the BMs, to visualize all activities in one map. However, it does not allow to cluster BMs according to their product category and fails to find interrelations and synergies.

Of course, there are also other literatures that already introduced frameworks to analyze portfolios. Particularly the diversification and technology literature have interesting and partly well-established frameworks. Although they use different units of analysis, these frameworks serve as an inspiration for my further work. The diversification literature mostly links strategic analysis frameworks to monitor a portfolio either to the BCG-Matrix (Figure 10), or the GE-McKinsey-Matrix (Figure 11). The former is a two dimensional matrix that classifies each BM according to their growth potential and the relative competitive position (Barksdale & Harris, 1982). It clusters the BMs into four cells to show their strategic potential and market

attractiveness, where each cell has its "corresponding strategy prescription in the achievement of the overall goal of a balanced product portfolio" (Morrison & Wensley, 1991). The matrix is used by executives to decide on how to focus resources and helps to determine investment requirements and predict the cash flow for each product or business unit (Morrison & Wensley, 1991).

Developed and introduced in the 1970s, shortly after the BCG-Matrix, the GE-McKinsey-Matrix helps to evaluate investment opportunities (Amatulli, Caputo, & Guido, 2011), by rating the general industry attractiveness (on the horizontal axis), and the BM's competitive potential (on the vertical axis), i.e. the business strength, on a three-stage scale (weak, medium and strong). The result is an analytic map with two dimensions and nine cells, each of them representing a different strategic implication (Kamalian & Ghasemnezhad, 2015). A product would be displayed in one of the nine cells which represents their respective strategic attractiveness to the company. They are illustrated as a circle with different sizes, proportional to their revenue (Amatulli et al., 2011). Both are viable tools to measure firm performance, determine investment strategies and examine a BM's market attractiveness. However, they only evaluate the portfolio a matrix of performance-oriented indicators. Indeed, it allows the company to analyze its product-market-attractiveness, growth potential or revenue distribution, but do not provide managers insights into the bigger picture of the portfolio and interdependencies across their BMs. Managers do not see to which strategic field the business belongs, which new trends they tackle, which maturity level they have, and why they are important and part of the corporate strategy. Also and most importantly, they only show the status-quo of the corporate portfolio, without providing a future scenario perspective.

The technology literature developed a more interesting approach, by using a radar design. Although it is used by many frameworks, I only elaborate on the example of the Cisco Technology Radar (Figure 12). It was developed and introduced by Cisco in 2012 and serves as a foresight system for emerging technologies. It maps the technologies vertically according to their current maturity level, and horizontally according to their specific technology field. This radar allows the company to determine, on which technology they should focus on and is thereby a tool for decision-makers (Boe-Lillegraven & Monterde, 2015).

The reviewed approaches have their own strength and shortcomings and all of them are indeed viable options to compare multiple BMs, each of them in different dimensions. The BM literature approaches are good to show interrelations between multiple BMs and to compare them accordingly, while the diversification literature has its strengths in supporting the financial decision making. However, they do not provide an overview about the whole portfolio and their

potential for further development in the future. As Sabatier et al. (2010) defined, that a BM portfolio reflects the medium viability and future development, this combination is crucial to illustrate.

Against this background, I set out to develop a framework that enables a company to monitor their BMs and all other activities on a multiple-dimension scale. The framework aims not only to find clusters, identify blind spots and answer questions about the current strategic composition of the portfolio, but also intends to shed light on the potential future composition and development of the portfolio. In general, I want to find out, how a company can monitor their corporate BM portfolio within both, a status-quo perspective and a future perspective.

3. Methodology

Throughout a comprehensive literature review, I revealed that the field of BM portfolio management is quite new and not many frameworks exist that help to monitor a diversified corporate BM portfolio. I use this body of scientific knowledge and combine it with insights from the practice. To bridge this gap, the automotive industry is analyzed. It serves as the basis for the prototype and its testing, because it is undergoing a drastic transformation, due to environmental changes, that force incumbents to add and/or innovate their BMs and to build entirely new ecosystems, making it more difficult to monitor all corporate activities. Choosing this industry as a case study shall not imply that it is an extreme case that cannot be applied to other industries. It is rather a representative case, i.e. a method to illustrate my findings based on an actual company. The industry context not only helped me to derive with well suited sub-categories for the prototype and final framework, but also allowed me to interview experts from that specific industry.

After explaining the reasons that led to a change in this industry, a prototype of a framework that links the scientific knowledge with the identified challenges from the automotive industry is developed. The idea is to have a condensed design to allow for a quick and easy summary of the BM portfolio, by giving the reader dimensions, that are already known in the business literature.

The framework shall allow to:

- Identify all current, new and future operating BMs
- Identify clusters and blind spots within the portfolio
- Explore synergies and interrelations between BMs.

To validate my prototype and adjust my results, I use practitioner interviews and finally derive with the final framework. Hence, I combine a top-down and a bottom-up approach as the basis

and input for my framework, as seen in (Figure 1). I reviewed six reports from industry experts to find a consensus about the transformation and environmental change of the automotive industry. The reports are prepared by McKinsey & Company, PricewaterhouseCoopers (pwc), Strategy& as well as Roland Berger and each of them is referenced in the following chapter. These companies are well established and leading strategy consulting firms, which gives me reason to believe, that the small number of reports already provides me with valuable insights to validate the current development of the automotive industry. In addition to these insights, the literature review helped me to understand, why OEMs need to diversify their BM portfolio, both in hardware and software.

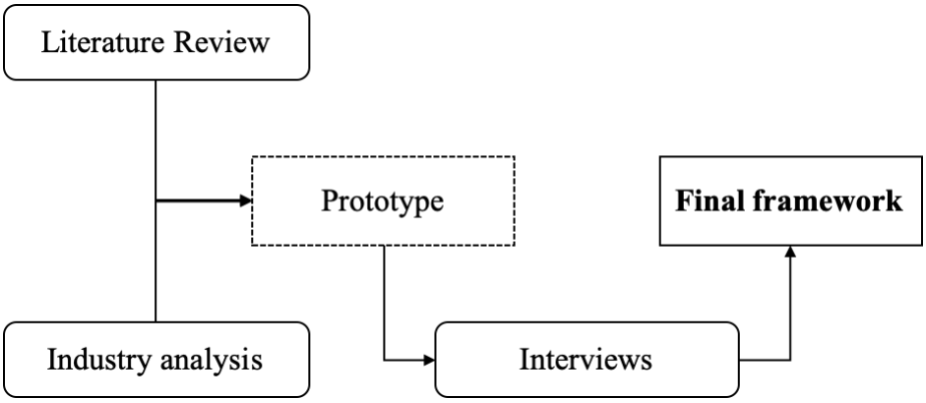


Figure 1: Research approach

3.1. Introduction to the environment of the automotive industry and the case

The automotive industry is facing a change that is unprecedented to this extent for the industry and also for the customers. Since the launch of the smartphone, it has become clear that even highly complex and expensive technology is quickly being adopted by customers when it makes their lives easier (Kunert, Stürmer, & Koster, 2017). The whole industry with its core business around the internal combustion engine is threatened by many new and diverse entrants that come to the market. Companies like Uber, Google, Amazon, Apple and many more disrupt the industry from various directions, thereby becoming rivals with completely different capabilities and BMs (Yin, Ansari, & Akhtar, 2017). Hence, the need for 'servitization', i.e. switching from selling products to selling solutions (Baines, Lightfoot, Benedettini, & Kay, 2009), is rising. It will no longer be enough to focus solely on the production and on the sale of vehicles (Kunert et al., 2017; Roland Berger, 2016), because the vehicle is a physical device, which is getting ready to be used in the digital world, to create value to both the customer and the manufacturing company (Franz, Bieger, & Herrmann, 2017). Therefore, OEMs must be ambidextrous (Viereckl et al., 2018). This means that incumbents still need to be highly efficient car manufacturers, but also have to become digital service providers. They have to introduce and

manage digital and physical customer channels that are different to their current retail structure, to increase the touchpoints with the customer, which allows for a better and more personal interaction with the customer. This matches with the understanding about BMs, because they reflect the corporates interpretation of what customers want and show the ability to engage with them (Teece, 2010).

Both, industry experts and the OEMs define the environmental change on four dimensions, i.e. connectivity, autonomous, shared and electrification (Kunert et al., 2017). According to the PwC Strategy& consumer research from 2018, "consumers expect mobility services that are convenient, personalized, multi-modal and connected" (Viereckl et al., 2018, p. 7). For example, this means that people do not necessarily want to own, but share a car via peer-to-peer platforms, want to combine multiple transportation modes to find the most convenient and fastest way, or look for personalized mobility offers. Alternative car ownership implicates the need for shared models, i.e. car-sharing and ride-hailing, to address new customer segments. Hence, OEMs must diversify their BM portfolios into hardware-, software- and service-oriented products to create new value to the customer, even after the car is bought, over its entire life cycle. A diversified portfolio is also a reply to shifting regulation and policy. For example, the market penetration of electric vehicles does not initially follow the market-based demand structure, but is a topic that is primarily directed by regulation and politics (Kunert et al., 2017).

Such changing BM portfolios bring many challenges to incumbents, because they entail a lot more complexity by an increasing number of diverse products and services. Thereby, each BM or service in the portfolio plays a different role and contributes to its own and extend to the overall strategy and corporate goals. For example, some BMs are not only implemented to generate an additional revenue stream but can also act to increase the brand value by increasing the customer interaction. Hence, they have to be evaluated in a different way and not only based on their contribution to the corporate cash flow or profitability. This is why the automotive industry is in need for an industry-specific framework, helping to monitor their current and future BMs and other activities accordingly. Volkswagen (VW) serves as my reference case study, as they represent one of the biggest and most successful automobile groups in the world. VW currently builds a new ecosystem around their original car-manufacturing BM, to increase their competitiveness and the digital relationship with the customer. Thereby, they not only added many new products and services to their corporate BM portfolio, but also have more internal development projects that are expected to be launched in the future. As these new

projects have the power to change the future composition of the portfolio, including them is inevitable.

3.2. Building the 'Business Model Portfolio Radar'

After defining the trends in the industry, I am looking into the current BM portfolio of Volkswagen and identify critical factors that help me to establish a framework design that suits a corporation in the era of information, data and technology.

3.2.1. Scope and analysis of the BM portfolio of Volkswagen

The first step of establishing the framework is to define the scope of research about the company and to clarify which BMs and other services should belong to the framework. I follow the view that "a business model articulates the logic, the data and other evidence that support a value proposition for the customer, and a viable structure of revenues and costs for the enterprise delivering that value" (Teece, 2010). Particularly, I analyzed the portfolio of VW Passenger Cars and exclude the rest of the car brand portfolio of the VW Group, such as Audi, Porsche, Seat et cetera. All products or services are included that deliver value to the customer, even those that do not generate revenue. This is because some BMs either start as a free service in order to start monetizing in later stages, or their intention is not to charge the customer anyway, but create value to the company by collecting data and offering the customer a more personalized brand experience. Additionally, only BMs that already operate or are at least officially communicated by VW are listed and categorized, because internal projects are strictly confidential. In practice however, internal projects can and should be included. I analyzed the VW website, press releases, annual reports and CEO interviews from VW to identify all relevant and current BMs. These not only validated the results of the industry experts about the changing industry environment, but also provided me with a set of 21 BMs that are considered for my analysis for VW (Table 5).

3.2.2. Identification of critical factors to describe and distinguish BMs

The second step is to identify which factors are critical to describe and distinguish a BM within a corporate BM portfolio. They help to build categories in order to cluster BMs and shall provide more detailed information about them. They set a BM into a context and allow to compare multiple BMs with each other. The BM literature was used to identify all relevant factors. I found that BM patterns are useful to compare BMs on various dimensions. Patterns are solutions to recurring problems (Remane, Hanelt, Tesch, & Kolbe, 2017) and a BM is a

combination of several patterns (Osterwalder & Pigneur, 2017). A pattern must be usable many times over again, therefore being in need for generalization (Timmers, 1998). Remane et. al. (2017) use four dimensions to differentiate these patterns. These are the value proposition, value delivery, value creation and value capturing. I will build my factors upon their four dimensions to describe and distinguish BM-related factors, as these dimensions capture the core logic and value of a BM and its configuration. More details on how these factors are characterized and described will be discussed in the findings. All factors are summarized in Table 7 in the appendix. Additional details about BM factors and sub-categories like the monetization strategy were also conducted by a comprehensive research within the existing BM literature.

3.2.3. Development of the prototype design

The third step is to establish a prototype design which will be the basis for the interviews with industry experts. As already described in the first part of the methodology, the idea is to have a framework design which allows to summarize the portfolio, by giving the reader dimensions, that are already known in the business literature. The three main contributions of the framework shall be to:

- Identify all current, new and future operating BMs
- Identify clusters and blind spots within the portfolio
- Explore synergies and interrelations between BMs.

As for the first and second ability and to better evaluate and compare the BMs, the following two dimensions are used, which build the core logic for my framework:

1. Distance to the core business (Degree of vertical integration)
2. Level of innovation.

The distance to the core business is evaluated by the degree of vertical integration, i.e. whether the BM is an upstream- or a downstream-service. I integrate it to visualize the corporate's value- and supply chain and to categorize BMs along it. The extent to which a company is vertically integrated influences its' ability to "control inputs and intermediate processes" (Grant, 2016, p. 193). The vertical integration can be used to describe and illustrate a company's degree of diversification (Ahuja & Novelli, 2016). The higher the extent to which a company is vertically integrated with distinct BMs, the more value through services does it deliver to its' customer. Further explanations about upstream- and downstream services can be found in chapter 4.1.

The level of innovation is determined by the three horizons model (Figure 13), developed by McKinsey. It serves as a representative for the time to implementation. I will further explain the three layers in the findings section. The two directions of vertical integration have to be

found on each of the three horizon levels. This requires the framework to be able to display them altogether, which limits the design choice, due to a more complex characteristic and more layers. After comparing existing framework designs throughout the literature review, only the design of a radar meets all the required characteristics. A radar is the preferred choice, because it allows to evaluate and map all BMs on more than two dimensions with multiple layers.

As for the vertical integration, BMs are plotted horizontally along the radar, based on their respective characteristic. Upstream-services are displayed on the left side of the radar and downstream-services on the right side. The level of innovation with its three horizons is mapped along the vertical axis. The BMs in horizon 1 are the core of the company, therefor being placed in the center of the radar, followed by horizon 2 and 3 towards the outer edge. The farther away from the core of the radar, the longer will it take for the BMs to be implemented on the market. I call it the "BM Portfolio Radar" (Figure 2).

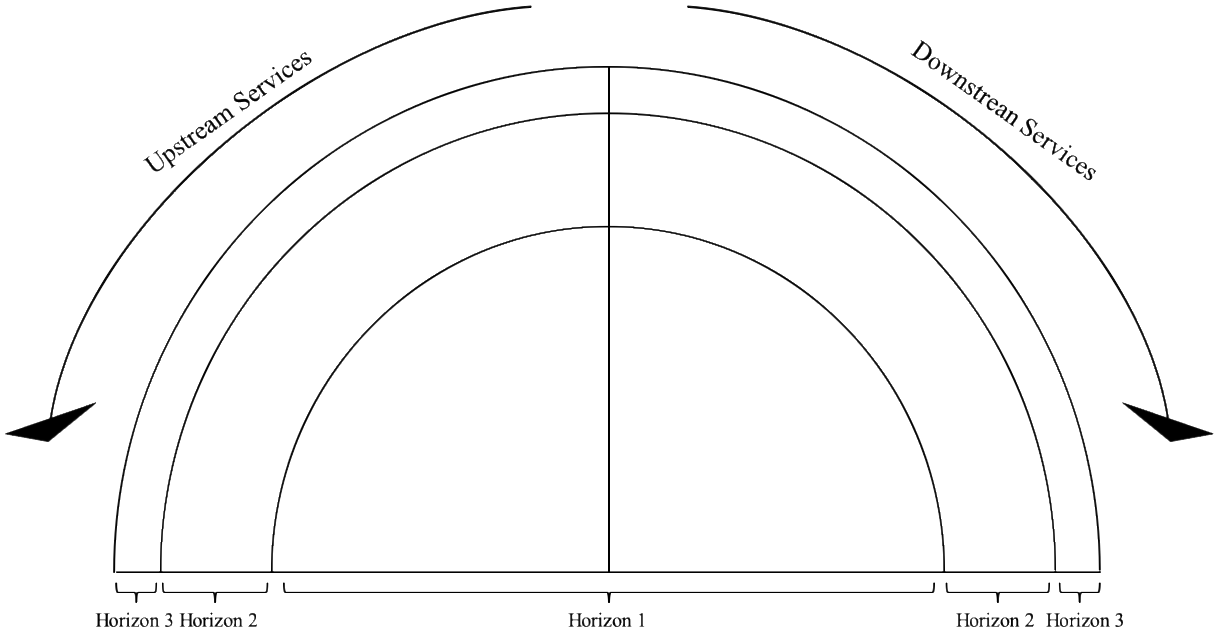


Figure 2: The 'Business Model Portfolio Radar'

At this stage, the radar represents a generic framework, that can be used for multiple industries. I use practitioner interviews and further literature research on BM portfolio monitoring to find more fine-grained categories to extend this framework, in order to fit it to the needs of the automotive industry.

As for the third ability of the framework, i.e. to explore synergies, the user might want to find BMs within the ecosystem that operate with similar characteristics. Thereby, the radar would help to exchange internal knowledge, best practices and lessons learned. However, there is a diverse set of possible synergies that can be explored. They most certainly help to increase

economies of scale or scope and improve the financial performance of the corporation, for example by cost savings. In order to find appropriate characteristics that trigger synergies and to validate the design of my framework and its categories, interviews with industry experts are conducted, which have knowledge and experience in portfolio management.

3.3. Validation of the prototype design with industry experts

To gain a better insight into the possibilities for categorizing BMs as well as the dimensions of interest when monitoring a portfolio of BMs, semi-structured interviews were conducted. In total, I interviewed 3 managers of VW and one automotive and strategy consultant from Porsche Consulting. They have different job responsibilities, but each has a close relationship to portfolio management.

	Interviewee 1	Interviewee 2	Interviewee 3	Interviewee 4
Company	Volkswagen	Volkswagen	Volkswagen	Porsche Consulting
Position	Manager Digital Services, Product Line e-mobility	Digital Portfolio Manager	Head of Sales Analysis & Reporting	Senior Consultant (Automotive & New Mobility)
Work experience	>15 Years	<5 Years	>15 Years	<5 Years
Type	Phone Interview	Phone Interview	Phone Interview	Phone Interview
Duration	40 min.	70 min.	60 min.	45 min.

Table 1: Interview characteristics

The fact, that they are industry experts with practical experience in portfolio management gives me reason to believe, that the interviews are a valuable source of information that help me establish a value-adding framework. Even though semi-structured interviews cannot be generalized beyond the focus group, they certainly help to understand the challenges, pain points and opportunities of my interviewees (Wilson, 2014). Structured interviews are less suitable for this kind of research, since they do not allow to explore a topic and are less conversational and more formal (Wilson, 2014). Another strength is that unstructured interviews can reveal issues that have not been considered by the interviewer upfront (Wilson, 2014). Interviews were conducted via phone calls and lasted approximately 45-60 minutes each. In total, 10 questions were asked and all answers were recorded by note-taking. The set of questions contained both, structured and unstructured questions (Table 8). Whereas structured questions only allow to select answers from a given set, unstructured questions give the

interviewee the chance to response in their own words, which allows for more information-rich and precise answers (Cooper & Schindler, 2011).

4. Findings

This section presents the main findings of my research regarding BMs and BM portfolio management as well as the insights of the conducted interviews. All relevant dimensions and factors to describe a BM are explained and the resulting design requirements are discussed. Furthermore, the opinion of the industry experts who finally supported me to derive the final 'Business Model Portfolio Radar' is summarized.

4.1. Critical factors to describe and distinguish business models

As noted above, BM patterns are a good way to characterize and describe critical factors of BMs. As for my work and the differentiation between BMs, I use the four dimensions, established by Remane et al. (2017). The first dimension is the value proposition, i.e. what value is generated for the customer. It describes, whether the BM is a physical product, or a service. Moreover, it characterizes the underlying strategy for differentiation, i.e. whether the company creates value over quality, customization, convenience, price or network effects. As for the automotive industry, self-driving cars or other mobility services have the potential to revise the value proposition, the customer and supplier relationship and the concept of ownership of vehicles (Hanelt, Piccinini, Gregory, Hildebrandt, & Lutz, 2015). Services can either be of tangible or intangible nature (Targowski, 2009). Targowski (2009) describes tangible services as directed towards people, whereas intangible services are directed towards people's awareness and include services that are typical for the information age, such as info-communication handling.

Another important differentiation between services is their degree of vertical integration, i.e. "a firm's ownership of adjacent vertical activities" (Grant, 2016, p. 733). The degree of vertical integration defines the business scope and is part of the corporate strategy (Grant, 2016). The extent of the vertical integration is evaluated by the amount of stages that it spans within the value chain. A firm can either integrate upstream into its suppliers' activities or downstream into its customers' activities. Upstream integration occurs when a retailer expands backward into the manufacturing process. For example, after Amazon was a successful online retailer of books, they started to publish books themselves. Downstream activities typically cut out the middlemen by establishing an own direct distribution channel or service (Grant, 2016). In the

case of the automobile industry, upstream services would be the production of electricity to supply the electric vehicles with their own energy, while a downstream service would be a mobility service, that offers a new form of transportation to the customer.

Value delivery, the second dimension, analyses the target customer group. The company can either focus on existing customers, attract specific new customer segments, lock-in existing customers by additional services within their ecosystem, or attract and focus on B2B customers. As for the automotive industry, both, the highly diversified car-model portfolio and all novel emerging services do have their own target group. Most of the new digital (mobility) services focus on specific B2C-customer. The interviews provided me with the following customer segments. However, the definitions are not generalizable, because each company has its own customer profiles. 'Urban', 'suburban' and 'rural' serve as a geographical differentiation, whereas 'volume', 'luxury' and 'B2B/Fleet' are characteristics that rather define the price sensitivity of a customer.

Value creation is the third dimension. It includes the sourcing, i.e. whether the BM is operated with internal resources and capabilities or operated by a collaboration. Hence, value creation characterizes the inclusion of third parties, such as suppliers, customers and competitors.

The fourth dimension, value capturing, defines the monetization strategy. In general, revenue is defined as the income generated by the sale of goods and services, or any other use of capital or assets (BusinessDictionary, 2019). There are several different revenue models that can be used. For my case, I will limit them to the following:

Revenue Models	Description	Reference
Freemium	A certain product is offered free of charge, while an advanced version is sold for a premium	(Gassmann, Frankenberger, & Csik, 2014)
Pay-per-use	Revenue is only generated for each use of the product or service	(Gassmann et al., 2014)
Physical Manufacturing (Direct Sales)	Create and sell physical assets	(Weill, Malone, & Apel, 2011)
Subscription	Continuous access is sold to the customer for a monthly or yearly fee	(Gassmann et al., 2014)

Table 2: Revenue models

Besides BM-related factors, there are more that are of descriptive nature. These include the innovation level and the organizational setup. Factors to describe the organizational setup are the company's name, whether it is a separate business unit or not, i.e. the business owner, and the number of employees and customers.

As for the innovation level, I use the established 'Three Horizon Model' introduced by McKinsey. This taxonomy describes and distinguishes innovation on three levels (McKinsey & Company, 2009), and is used to include the time-dimension into the framework:

'Horizon 1' entails the core business and manages the current fiscal period, thereby being the prime source for revenues and profitability. However, the growth potential of these BMs is shrinking, as the market becomes more and more saturated. The time interval in which these BM add value is between 0-6 months.

'Horizon 2' focuses on extending the core business with new resources and capabilities. It onboards BMs that come with a high growth potential by approaching new customers and markets. They should have to have the potential to fundamentally extend the core business or even replace it. The interval in which these BMs are about to come out is between 6-24 months.

'Horizon 3' looks far into future perspectives and options. BMs that are displayed here have not proven to be feasible yet but may have the potential to disrupt the core business one day. However, they get developed on lower budgets and less priority. These BMs have a broader time interval of 24-72 months.

4.2. Interview results

A summarized overview of the outcome of my interviews can be found in Table 8. However, some conclusions that can be drawn out of the interviews still need to be highlighted.

The higher the number of BMs in a portfolio, the more complex the management and coordination of it. The sum of simultaneously performed BMs overwhelms a huge part of the management, as important information is stuck at the c-level management and does not get distributed well among others. They find it difficult to distinguish between the strategic relevance of BMs. For example, there are holistic and solution-oriented BMs. Holistic BMs are novel configurations of the value proposition and deliver value to the customer in a completely new way, whereas solution-oriented BMs are rather characterized as add-ons or complementary services to existing products. All interviewees did not know how to map a whole portfolio. They confirmed that a framework which provides an overview about all current and future projects of the company would add significant value to many portfolio managers and acts as a good starting point for further research.

There are many strategic questions that managers would want to answer with such a framework. The most important are to identify synergies, which knowledge one BM can extract from another, how the future constellation of the portfolio looks like, and which supply gaps the corporation still needs to close. The following question stood out as well: 'How are we positioned against current trends that shape our industry?'. This reflects the need for a market analysis framework that classifies current and future BMs and makes them comparable.

The interviewees concluded, that important synergies to show within the framework might be the customer segment and the monetization strategy. These two are a good source to understand the underlying logic of the BM. The customer segment has been classified as important, because once you gathered sufficient data and personal information, you can take advantage of this knowledge to offer personalized services. Synergies arise, because customer segments share specific characteristics, such as price sensitivity, willingness to pay, geographical area, leisure time or the likelihood for the adoption of digital services. In this way, they can exchange valuable data and best practices for addressing customers when they enter the market. The monetization strategy, i.e. the revenue model, gained a lot of attention through the implementation of digital services, because they meet different customer expectations. As most incumbents are new in the field of such services, synergies arise by sharing best practices of success stories and lessons learned.

In relation to that, there is only little transparency when it comes to cooperation partners and other investments in external businesses, which generate valuable know-how for the company, from which several projects can benefit in the long term. Integrating them would add value, according to three of the interviewees.

Another characteristic was discussed a lot in the interviews, namely the technological base. Portfolio- and technology-manager had many problems exploiting economies of scope, because of a technological heterogeneity throughout the corporation-wide BMs. Even though the approach to identify synergies at this level sounds promising, my interviewees concluded that due to a high complexity and high number of different existing technologies, this would neither add any value, nor help to make it more transparent. It is by no means possible to generalize technologies and would go beyond the scope of the framework.

The financial performance indicators were evaluated as important synergies as well. However, it would be almost impossible to predict common financial valuation methods as they require assumptions about the future, which negatively affects reliability. One interviewee said, that evaluating a novel BM requires a certain gut feeling. Of course, this cannot be reflected in a framework, but it gave me reason to believe that integrating the financial performance of BMs

would not add value to my specific model. It can rather be concluded, that a practical framework would need to be able to identify current and future blind spots and show other synergies within the BM configuration.

The interviews served to find out which design would add the most value for a portfolio manager and which dimensions are important to include. Especially the time-dimension grabbed a lot of attention and was evaluated as a beneficial and value adding idea. As for the product categories, managers themselves struggled to define categories that best fit the practical need. However, they confirmed the choice of using the degree of vertical integration, because it is a common approach to describe a corporate's value chain. Moreover, they have been using it both in their academic as well as professional careers, allowing them an easy handling.

As for the other categories, one interviewee preferred to see the actual trends that shape the industry and suggested to include: 'Mobility Services', 'In-Car Services', 'Around-the-car Services', as well as 'Supporting systems, devices and energy supply'. The other three preferred a more general categorization along the vertical integration, as trends can change quickly. My second interviewee introduced me the layered architecture by Yoo et al. (2010) which was discussed in the last two interviews accordingly. All three practitioners confirmed that these categories add significant value and find practical relevance. However, because the design of the framework allows to be tailored to individual needs, the sub-categories can get exchanged at any time.

4.3. The final framework

After conducting the interviews with industry experts, I have sufficient insights to finalize the 'Business Model Portfolio Radar'. The base was already developed and described in the methodology part, which is now supplemented with BM characteristics, in order to show synergies and interrelations within the portfolio. Furthermore, more fine-grained sub-categories are added to the radar design to better map the BMs into the radar.

As for the sub-categories, I use the idea of the multi-layered architecture (Yoo et al., 2010), which uses four layers to describe digital innovation. Originally, Yoo et. al. (2010) used this architecture (Figure 3) to describe the transformation and logic of digital innovation and technology. This architecture emerges, as firms integrate digital solutions into their physical products. The idea to use this approach was developed during my second interview. In my case, the four layers I am going to use are interpreted differently and serve to categorize BMs along their degree of vertical integration. The layers serve as a characteristic to map a BM portfolio of the automotive industry and shall allow to easier distinguish BMs between upstream and

downstream services. Furthermore, the following four layers shall describe and cluster the main activities of an OEM.

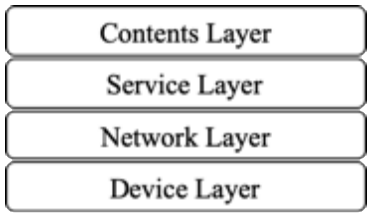


Figure 3: The layered architecture of digital technology (Yoo et. al. (2010))

Each of the four heterogeneous layers represent an own value proposition for the customer and can be managed by different departments. For my framework, the distinction between device, network, service and contents describe the value chain of an BM portfolio and an ecosystem of an OEM. Traditional car manufacturer begin in the 'Device Layer', which includes the hardware and logical capabilities to control and maintain the products (e.g. the vehicle). As for the 'Network Layer', Yoo et. al. (2010) used it to describe physical network standards (e.g. cables, transmitters etc.), but also logical network standards (e.g. peer-to-peer protocols) in digital technology. For the case of the automotive industry, I adapt this layer and call it 'Infrastructure Layer', because building an infrastructure became more and more important when offering the customer a holistic value chain and brand experience. It includes all activities regarding the supply of sustainable energy, as well as activities that tackle the infrastructure around multi-modal mobility. As for my framework, the first two layers can be classified as upstream activities, because they represent an action that is biased towards a supplier activity and are farther away from the actual customer. BMs that can be mapped into either of these layers will be placed on the left side in the radar.

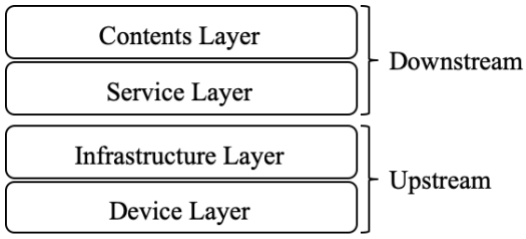


Figure 4: The layered architecture of digital technology for the automotive industry (adapted from Yoo et. al. (2010))

The 'Service Layer' includes all BMs that allow the customer to consume content and other activities around and with the vehicle. It mostly describes digital solutions that are consumed in combination with a physical device (e.g. mobility services). The 'Contents Layer' is used in this radar to give insights into all applications that deliver content such as information, music, personal data, geo-directions and more. Hence, this layer entails all BMs that enhance the connectivity and entertainment of the customer. Both, the 'Service-' and 'Contents Layer' are

used in the BM portfolio radar to describe downstream activities, as they are directed towards the customer. Finally, the radar presented in Figure 5 is the final framework, adapted for the automotive industry.

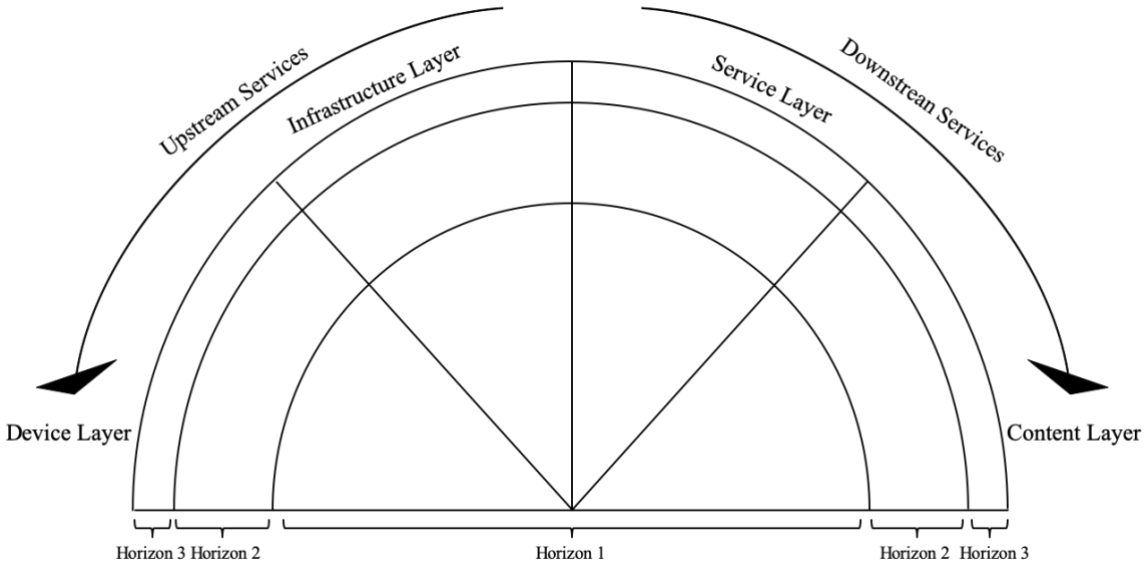


Figure 5: The 'Business Model Portfolio Radar' for the automotive industry

To visually distinguish BMs and identify synergies between them, the following characteristics are added to the model (Table 3). I use five different revenue models to operationalize the dimension of value capture, which have been described above in Table 2. The customer segment is split into 5 different segments, which operationalizes the value delivery. The segments are derived from the interviews. Moreover, the type of 'operation' of the BM has proven to be important within the interviews. This category describes, whether the BM is operated only with internal resources and capabilities, or with external support. Including them within the framework is a translation for value creation, as well as the degree to which a corporation outsources its activities, which enhances flexibility and helps the company to concentrate on activities where they possess capabilities (Grant, 2016).

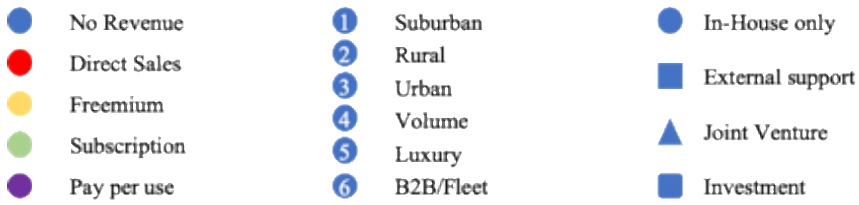
Revenue Model	**Customer Segment**	**Operation**
No Revenue	Urban	Inhouse only
Direct Sales	Suburban	External support
Freemium	Rural	Joint Venture
Subscription	Volume	Investment
Pay per use	Luxury	
	B2B/Fleet	

Table 3: Business model characteristics

External support describes an operation in which the OEM uses external resources or capabilities to operate the BM. For example, Volkswagen has partnerships with retailers (e.g. Kaufland in Germany), who supply them with a network of electric vehicle charging stations. An 'investment' is used to buy shares of another company, which gives a corporation access to new markets and customers, but also buys-in knowledge and new technologies. Another form is a 'Joint Venture', which is a cooperative enterprise operated by two separate companies with common interests and goals. Resources and expertise in a specific field are combined, and all expenses and revenues are shared. A joint venture also gives the corporation access to new markets and is used, among others, to get access to a greater amount of resources, but with less risk and shared responsibility.

Of course, the characteristics are not fixed and can be exchanged, according to the specific needs of the user. My results are based on the findings from the interviews.

In order to map BMs into the radar, the characteristics are translated in the following logic:



Each BM represents an own symbol. The type of operation determines the type of the symbol, i.e. a circle, square, triangle or a rounded square. The revenue model determines the color of the symbol and finally, the customer segment is translated by a number within the symbol. For many BMs, more than one customer segment may be relevant. In this case, several numbers, a range of numbers or 'all' is written within the symbol. An illustration of the radar is provided in the next chapter.

4.4. Application of the 'Business Model Portfolio Radar' for Volkswagen

In the following, I want to illustrate the 'Business Model Portfolio Radar' for the case of Volkswagen Passenger Cars. Two different BMs are described in depth to show how they are mapped into the radar accordingly. In order to use the radar, a company needs to gather information to fill out a BM-profile. This profile entails the characteristics from Table 7. After all relevant information is collected, the BM can be mapped into the framework. In the end, a manager has to determine the degree of vertical integration and the maturity of the BM, in order to place it into the radar.

The first BM that is mapped into the 'BM Portfolio Radar' is 'WeShare', the new all-electric carsharing service from Volkswagen. The idea of WeShare is to offer an alternative mobility solution to urban customers, by placing all electric vehicles in the metropolitan area. This increases the brand awareness and interaction and introduces a novel revenue stream for VW. WeShare operates digitally via an App and monetizes through a pay-per-use revenue model, without a subscription fee which can be characterized as a mobility service, i.e. a downstream activity. VW tackles a broad range of customer segments with it, including existing customer, but also new B2C and B2B customers. Due to a limited business area, urban customers are the main target. It is operated both by internal and external sources. As for the external sources, they get support by the Schwarz Group, which establishes a network of charging stations to safeguard the operations. WeShare finds itself in the first horizon of the service layer and is placed in the first horizon, as it actively operates (Figure 6).

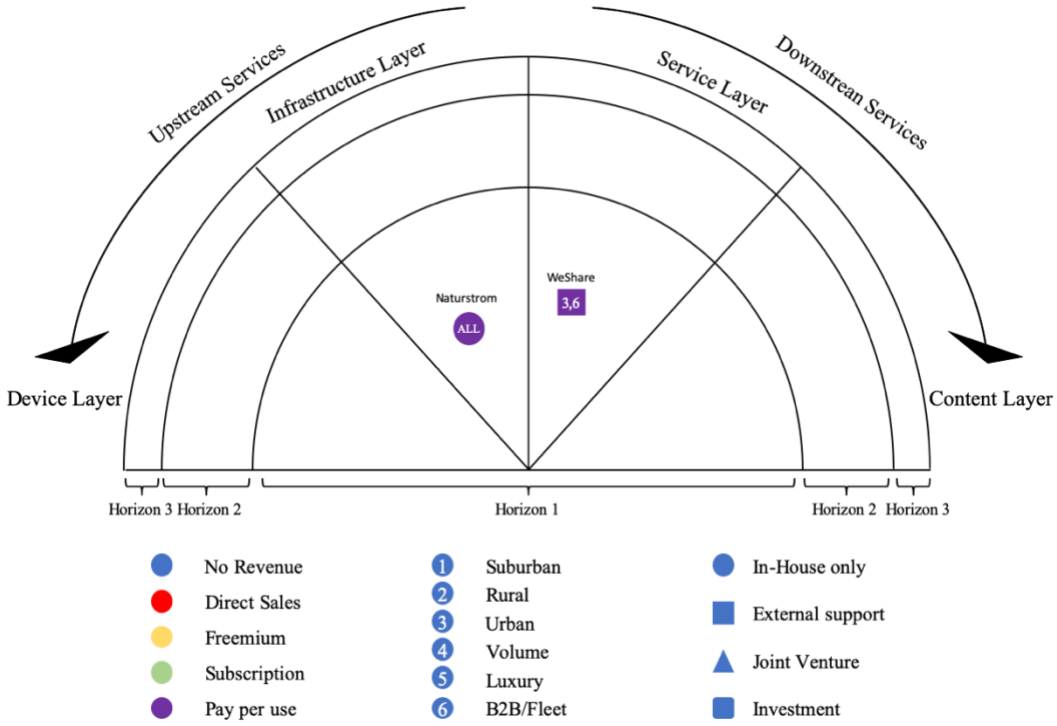


Figure 6: The 'Business Model Portfolio Radar' for VW (Example of WeShare & Naturstrom)

In order to take the next step towards a more sustainable future, Volkswagen founded the company Elli (Electric Life), an energy and electric mobility service provider. The first product is 'Volkswagen Naturstrom' which is sustainable energy for homes and electric vehicles, 100% generated by renewable energy sources. Currently, they offer its' German customers the electricity through a 24-month contract with monthly advance payments and an invoice at the end of the billing period. Volkswagen Naturstrom is offered to every customer segment. In the future, Elli will offer a comprehensive charging solution for electric vehicles, as well as wall

boxes and IT-based energy management systems. Thereby, VW has both, new upstream- as well as downstream activities in their BM portfolio. 'Naturstrom' represents an upstream service and belongs to the network layer.

As for the rest of the identified BMs from VW, they are mapped altogether in Figure 7. A summary of all BMs and its underlying characteristics is presented in the appendix in Table 6.

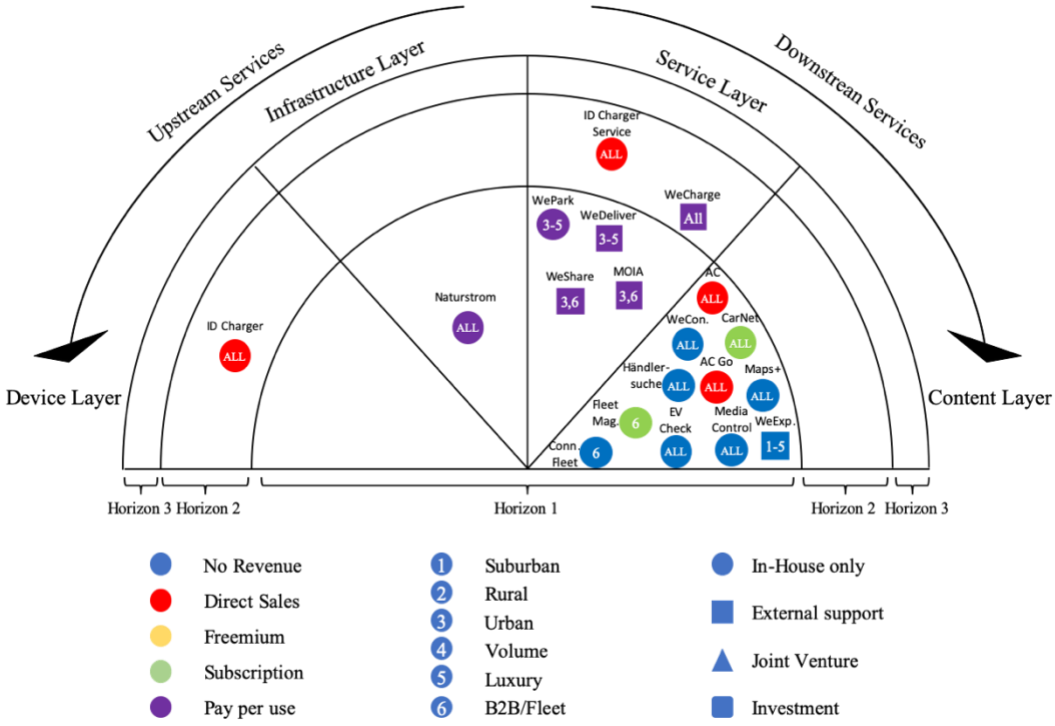


Figure 7: The 'Business Model Portfolio Radar' for VW

When all relevant information is gathered and the BMs are mapped into the radar, a corporation like VW can answer several questions with the radar.

First and foremost, VW gets a good overview about their current BMs and in which way they generate value and revenue. For example, one can see clearly that VW is focusing on the service- and content layer. On the one hand, there is a strong focus on downstream services and on the other hand, there is a blind spot within the upstream services, as they lack innovative BM, yet. However, by including internal and non-disclosed knowledge about the projects and ventures that are in development, the radar would add significantly more value to the reader. What is more, is that the reader can see which BMs are in place to generate revenues, and which not. For instance, the content layer has more distinct BMs, but the service layer is more revenue driven and has a higher potential for revenues. Even though not all products and services that are mapped in this radar actually generate revenue, they still play an important role within the strategy to shape future mobility and to connect the customer digitally to the car by building a

bunch of digital networking services. More benefits and weaknesses of the radar are discussed in the next chapter.

5. Discussion and conclusion

This research was aimed to find a different approach to map and monitor a corporate BM portfolio, thereby bridging the gap between scientific knowledge and practice. Literature was reviewed to establish a scientific body of knowledge regarding the evolution of BMs towards the practice to operate multiple BMs in a portfolio and its underlying challenges when monitoring it. In addition, current approaches were compared and finally, a new concept was developed. What could be found is that most other approaches only give the reader an overview of all currently operated BMs, while internal development projects, i.e. potential future BMs, are neglected. Moreover, other literatures focus on more specific factors without giving insights into the strategy of the company. For example, the diversification literature mostly focuses on performance-oriented indicators to compare BMs and neglects the fact that a BM can have other purposes than just being the next 'cash-cow'[1]. As for the BM literature, it does well in comparing the interrelations or value proposition of multiple BMs, but does not provide an outlook for potential future constellations of the portfolio.

The interviews provided me with deeper insights about the challenges and opportunities to map and monitor a corporate BM portfolio. It has led to qualitative insights regarding the characterization of BMs. My interviewees concluded that the framework should be able to explore synergies between the different BMs. Even though it was assessed not to be useful to see a financial performance indicator to explore synergies, there still could be a different way in doing so. Practitioners argued, that forecasts would not be reliable, as they rely on too many assumptions. However, using the NPV is not the only way to evaluate BMs. One alternative that can be considered as value-adding might be to use the contribution margin, which represents the incremental profit earned for each unit sold. It is calculated by the BM's price minus the associated variable costs. Thus, it can be used to show how a particular BM contributes to the overall profit. As for the management, the contribution margin can help select from various possible BMs that compete to use the same set of resources and capabilities. A BM that owns a higher contribution margin will be the preferred option, due to a higher profit

[1]This refers to a box within the BCG-Matrix. A cash-cow is "a product or service that makes a lot of money over a long period of time for the company that sells it, often money that is used to support the company's other activities." (Cambridge Dictionary)

potential. Also, it can easily be integrated into the radar, by assigning different symbol sizes of the BMs to different levels of the margin, allowing to quickly compare the profit potentials within the set of BMs. However, the interviews revealed that there is the need for a framework which takes a market- and customer perspective. Hence, financial evaluation methods are neglected in my work. Other synergies explored within the radar are the customer segment and the monetization strategy, i.e. the revenue stream. These are typical characteristics of the BM and were mentioned as important within the interviews.

The radar is a first attempt to give a big picture about which trends and service directions a corporation is following. Another main contribution of the radar is the second dimension, i.e. the time dimension. Due to the possibility to distinguish between the innovation level of the BMs through the three horizons, the radar serves as both, a status-quo-radar and a forecasting-radar. The focus can be defined as to identify all current and future BMs and innovations within the corporation. Other designs such as the BCG 4-box matrix (Figure 10) would indeed allow as well to use the two dimensions, but not as particularized as with the radar, because multiple layers can be drawn within the vertical axis. This is why the respective radar design was chosen, allowing to give the best results for the needs of practitioners. The chosen visualization was confirmed as value-adding and was appreciated throughout the interviews. The radar is similar to the so called horizon scanning, which is mostly described as "a systematic approach to bringing and assessing information about future trends" (Boe-Lillegraven & Monterde, 2015, p. 73), to the extent that managers can get the bigger picture about which projects are currently in development and how the portfolio is about to change in the next years, based on the number of projects in the second and third horizon.

The 'BM Portfolio Radar' has several strengths and benefits for corporations and a high practical relevance for multiple industries, as its dimensions and layers can get exchanged and tailored through industry-specific categories. As for the automotive industry, one can also use categories that display the trends, such as 'mobility services', 'electrification', or 'autonomous driving'. This would allow to see which trends of the business environment are tackled by the strategy and which trend is getting neglected, thereby having blind spots and the potential to implement new BMs. As for the current design, it gives an overview about the value chain of a corporation. Furthermore, it can serve as a tool to find relevant points of contact, which facilitates the flow of information throughout the company. Managers from different BMs can identify how other BMs are executed and how they generate revenues. Thus, it can help to find relevant partners within the corporation that share specific characteristics of the BM. Once these managers are connected, they can benefit from exchanging knowledge and best practices. In

addition, the ability to differentiate between inhouse operations and partnerships or joint ventures gives the management an overview about the existence of external knowledge, as well as an estimate of how many BMs are outsourced and operated within partnerships. A synergy can arise, when current partnerships are getting extended for other novel projects, as managers can identify which BM collaborates with third parties. Once a good relationship with external suppliers and third parties is in place, other departments can possibly benefit from it as well by using the same external knowledge and capabilities. This reinforces the technological progress and might also help to increase the product homogeneity within the corporation. The more homogeneous the technological base throughout different services, the more efficient and cheaper it gets. Moreover, the radar can also be used to compare oneself with competitors, at least from the status-quo perspective, as many information from competitors are confidential as well. This would require the company to analyze the current portfolio of their competitors to map them against their own BMs.

By now, the radar does also have limitations in its ability and scope. Two participants in the interview mentioned that they want to know, whether the current composition of the portfolio is sufficient and matches the customer's demand. It is a challenge to make a well-founded statement about this strategic question. The radar lacks the ability to evaluate whether the corporation is well positioned with the portfolio or not and it does not tell if the strategy is good or bad. This will remain the responsibility of the managers themselves. Additionally, the main purpose is not based on facilitating decision making for investment decisions. Other frameworks from the diversification literature are better suited to perform this task. It should rather give an overview about the current and future constellation of the portfolio and show clusters and blind spots along the corporate value chain.

Most other matrixes and frameworks focus on performance-oriented indicators to map the portfolio. However, it does not give a good overview about the portfolio's constellation and its interrelations and synergies. Because corporations such as car manufacturers nowadays do not only compete over the quality and performance of the car anymore, but also over the digital interaction, digital integration and digital engagement with the customer (Kunert et al., 2017), new dimensions need to be considered in a framework that wants to monitor a well-diversified portfolio. To point out the advantages of my design more precisely, it is compared with the BCG-Matrix (Figure 10), which serves as a good comparison, because it is a well-known framework with a high practical relevance that is actively used in both academia and business. The BCG-Matrix maps the portfolio into 4 cells. Each of the cells represent a different profit potential and cash-flow characteristic of the product. Therefore, it compares the market growth

rate and the relative market share. This matrix helps to allocate resources and to determine investment requirements. Indeed, it has gained a lot of attention in the business literature, because it is an intuitive and value adding approach. However, the interviews revealed that managers want to do more than just analyzing the financial performance to decide which BM to invest in. This is because many services are not created to make a big profit, but to serve as a complementary service to reinforce existing products. Moreover, it is important to lock in the customer by creating an ecosystem of services around the car. Therefore, managers want to analyze which parts of the customer journey are already covered and which go-to-market strategy and partnerships are used for it. In addition, they find it important to recognize which products and services are missing in the portfolio, so that the customer is fully supported. The BCG-Matrix completely omits the factor 'customer' and does not provide information about potential synergies within the portfolio and between the BMs. In addition, it completely ignores the time-based dimension. As a result, only a status quo analysis is possible and no statements can be made about the development of the portfolio. In order to emphasize the strategic relevance and to discover which supply gaps need to be closed, the BM Portfolio Radar is more appropriate. When changing the sub-categories along the horizontal axis, it can provide insights into the latest trends of an industry and not only enables to match them against current operations, but also to check whether the trend is tackled by services that are currently in development. Thereby, supply gaps along the customer journey can be identified.

My research has limitations that are important to be mention and further research avenues are discussed as well. I chose the automotive industry and more specifically, VW passenger cars, as my case study and validation strategy. Therefore, only employees of VW and Porsche Consulting, a subsidiary of the VW Group, were interviewed. As other sectors are not included in my research, the outcome is biased towards the practical suitability in the automotive industry. However, questions of the interviews are framed as generic as possible to allow for more generalization of the framework. Unfortunately, internal projects and BMs that are currently in development could not be displayed here, because they are not disclosed, yet and are highly confidential for the corporation. In addition, the set of BMs in the radar in (Figure 7) might be incomplete, due to a lack of information about the whole portfolio. Furthermore, as VW is a multi-national corporation, no small and medium sized companies are part of my study. Hence, I suggest for deeper research to include them. This could deliver results with a higher generalizability over different company sizes. However, for the case of a company that operates only a small number of BMs, the radar might be too detailed and less useful.

Moreover, in the case of VW, the framework can get extended by all car brands and subsidiaries of the Volkswagen Group. This would allow to analyze the relationships and interrelations within the whole group. VW already has many interrelations between their 12 car brands. Among others, a shared vehicle-platform and synergies through collaborations and the shared use of data and software components. This would not only result in an exploration of synergies within one brand, but also between multiple brands, thereby potentially helping to reduce the VW Groups' costs for research and development (R&D) by increased economies of scale. The core contribution of this thesis was to compare existing approaches and to design and validate a new framework to map a corporate BM portfolio. In order to see final results and a full portfolio, data of each BM need to be collected and evaluated according to the dimensions of the radar.

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Appendix A – Approaches to analyze portfolios

Name	Authors	Year of Introduction	Literature	Visual Design	Dimensions	Key Purpose
BM Portfolio Analyzer	Paolo Aversa	2017	Business Model	Flow chart	1) Business model 2) Resources 3) Capabilities 4) Performance	Examine the fit across several business models and identify relationship between the different business models' resources and capabilities, and their impact on performance
Strategyzer	Alex Osterwalder & Yves Pigneur	2017	Business Model	4-Box Matrix	2 Dimensions: - Profitability - Sustainability	Help organizations understand if their business is prepared for the future or risks disruption
BCG Matrix	BCG - Bruce Henderson	1970s	Diversification	4-Box Matrix	1) Market Growth Rate 2) Relative Market Share	Help corporations make investment and disinvestment decisions related to their business units or product portfolios.
GE-McKinsey Matrix	McKinsey	1970s	Diversification	9-Box Matrix	1) Industry Attractiveness 2) Business Unit Strength	offers a systematic approach for the multi-business corporation to prioritize its investments among its business units
Cisco Technology Radar	Cisco	2012	Technology	Radar	2 dimensions: Product categories Maturity Level	Analyze trends that impact IT

Table 4: Approaches to analyze portfolios

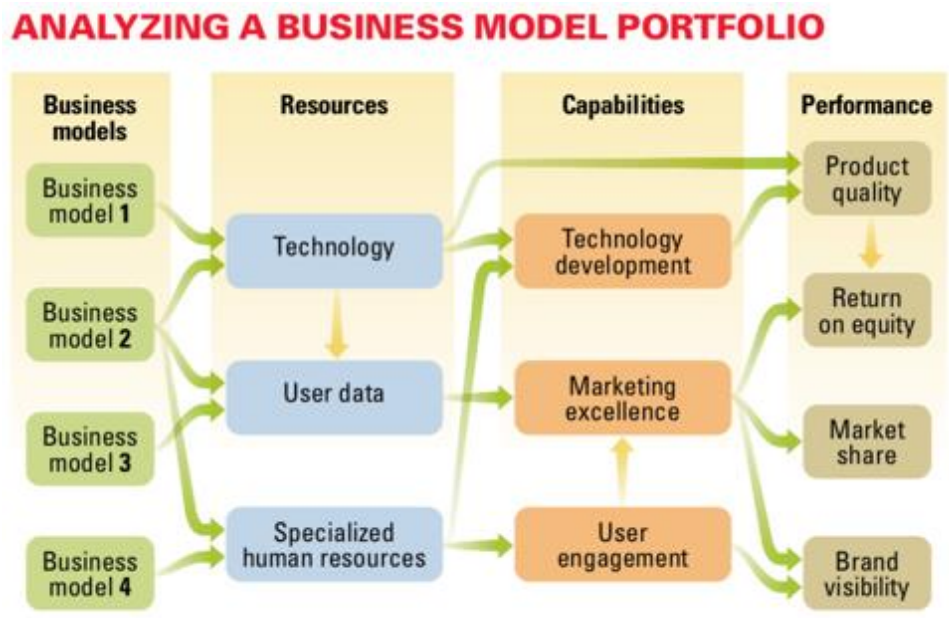

Figure 8: Analyzing a Business Model Portfolio (Paolo Aversa)

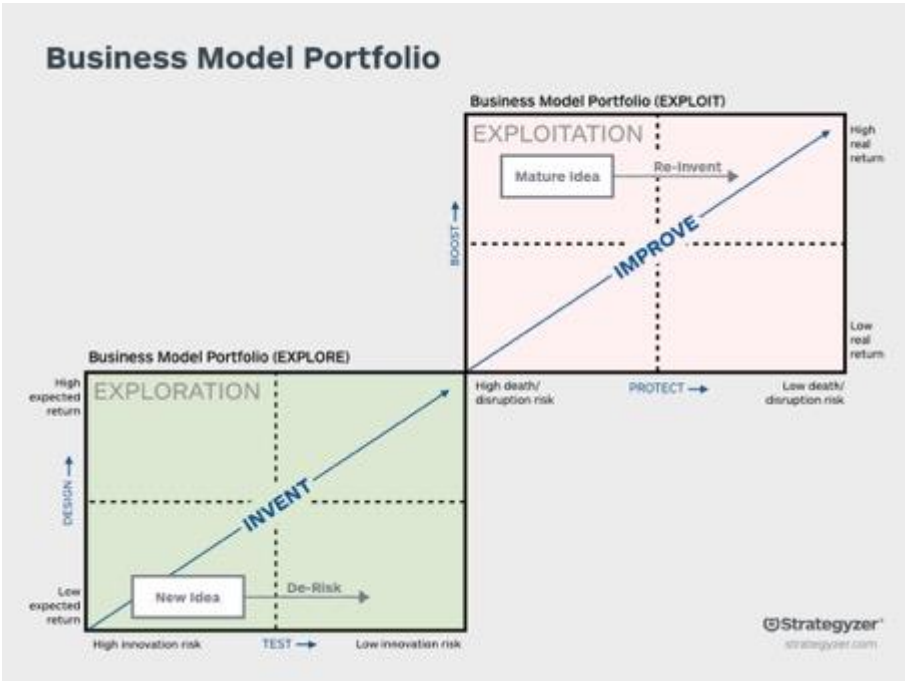

Figure 9: The Business Model Portfolio Map (Strategyzer, 2019)

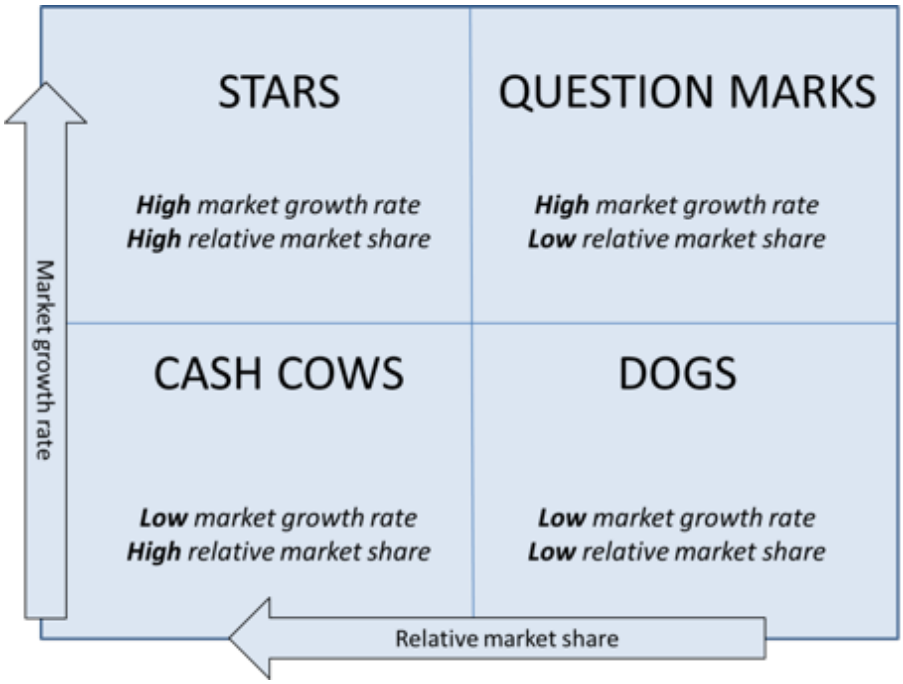

Figure 10: The BCG matrix

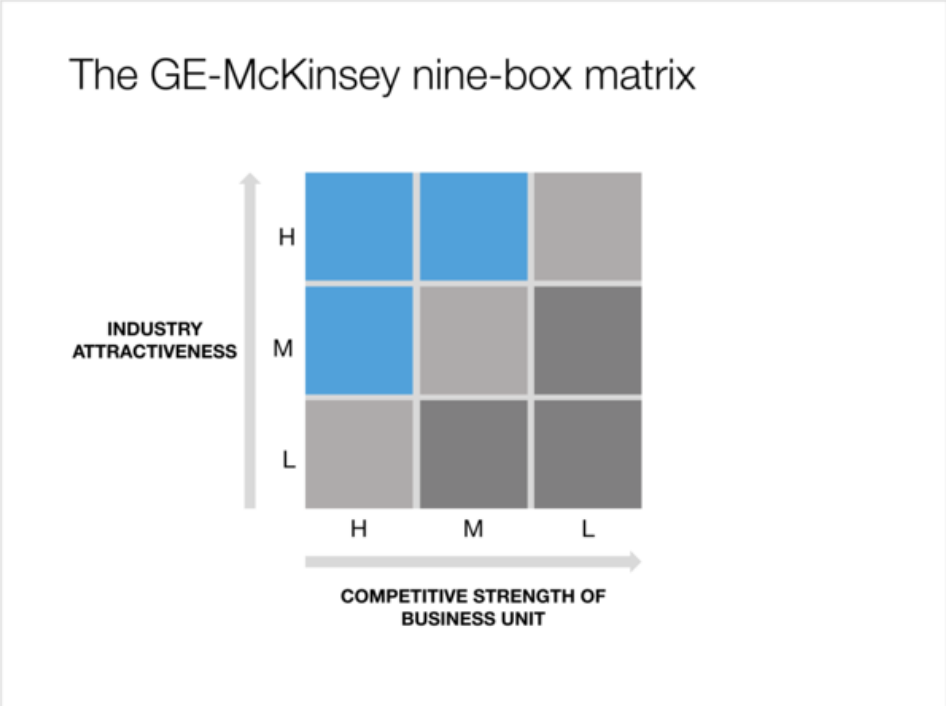

Figure 11: The GE-McKinsey nine-box matrix

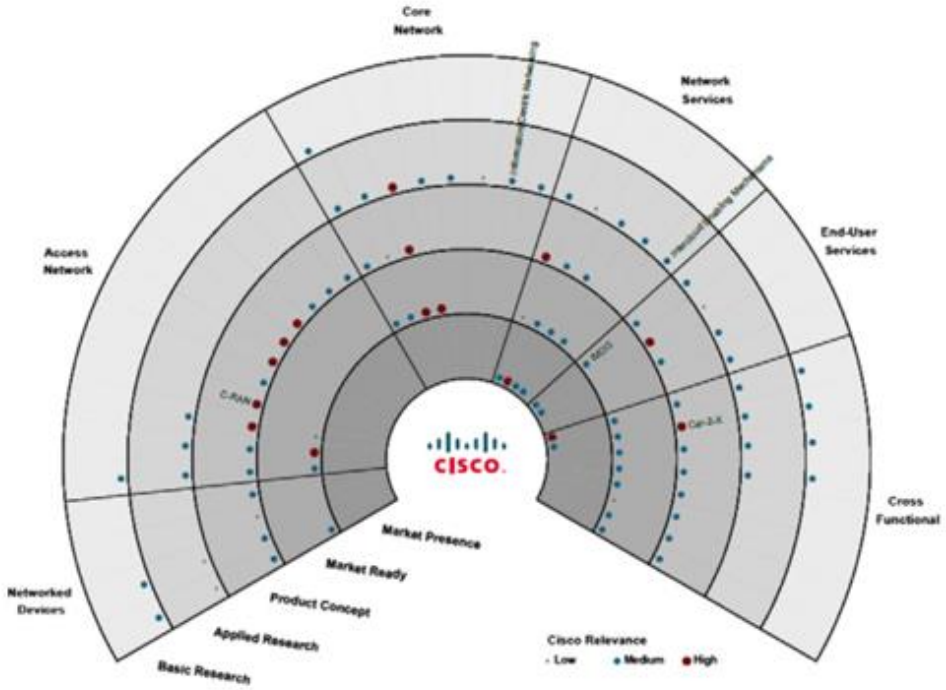

Figure 12: The Cisco Technology Radar

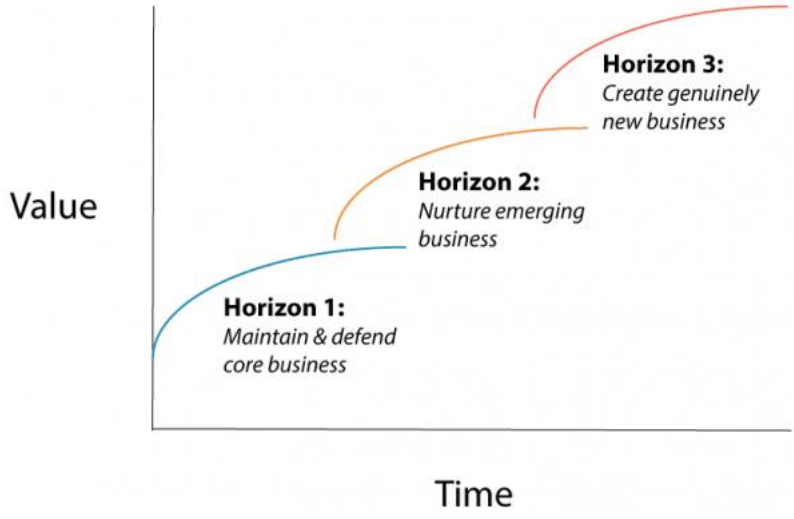

Figure 13: Three Horizon Model

Appendix B – Analysis

Nr.	Business Model	Description
1	Vehicle Manufacturing	Manufacturing of vehicles
2	We Connect	Online media streaming, real-time traffic navigation and cloud-based personalization
3	Car Net	Other day-to-day online services
4	We Connect Go	Real-time information via Bluetooth for mobile phones
5	App Connect	Integration of Apple Carplay, Android Auto etc.
6	We Share	All-electric carsharing
7	We Park	Digital parking solution (includes payment)
8	We Deliver	Service to use the car as a postbox
9	We Experience	Personalized journey extensions and recommendations
10	We Charge	Route planning and payment solution for EV chargers
11	Elli (Electric Life)	Seamless and holistic energy and charging experience
12	Volkswagen Naturstrom	100% renewable energy supply
13	ID Charger	Wall box for homes to charge an electric vehicle (EV)
14	ID Charger - Installation Service	Service to install the box at homes
15	MOIA	All-electric ride-sharing service (Operates in Hamburg)
16	Volkswagen Media Control	Turns smartphones into a remote control for vehicles
17	EV Check App	Analyze driving behavior and check EV fit
18	maps+ more	Integrates the smartphone into the infotainment system
19	Volkswagen Händlersuche	Dealer locator
20	Connect Fleet App	Fleet management system for commercial customers
21	Fleet Magazine App	Entertainment and information features for company car drivers

Table 5: Volkswagen's business models (As of December 2019)

Nr.	Business Model	Customer[2]	Revenue	Operation	Layer	Horizon
1	Vehicle Manufacturing	All	Direct Sales	Inhouse	Device	1
2	We Connect	All	No	Inhouse	Content	1
3	Car Net	All	No	Inhouse	Content	1
4	We Connect Go	All	No	Inhouse	Content	1
5	App Connect	All	No	Inhouse	Content	1
6	We Share	3-6	Pay-per-use	External Support	Service	1
7	We Park	3,4,5	Pay-per-use	Inhouse	Service	1
8	We Deliver	3,5	Pay-per-use	External Support	Service	1
9	We Experience	1-5	No	External Support	Content	1
10	We Charge	All	Pay-per-use	External Support	Service	2
11	Elli (Electric Life)	All	Pay-per-use	Inhouse	Service	2
12	Volkswagen Naturstrom	All	Pay-per-use	Inhouse	Infra-structure	1
13	ID Charger	1,2,3,4,5	Direct Sale	Inhouse	Device	2
14	ID Charger - Installation Service	1,2,3,4,5	Direct Sale	Inhouse	Service	2
15	MOIA	3,6	Pay-per-use	External Support	Service	1
16	VW Media Control	All	No	Inhouse	Content	1
17	EV Check App	All	No	Inhouse	Content	1
18	maps+ more	All	No	Inhouse	Content	1
19	VW Händlersuche	All	No	Inhouse	Content	1
20	Connect Fleet App	6	No	Inhouse	Content	1
21	Fleet Magazine App	6	No	Inhouse	Content	1

Table 6: Allocation of VW business models into the 'Business Model Portfolio Radar'

[2]Categories: 1= Suburban; 2= Rural; 3= Urban; 4= Volume; 5= Luxury; 6= B2B/Fleet; All= 1-6

BM-related factors	1) Value Proposition	Product	
		Services	- Tangible Service - Intangible Services - Upstream Service - Downstream Service
		Differentiation	- Quality - Customization - Convenience - Price - Network effects
	2) Value delivery	Customer	- Urban - Suburban - Rural - Volume - Luxury - B2B/Fleet
	3) Value creation	Operations	- Only by internal resources - External support - Investment - Joint venture
	4) Value capturing	Monetization / Revenue Model	- Freemium - Pay-per-use - Direct Sales - Subscription
Descriptive factors		Innovation Level	- Horizon 1 - Horizon 2 - Horizon 3
		Organizational setup	- Name - Business Owner - Number of employees - Number of customers

Table 7: Critical factors for business models

Appendix C – Interview design and answers

Question:	**Interview 1**	**Interview 2**	**Interview 3**	**Interview 4**
What are the challenges and pain points when it comes to portfolio mapping and monitoring	- No consolidated design to show all business models - Forecasting is difficult	- Hard to compare BMs - Operate on different levels	- Hard to compare BMs - Forecasting is almost impossible	- The portfolio is very dynamic and hard to capture in a moment - Forecasting is difficult
How is the portfolio management structured at Volkswagen?	- No comment	- Split into three portfolios (digital, vehicle & future BM) without good interplay	- No comment	- No comment
Do you think there is the need for a framework that maps all BMs? (Y/N)	- Yes	- Yes	- Yes	- Yes
Which (strategic) questions would you try to answer when monitoring a portfolio of multiple business models?	- Find out synergies between BMs - Identify supply gaps - Future composition of the portfolio	- Which services are currently operated - Does one BM reinforce other BMs? - Can it help other BMs with its knowledge and capabilities?	- Find out synergies between BMs - What services do we offer to the customer and what are we missing? - Future composition of the portfolio	- Which parts of the customer journey are we already covering? - What additional value does a BM deliver? - Future composition of the portfolio

Which synergies are interesting to explore within a framework?	- Customer Segment - Technological Base - Internal or external operation?	- Customer Segment - Revenue Model - Financial performance - Internal or external operation?	- Customer Segment - Revenue Model - Technological base - Financial performance	- Customer Segment - Revenue Model - Internal or external operation?
How would you evaluate a BM?	- Profit potential - Value to the customer (Value proposition)	- NPV - Potential customer size	- NPV - Value to the customer (Value proposition)	- NPV - Value to the customer (Value proposition)
Do you think it would make sense to include the financial performance?	- No, because all assumptions about future BMs have no validity	- Yes, but I do not know with which financial indicator	- No, because forecasting is not possible and other synergies are more interesting	No, the market perspective is more interesting for such a framework than the financial performance
Do you agree with the idea to map BMs into a radar and according to their degree of vertical integration?	- Radar: Yes - Vertical integration: No comment	- Both: Yes	- Both: Yes	- Both: Yes
How would you categorize the BMs of VW?	- Difficult to categorize - Maybe along the trends of the industry	- I would suggest to use the multi-layered architecture by Yoo et al. (2010)	- Difficult	- Mobility Services - In-Car Services - Around-the-car Services - Supporting systems, devices and energy supply

Would you understand the multi-layered architecture by Yoo et al. (2010) and does it make sense to cluster BM according to these dimensions?	- Did not ask this interviewee this question	- Yes (It was the suggestion of this interviewee)	- Yes	- Yes

Table 8: Interview design and summary of answers