BUSINESS MODEL INNOVATION BASED ON SOFTWARE ROBOTICS FOR MOBILE NETWORK OPERATORS

FLORIAN TOBIAS

A submission presented in partial fulfilment of the
requirements of the University of South Wales / Prifysgol De Cymru
for the degree of

Doctor of Business Administration

March 2021

Abstract

If Mobile Network Operators (MNO) do not change significantly, they will become a commodity and replaceable. MNOs have to be disruptors and innovators or will lose their position in the telecommunication market. While the market capitalisation of a typical MNO decreased to about 38% of the value five years ago, the market capitalisation of a typical user of MNOs' networks increased to over 600% of the value it had five years ago (Wallstreet-online, 2020b). The typical user of MNOs' networks would not have achieved such an increase without using the networks provided by MNOs.

MNOs face strong competition in the telecommunication market from other MNOs, mobile virtual network operators and over-the-top providers (European Commission, 2013; GSMA, 2020; Statista, 2016). Moreover, they have to deal with challenges, such as increasing cost pressure, high investment costs for 5G and strict regulation (European Commission, 2013; GSMA, 2020). At the same time, growth of subscriptions is stagnating, monetisation of traditional services becomes harder and margins decrease (GSMA, 2020; Krämer and Wohlfarth, 2017). Many MNOs have tried to tackle these challenges through diverse actions but could not improve their situation. The combination of all these factors suggests that MNOs have no good prospects. At the same time, technologies like BI, Big Data and software robotics are emerging and provide many opportunities and advantages, while the requirements of MNOs' customers change drastically. Hence a new way of doing business for MNOs focusing on available technology and taking their contemporary and future situation of the market into account is required.

This work proposes answers to the questions: "Are MNOs' current business models appropriate to their future and what could a potential future business model for MNOs look like, taking BI, Big Data and software robotics into account?"

An interpretivist epistemological and a subjectivist ontological approach are followed in an overall inductive research setting. A case study method is applied in a mono-method qualitative setting. The case studies are conducted in an embedded multiple-case approach with four

cases. The data are gathered from semi-structured in-depth interview conducted with experts and are analysed starting with within-case analyses followed by cross-case analyses.

The outcome provides the baseline for holistic and well-grounded advice on adapting MNOs' business models to the changing market. MNOs applying the results of this paper in practice can reinvent their business models by taking advantage of the data they have in combination with BI, Big Data and software robotics, and thus reach organisational sustainability.

Table of Contents

List of Figures

List of Tables

List of Abbreviations / Acronyms

AI	Artificial Intelligence
API	Application Programming Interface
AR	Augmented Reality
ARPU	Average Revenue Per User
BI	Business Intelligence
BMI	Business Model Innovation
BPO	Business Process Outsourcing
CAGR	Compound Annual Growth Rate
Capex	Capital expenditure
CPE	Customer Premises Equipment
CRM	Customer Relationship Management
DC	Dynamic Capabilities
DL	Deep Learning
ERP	Enterprise Resource Planning
FTE	Full-Time Equivalents
IBV	Institution Based View
ILM	Innovation Landscape Map
IoT	Internet of Things
IP	Internet Protocol
LAN	Local Area Network
M2M	Machine to Machine Communication
M&A	Merger and Acquisitions
ML	Machine Learning
MNO	Mobile Network Operator
MVNO	Mobile Virtual Network Operator

OCR	Optical Character Recognition
Opex	Operational expenditure
OTT	Over-the-top
RAM	Random Access Memory
R&D	Research and Development
RBV	Resource Based View
ROI	Return on Investment
RPA	Robotic Process Automation
SIM	Subscriber Identity Module
SMB	Small and Medium Businesses
SMS	Short Message Service
TCO	Total Cost of Ownership
VR	Virtual Reality

1 Introduction

'In god we trust, all others bring data' is an aphorism attributed to William Edwards Deming, a pioneer in quality management. This aphorism is still relevant today as many companies only have a little idea how their business runs and what causes their performance, although this information can be found in the data they have. And more importantly, many do not know how to identify ways to improve their performance and market standing. The quote emphasises how important the understanding and interpretation of data and information are that are created constantly in any business.

The above also applies to Mobile Network Operators (MNO) as they have many millions of customers that use their services mostly several times a day and generate masses of data that are stored at MNOs (GSMA, 2020). These data are crucial to MNOs and can build the baseline for a better market standing, a sustainable future, and the creation of innovative business models (Manyika et al., 2011).

MNOs face increasing pressure caused by immense competition from other MNOs, but also Mobile Virtual Network Operators (MVNO) and Over-the-top (OTT) providers, that leads to decreasing margins and high pressure on revenue (European Commission, 2013; Financier Worldwide, 2014; Glaser et al., 2019; GSMA, 2020; Prabhu, Arora and Mishra, 2018). At the same time, MNOs' business is highly capital-intense as at least with every new generation of mobile technology huge investments in MNOs' network infrastructure have to be conducted. This is also currently the case with the worldwide introduction and roll-out of 5G, which not only generates new opportunities for MNOs but also new threats (Banović-Ćurguz and Ilišević, 2017; GSMA, 2020). Moreover, in the past MNOs have tried to launch new products, which were not as successful as expected, in order to realise a long-term perspective for upturns (Statista, 2016). But these products could not solve the problem of decreasing margins and revenues (GSMA, 2020; Taga et al., 2010) in combination with the increasing investment costs (Roland Berger, 2015). The stressed situation in the market is also illustrated in the development of MNOs' share prices. As shown in figure 1, the share prices of five of the world's biggest MNOs have not developed positively over the last five years due to the challenging market environment. Nearly the same picture can be drawn if the last three years are reviewed.

Figure 1: Development of MNO Share Prices from 2015 – 2020 (Wallstreet-online, 2020a)

Considering the above, it can be seen that there is a need for Business Model Innovation (BMI) in the telecommunication market, and especially for MNOs. Therefore, MNOs' business models have to be challenged critically and prepared for the future. MNOs can use the possibilities offered by software robotics technologies such as Robotic Process Automation (RPA) and Intelligent Automation, which is used as an umbrella term for technologies like Artificial Intelligence (AI), Machine Learning (ML), and Deep Learning (DL) to innovate their business models. Through software robotics among others business processes can be automatised, costs cut, decisions prepared, and large amounts of data analysed (IRPA, 2016; Kibria et al., 2017). Besides this, the use of software robotics also enables the generation of huge amounts of data in a standardised format. These data, in combination with the masses of additional data, such as customer profiles, network data, usage patterns, or location information (Cloudera, 2015), that are available to MNOs can be used with Big Data technology and Business Intelligence (BI) systems, which support in further leveraging the available information. In this way, MNOs are expected to have a better chance to overcome the obstacles in their way. With the help of these technologies MNOs can e.g. optimise their overall internal and external performance as well as issues in their networks, and use the available data even more efficient than today. Although Big Data and BI or software robotics on their own already help MNOs, their combination enables further levels of efficiency by leveraging the capabilities of these technologies. To realise the advantages and high potential offered by these technologies, especially in combination with data and thus improve MNOs' situation, they need to use them as the anchor point for the innovation of their business models.

This thesis explores new and innovative business models for MNOs that will advance them to reach organisational sustainability in a competitive and changing market environment in the light of BI, Big Data and software robotics.

This chapter provides first an overview of the literature on the research topic in order to enable a better general view and highlight the fields of research. The research design is depicted and the author's motive stated.

1.1 Problem Statement

This section presents an initial impression of present knowledge of the research topic to provide an understanding of the MNOs' challenges.

1.1.1 Trends and Challenges in the Telecommunication Market

This subsection introduces trends and challenges in the telecommunication market for MNOs as major focus of this thesis. It aims to enable better understanding of MNOs' current situation.

Services provided by MNOs are in great demand, as can be seen from the number of subscribers, which reached 5.2 billion in 2019 and is expected further to increase in the next few years. 4G became the dominant mobile technology in 2019 and is followed by 5G, which is in its introduction and roll-out phase in most countries. Despite the increase in mobile subscriptions and the introduction of a new standard, 5G, revenues are only expected to grow slowly over the next years, while the costs of the implementation of 5G are relatively high. The slow growth of revenue is caused in part by fierce competition and saturation in the market, a decrease in traditional telecommunication services' revenue and regulation (GSMA, 2020). At the same time as traditional telecommunication services decrease in importance, data become more crucial, e.g. to mobile internet access and streaming of video and music (Analysys Mason, 2020a; Banović-Ćurguz and Ilišević, 2017). The slow growth of revenue is also caused by declining average revenue per user (ARPU), which originates from various actions of MNOs, such as strategies to reduce churn, introduction of flat-rate tariffs, and competition through lower prices.

According to GlobalData (2020a) and Banović-Ćurguz and Ilišević (2017), esports, mobile gaming, online gaming and streaming are on the rise, and can significantly affect MNOs revenue as well as strongly support the placement of 5G as technology of the future.

Another topic MNOs have to focus on is customer experience in combination with operational efficiency, as it provides the baseline for customers that stay with the company and reduced costs in operations (Benhima et al., 2013; EY, 2015; GSMA, 2020). EY (2015) identifies cloud infrastructure services, smart building services and mobile advertising as further trends in the telecommunication market. Also Internet of Things (IoT) and Machine to Machine (M2M) communication are expected to play an even bigger role in the future (than they already play today), for the industry but also for the private sector (Banović-Ćurguz and Ilišević, 2017; GSMA, 2020). According to GSMA (2020), mobile technology may be regarded as an enabler of a low-carbon future. Besides these trends there are also several challenges MNOs have to focus on.

One of the biggest challenges is the immense cost pressure caused by other MNOs, MVNOs as well as OTT providers, which basically all act on the same market with comparable products and want to increase their own share. Through this fierce competition with comparable services many MNOs decrease the prices of their services to secure an advantage. But this does not cause a long-term effect (European Commission, 2013; GSMA, 2020; Statista, 2016). Monetising traditional telecommunication services also becomes more and more demanding, while at the same time huge investments in network infrastructure are required to be able to provide the newest telecommunication technology and meet the growth rates of mobile data. To stay profitable in a low growth environment many MNOs introduce additional services that are not part of their core business to increase revenue (GSMA, 2020). Through globalisation barriers are lowered and more competition cross-border is enabled (Al-Debei and Avison, 2011; European Commission, 2016).

Regarding IoT the integration of this technology, security concerns, data privacy, and high implementation costs present further hurdles to MNOs (GSMA, 2020). Moreover, declining revenue from mobile voice and Short Message Service (SMS) leads to a reduction of ARPU, which in turn leads to lower overall revenue if not compensated by data revenue which is still not sufficiently high. This challenge is further increased by OTT services, which are often provided free of charge (GSMA Intelligence, 2020b; Krämer and Wohlfarth, 2017). Through the provision of services over MNOs' networks through OTT providers MNOs lose control of their network with regard to the services that are provided over it. In this way, they risk becoming dump pipe providers (Krämer and Wohlfarth, 2017). Furthermore, MNOs do not fully exploit available technological opportunities (Arthur D. Little, 2018a; Atluri, Dietz and Henke, 2017). EY (2015) also lists an uncertain regulatory environment, missing organisational agility, shortening technology cycles, and poor innovation rates as additional challenges MNOs must face.

The smart home market is another opportunity but also a challenge for MNOs. The market is highly competitive but offers high growth rates (GSMA, 2020; Omdia, 2020c, 2020d)

A further challenge for MNOs' core business is the availability of spectrum to provide their services. This spectrum is closely regulated in most countries and only available at high cost (GSMA, 2020).

The overall trends and challenges in the telecommunication market force MNOs to think about their future role. In order to participate in the market opportunities and generate higher revenue they need to start a transformation based on a solid strategy through development of a business model that fits the market as well as MNOs' capabilities.

1.1.2 Business Model Innovation

This subsection introduces BMI as a further main part of this thesis besides the telecommunication market and helps to identify its meaning for MNOs. As stated in the previous subsection, MNOs need BMI to generate greater revenue and become future-proof.

According to Chesbrough (2010), the economic value of an invention is not clear until it is commercialised on a business model. The company that finds the best fitting business model for an innovation will realise the highest economic value. Thus, companies need to be able to innovate their business models. Before the implementation of a new business model, barriers have to be overcome. It is crucial for companies to experiment with their business model and identify internal leaders to manage change. New markets have also to be tested to learn faster than competitors. At the same time, the current business model has to be maintained during the implementation and until the new one takes over. Rouse (2015) stresses the importance of BMI due to technological change and shortening lifecycles of existing business models. Innovations are required to be financially successful and new business models are needed to stay competitive and grow. Amit and Zott (2012) state that BMI can be a powerful tool for competition as it can improve the position of the innovating company and replication through competitors can be difficult. Overall, they identify three ways to innovate a business model:

1. Content: adding novel activities to the existing business model, e.g. through forward or backward integration
2. Structure: linking of activities in novel ways
3. Governance: Changing one or several parties that perform any of the activities

Amit and Zott (2001; 2012) go on to explain that the major value drivers increasing the chances to develop the right business model are novelty, lock-in, complementarities and efficiency. Additionally, BMI can disrupt existing industries and structures and pose a substantial threat to incumbents. Girotra and Netessine (2014) state that BMI is the change of decisions regarding offers, time of decisions, decision-maker, and reasons for particular decisions. Lindgardt et al. (2009) believe that BMI is a way to renew the competitive advantage and growth of a company in a challenging market with shorter business model lifecycles and new emerging competitors. However, BMI has to be done in a systematic way and explicitly managed. BMI helps companies to escape from intense competition and find disruptions which require new approaches. Returns based on BMI are more sustainable than those based on innovation.

In light of the preceding discussion of BMI, it can be seen that BMI offers many possibilities and opportunities to companies. The discussion suggests that companies using BMI can realise higher economic value, gain a competitive advantage, create lock-in effects, and are supported in identifying disruption possibilities. BMI could also be a suitable tool to improve MNOs' situation. Hence the possible application of BMI at MNOs is identified as a gap that will be further explored in this thesis.

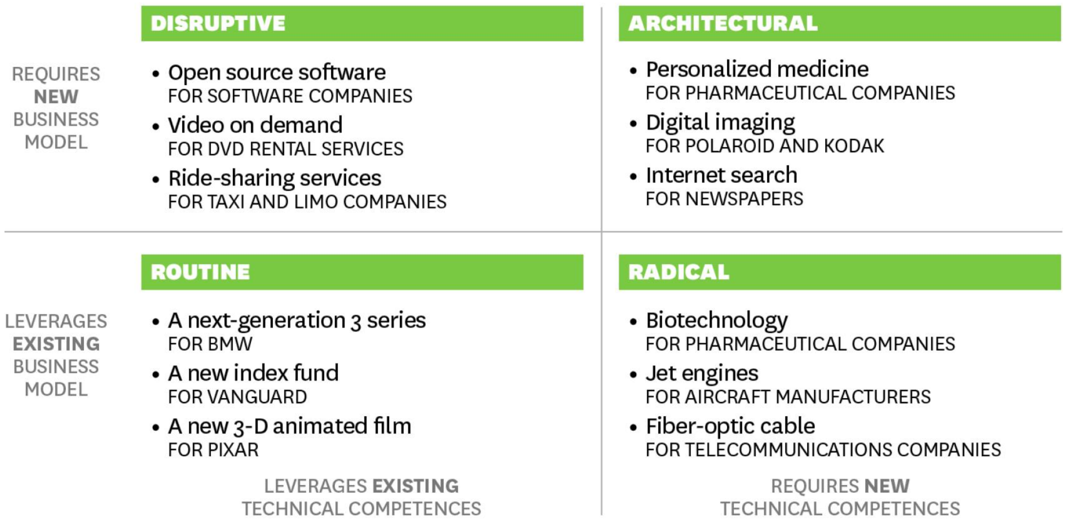
Business models revolve around forward or backward integration, as well as doing things in a different and novel way to enable efficiency and customer lock-in. The goal of MNOs focusing on BMI is to find and implement a new competitive advantage, foster their company's growth in the market, and become a disruptor. Moreover, new markets are tested by these subsidiaries, which often focus on technological change. Also, MNO's focus shifted to attracting change managers that accompany this process. This is, among other things, done to realise the highest possible benefit from innovations.

Osterwalder and Pigneur (2010) depict tools to support the creation of new business models, such as the Business Model Canvas. They highlight the importance that customer insights, ideation, and prototyping have for designing a business model, besides the importance of revenue streams, customer segments and cost structures. MNOs should consider their model when creating a new business model.

Teece (2010) emphasises that BMI should be fostered by the company itself and not be a result of the market or external events. Moreover, a defined business model needs to be flexible to new situations and is usually found through trial and error. The intrinsic motive for BMI is inherent in MNOs as they came up with many new ideas and inventions that needed new business models over the years.

Pisano (2015) also concentrates on BMI. He defined a matrix that characterises innovation regarding the degree of change in technology and technical competence as well as the degree of change in the business model. This matrix is known as the 'Innovation Landscape Map' (ILM) and is shown in figure 2. The ILM is a model suitable for many industries and also for MNOs engaging in innovation and BMI. It aims at supporting companies requiring an innovation strategy to monetise their innovations and thus is highly valuable to MNOs. In his research Pisano (2015) refers to the applicability of the ILM to telecommunication companies, which proves that it is suitable for MNOs.

Figure 2: Innovation Landscape Map (Pisano, 2015)



The possibilities and opportunities provided by BMI may not be neglected by MNOs as BMI promises a bright future to companies if done correctly. Hence MNOs should deal with it and foster it to sustain or even increase their market standing. Nevertheless, the path is not as straight forward as it seems, as MNOs have to overcome several challenges and make many decisions if it comes to finding their innovation strategy and right business model. However, concentrating only on BMI without looking any further might not be the correct way to go on. MNOs could also take the possibilities provided by the data they have as well as by technologies, such as software robotics, Big Data and BI, into account to get the most out of the innovation of their business model.

1.1.3 Software Robotics

This subsection introduces software robotics as an additional major focus of this thesis and stresses its meaning for businesses. It aims to provide an understanding of software robotics' capabilities and potential uses for businesses, also regarding BMI.

RPA is the use of special software that mimics human action on computers. In this way, tasks formerly performed by humans or completely new tasks are automated. This automation is mainly used for routine tasks but is also applicable to more complex processes. RPA is strongly used by outsourcing providers but also further companies, such as MNOs, creating a virtual workforce. Through RPA no new staff needs to be hired for new tasks, or freed-up employees can take over more demanding non-routine jobs, such as intelligent decision-making. Simple decisions made by RPA base on an enhanced logic and on rules as well as access to underlying data (Barnett, 2015; Willcocks, Lacity and Craig, 2015). Barnett (2015) adds that scaling up and down depending on the demand for the virtual workforce can easily be done nearly instantly through licensing. Overall, RPA can lead to a reduction of staff and cost savings. Also lower expenses are enabled, e.g. for recruitment or training (Forrester, 2017b).

RPA is mainly used for the automation of processes that are highly repetitive and predictable. It is also used as integration and support tool for employees and as intermediary solution for IT developments. RPA itself is a non-disruptive technology needing no or minimal IT integration (CFO, 2017). Willcocks, Lacity and Craig (2015) stress its benefits in highly competitive markets, such as the telecommunication sector, and its application in high-volume, rule-based, standardised and stable processes.

Besides cost savings RPA fosters e.g. decrease in costs, higher efficiency, better regulatory compliance, and higher reliability (Lacity, Willcocks and Craig, 2015a).

According to Justice (2016), companies have to reframe their strategy and business model if RPA is introduced as RPA is also used to create advantages over competitors.

Willcocks, Lacity and Craig (2015), and Forrester (2017a) add that the focus of RPA will shift from automation and working with structured data to unstructured data over time if other technologies, such as AI or ML, are incorporated.

AI consists, according to Bataller and Harris (2016), of multiple technologies that enable information systems sensing, comprehending and acting. Therefore, the systems need to perceive their surroundings, collect data, analyse and understand collected data, and make decisions based on available data. ML learns from experience and is able to change decision processes in response to this experience. PwC (2017) states that AI can work with information and generate results in a way that is similar to the thought process of humans. AI systems aim, among other things, at the use of learned things to reason, solve complex problems and understand language.

AI can interpret structured and unstructured data, and be used to automate more complex processes than RPA. The creation of cost savings is not the main focus when implementing AI, but rather the generation of additional benefits, e.g. in customer service through chatbots for dialogue with customers. Well known applications of AI are the chess playing Deep Blue and the Jeopardy playing IBM Watson (Scheer, 2017).

ML, which is part of AI, is able to learn in supervised and unsupervised ways. If multiple layers of it are combined further to improve its results, it is called DL (Berruti et al., 2017; Scheer, 2017). DL is intended for even more complex tasks and imitates human brain activity using neural networks (Bataller and Harris, 2016).

According to Samulowitz, Reddy and Sabharwal (2014), such a highly developed software uses knowledge from diverse structured and unstructured sources as well as from past and current experience to think with this knowledge and to adapt. Furthermore, the software is able to interact with others and is capable of generating novel hypotheses.

Such solutions are, unlike RPA, better suited to complex tasks, such as pattern recognition (Lacity and Willcocks, 2016). Among the advantages of AI, ML and DL are continuous learning, 24/7 availability, shared learning between different systems, and improved decision-making (Azoff, 2017). Moreover, these technologies enable and foster new business models (Omdia, 2020b).

Given the aforementioned advantages and opportunities that software robotics provide, such as improved decision-making, faster, more efficient and automated processes, cost saving, and support in interactions with customers, it can be seen that their use leads to benefits for MNOs. Moreover, software robotics help to focus on and overcome challenges at MNOs. Therefore, the opportunities provided by software robotics need to be realised by MNOs in order to improve their situation and become future-proof. It is also shown that for the greatest possible use of software robotics the available business models have to be adapted in order to have not only a short-term but a long-term benefit from software robotics and to make software robotics part of the overall company strategy. However, further to utilise the possibilities provided by software robotics to the greatest possible outcome, the ability to work with the huge amount of data available at companies, known as Big Data, has also to be considered. Moreover, software robotics itself generates additional masses of data through its actions which also have to be taken into account when dealing with Big Data and BI, and in the generation of a future business model.

1.1.4 Big Data and Business Intelligence

This subsection introduces Big Data and BI as a fourth main topic of this thesis and highlights concepts of their functionality, the possibilities they provide as well as their significance for companies. As shown above, Big Data and BI are closely connected to software robotics as well as to BMI. Moreover, all these technologies are expected to influence MNOs not only in the current time but also in the future. Therefore, they play a crucial role for MNOs.

According to Manyika et al. (2011), Big Data are datasets of a size that makes it impossible for standard database software to work with these data. They use a moving definition of ‘Big Data’ as technology improves, meaning that the size of datasets regarded as Big Data will increase over time. Snijders, Matzat and Reips (2012) adopt a moving and loose definition stating that Big Data are datasets that are too large and complex to handle using standard software.

As already indicated, the amount of data is constantly increasing and the use of this data can lead to deeper insights into the subject of interest. Fast data collection and conversion to information enables competitive advantage to companies. Google, for example, can detect outbreaks of flu in a region faster than public authorities due to an increase in searches for terms connected to the respective flu (Magoulas and Lorica, 2009). Also decision-making is supported and better cost structures are enabled through Big Data (Deloitte, 2015). Moreover, Big Data assists in customising products and services through the creation of consumer microsegments (Bughin, Chui and Manyika, 2014). But Big Data is also crucial to the creation of new business models in using data from a company’s core operations and monetising them (Chui et al., 2013; Manyika et al., 2011).

Manyika et al. (2011) go on to explain that Big Data’s broad application will lead to a wave of innovation, productivity and growth. It will also support meeting competition and value creation, as well as efficiency and effectiveness.

Given this information Big Data’s important role for MNOs can be seen as MNOs have access to huge amounts of data through their business, such as profiles of customers, data of customers’ devices, network data, usage patterns and location data (Cloudera, 2015).

BI supports companies in converting data, e.g. Big Data, into useful information, which leads to better and more informed decision. This enables companies to stay ahead of their competitors as decisions can be made faster and based on more accurate information (Pareek, 2007). Moreover, BI helps in the consolidation and management of multiple data sources to use Big Data in the best possible way (Jou and Ng, 2013).

Bi is defined as a technology used to analyse business data to enable historical, current and predictive views of the underlying data. Its functionalities mainly concern retrieving, analysing and reporting data, including data mining and predictive analytics with the goal of supporting decision-making (Elena, 2011). It further helps in detecting significant events, predicting business situations, and discovering new business scenarios (Olaru, 2014). Overall, the excelling use of BI lies in transforming data to information and transforming information to knowledge (Leung et al., 2013). BI is also used for predictive analytics and data visualisation (Jou and Ng, 2013). For MNOs predictive analytics provided by BI can e.g. help in creating forecasts of network components that are most likely to fail within a given time frame. Also, expected churn rates or the probability of sales of new devices or tariffs can be predicted with certain limits. Moreover, movement paths of commuters as well as large crowds of people can be assumed and the antennae to cover the respective areas can be aligned.

BI is crucial to handling Big Data effectively to enable good, well-informed and strategic decisions to support companies' success. Faster business, better software and bigger data will transform the use of BI, which has to face the challenges imposed by volume, velocity and variety of data (Leung et al., 2013).

In light of this information it can be seen that BI is crucial to MNOs getting the most value out of the Big Data they have. It supports MNOs in better and faster decision-making and also in the identification of potential new business areas in which they should engage in. Hence it has great influence on MNOs' BMI.

As indicated above, the greatest advantages and outcomes can be realised when combining software robotics with Big Data and BI. AI and ML are especially powerful tools for managing large sets of data, such as Big Data, regarding predictive analytics, suggestions, and decision-making (Kibria et al., 2017). The capabilities of Big Data can thus be further enhanced through AI and ML

The other way around, Big Data is a prerequisite to ML unfolding its true potential (Arthur D. Little, 2018a). Fostering ML through Big Data also speeds the development of AI. Therefore Big Data also influence AI to a great extent (Datameer, 2018). Hence, these technologies are interdependent and support each other.

RPA is also an important factor in the realisation of Big Data's full potential, especially if it comes to the extraction of meaning from Big Data as RPA supports the gathering of data from various systems and analysing them. On the other hand, RPA generates data for Big Data and is able to transfer raw data into understandable information that can be used for decision-making (UiPath, 2017). Hence these technologies are also interdependent and complement each other.

RPA can transfer data into predefined formats for data storage, which makes the data processible for technologies such as BI.

The combination of BI and ML can help in achieving, among other things, performance improvement, operational efficiency, cross- and upselling, and churn prediction (McKinsey & Company, 2016).

Chatbots using natural language require a combination of AI, ML and DL. The outcome of chatbots' interaction with customers generates huge amounts of data – Big Data - that in turn are used further to improve the performance of the chatbot.

Another example would be the conversion of unstructured into structured data using RPA. RPA can then load the data into a data warehouse designed for Big Data, while additional information is added by AI. Finally, the information can be integrated in BI to enable better and more informed decision.

The possibilities that Big Data and BI offer must be taken into account by MNOs in order to have a better chance of improving their current situation but also their potential future standing. They also support MNOs with BMI. The biggest outcome from the available technologies for MNOs can be achieved by combining software robotics with Big Data and BI as these are mostly interdependent and not only support each other but improve the capabilities they can provide.

Summarising section 1.1 it is shown that MNOs' market situation is not as bright as it could be and that their current situation has to be changed to be better prepared for the future. Innovation and especially BMI provides a possible way to prepare MNOs for the future and best bases on one of the most valuable assets MNOs have, namely data. The best advantages and outcomes of the available data are expected to be achieved when used with software robotics, Big Data and BI, which are also highly interdependent.

1.2 Aim, Objectives and Research Overview

In this section the purpose of this thesis is stated as well as its objectives and research questions. The overall research design is also shown.

The aim of this thesis is to provide a framework within which MNOs are guided to innovate their business model for organisational sustainability by exploring key aspects based on the contextualised 'Innovation Landscape Map' of Pisano and by developing an industry-specific, new transition model grounded on the same.

The focus will not be on all telecommunication companies, like fixed net providers, MVNOs, OTT providers, or mobile network enablers, but solely on MNOs as these companies are those most affected by the market changes and in the most critical situation in the market.

Nor will the relevance of brands be covered, as this research focuses on the innovation of MNOs' business models without the influence brands can have on the individual developments of companies and their respective business models. Nevertheless, it is recognised that brands are an important factor in the development of future ecosystems to sustain customer relations (Atluri, Dietz and Henke, 2017).

MNOs' processes are mostly digitalised and they theoretically possess all the data available due to their digitalisation. Their market entry was much later than the appearance of fixed net providers as the respective technologies were not developed simultaneously. This gave MNOs the opportunity to start from scratch and begin their operations with completely or mostly digitalised processes. Hence it could be assumed that MNOs are at the leading edge as they have all the data in digitalised form, but paradoxically they are not, as they did not use these data effectively.

To reach the research aim, the following objectives and research questions are defined:

Objective 1: To show the contemporary situation in the telecommunication market for MNOs as well as to develop the look of a future MNOs business model and telecommunication ecosystem.

Objective 2: To depict the role of innovation for MNOs as well as the implication of Pisano's 'Innovation Landscape Map' on MNOs.

Objective 3: To illustrate the role of BI, Big Data and software robotics for MNOs, their future business model and a future telecommunication ecosystem.

RQ1: How can the contemporary situation in the telecommunication market for MNOs be described and how and why do BI, Big Data and software robotics have an impact on MNOs?

RQ2: How and why does innovation impact MNOs' future development and what is the implication of Pisano's 'Innovation Landscape Map' on MNOs?

RQ3: What could a future MNO business model look like and how and why will BI, Big Data and software robotics have an impact on it?

RQ4: hat could a future telecommunication ecosystem look like and how and why will software robotics have an impact on it?

This thesis consists of seven chapters. The (1) introduction embraces the relevance of the field of research and provides a first overview of the literature as well as the gaps in knowledge, which are addressed and will be closed by this research. The procedure by which the objectives of the work will be met and by which the research questions will be answered are then presented. The author's motive for this thesis is explained.

In the (2) literature review, the knowledge in literature is used to build the baseline for the further research. This is achieved through descriptive research. Data are collected in several ways, including use of the Bavarian State Library, university library of Ludwig-Maximilians-University Munich, as well as the online library network of USW. In this way, an understanding of the field is enabled and the gaps in knowledge are further elaborated. Section 2.1 provides insights into the current situation of the telecommunication market for MNOs. Section 2.2 summarises the relevant knowledge of innovation, with a special focus on the ILM and disruptive innovation as well as BMI and its significance for MNOs. Section 2.3 covers the concepts and possibilities provided by software robotics in general and especially for MNOs. Thereafter, section 2.4 concentrates on data insights, meaning Big Data and BI, by depicting their concepts and the possibilities they provide, including their current use at MNOs. The link between Big Data, BI, and software robotics is also established.

The (3) research methodology picks out the procedure of how the data and findings required to answer the research questions and reach the research aim are generated and evaluated as central theme. Therefore, section 3.1 addresses the overall philosophical approach by taking a closer look at ontology and epistemology. Section 3.2 defines the research approach, meaning qualitative or quantitative as well as deductive or inductive. The following section (3.3) focuses on the mono research method. In addition, the case study as chosen research method for this research is delineated as well as in-depth interview as research instrument. Section 3.4 covers the research design, consisting of the procedure followed to collect data, validity and reliability of the research, data analysis, as well as pilot study adjustments. Section 3.5 focuses on research ethics applicable to this research.

Afterwards, the analysis of the conducted interviews is executed by summarising the interviews and stating the main findings.

In the (4) analysis chapter, the data collection process is firstly described by stating the procedure followed. The conducted interviews, which are split in the cases MNOs, consulting companies, Intelligent Automation providers, and RPA providers, are then analysed guided by identified themes. The single interviews per case are then summarised and the key statements highlighted.

In the (5) discussion, the results of the analyses conducted are discussed. In section 5.1, within-case analyses are conducted to compare the single interviews of each case. This enables more accurate information than is available on only one interview per case, as commonalities and differences between the single interviews of each case are identified. Section 5.2 covers the cross-case analysis, which enables comparison of the key statements and findings of the interviews between the single cases. In this way, commonalities and differences between the cases are shown, which assists in the provision of distinct points of view on the research topic. In section 5.3 a modified conceptual framework populated for the telecommunication industry based on literature, insights from conducted interviews and inside knowledge of the researcher is examined.

The (6) contribution chapter transfers the findings and results of the analysis of the conducted research to contributions. Section 6.1 depicts the contribution to knowledge, which is based on the insights gained from the within-case analyses as well as the cross-case analysis, and suggests (I) a framework within which MNOs are guided to innovate their business model in order to reach organisational sustainability, (II) a possible extension of Pisano's (2015) ILM, and (III) a modified conceptual framework populated for the telecommunication industry. Section 6.2 discusses the contribution to practice, which is (I) the suggestion of key aspects of an industry-specific business model for MNOs and (II) the provision of recommendations for practitioners based on the modified conceptual framework and identified influencing factors. In section 6.3, the contribution to practice is assessed. The limitations of this thesis and impulses for further research are stated in section 6.4.

The thesis ends with (7) conclusion and outlook. A final overview of the thesis is provided, the most important findings are recapitulated as well as the contributions, and a further outlook is depicted.

Figure 3 provides an overview of the research process.

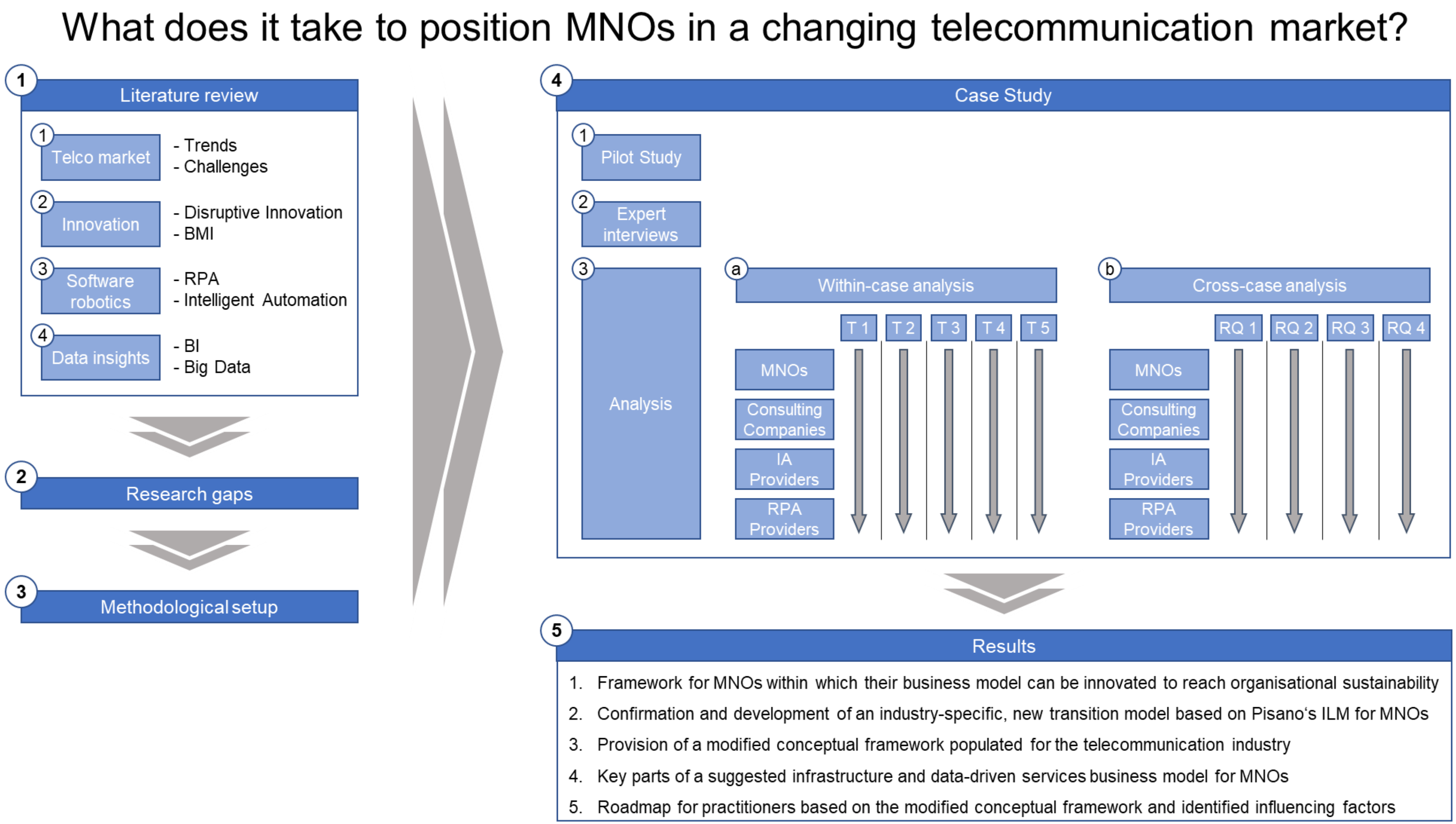


Figure 3: Research Overview

1.3 Author’s Motive

The selected topic is especially motivating for the author as his interest in the areas ‘telecommunication’, ‘software robotics’, ‘BI’ and ‘Big Data’ developed over a couple of years. From 2013 to 2016 the author worked at a German subsidiary of Telefónica, one of the world’s biggest telecommunication providers. In this time, he had his first deep contact with the strategy of a telecommunication company by participating in the project team responsible for Telefónica Germany’s acquisition of the former competitor E-Plus. In this project he was among others responsible for analysing several purchasing contracts regarding the possibility to integrate the respective contracts of the other company to realise the best possible benefit for the new company as soon as the acquisition was approved by the antitrust authority. After the approval the author realised the formerly identified benefits through renegotiation, consolidation and re-tendering. Besides this he was member of the team responsible for the general contractors that built Telefónica's network in Germany, which enabled him to get further insights to the company's strategy. Also his responsibilities for consulting and HR-related procurement contracts provided him insights into Telefónica's plans and projects. This was supported by the task to improve procurement processes in his area of responsibility and defining category strategies. As the participation in the acquisition project led him to focus more on topics of Merger and Acquisition (M&A), telecommunication market and company valuation, he wrote his Master’s thesis on the consolidation of the German telecommunication market, using the example of Telefónica Germany’s acquisition of E-Plus. Through this thesis he became even more interested and knowledgeable in the field of telecommunication and gained interesting insights from the experts he conducted interviews with for this research. After 2.5 years at Telefónica the author started working at KPMG, a worldwide acting auditing and consulting company, in the area of Value Chain Transformation for KPMG Germany’s Head of Telecommunications. This step was chosen as the author expected to get even more knowledge about the telecommunication market and its participants through participation in various projects for telecommunication companies. During his work at KPMG, he made his first contacts with software robotics and participated among others as project lead in several projects to implement RPA in diverse telecommunication companies, e.g. to improve finance, accounting and procurement processes and to replace employees who voluntarily left the company as part of a downsizing process with software robots so that their previous work would be done and remaining employees could be relieved from additional work. During this work he also learned about and used further technologies, such as ML, AI, Big Data and BI. The latter two were required as several projects were related to such a huge amount of data that standard software was not sufficient to handle them. Given his Master's thesis, interest in and knowledge of the telecommunication market gained through academic and professional work the author knew about the need to improve the economic situation of MNOs. Through his participation in above mentioned projects, he saw the benefits the aforementioned technologies could provide to MNOs. Looking for ways for a possible improvement of MNOs' situation, he formed his first thoughts on the introduction of software robotics in combination with Big Data and BI into MNOs' business models in order to improve their economic situation and gain advantages over competitors. To elevate his interest and knowledge to the next and more professional level, and to generate original knowledge, the author decided to approach this issue in a more scientific way through research within the framework of a DBA.

2 Literature Review

MNOs have to face many challenges, like cost pressure initiated by other MNOs and MVNOs, pressure through new technologies, stagnating growth of subscriptions, competition from OTT providers, monetisation of traditional services as well as decreasing margins. Accordingly, they try to diversify their portfolio, e.g. by reselling energy and gas agreements, providing smart metering services, or providing bank services. As these actions do not improve MNOs' situation significantly, new technologies as well as new trends and drivers are emerging, and customer needs are changing, and a novel way of doing business for MNOs is required. As they usually have multiple millions of customers that use their services mostly several times every day, a huge amount of data is generated and stored in MNOs' systems. These data could be the anchor point for the creation of innovative business models for MNOs.

This thesis' overall exploratory research question is 'What does it take to position MNOs in a changing telecommunication market?'. This research question is answered following a conceptual framework. The research aim is to provide a framework within which MNOs are guided to innovate their business model for organisational sustainability by exploring key aspects based on the contextualised 'Innovation Landscape Map' of Pisano and by developing an industry-specific, new transition model grounded on the same.

The literature review consists of four sections that summarise the current state of knowledge in the following areas: telecommunication market, innovation, software robotics and data insights. The literature review enables understanding of the thesis' topics through description and analysis. It builds a fundamental part and forms the foundation of the research project. The literature review enables the identification of the gaps of knowledge from which the research questions are derived.

Peer-reviewed journals are used as major source of literature and have a high level of academic acceptance. Further sources are used to a minor degree in the literature review, e.g. to provide additional information, to define topics, and to show current situations and developments. Amongst these other sources are reports, contributions, conference papers and monographs.

In the first section of the literature review (2.1), trends and challenges in the telecommunication market are analysed to provide an overview of the current situation of this market. In the first part of this section, trends like the increase of 4G connections, increase in data service usage, saturation of voice services, and declining year-on-year growth concerning revenues are depicted. The second part of the first section concentrates on challenges MNOs have to face, such as cost pressure initiated by other MNOs and MVNOs, as well as competition from OTT providers.

Section 2.2 covers the topic 'innovation' and focuses on the theory of innovation including its development over time. In a next step the ILM with a special focus on disruptive innovation is explored. This is followed by taking a closer look on BMI with a focus on the definition of the term 'business model' as well as its components. An overview of the theory on BMI and its significance for MNOs as well as of strategic management views is then provided.

Section 2.3 covers software robotics and explains the capabilities and challenges of RPA as well as Intelligent Automation. The current use of software robotics at MNOs is also highlighted.

In the last section (2.4), data insights enabled by technology are picked out as a central theme due to the possibilities they provide to companies. The concept of Big Data and its usage at MNOs is described. This is followed by an illustration of the concept of BI and its respective usage at MNOs. In addition, the link between Big Data, BI and software robotics is illustrated.

Finally, the literature review is concluded.

2.1 Telecommunication Market

In this section the knowledge in the literature of the current situation of the telecommunication market for MNOs is summarised.

To build the baseline for the provision of a framework within which MNOs are guided in innovating their business model and relevant and irrelevant parameters of their current business models in order to reach organisational sustainability are identified, it is important to understand the developments, problems and trends of the telecommunication market that affect MNOs. Moreover, it is crucial to analyse the current situation MNOs face as well as the chances and challenges present in the telecommunication market. Accordingly, this section focuses on the first objective, to explore the contemporary situation in the telecommunication market. In the following, the current trends and their respective anticipated developments are identified, while also stating the challenges that affect MNOs. At the end of this section the results from the literature review on the current situation of the telecommunication market for MNOs are summarised.

2.1.1 Trends in the Telecommunication Market

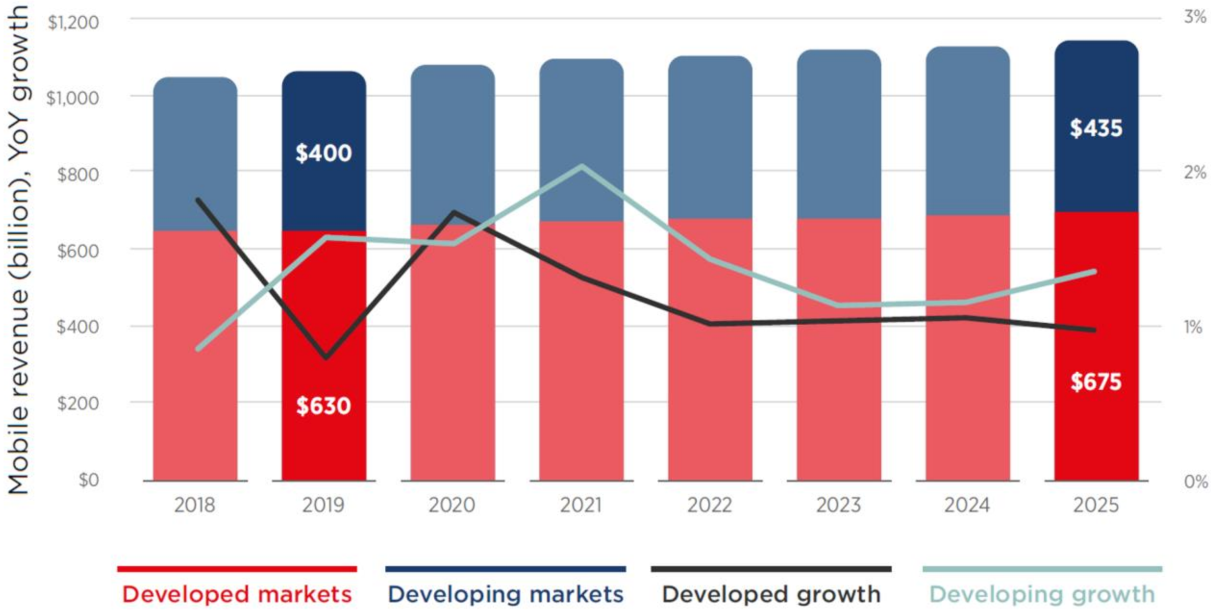
In this subsection ongoing trends in the telecommunication market are described to provide an overview of the overall developments. For this it is helpful to have the value drivers of MNOs in mind.

According to Kaleelazhicathu et al. (2014), MNOs rely on various value drivers that are at the core of their business. These drivers are:

- Connectivity as the central value of MNOs and the centre of their service provision. Through connectivity people and machines can exchange information.
- Mobility and reachability to increase connectivity as communication is enabled regardless of time and place.
- Converged services as the ability to access services independently of used devices or access network.
- Online-services to enable users to fulfil their daily tasks, like ordering, invoicing, or paying bills, more easily.

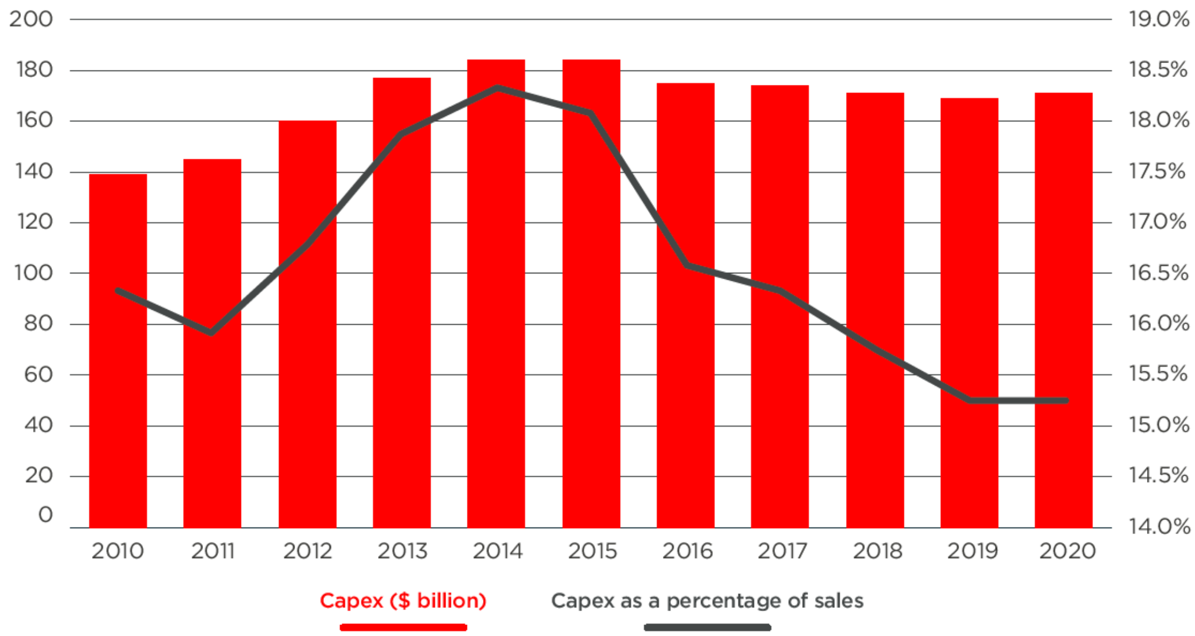
While wireless services, mainly due to mobile communication, “have advanced faster in the last 10 years than the whole of telecommunication technology over the last 100 years” (Bohlin, 2007, p. 217) and the number of subscribers to mobile services was already above one billion in August 2000 (Bohlin, 2007), the number reached 5.2 billion in 2019, which means a penetration rate of 67% (GSMA, 2020). For the year 2025, 5.8 billion unique mobile subscribers with an overall penetration rate of 70% are expected, resulting from a compound annual growth rate (CAGR) of 1.9%. Between 2019 and 2025 4G, which became the world’s dominant mobile technology in 2019, is expected to increase from 52% to 56% of connections, while 5G is predicted to reach 20% of total connections or 1.8 billion connections in total. Overall, MNOs need to evolve their network through innovation in order to be ready and meet the requirements of the 5G age. Until 2023 4G is forecasted to grow and reach its peak below 60% of global connections (GSMA, 2020). A study conducted by McKinsey (2017) found out that the revenue of the largest 250 telecommunication companies dropped by an average of 6% per year between 2010 and 2016. The overall mobile revenue was $1.05 trillion in 2016 (GSMA, 2017), declined to $1.03 trillion in 2019 due to fierce competition, regulatory intervention and slower subscriber growth, and are forecasted to reach $1.14 trillion in 2025 with an annual growth rate of about 1% (GSMA, 2020). Analysys Mason (2020c) is a little more optimistic, stating a CAGR of 1.4% for MNOs between 2019 and 2024, while another study of Analysys Mason (2020d) is less precise and states that MNOs’ revenue is flattening due to competition and saturation in the market. The past and forecasted revenue developments are shown in figure 4. Furthermore, the share of traditional telecommunication services’ revenue of total revenue is declining. The growth of mobile data has led to a substitution of traditional telecommunication services for data. More MNOs need to capitalise on their investments in mobile broadband, e.g. through evolvement of their networks, and need to diversify in order to grow beyond their core services. (GSMA, 2020; GSMA Intelligence and CAICT, 2016).

Figure 4: Global mobile Revenues and annual Growth Rate, 2018 – 2025 (GSMA, 2020)



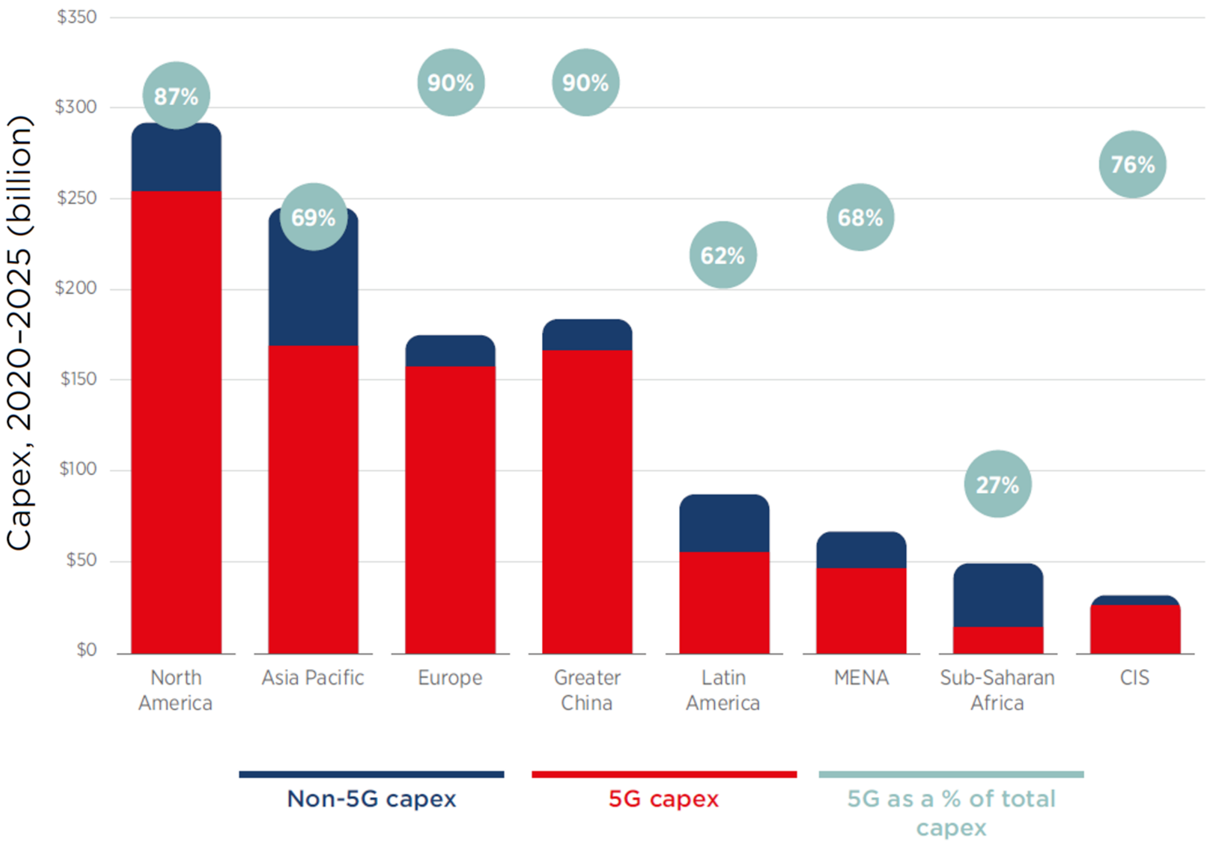
In the years from 2010 to 2016, operators invested $1.2 trillion in capital expenditure (capex) to roll out 4G networks, extend coverage and capabilities, as well as to upgrade their network (GSMA Intelligence and CAICT, 2016). The past and expected development until 2020 is shown in figure 5.

Figure 5: Development of global mobile Capex, 2010 - 2020 (GSMA Intelligence and CAICT, 2016)



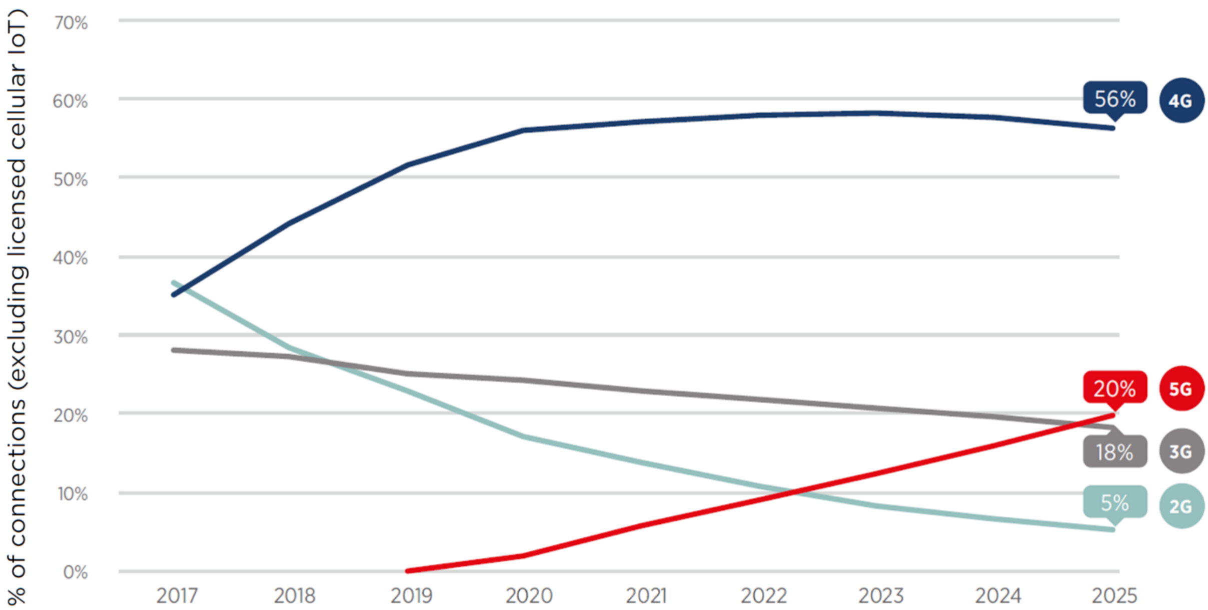
It is expected that between 2020 and 2025 MNOs will invest a further $1.1 trillion in capex, whereof almost 80% will be for the deployment of 5G (GSMA, 2020). The distributions of the investments in non-5G capex and 5G capex as well as the percentage of 5G of total capex are illustrated in figure 6.

Figure 6: Global mobile Capex according to Region, 2020 – 2025 (GSMA, 2020)



There is a fast growth of messaging platforms and players participating in the telecommunication ecosystems that already introduce open innovation strategies and foster collaborative partnerships. The worldwide mobile internet access through individuals increased to 3.6 billion in 2017 (GSMA, 2017) and 3.8 billion in 2019, and is expected to reach 5.0 billion by 2025 with a CAGR of 4.6%, showing an increasing demand for telecommunication services and more data (GSMA, 2020). The need for more data is confirmed by Analysys Mason (2020a), stating that consumers mainly need more data for streaming purposes, such as music and video. According to Du Preez and Pistorius (2002), and GSMA (2020), the increase in data service usage can be explained by an increase in the amount of time spent on the move, an increase of telecommuting and mobile workforces, globalisation, a decrease in costs for mobile services, advances in technologies, a high mobile phone adoption rate, as well as device-linking technologies. Cisco (2016) adds that it is forecasted that global mobile data traffic per month is likely to exceed 30.6 exabytes globally in 2020 and that per capital 1.5 mobile connected devices will be used. According to GSMA (2020), in 2019, about 66% of the global population subscribed to mobile services. This number is forecasted to increase to 5.5 billion subscribers in 2022, and in 2025 the subscription rate to mobile services is expected to reach 70%. In 2020 half of the population, meaning about 4 billion people, is expected to be using mobile internet, with an increase to 5 billion people in 2025. Total mobile connection will increase from 8 billion in 2020 to 8.5 billion in 2024. For 2023 it is predicted that 5G connections will overtake 2G connections and two years later 5G connections will also overtake 3G connections (GSMA, 2020). The expected development of the connections is shown in figure 7. Overall, 5G was already commercially available in 24 markets in January 2020 (GSMA, 2020) and 73 MNOs had launched 5G services in 41 countries by April 2020 (Analysys Mason, 2020a), with strong use cases in smart manufacturing, such as robots, remote real-time manufacturing and labour augmentation, as well as in autonomous vehicles, e.g. for communication between vehicle and vehicle, pedestrian, network or infrastructure. However, MNOs' task is mainly seen in the communication between cars and their surroundings. Besides new communication possibilities, 5G is expected to improve mobile data speed and mobile service coverage, as well as to provide new services and connectivity for formerly unconnected devices (GSMA, 2020). According to IDC (2020) site connectivity and management, handling of emergencies, remote doctor visits, virtual reality (VR) and augmented reality (AR) based trainings, massive M2M communications, and ultra-reliable communications are among potential 5G use cases, which make the technology even more attractive.

Figure 7: Development of mobile Connections, 2017 – 2025 (GSMA, 2020)



Mobile broadband is forecasted to account for 85% of total connections in 2021. This will increase to 95% until 2025. The smartphone adoption rate was 65% in 2019, which means 5.2 billion smartphone connections, and is forecasted to increase to 7.1 billion connections by 2025, which means a smartphone adoption rate of 80% (GSMA, 2020). For 2020 it is expected that smartphones will cause 80% of mobile data traffic due to their increased usage, with 4G connections having the highest share of the connections. Moreover, 75% of data traffic will be for video in 2020 (Cisco, 2016). Additionally, global mobile data use will increase and be four times higher in 2025 than in 2020 (GSMA, 2020).

Banović-Ćurguz and Ilišević (2017) add that the number of users of multi-Subscriber Identity Module (SIM) services increases rapidly and the importance of improving user experience is rising strongly. They also explain that the telecommunication market is saturated with voice and that rapid data growth results in the need to develop new strategies. Traditional services like voice and SMS are in retreat caused by social networks, online games and OTT applications. Even though MNOs invest huge amounts of money in their infrastructure and technology, this does not lead to the expected profits. As most MNOs base their strategy on reduction of churn, flat-rate tariffs and fixed broadband in nearly countless packages, this leads to the situation in which most subscribers use high-speed data services that are offered relatively cheaply. Concluding, this causes a declining ARPU. Analysys Mason (2020a) states that MNOs try to increase their ARPU by positioning their 5G networks and by developing tariffs that target the high-value part of the market. Therefore, several MNOs follow strategies to change 4G subscribers to 5G subscribers, e.g. by bunding value-adding propositions and delivering unlimited data offers which are only slightly more expensive than 4G tariffs. A study conducted by GSMA Intelligence and CAICT (2016) supports the statement that MNOs' growth is slowing down and OTT providers cause a decline of MNOs' core services. It is added that this happens while the broader mobile communication ecosystems profits from significant growth in revenue. They also identified two trends, namely the significant growth of the global mobile ecosystem by more than 70% until 2025, with IoT and video and music contents being the biggest drivers, and the continuing decrease of MNOs' share of the revenue.

Banović-Ćurguz and Ilišević (2017) and GlobalData (2020a) stress the importance of esports, mobile gaming and online gaming for MNOs. Additionally, IDC (2020) confirms that online gaming is one of the important topics for MNOs, especially if it comes to 5G. According to GlobalData (2020a), esports is the fastest growing sector in the gaming area with a reach of about 450 million people, which is expanding rapidly. In esports mobile gaming is the fastest growing part. Gaming via mobile devices becomes more and more popular partly due to chip developers that make mobile devices faster and more capable. Mobile gaming is expected to become even more popular and important over the next three years with hotspots in Southeast Asia and Latin America. Given 5G's low latency and high speed, a change of connections for esports from local area network (LAN) to 5G is expected. Also streaming esports events using 5G is highly relevant to MNOs, which is the reason for which the fight for market share in this area has already started. Another upside for MNOs is the possibility to promote their 5G network using esports and the respective events. Omdia (2020a) confirms the importance of streaming for MNOs, especially if it comes to the generation of revenues in the TV area. Analysys Mason (2020f) also confirms the importance of mobile and cloud gaming but states that MNOs have to do more to get and secure their part of the overall market expenditure by embracing this new way of gaming. According to them, MNOs can realise their share through the provision of infrastructure services, acting as partner for sales channels, or through the provision of own services. Moreover, cloud gaming and streaming of games is regarded as a disruptive force. MNOs' revenue opportunity is calculated to be $ 4.5 billion in 2024. MNOs are recommended to use the connectivity they provide to secure their part of the revenue and to bundle cloud gaming with connectivity plans in cooperation with partners.

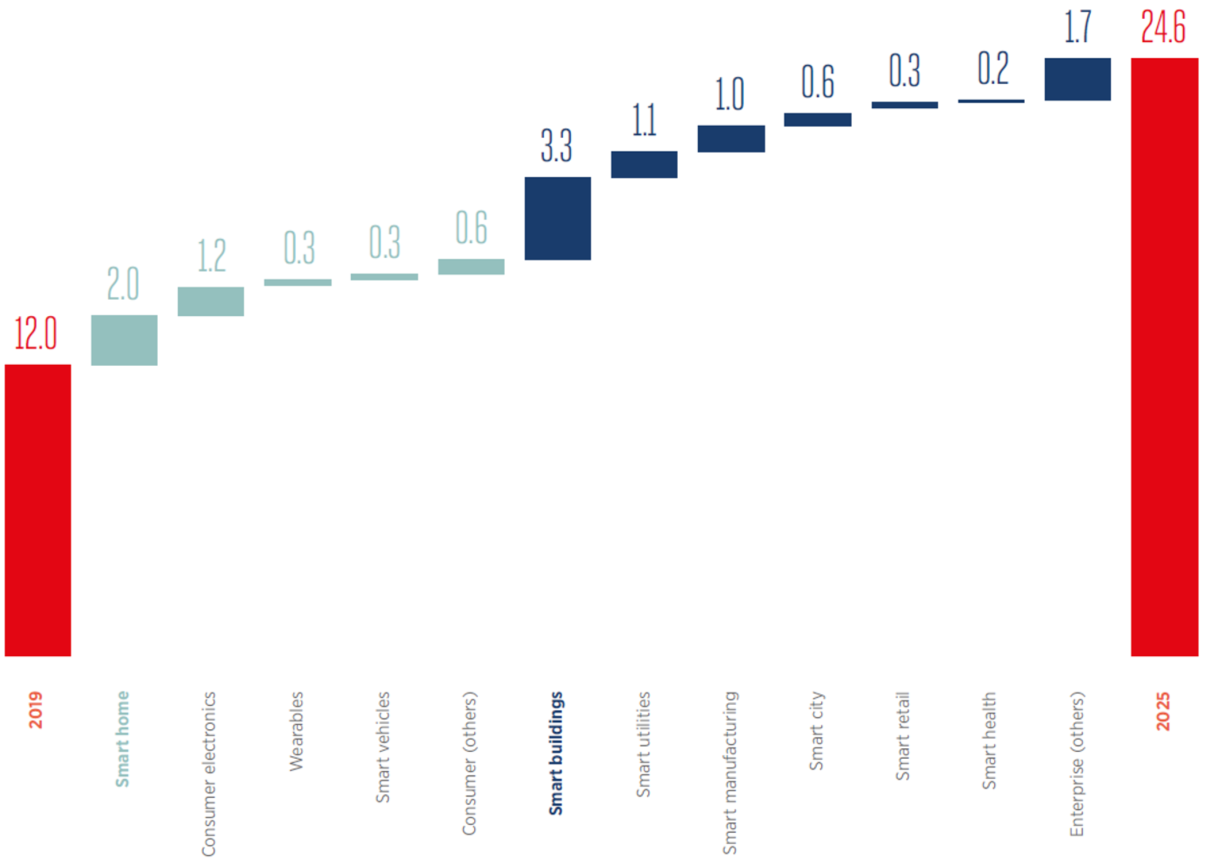
Benhima et al. (2013) identified three topics that MNOs have to focus on in the future, namely customer experience, operational efficiency and revenue and margin. Changwei (2012) adds the change in subscriber behaviour and demand as subscribers expect instantaneous and ubiquitous connectivity and access to mobile services. According to Analysys Mason (2020b), the strongest predictor of customers' willingness to promote a MNO is their satisfaction with customer service. Thus, customer service is regarded as a strong differentiator between MNOs. But customer satisfaction is also a good measure of the churn intention of customers. Moreover, the perceived network performance, especially data speed, plays an important role in customer satisfaction. The importance of fast data can be regarded as an indicator of the demand for 5G, which can be monetised through speed tiering. Self-care apps are regarded as an integral part of customer experience, with an adoption rate of 30%. EY (2015) states that customer experience management has the highest strategic priority for MNOs, causing them to shift their focus on agility, efficiency and network quality. Many customers solely know the digital world and thus expect high quality with ubiquitous and fast network coverage and will quickly change their provider if the incumbent fails to fulfil their expectations. Concluding, MNOs react by increasing their customer centricity, improving their support functions, personalising services and improving network quality. According to Glaser et al. (2019), advancing in digital customer engagement will secure the biggest advantage to MNOs. Therefore, they should engage in driving customer acquisition, evolving their operating model, driving customer value, marketing technology and infrastructure, as well as optimising their marketing Return on Investment (ROI).

There is also a shift of focus towards competences in customers and content. Telecommunication companies are forced to adapt their business by a more complex and open system that consists of comprehensive collaboration, communication and coordination. To face these changes many telecommunication companies have fostered merger and acquisition as well as various types of strategic alliance to sustain or improve their current status. Because of the adaptation of appropriate business models, some telecommunication companies have been able to make use of the technological change and improved their market position (Al-Debei and Avison, 2011; GSMA, 2020).

Frisanco (2010) identifies and explains the trend of departing from a vertically fully integrated to a disaggregated company. While the fully integrated MNO covers all relevant topics, like network rollout, operation and maintenance, over customer services and interaction, a disaggregated MNO specialises either in the building of networks, asset ownership and operation, or service development and hosting, marketing and sales, and billing. Through specialisation MNOs are able to focus on the topics in which they excel, while others cover the topics in which they in turn succeed. Accordingly, many MNOs outsource the services that are not in their main interest to reduce operational expenditure (opex), replace fixed by variable costs, better predict cost, share risk, enable more entrepreneurial flexibility and improve service quality.

Further trends in the telecommunication sector include cloud infrastructure services, mobile advertising and smart building services. These services are also identified as potential revenue generators for telecommunication companies. Furthermore, internet protocol (IP) messaging, video and TV, mobile money, connected cars, retail and healthcare are potential revenue drivers (EY, 2015). As stated above, trends like IoT and M2M are also affecting MNOs. According to Banović-Ćurguz and Ilišević (2017), the number of M2M connections increases rapidly. GSMA (2017) expects the number of M2M connections to reach 1 billion in 2020, while the total IoT connections are forecasted to rise from 12.0 billion in 2019 to 24.6 billion by 2025 with an expected revenue of $1.1 trillion (GSMA, 2020). GSMA (2020) and GSMA Intelligence and CAICT (2016) define IoT as the linkage and coordination of various devices, machines or appliances that are connected to the internet using several networks and technologies. During the early adaption phase IoT was focused on the provision of vertical-specific services. This changed as IoT now focuses also on the provision of horizontal solutions using Big Data analytics. M2M is a part of IoT and connects appliances using diverse communication channels to provide services without or with only little human intervention. Through the communication of the linked appliances, normal machines are transformed into intelligent ones and enable new ways of business operation. The communication channels of M2M connected appliances include IP and SMS. Thus, it is of interest to MNOs as their networks are used. M2M consists of three categories: devices, networks and applications. While in the beginning MNOs' role was mainly to provide connectivity between the appliances, which accounts for only 10-20% of the overall M2M revenue opportunity, they are now looking for opportunities to increase their share by enlarging their M2M portfolio to offer holistic solutions. This is reached by strategic partnering with other important players in the value chain. Deutsche Telekom, for example, monetises its IoT solutions not only in accordance with the provided connectivity, but also on the value that is delivered through their solutions, like cost savings or additionally generated revenue. IoT for enterprises enables new business models and aims at reducing costs, increasing efficiency and enabling greater innovation. IoT for consumers aims at enhancing quality of life, e.g. through greater energy efficiency, home security and fitness tracking (GSMA, 2020; GSMA Intelligence and CAICT, 2016). The forecasted development of IoT connections between 2019 and 2025 can be seen in figure 8.

Figure 8: Development of IoT Connections, 2019 - 2025 (GSMA, 2020)



Small and Medium Businesses (SMBs) are often attacked by external parties that want to steal data. In the 12 months from April 2019 32% of small businesses and 57% of medium businesses were attacked. This is mainly caused by a paucity of cyber-security skills available at the companies that are also often not aware of the cyber-threats and possible solutions. As this is an ongoing trend, MNOs, which are closely connected to SMBs and have to cover security risks for business reasons, can raise awareness of these problems at SMBs and help them to overcome the shortage of internal skill by providing respective services to manage these risks. MNOs are in a good position to do this due to the many attacks on their network and further infrastructure that they experience. By providing security assessments and support for SMBs' security infrastructure they can secure and strengthen their relations with SMBs. MNOs can focus on the management of cyber-security regulations, compliance and the provision of security management (Analysys Mason, 2020e). Overall, security is an important topic for MNOs with double digit growth rates of the respective revenue (GSMA Intelligence, 2020b). GlobalData (2020b) confirms the importance of offering security services for MNOs by taking Telefónica as an example. Telefónica partners with other companies to leverage AI and IoT in their managed security offering. Generally, the security offering includes network and cloud security, fraud management, data protection, identity solutions and IoT security.

An important component of MNOs' strategy is the move of their data centres but also their networks to a cloud-based infrastructure, enabling network virtualisation and software-defined networks. This enables agile reactions and ability to offer a wider and more flexible range of communication services (GSMA Intelligence and CAICT, 2016).

A study conducted by Deloitte (2017b) states that although topics such as robotics, IoT, speech recognition, Big Data, data analytics and AI are considered to have a high degree of uncertainty, they still are expected to have a high impact on telecommunication companies. Additionally, GSMA (2020) makes several predictions for MNOs. By 2025 5G will have a bigger impact on enterprises than on consumers. MNOs and cloud providers will compete for private enterprise networks, and health care wearables will support the public health. Analysys Mason (2020a) acknowledges MNOs' efforts to use 5G to broaden market reach and increasingly focus on the enterprise segment. IDC (2020) confirms that the greatest part of the potential for revenue with 5G is in the enterprise market. However, for the consumer market offering unlimited 5G plans are forecasted to be the best way for MNOs. GSMA (2020) pursues this policy, then by 2030 it is expected that the first autonomous mobile network in the world will be commercially active, global internet penetration will reach 90%, and China will become the largest mobile market in terms of revenue. Moreover, it is expected that health information and public services can be accessed and used via mobile internet in the future. Furthermore, digital payments are forecasted to gain more significance.

Mobile technology is seen as an enabler of a low-carbon future, e.g. through smart traffic management, smart urban lightning, smart parking, smart logistics, building of energy management systems, remote working, sharing economy, smart grids and precision agriculture. Moreover, the telecommunication industry is regarded as a key player in the mitigation of the potentially catastrophic impacts climate changes have (GSMA, 2020). MNOs are expected to offer support in “helping people realise the full benefits of accessing health information, public services and digital payments, and leveraging new technologies to reduce pollution, improve resilience to climate change and increase energy efficiency” (GSMA, 2020, p. 4).

Summing up this discussion, several trends in the telecommunication market can be discerned. Among them is the rise of 5G as well as increases in IoT and M2M connections, worldwide internet access, mobile service subscription, mobile phone adoption and data traffic. Cloud infrastructure, online gaming, network virtualisation, and a shift to a low-carbon future are also important trends in the telecommunication market. While these trends can be regarded as positive for MNOs, there are also trends that harm them, like limited revenue growth rates, substitution of traditional telecommunication services through OTT services, declining ARPU and a decrease in MNOs’ share of revenue in the mobile ecosystem. In addition, capex stays on a high level due to the roll-out of 5G, while there is only limited potential for growth. Thus, there are positive trends that provide opportunities to MNOs, but also negative trends that need to be worked on by MNOs in order to minimise the risks they present.

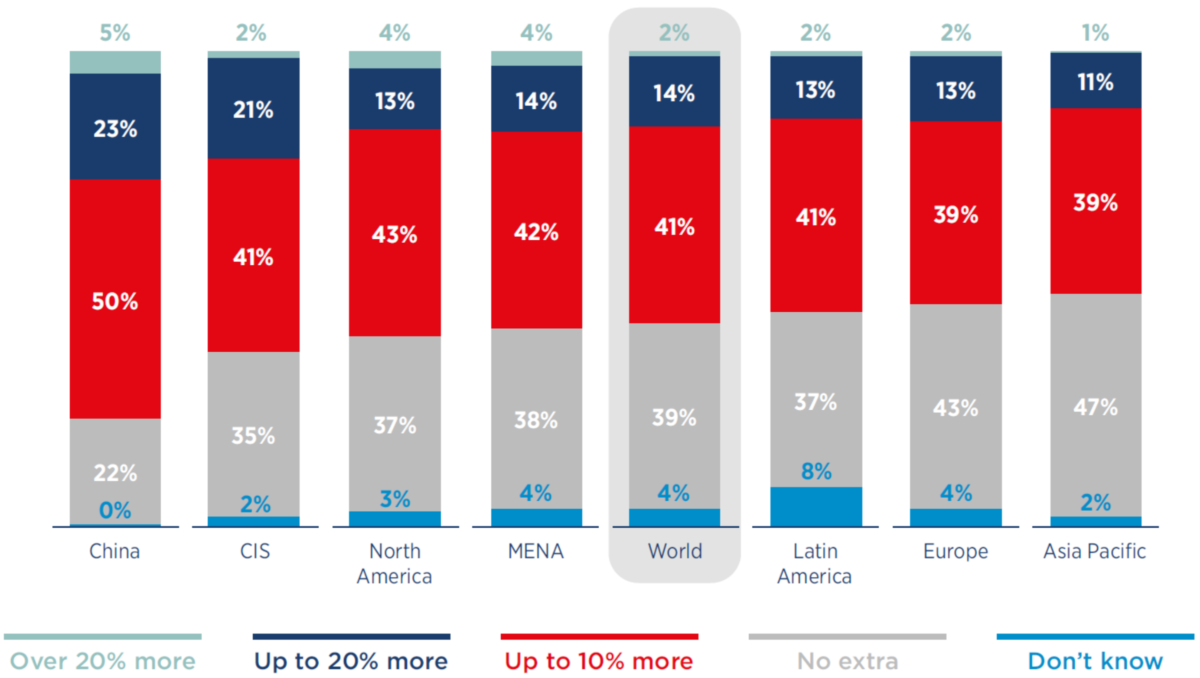
2.1.2 Challenges in the Telecommunication Market

In this subsection challenges to MNOs in the telecommunication market are discussed. Due to the number of challenges only a few are selected and the most severe according to the literature are considered.

For some time many MNOs have experienced a huge cost pressure caused by the competition between MNOs and MVNOs (European Commission, 2013; GSMA, 2020). MVNOs provide mobile services using the network of another operator, a MNO. The MNO owns mobile radio licences and the necessary infrastructure, whereas a MVNO does not own a network at all or only some parts of it. Concluding, MVNOs have to use the mobile network of MNOs or a part of it to provide their services. Therefore, contingents for the use through MVNOs’ customers have to be bought in order to be able to provide services based on parts of these contingents to MVNOs' customers. Those contingents can consist of minutes of voice, gigabytes of data and a defined amount of SMS. Seen from a customer's point of view, the MVNO delivers the required services, although the MVNO creates its main value through the definition and sale of mobile services (Balon and Liau, 2012). The cost pressure develops in part because several competitors act on a single market trying to increase their market share and lead it (Financier Worldwide, 2014). In order to participate in this highly competitive market using existing or new products, which are mostly similar and comparable to competitors' products, many companies see their only chance to stay profitable in decreasing the prices of their services to attract more customers. The idea is that by offering current and potential future customers a cost advantage, it is possible to distinguish oneself from rivals and thus get a higher market share. As many companies apply this policy, a downward spiral of lowering prices is created that leads to decreasing profits or even loss (Statista, 2016). Simultaneously the price pressure leads to a situation in which companies are not able to realise the formerly high margins and profits and even revenue decrease (GSMA, 2017, 2020; Taga et al., 2010). In order to enable companies to stay active in the market while facing lower margins and declining profits, costs have to be reduced if other measures are not considered. A cost driver often approached in such situations is labour costs (compare section 2.3). As stated by Chang and Tang (2010), and GSMA (2017), due to fierce competition in the telecommunication market, and many alternatives to traditional telecommunication services, the telecommunication industry faces a devaluation and a decline that can mostly be seen in developed as well as rapidly developing countries.

MNOs are also exposed to pressure through new technologies. The formerly existing market power in the telecommunication market has changed due to the growing importance of digital services, like video streaming and instant messaging. In the past MNOs owned and controlled the physical infrastructure and the services available in their network. The various services were accessed using the same network and could be monetised individually. Hence regulation focused on the security of information and media diversity as well as interoperability. Nowadays, in Next Generation Access Networks the network layer is separated from the services layer, leading to the situation in which the former way of monetisation of different services by MNOs is no longer granted (Krämer and Wohlfarth, 2017). This is confirmed by Wulf, Zernekow and Duser (2010) and GSMA (2020) covering MNOs' challenge of monetising traditional telecommunication services while enlarging the network to meet the growth rates of mobile data. Wulf, Zernekow and Duser (2010) add that migration to next generation network infrastructure led to a reduction of opex, but the revenues from the core business stayed at the same level. Concluding, strategies to meet business and economic challenges have to be identified. GSMA (2020) further states that MNOs are seeking additional ways to increase their revenue and to cut existing costs due to the low-growth environment. As shown in figure 9, this challenge is not expected to be mitigated by focusing on revenue generation through the use of 5G services because early adopters of 5G are not invariably willing to pay much more for the use of the new technology.

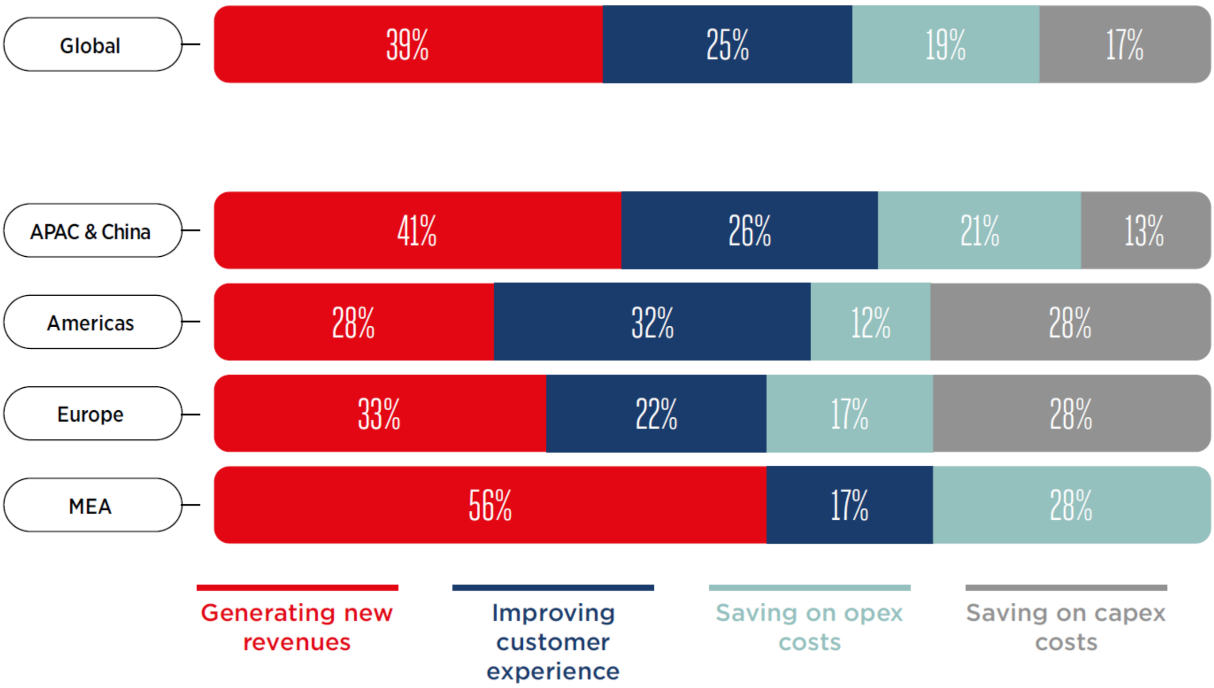
Figure 9: Willingness to pay more for 5G (GSMA, 2020)



Furthermore, the telecommunication industry faces a revolution due to globalisation and deregulation, which further increases pressure (Al-Debei and Avison, 2011; Scalera, 2012). Telecommunication itself, as well as the respective cellular networks cause changes in the way the telecommunication business is conducted. The ongoing globalisation tears down barriers causing formerly monopolistic, national telecommunication companies to face competition on an international level. Due to increasing deregulation and liberalisation in many countries telecommunication market power increases and fosters more acute competition (Al-Debei and Avison, 2011; European Commission, 2016). Entry barriers further decrease due to unbundled networks as 5G enables new possibilities to operate a network with or without licensed spectrum. This means that competition on infrastructure becomes harder and capex has to be spent more selectively (GSMA, 2020).

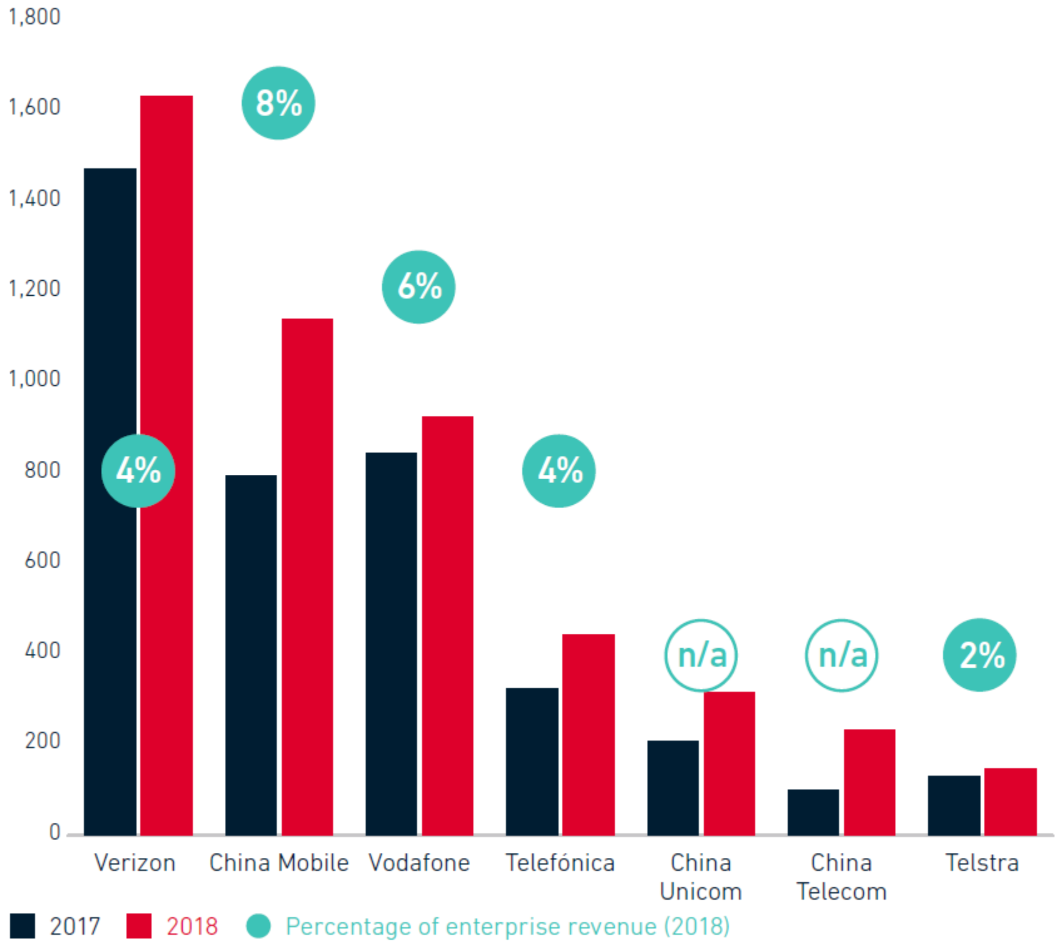
Other obstacles are considered by Becot et al. (2010), GSMA (2020), GSMA Intelligence (2020b), Prabhu, Arora and Mishra (2018), and Schön, Zimmermann and KVJ (2011) stating that MNOs are threatened by OTT business models from internet players as well as from device manufacturers that could cause a decrease in MNOs' importance in the communication ecosystem. Glaser et al. (2019) confirm the threat presented by OTT providers, which could cause a decrease in customer spending for traditional mobile communication services of up to 36%. This trend is expected to continue. Becot et al. (2010) and GSMA (2020) stress that the development of communication services is a competitive environment and a very challenging task for MNOs. MNOs enable bridges between their own network and web-service providers as well as device manufacturers and are already developing solutions that are outside their network. Schön, Zimmermann and KVJ (2011) further add that this is even enhanced by a decline of revenue streams and opportunities to invest and act in other existing and new sectors, which is confirmed by GSMA (2017, 2020). According to GSMA (2020), this is a reason for MNOs to seek new ways to increase their revenue, diversify their revenue streams, e.g. through Pay TV or IoT, and decrease costs. Analysys Mason (2020d) confirms that a diversification through typical non-telecommunication services can open up new revenue streams for MNOs, while reducing churn at the same time. Moreover, churn can be further reduced through sufficient data speed (Analysys Mason, 2020a). Therefore, MNOs could bundle smart home solutions with their core services, and consider the bundling of financial services and utilities if the market is ready. Additionally, consumer equipment, media and IT services are further possibilities for new revenue streams. GSMA Intelligence (2020b) adds that in the enterprise area traditional telecommunication services generate the most revenue with about 60%, while IoT, cloud and security are the growth drivers. Moreover, for 50% of MNOs enterprise services are the sole source of growing revenue, with growth rates in the single-digit area, due to stagnating or declining consumer revenue. GSMA (2020) also states that MNOs have to look for growth potential outside the traditional telecommunication services. However, for many MNOs non-telecommunication services are their sole source of growth, but these adjacent services are only responsible for 10 – 20% of MNOs' revenue. Generally, the primary goal that is driving the transformation strategy of MNOs is the generation of new revenue and improving customer experience. A more detailed breakdown is given in figure 10.

Figure 10: Primary Goal driving Network Transformation Strategy (GSMA, 2020)



While deploying solutions based on IoT, integration with existing technology, security and data privacy concerns, implementation costs, and lack of available resources inhouse are among the biggest challenges for MNOs (GSMA, 2020). According to GSMA Intelligence (2020a), when choosing a provider for IoT solutions, 58% of companies regard the security of the solution as vital factor, while 56% focus on network coverage and 55% look for tailored solutions. However, less than 10% see MNOs as their first port of call for IoT topics. Moreover, about one third of companies regard IoT as not mature enough and list the high number of challenges associated with it, such as the high investment costs for the monetisation of the available data and the securitisation of data. Nevertheless, cost savings are the primary goal for the deployment of IoT and 62% of companies have a dedicated budget for IoT. In order to be regarded as a mature provider of IoT services MNOs have to work on this topic and persuade potential customers of their solutions and experience by focusing on the general market challenges. GSMA Intelligence (2020b) states that although IoT is increasingly important to MNOs, it is still only responsible for a small part of MNOs' revenue. The respective numbers for selected MNOs can be seen in figure 11.

Figure 11: IoT Revenue by MNO (GSMA Intelligence, 2020b)



Another challenge is the decline of the traditional fixed-line business in combination with maturing mobile voice services, leading to declining mobile voice revenue. This situation is worsened by missing working pricing models to monetise mobile broadband in a sufficient way. Krämer and Wohlfarth (2017) add that this challenge is even fostered by the provision of OTT services that are free of charge. Regarding traditional telecommunication services this would mean zero revenue, but for platform business models it can mean a maximisation of revenue as they can generate revenue through advertisements on their platforms. GSMA (2020) adds that although mobile broadband produces the greatest part of traffic, the respective contribution to revenue has been relatively low in recent years. Nevertheless, telecommunication companies have to invest in the network infrastructure to handle the currently high, but ever increasing demand for mobile data. The traditional mobile data consumption is changing due to the increasing popularity of the mobile internet and the increased use of social media. However, the use is not as high as it could be, according to available coverage. This means that not only is the available infrastructure holding back mobile internet adoption but also affordability, readiness of consumers, and the availability of required and relevant content regarding the respective locations. GSMA (2020), IDC (2020), and Schön, Zimmermann and KVJ (2011) add that the provision of messaging and voice services through third parties like Facebook, using MNOs' networks reduces the possibility for telecommunication companies to monetise the services and infrastructure they provide. Due to these factors many telecommunication companies are looking at opportunities in other sectors like healthcare, automotive and energy, to generate new revenue streams. This causes telecommunication companies to change their traditional business to meet the requirements of potential new sectors, which in turn forces them to develop business models that are flexibly deployable in various sectors. Krämer and Wohlfarth (2017) see the cause of the problems that OTT providers present to MNOs in network operators losing control of the services that are provided over their network leading to the situation in which MNOs become substitutable as digital services can be consumed independently of a specific network. Furthermore, they lose control of transmission and cannot guarantee the quality of the services provided over their network. Nevertheless, the services provided by OTT providers are not only substitutive to the services provided by MNOs, but they can also be complementary to existing services.

There are additional challenges MNOs have to cope with. The need for new data services, mobility and ubiquity negatively influenced the viability of MNOs' business models (European

Commission, 2016; Kallio, Tinnilä and Tseng, 2006). Despite this aspect, MNOs are not exploiting the available technological opportunities to their full extent (Arthur D. Little, 2018a; Atluri, Dietz and Henke, 2017). According to a survey conducted by EY (2015), the most significant challenges for the telecommunication industry are disruptive competition, uncertain regulatory environment, lack of organisational agility, lack of ROI, changing customer needs and attitudes, shortening technology cycles, poor ecosystem relationships, global economic uncertainty, and poor rates of innovation. This is approved by GSMA Intelligence and CAICT (2016), who add that the mobile telecommunication industry has been disrupted by digitisation, while the transformation of other industries, like healthcare and finance, has already begun due to digitisation. This creates the opportunity for MNOs for innovative new services, e.g. in customer engagement, focused on their networks. Moreover, this offers the opportunity to get a share of the growing revenue from the new services mainly provided by internet players, so far. To participate in the race to increase revenue and benefit from these developments MNOs need to start the digital transformation in reliance on a profound strategy in their company through the development of new business models. A few MNOs have already implemented such strategies with the goal of generating new revenue sources through BMI by focusing on the goal of new business development while at the same time strengthening their core business, which is a further challenge. According to Analysys Mason (2020d), GSMA (2020), and Weber, Haas and Scuka (2011), another challenge is the stagnating growth of mobile subscriptions most countries have to face, especially mature markets like Western Europe. In these markets telecommunication companies' voice-based revenue becomes decreasingly profitable due to subscriber saturation and fierce cost competition.

The emerging distribution of devices like smartphones and tablets, and the expansion of content that is relatively data-hungry, like video streaming, increase the consumption of mobile data enormously (GSMA, 2017, 2020; Whitehead et al., 2011). The provision of the increasingly needed data volume is enabled by innovation and investment in network infrastructure technology. Due to cheaper tariffs for mobile data, data-intensive content is even more available. Also the complex competitive environment, changing customer needs and the market position of competitors are important factors (Du Preez and Pistorius, 2002; GSMA, 2020). To cope with these changing conditions and also with a continuous technological change new pricing mechanisms and business models have to be operated (Fernández and Usero, 2009; GSMA, 2020).

A further challenge thematised by GSMA (2020) is smart home, which is regarded as a battleground of the future. According to Omdia (2020d), although smart home is a major growth market with a CAGR of 15%, the biggest part of the respective revenue originates in device sales, while service providers struggle to scale their services and realise the required monthly fees. To realise a share of the forecasted overall smart home services revenues of $197 billion between 2020 and 2025, MNOs have to develop the right business models for the mass-market. Omdia (2020c) states that MNOs should work with companies such as Google to get a better foothold in the market by offering attractive sales promotions.

Policy-related challenges identified by GSMA (2020) include the continuous investment needed to enable mobile connectivity in order to provide the services required by private and business customers. Moreover, MNOs need access to sufficient radio spectrum with the right frequencies to provide their services in the best possible way. Therefore, an inflation of the 5G spectrum prices or reserving spectrum for other industries is counterproductive. The support of governments and regulators to propel 5G’s commercial use is required. This could be achieved through the implementation of policies encouraging new technologies that require 5G. Overall, a less cost intensive and more flexible business environment for MNOs could increase performance, speed of innovation and user confidence. GSMA Intelligence (2020b) adds that the enterprise area is especially important for 5G, but the challenges to build the network, to get network slicing in place and to get the required spectrum will take time. Besides the pure provision of connectivity, a greater technical maturity is also required, e.g. for autonomous driving or smart manufacturing. Moreover, cloud providers such as Amazon or Microsoft also want to realise the opportunities enabled through customised networks and network slicing by providing their services. In this way, MNOs have to face greater competition with these companies.

Summing up this discussion, participants in the telecommunication market have to deal with challenges, such as the huge cost pressure caused by a highly competitive environment, while many market participants offer similar or comparable products, which leads to decreasing prices. Also, competition through OTT providers offering alternatives to traditional telecommunication services, such as instant messaging, is a challenge MNOs have to face. This means e.g. that traditional telecommunication services cannot be monetised as easily as before. Moreover, the growth rates of mobile data have to be covered by the telecommunication network, which is connected to high investments costs for MNOs while customers have only a moderate willingness to pay for 5G and revenues are stagnating. Furthermore, MNOs have to face policy-related challenges in a generally uncertain regulatory environment. Concluding, MNOs have to face many challenges and work on positioning themselves correctly to overcome these challenges and to secure their business.

The goal of this section is to provide an overview of the current situation in the telecommunication market for MNOs. Therefore, not only current trends including forecasted developments and opportunities, but also challenges MNOs have to face in a highly competitive environment are discussed. To have a general overview and understanding of the contemporary market situation is an important starting point for exploration of what it takes to position MNOs in a changing telecommunication market. Given the literature, it cannot be clarified whether MNOs’ current business models are future-proof. Moreover, the literature provides no information on what a future telecommunication ecosystem could look like and whether it is comparable with that of today. Additionally, in light of the latter, it cannot be determined whether a future telecommunication ecosystem will consist of the same companies as those of today. These research gaps form the baseline for the first parts of RQs 1 and 4.

The influence that software robotics as well as BI and Big Data have on MNOs and their role for MNOs are covered in sections 2.3 and 2.4. However, to secure sound understanding of the telecommunication market this topic has to be further explored.

2.2 Innovation

This section focuses on the second objective, to depict the role of innovation for MNOs as well as the implication of Pisano's 'Innovation Landscape Map' on MNOs. The baseline for the first objective, to explore the look of a future MNO business model, is also laid.

Subsection 2.2.1 engages in the theory of innovation to provide the theoretical basis on which this section relies. In subsection 2.2.2, the ILM is highlighted including disruptive innovation as a special kind of innovation that provides the setting for the next subsection. Subsection 2.2.3 focuses on BMI, starting with a definition of the term ‘business model’ and its components, followed by the theory on BMI, and BMI at MNOs. It ends with a closer look at strategic management views. At the end of this section the results from the literature review regarding the role of innovation for MNOs’ future development as well as the most relevant innovation dimension for MNOs, and the baseline for a potential look of a future MNO business model are summarised.

According to Pisano and Teece (2007), innovations can be regarded as foundation for growth, profitability and competitive advantage, but it is not granted that innovations lead to success and generate rewards for the efforts invested. While Apple and Google are examples of the rewards innovations can deliver, the Hydrox Cookie Company is a negative example. The latter invented a chocolate cookie with a vanilla cream filling. Another company, Nabisco, created the Oreo cookie based on that created by the Hydrox Cookie Company and caused them to disappear from the market. The challenge is not only to create value from an innovation, but also to capture this value (Pisano and Teece, 2007) as return from innovations can be lower than expected and planned due to the offering of complementary products and services by imitators, suppliers, customers and other parties (Teece, 1986). To avoid imitations, at least to a certain degree, protective measures have to be taken in order to increase profitability for the innovator. Such protection can be provided by patents, copyright or trade-secrets. In addition, it is necessary to earn sufficiently from an innovation to be able further to invest in R&D to bring up the next innovation (Pisano and Teece, 2007). Despite the possibility of low or even no returns from innovation, the advantages that can thereby be achieved may not be neglected. According to Teece (1986), one upside of innovation is the first-to-market position that can lead to a competitive advantage by creating a new or enhancing an already existing value stream. Rammer and Peters (2015) add that product innovation can lead to increased employment rates and an increase in exported goods. They also list a higher probability of growth as well as the possibility of competitive advantages caused by innovations.

2.2.1 Theory of Innovation

In this subsection the theory of innovation is picked out as a central theme to provide an overview of what innovation is and what sources of innovation exist. This is important to understand as it lays the foundation on which the further subsections of section 2.2 rest.

The theory of economic development and new value creation, based on the process of technological change and innovation, is mainly based on Schumpeter (1934). According to him, innovation is the cause of discontinuous change and disequilibrium that leads to technological development. The sources of innovation include:

- The introduction of new goods or new production methods
- The creation of new markets
- The discovery of new supply sources and
- The reorganisation of industries

The source of value creation is found in innovation. Emphasised is the importance of technology and strong consideration is given to novel combinations of resources for new production methods or products (Schumpeter, 1934). The term ‘creative destruction’ was also introduced by Schumpeter (1942). Its triggers are innovations made by companies. Through these innovations companies can lead the market, established structures are changed or diminish, and are destroyed in a last step. After a while the innovations that caused the destruction of the established become established in turn and are destroyed by the next innovation in the cycle (Schumpeter, 1942). This theory is extended by Teece (1986), who adds that the value creation potential of innovations can be increased through complementary assets as well as effectiveness of protective property rights. Amit and Zott (2001, p. 497) state that "the evolution of the (resulting) virtual markets can be described in terms of Schumpeter's model of creative destruction". They further state that virtual markets lead to a broadening of notions of innovation as new exchange mechanisms as well as unique transaction methods are involved and new inter-firm collaborations are fostered (Amit and Zott, 2001).

In the 1950s and 1960s the perspective of theoretical research on innovation broadened and focused on the promotion of innovation in organisations by effectively managing Research and Development (R&D) departments and their activities (Xu et al., 2007).

Drucker (1998) states that executives are responsible for innovations and that innovation is a function of entrepreneurship and the way "by which the entrepreneur either creates new wealth-producing resources or endows existing resources with enhanced potential for creating wealth" (Drucker, 1998, p. 3). According to him, especially successful innovations are the result of conscious search for opportunities. He identifies seven sources of innovation that overlap and differ according to their risk, difficulty and complexity. Internal sources of innovation are:

- Unexpected occurrences like unexpected success and failure
- Incongruities, e.g. in the logic or rhythm of a process, between economic realities or between expectations and results
- Process needs and
- Industry and market changes

External sources of innovation are:

- Demographic changes, which are the most reliable of external sources
- Changes in perception, which do not change facts but their meaning
- New knowledge, no matter whether scientific, technical or social

Drucker states that innovation has to begin by analysing the sources of new opportunities and in order to be effective, innovations have to be simple and focused. They start small and aim to become the standard-setter from the beginning in order to guide the direction of a new technology or industry (Drucker, 1985, 1998). Later in the 20th century innovation theory further changed and was mainly supported by three approaches to understanding change in technology, namely path-dependent models, induced innovation and evolutionary approaches (Ruttan, 2001).

A guideline provided by the OECD (2005), also known as 'Oslo Manual', covers technological innovation concerning products and processes at the company level. It uses a conceptual framework to classify conditions in four topics of innovation capacity. These are:

- Framework conditions, meaning the external area a company operates in, like basic educational system, communication infrastructure or financial institutions
- Science and engineering base, meaning science institutions supporting the business innovators
- Transfer factors, meaning factors that influence the transmission of information to firms
- Innovation dynamo, which is a complex system of factors shaping the innovative capacity of a company

According to OECD's (2005) definition, product and process innovations in technology changes include implemented new products and processes as well as significant improvements in products and processes. If an innovation is implemented, it has been introduced to the market or used in a production process. According to Teece (2006), the appropriability and success of innovations are more closely related to the innovator's asset structure, the company's market entry timing, and the access to complementary assets that are not produced in-house, than to the respective market share.

Summing up this subsection, innovation leads to the destruction of the established and after a while the former innovation becomes the established that in turn is destroyed by the next one. Sources of innovation can be unexpected occurrences, incongruities, process needs, market changes, demographic changes, changes in perception and new knowledge. In light of the information obtained in this subsection the general relevance of innovation is described.

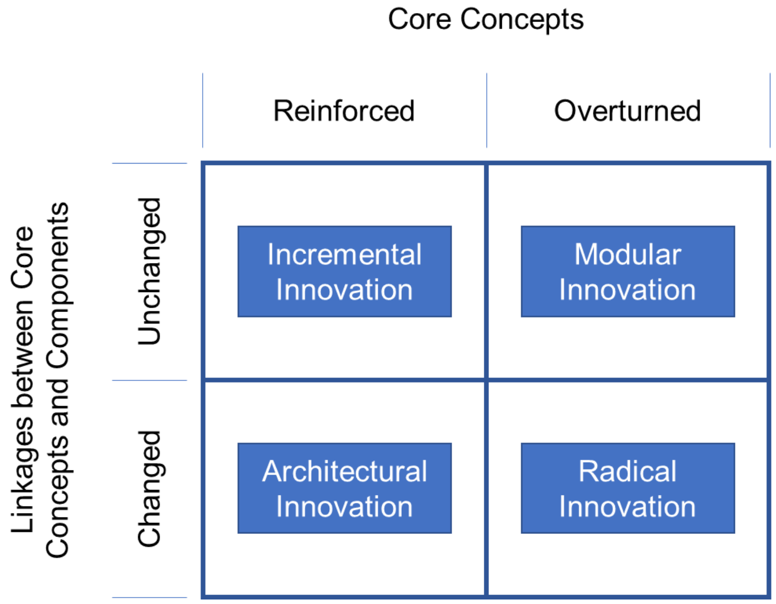
However, the role that innovation plays in MNOs cannot be determined completely by relying on literature. It is therefore regarded as a research gap, meaning that this topic has to be further investigated. This research gap forms the baseline for the first part of RQ2, namely what role innovation plays in companies.

2.2.2 Innovation Landscape Map

This subsection focuses on Pisano’s (2015) ILM and disruptive innovation as one of its kinds. As with many new business models it is expected that they are intended to be disruptive in order to be competitive at a given environment. This subsection examines what disruptive innovation means to enable a further view on the meaning of innovation for MNOs’ future development as well as the importance of disruptive innovation for MNOs. The focus is on Pisano’s (2015) ILM and the ‘Disruptive Innovation Model’ of Christensen, Raynor and McDonald (2015) as these models are the most important and relevant ones for this research.

Pisano (2015) states that companies require an innovation strategy in order to monetise their innovation efforts. A problem for companies is that their innovation capacity bases on an innovation system, which is a set of processes and structures defining the way a company searches new solutions, transforms ideas into concepts and decides on funding for projects. However, an innovation strategy can help companies to create a system that matches their individual competitive needs. Without such a strategy, it is not unlikely that a company tries to achieve two or more conflicting priorities at the same time. A company’s leaders are central to its innovation strategy because they are regarded as enablers of innovation. They have to assess the way to create value through their innovations and to keep the value in the company. This is followed by the decision on the type of innovation to be chosen. Pisano (2015) created the ILM to support companies in focusing on the problem described above. The ILM bases on Pisano’s (2015) research as well as research of other scholars, such as Henderson and Clark (1990), who showed that a categorisation of innovations as either radical or incremental can be misleading and is incomplete. Therefore, they took a closer look at such innovations and distinguished between a product's components and their integration in the system. In their research they defined a framework for defining innovation. This framework is shown in figure 12.

Figure 12: Framework for defining Innovation (Henderson and Clark, 1990)



The ILM, basing on Henderson's and Clark' (1990) framework for defining innovation, assists a company in linking different kinds of innovation to its strategy in terms of corporate development and technical capabilities. The ILM helps to characterise innovation regarding the degree of change in technology and technical competence, respectively, as well as the degree of change in the business model using four quadrants: (I) routine, (II) radical, (III) disruptive, and (IV) architectural innovation.

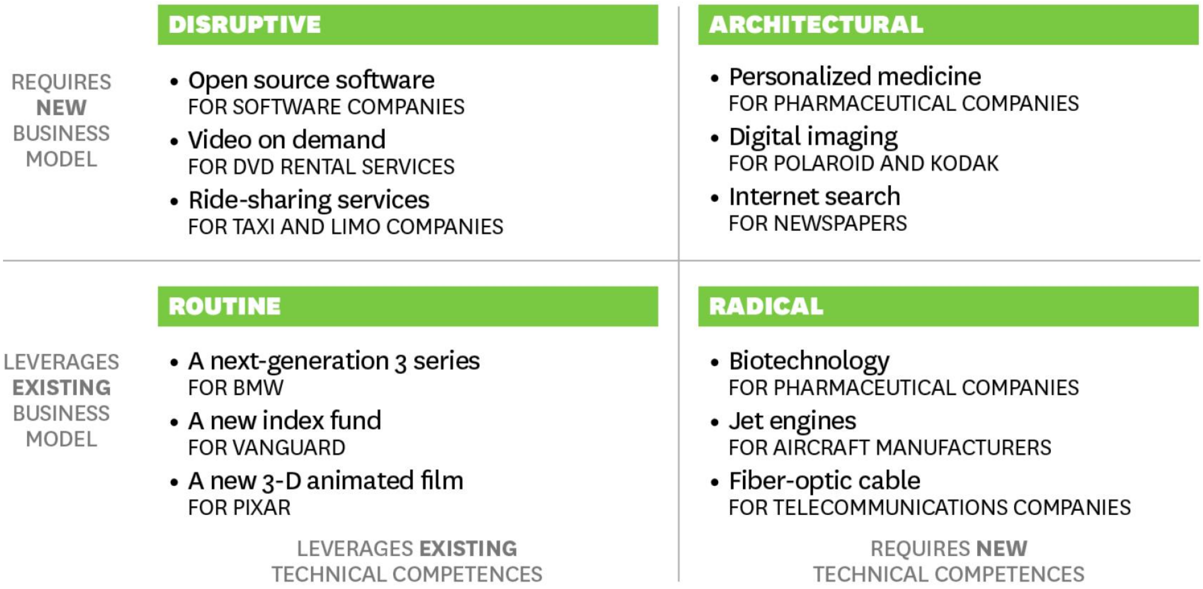
- Routine innovations are based on existing technical competence in a company and fit the company's current business model and its customer base. As examples Pisano cites the publishing of new Microsoft Windows versions or new versions of Apple's iPhone (Pisano, 2015). An example for MNOs would be the offering of an overall amount of data volume that can be used per month by all employees of a company instead of offering single contracts for every employee.
- Radical innovations leverage the existing business model of a company, but require new technical competences. An example would be the approach to discover new drugs

based on genetic engineering and biotechnology beginning in the 1970s (Pisano, 2015). For MNOs the introduction of data services in addition to telephony and text messages can be seen as a radical innovation as the existing business model could be used while a new technology for the provision of data services was required.

- For disruptive innovation a new business model is required while a technical breakthrough is not necessary. It challenges and disrupts the business models of other companies. As an example Pisano cites Google's Android operating system, which disrupts e.g. Microsoft and Apple as it is free of charge (Pisano, 2015). For MNOs this could mean the use of the enormous amount of data they own to offer new services to existing or new customers.
- For architectural innovations new business models as well as new technical competences are needed. Thus, it is the most difficult kind of innovation included in the ILM. An example is the emergence of digital photography for companies such as Kodak and Polaroid, making their money mainly through the sale of film, paper and chemicals, that had to master new competences and find a new way to make profits in the digital world (Pisano, 2015). MNOs could offer to digitalise customers' invoices when they take a picture of them, making them machine-readable through Optical Character Recognition (OCR) and storing them on a dedicated server for a monthly fee. This would require a new business model for the offer as well as new technology and competence to create the prerequisites of such a service.

The four quadrants do not have to be substitutes but may complement each other. It is decisive to decide on the kind of value created by an innovation and to stay with it while continuing to invest in innovation to protect from imitators and prevent loss of bargaining power. From the research of Pisano (2015) it may be concluded that disruptive innovation means the innovation of a business model while already existing technical competences of a company are used. The four quadrants are shown in figure 13.

Figure 13: Innovation Landscape Map (Pisano, 2015)

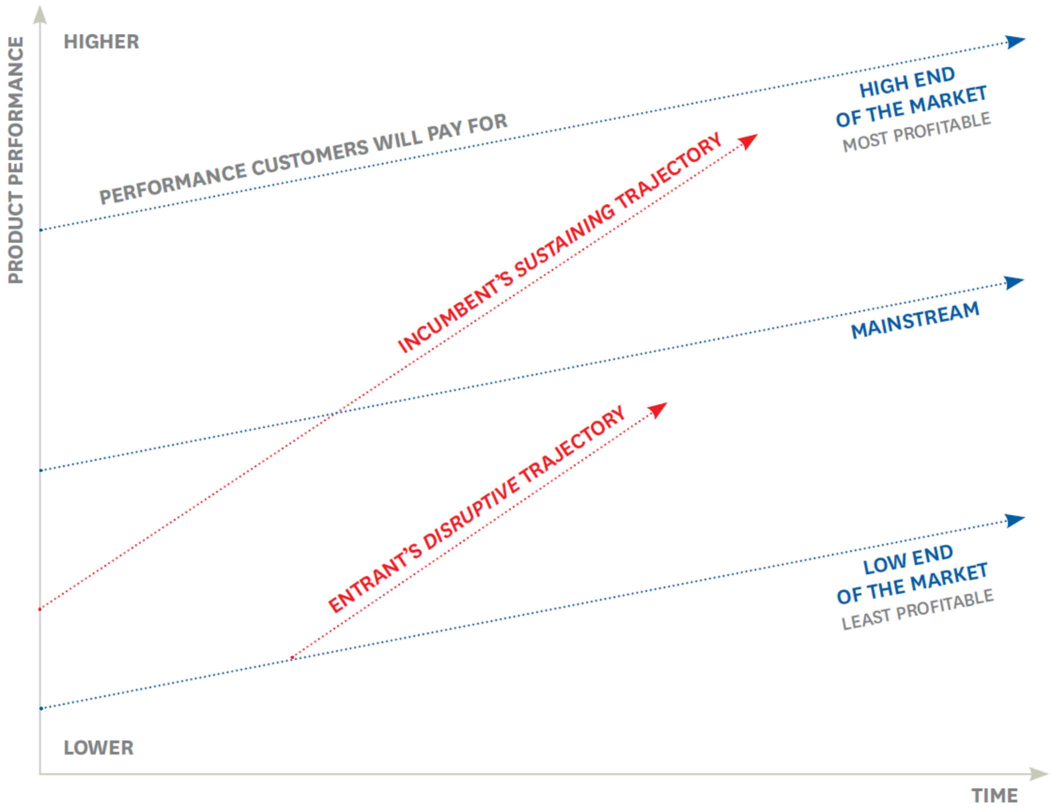


The ILM is suitable and usable by as well as beneficial for many companies and industries, such as a contact lens company, where it supported senior management in creating explicit targets for differing kinds of innovation, which helped the company to progress in the development of new offers that in turn supported the company’s long-term strategy (Pisano, 2015). Also for IT companies it is highly relevant, as shown by Bronkhorst, Schaveling and Janssen (2019), who confirmed in their study that an immediate positive impact on business performance for IT firms is enabled by using different types of IT product innovation. This mix of innovation types shall also be part of IT companies’ innovation strategy. According to Calza, Parmetola and Tutore (2017), in the automotive industry the ILM is used among others for identifying different types of green innovation in terms of their suitability with technical capabilities and existing markets. They regarded the impact of the innovation types on resources and capabilities of a company and considered the individual efforts required for each type of innovation. They further determined the innovation types fit with the green innovation strategy of a company. Godelnik (2020) categorised innovations in various industries according to Pisano’s (2015) ILM. Among the industries categorised are retail, transportation, airlines, media, finance, insurance and manufacturing. Godelnik (2020) used the ILM to determine if companies’ actions may be regarded as innovation and if so, which level of innovativeness may be given to them. As a result, the study found that less than 50% of analysed actions are considered to be innovative. 91% of the innovative actions were categorised as routine innovation and 9% as disruptive innovation, while no action was considered as radical or architectural innovation. As it can be seen, Pisano's (2015) ILM is suitable to many industries providing many benefits and possibilities and thereby also to MNOs engaging in the fields of innovation and BMI. It is highly valuable to MNOs as it supports them with their innovation strategy to monetise their innovations. In his research Pisano (2015) refers to the applicability of the ILM to telecommunication companies, which further proves its suitability to MNOs.

Another example of a successful disruptive BMI is Apple, with the introduction of its iPod and the connected iTunes. By not only producing the iPod hardware and software, but also uniting it with music distribution, which links music label owners and end users, they transformed the distribution of music. In this way, Apple generated revenues by selling their hardware and software as well as by creating an ongoing value stream through the use of their iPod (Amit and Zott, 2012). While this is an example of another industry, it has to be considered that this disruptive BMI would not be possible without the services provided by telecommunication companies that offer transport and network, which are critical to this kind of business model. However, although they are a key factor here, they did not or only to a marginal degree participate in the outcomes of this disruptive innovation.

Christensen and Bower (1996) state that disruptive innovation enables a completely different value proposition for the market. Disruptive technologies disrupt existing and acknowledged trajectories for the improvement of performance, or redefine performance. While in the beginning typically underperformance of the disruptive technology in comparison with the existing technology and a focus on niche markets or the lower end of a market can be regarded, the disruptive technology improves over time and meets the needs of nearly the whole market. For the niche and low-end market the new technology more conveniently and often cheaply meets their needs (Christensen, 2002). This procedure is made possible by incumbent firms that focus on the improvement of the products and services they offer to their most demanding customers. Often they ignore less demanding customers as well as the needs of other groups, while exceeding the needs of others. Market participants that focus on the groups not focused by incumbent firms gain a foothold in the market by delivering more suitable products and services to these unfocused groups. As existing firms concentrate on higher profitability that can mostly be found in more demanding groups, they do not react to niche players vigorously. Hence niche players get the chance to move upmarket by fulfilling the needs of established firms' customers while maintaining the advantages that enabled their success. In the beginning of the offer of new products and services, incumbent firms' customers typically do not switch to the new offer as it is assumed to be of lesser quality than the incumbent companies' offers. Once the quality is assumed to be the same or even better than the quality of incumbent companies' products, these customers are also willing to switch (Christensen, Raynor and McDonald, 2015). Figure 14 shows the enablement of disruptive technologies' emergence. While the red lines show the improvement of products and services over time, the blue lines show customers' willingness to pay for the respective performance. Christensen, Raynor and McDonald (2015) further state that disruption is a process, disrupters build business models different from those of incumbent firms, and not all disruptive innovations succeed.

Figure 14: Disruptive Innovation Model (Christensen, Raynor and McDonald, 2015)



Summarising this subsection, disruptive innovation is one quadrant of the ILM that also consists of routine, radical and architectural innovation, and is applicable to MNOs. Disruptive innovation disrupts acknowledged trajectories to improve or redefine performance. Disruptive innovations require a new business model, while existing technical competences are leveraged.

The above discussion shows that disruptive innovation offers many opportunities and advantages to the companies applying it. The advantages range from challenging and disrupting competitors' business models, to improving the competitive situation, leading the market, improving performance and attracting more customers, to improving a company's market position and outlook. As these opportunities and advantages are described as detached from a concrete industry, disruptive innovation could also be appropriate to improving MNOs' situation and is of high interest for MNOs. Therefore, and because according to the literature it cannot be determined which innovation dimension is the most important for MNOs, disruptive innovation could be seen as the most important innovation dimension for MNOs. Its importance for MNOs is identified as a gap that will be further explored in this thesis. This research gap forms a baseline for the second part of RQ2.

2.2.3 Business Model Innovation

According to Ireland et al. (2001, p. 53), entrepreneurs often “try to find fundamentally new ways of doing business that will disrupt an industry’s existing competitive rules, leading to the development of new business models”. As new business models are requirements for disruptive as well as architectural innovation according to the ILM, this subsection focuses on business modelling in general, beginning with a definition of the term ‘business model’. The components of which a business model consists are then identified, followed by on overview of the components of MNO business models. In this way, the baseline for determining how a future MNO business model might look like is provided. The theory on BMI is explored as well as its significance for MNOs. This subsection finally focuses on strategic management views. Through these focuses the role of BMI for MNOs will be clarified, while at the same time a potential base for future MNO business models is built.

2.2.3.1 Business Modelling

This subsection first provides a background to the various definitions of the term ‘business model’. It then discusses the components of a business model and suggests those of which a MNO business model consists.

2.2.3.1.1 Definition of the Term ‘Business Model’

Technology is taken to market using specific business models. The value of the underlying technology is latent as long as it is not commercialised in any way. For this commercialisation a business model is needed. In some cases the value of the technology can be realised on a business model that is familiar to the firm. In other cases the familiar business model does not fit the opportunity enabled by the technology and the right business model has to be found to commercialise the value of a technology (Rosenbloom and Spencer, 1996).

Many researchers have covered the topic of defining the term ‘business model’, but so far no common definition could be established as the provided result of research varies upon their understanding of the term. Thus, providing a definition of ‘business model’ is not straightforward. The task is further complicated by a tendency to confuse business model with strategy.

Chesbrough and Rosenbloom (2002) state that a business model provides a framework, which uses technological characteristics and potential as inputs and converts them into economic outputs through customers and markets. A business model is here regarded as a device between technology development and economic value creation. If firms fail effectively to manage a time of technological change, this may be regarded as difficulty in enacting new business models that are required because of technological change. Accordingly, firms must understand the role of business models in order to be able to commercialise innovations and technology, when opportunities exist that cannot be realised with the firm’s current business model. The main role of a business model is to ensure that an innovation delivers value to the customer. According to Chesbrough and Rosenbloom (2002, pp. 533–534) the functions and the purpose of a business model are to:

- “Articulate the value proposition (…)
- Identify a market segment (…)
- Define the structure of the value chain (…)
- Estimate the cost structure and profit potential (…)
- Describe the position of the firm within the value network (…)
- Formulate the competitive strategy (…)”

According to Amit and Zott (2001), the business model of a company is important for innovation and an even more important source of the creation of value for the company itself, but also its customers, suppliers and other partners. Ballon (2005) states that the focus of business modelling was formerly on single firms and shifted to networks of firms. Furthermore, the focus on simple interaction concepts and revenue models shifted to extensive concepts including value network, functional architecture, financial models and value proposition. Magretta (2002) defines a business model as the telling of a story that explains who the customers of a company are, what the customers value and how the company will be able to earn money by providing the value demanded by customers. According to Al-Debei, El-Haddadeh and Avison (2008, pp. 8–9), “The business model is an abstract representation of an organization be it conceptual, textual, and/or graphical, of all core interrelated architectural, co-operational, and financial arrangements designed and developed by an organization presently and in the future, as well as all core products and/or services the organization offers, or will offer, based on these arrangements that are needed to achieve its strategic goals and objectives.” According to Osterwalder and Pigneur (2010, p. 14), a “business model describes the rational of how an organisation creates, delivers, and captures value”. Chesbrough and Rosenbloom (2002) define a business model as a framework that uses technological characteristics and potential as inputs and transforms them into economic output through customers and markets. De Reuver, Bouwman and MacInnes (2009) add that the concept of business models was developed for the explication of the value enabled by information and communication technology driven innovations for companies.

It can be summarised that the definitions given above are similar, at least to a certain degree, and mainly focus on the generation of value to customers and a company afforded by the input of technology and innovation. As this definition is perceived as value adding, it is used in this work. A fitting business model is regarded as an important factor in delivering the generated value to customers and company. The definition of ‘business model’ is important in this work because to answer RQ3, which focuses on the look of a potential future MNO business model, it has to be understood what a business model is. This enables the baseline for the further research.

2.2.3.1.2 Components of a Business Model

For a better understanding of the meaning of business models, not only is definition important because it lays the baseline for orientation of a business but also the single parts a business model can consist of because they describe the business model in more detail. Accordingly, this subsection focuses on the components business models can consist of to provide understanding on this topic.

Osterwalder (2004) developed a general business model framework that consists of the four dimensions: product, customer interface, infrastructure management and financial management. In the product dimension, value proposition is the central component. The product dimension enables an overview of a company's products and services that provide value to customers. Its key elements are product offers, value reasoning and value level. The customer interface dimension identifies the target customer segments, the channels by which they are reached and the respective relationships. The infrastructure management dimension defines the value creation process of a company. It describes the abilities necessary to provision of value propositions to the customer and to maintenance of the customer interface. The vital elements are the key activities, resources and partners. The financial management dimension consists of the revenue model and the cost structure of a company. These two define the profit- or loss-making concept of a company. This dimension's key elements are cost and pricing elements as well as the revenue stream.

Ballon (2007) states that the business model design concerns the configuration of control parameters, like value networks and functional architecture parameters, as well as value parameters, like financial models and value propositions. The interdependency of these parameters for business models are, however, not discussed and thus no consistent and connected model is provided.

According to Lindgardt et al. (2009), a business model consists of the two components 'value proposition' and 'operating model'. The first combines target segments, product or service offers and the revenue model. The target segment defines the customers a company wants to serve and which of their needs are to be addressed. The product and service offers specify what the customers shall be offered to satisfy their needs. The revenue model deals with the compensation for the offered product or service. The second element, the operating model, combines the areas value chain, cost model and organisation. The value chain treats topics like what shall be done in-house and what shall be outsourced, whereas the cost model concerns the question of the asset and cost configuration to deliver profit. The organisation determines the deployment and development of employees in order to maintain competitive advantage.

According to Teece (2010), a well-developed business model is essential to delivering or capturing value from innovations. Hence excellence not only in product innovation but also in business model design and design options as well as in understanding of customer needs is required. The business model has to be distinctive hard to imitate, and at the same time effective and efficient. It is thus more likely to yield profit than is developing a successful business model that is easy to copy and therefore does not enable competitive advantage. The selection, adjustments and improvement of business models are complex and the design often needs iterative processes. While business modelling is not as granular as the definition of a business strategy, coupling these two can prevent competitors from imitating the business model and strategy and therefore sustains the competitive advantage enabled by a new business model. To protect a business model usually some barriers are created:

- Systems, processes and assets that are hard to imitate can be used when the business model is implemented.
- A certain level of opacity should be included so that people outside the company are not able fully to understand the business model.
- Even if the business model would be easy to imitate, the pioneers of the new model can enjoy a certain period of competitive advantage if copying the model leads to the situation that existing sales and profits have to be cannibalised or business relationships are upset (Teece, 2010).

Teece's (2010) model focuses mainly on the innovation of products, such as new services and offers, and the respective business models for the invented products in order to secure a competitive advantage, while always having customer needs in mind. However, unlike Osterwalder (2004) and Lindgardt et al. (2009), Teece's (2010) model does not cover infrastructure management as well as financial management including costs.

Chesbrough (2006) states that it is fundamental to make a business model explicit, dynamic and open. Through explicit business models knowledge sharing and dissemination are facilitated, and telecommunication companies are supported in the analysis and evaluation of the feasibility of their business models. A certain flexibility in this very competitive market has to be provided. The upsides of open business models are that ideas may come from any source and that they enrich value networks, which leads to the enablement of the innovation required for value creation. Sandulli and Chesbrough (2009) confirm the value creation in open business models through integrating external resources and exchanging with partners. They further state that close collaboration between partners, as well as a better access to markets and knowledge is enabled. This is acknowledged by Storbacka et al. (2012), who further state that customer value is cocreated by participants in a network. Frankenberger, Weiblen and Gassmann (2013, p. 671) state, "For open business models with low solution customer centricity, a network configuration characterized by many weak ties to service partners leads to superior performance. Conversely, for open business models with high solution customer centricity, few but strong ties to partners lead to superior performance". Mejía-Trejo (2017) finds in his research that open business models are based on five main factors: business management, strategy, technology, new entrepreneurship and open innovation orientation. Khumalo and van der Lingen (2017) regard open business models as a bridging construct for innovation with organisational performance in the environment of public and private organisations. Open business models are constantly changing in the pursuit of competitiveness. They add that companies try to reach the same objectives with open business models as with their 'normal' business models, even though external parties are involved. According to Gassmann, Enkel and Chesbrough (2010) one of the biggest challenges to open business models is to prove the benefits it provides as an instrument to measure the value generation is missing. Demil and Lecocq (2014) conclude that the success of open business models depends on cooperation and "diffusing cautiously IP and knowledge and keeping an eye on the aggregate consequences of open innovation should be a golden rule for any company moving into this path" (Demil and Lecocq, 2014, p. 111).

Johnson, Christensen and Kagermann (2008) note a prevailing lack of definition of dynamics and processes of business model development. They add that only few companies understand their business model well and this is the reason for which they do not know when a new business model is required. They recommend companies that have a new business model be patient for growth but impatient for profit, because if the business is profitable, this is a good early indicator of a viable model.

Osterwalder and Pigneur (2002), as well as Osterwalder, Lagha and Pigneur (2002), who have been highly engaged in research on business models, describe a business model as the value offered by a company to customers as well as the firm's architecture and network of partners for the creation, marketing and delivery of this value to generate profit and sustainable revenue. They elaborated an overview of business model components, analysed and compared the literature and clustered the various components. According to them, a business model consists of the following components:

- Product innovation consists of the value proposition a company offers to its target customers and the capability to provide this value
- Infrastructure management describes the required infrastructure to deliver the value proposition, consisting of the activities for creation and delivery of value and the relationship of the company and its partner network
- Customer relationship revolves around the understanding of customers by focusing on an information strategy, multiple channels to deliver value as well as trust and loyalty
- Financial aspects are influenced by the other three pillars and consist of the company's revenue model and its cost structure

As with the definition of the term ‘business model’, there is also ongoing discussion of the definition of its components. As long as there is no generally accepted understanding and definition of a business model, it is hard to define the components it consists of as these are dependent on the definition. While the definitions of the term ‘business model’ are relatively homogeneous among researchers, the definitions of the components necessary for a business model are more heterogeneous but analogies exist between the single approaches. In light of the available information in the literature, the components (I) product innovation, (II) infrastructure management, (III) customer relationship, and (IV) financial aspects, according to Osterwalder, Lagha and Pigneur (2002), as well as Osterwalder and Pigneur (2002) are believed to cover the essential aspects of business models. As the definitions do not specifically focus on MNOs, but on companies in general, these components could also be applicable to MNOs. However, no commonly accepted components of MNO business models are defined so far, and this may be regarded as a gap in research. Understanding which components are important for a MNO business model is important in this research project to answering RQ3, which focuses on the look of a potential future MNO business model. With this understanding the baseline for the research is further extended and improved.

2.2.3.1.3 MNO Business Models

Surrounded by increasing complexity in the business environment telecommunication companies need to adapt due to changes to their strategies and information systems. In this turbulent environment it is a challenge most telecommunication companies have to face in the creation of a viable business model that meets their strategic objectives. Through fast responses to these changes with respective business decisions, their competitive position can be improved. An appropriate business model can support the enhancement of MNOs’ competitive position. Although the definition and design of a business model for telecommunication companies is complex and many different and conflicting requirements have to be balanced, there is an urgent need to focus on this topic (Al-Debei and Avison, 2011; Arthur D. Little, 2018a; GSMA Intelligence, 2020a). This need for new MNO business models is also confirmed by Prabhu, Arora and Mishra (2018) who state that consumer behaviour is changing rapidly, which has led to increased pressure on existing MNO business models showing first signs of instability. Mihailovic (2019) also acknowledges that MNOs' business models have to change to generate sufficient revenue. Therefore, portfolios need to be changed and innovative data services have to be offered. Moreover, end-to-end services need to be provided, which require innovation and new ideas based on knowledge and skill that are often not available at MNOs. IDC (2020) covers the emergence of new MNO business models based on 5G, such as those focused on the automotive, energy, manufacturing or healthcare sector as well as on governments. For automotive, a potential business model could revolve around autonomous vehicles or traffic management. Regarding the energy sector, an inspection of the distribution infrastructure in an automated and remote-controlled way would be possible. In the manufacturing area, production lines could be controlled as well as mobile robots, and products could be monitored. At healthcare, controlling operational equipment remotely, or training with VR could be feasible. For governments, the optimisation of traffic flows and smart cities could be of high interest.

According to GSMA Intelligence (2020b), one possible business model for MNOs could be the provision of data analytics services as MNOs have access to a vast amount of data, such as use of mobile apps, data consumption, location data, movement data, network performance, IoT applications, IoT connections, user demographics, or contact and payment information. In light of this, MNOs could offer basic analytic services, e.g. by combining location and movement data with further information on the customer. These analytics could be sold to cities or retailers. Also offering IoT analytics would be possible as an addition to the provision of an IoT platform. Moreover, business analytics could be offered to enterprises as managed services. Wireless Week (2018) confirms the importance of location data for MNOs to new monetisation possibilities.

Ballon (2007) states that the main business model issue for MNOs is to provide new services enabled by cooperation and coordination modes. The questions closely connected with this issue are those that concentrate on shifting of firm boundaries, the integration levels, horizontal and vertical, as well as the provision of new services. He summarises the main parameters and trade-offs he identified in a table, which can be used to design and analyse MNO business models. This is presented in table 1. Ballon’s (2007) table is still applicable, as MNOs still revolve around the provision of new services enabled by cooperation and coordination modes. Also, topics, such as combination of assets, modularity, cost (sharing) models and positioning, are still relevant to MNOs.

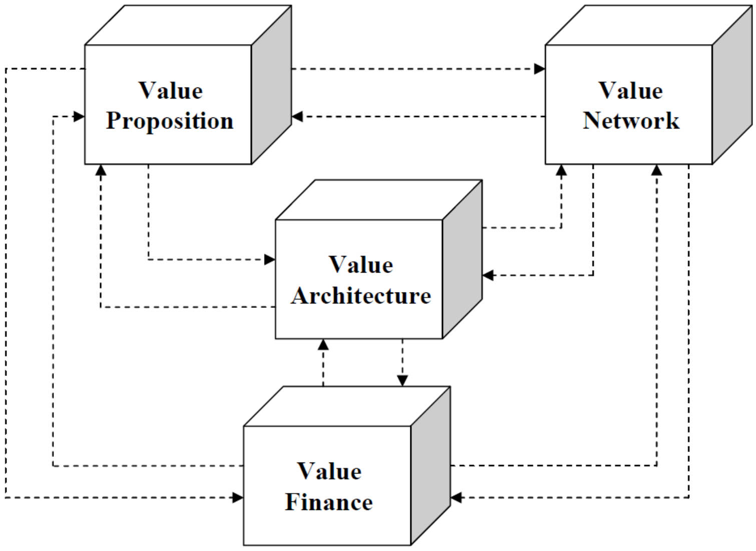
Control parameters				*Value parameters*			
Value network parameters		*Functional architecture parameters*				*Value proposition parameters*	
Combination of assets		Modularity		Cost (sharing) model		Positioning	
Concentrated	Distributed	Modular	Integrated	Concentrated	Distributed	Complement	Substitute
Vertical integration		Distribution of intelligence		Revenue model		User involvement	
Integrated	Disintegrated	Centralised	Distributed	Direct	Indirect	High	Low
Customer ownership		Interoperability		Revenue sharing model		Intended value	
Direct	Intermediated	Yes	No	Yes	No	Price/quality	Lock-in

Table 1: Business Model Design Matrix (Ballon, 2007)

Al-Debei and Avison (2011) state that despite business models’ increasing importance, only little attention has been given to business models of telecommunication companies. They further state that telecommunication companies need to adapt their strategy due to increasing complexity in their business environment and therefore an appropriate business model is needed that can enhance their competitive position through improvement of their ability to react quickly to changing business environmental situations with improved business decisions.

According to Camponovo and Pigneur (2003), who mainly concentrate on a general overview of parties in the mobile business, a telecommunication business model consists of the five components, value proposition, target customers, business partners, core activities and revenue flows, which is not completely consistent with the theory of Osterwalder (2004), but is based on it. Their focus is on the provision of an overview of the actors in the mobile business, rather than on detailed description of the single components. Kallio, Tinnilä and Tseng (2006) note that business models of telecommunication providers are influenced by external and internal factors. The latter consist of strategies for product development, sales and marketing, servicing and implementation as well as value creation. They regard strategy concepts and business models as identical and therefore use the terms interchangeably. The external factors are customer base, government policy and regulation, technological advances and value chain dynamics. They further state that there is no direct proportional relationship between telecommunication companies' outcome and the technological excellence of the services provided. The viability of telecommunication companies' business models is strongly influenced by changing environmental factors, e.g. size and nature of the customer base, competition level, regulations and market opportunities. Their approach again differs from those above. Ghezzi, Cortimiglia and Frank (2015) define three areas telecommunication providers have to focus on with their business model. The first is customer relationship, which is necessary to creating sustainable competitive advantage. The second area is content commercialisation and innovation, which requires focus on innovative services and shortening the time-to-market of new services and content. The third area is infrastructure management, which is based on network access services and mediation capability. They declare that telecommunication companies have to explore the opportunities they have due to their network's functionalities and that they have to manage the quality of their services, which is a basis of competitive advantage. They conclude that the business model is a tool to identify discontinuities and a trigger to replanning processes that will generate a strategy consistent with the developing environment. Also, their approach differs from others. As Al-Debei and Avison (2011) regarded the literature and research on business models for telecommunication companies as too inconsistent, due to short and general descriptions, different points of view, concentration on only few parts of the whole, different levels of detail and the use of different terminology, they developed their own business model framework for telecommunication companies, the V^4 model. It has the four dimensions value proposition, value network, value architecture and value finance, which all add value to a MNO's business. They suggest consideration of the business model of a MNO at the operator level. Their MNO business model is shown in figure 15.

Figure 15: V^4 Business Model (Al-Debei and Avison, 2011)



While the value proposition contains the description of core services and products that are offered by a MNO including value elements and the needs and wants of targeted customers, the value network covers the external arrangements a MNO needs with other companies in its value system as all the required diversified resources rarely exist in the organisation of a MNO. The central component of the model is the value architecture that specifies technological architecture and arrangements as well as organisational arrangements concerning resources and capabilities. The fourth component is value finance that concentrates on the three categories, total cost of ownership (TCO), pricing methods and revenue structure (Al-Debei and Avison, 2011). Regarding the value network, Von Hippel (2005) adds that MNOs' products and services can basically be used by every participant in the market, which includes end users, to create new products and services. Thus, even end users become designers of products and services and are able to start competition with MNOs.

Wulf, Zernekow and Duser (2010) compare several studies of value chain concepts and identify the following common activity classes for telecommunication companies:

- Transport
- Hosting and delivery
- Terminal management

- Customer Relationship Management (CRM)
- Content and service management

Telecommunication companies combine some or all of these activity classes, depending on their degree of integration. The resulting differing strategies concerning the integration of activities are reflected in the respective organisational strategies, which in turn are reflected in the differing business models. Wulf, Zernekow and Duser (2010) developed a business model typology based on the diverse activities for transit and access, delivery, portal and service. While transit and access include the provision of transport-orientated services and focus on use of telecommunication companies' traditional core competence, delivery includes transit and access, and adds the incorporation of server management activities and the integration of server infrastructure. In this business model retail content and service providers are targeted. The portal business model adds the management of end customer terminals and the management of charging, billing and CRM. A portal to third-party content and customer services is provided to foster a tight relationship with customers. In the service business model everything of the other three business models is included plus the carrying-out of content and service management. This business model includes traditional telecommunication services and allows the expansion to offer additional services.

Haaker, Bouwman and Faber conducted several researches and did not focus on business models for single telecommunication companies, but on a cross-company collaboration in the complex value networks that are required to provide telecommunication services. In their opinion telecommunication business models consist of the four design components service, technology, organisation and finance. In their research value networks were not discussed as part of a business model as they regard a telecommunication business model as a complex system of several companies that requires balancing of often conflicting requirements. Nor do they sufficiently cover critical issues like network coverage, capacity, reliability and interoperability (Bouwman, Faber and Haaker, 2004; Bouwman, Haaker and Faber, 2005; Faber et al., 2003; Faber, Haaker and Bouwman, 2004; Haaker, Bouwman and Faber, 2004).

Another approach is followed by Kaleelazhicathu et al. (2014) stating different standard business models for telecommunication providers:

1. At the basic service provisioning model, services a user needs are bought from the services operator through subscription. The service operator is the company responsible to the user and provides the required services. These services can only be provided to customers when the service operator buys network access and transport service from a network operator.
2. The Customer Premises Equipment (CPE) distribution model revolves around the provision of CPEs. On the one hand, the CPE vendor can sell the devices to the service operator that sells them to the end-users. In this way, the cost of the CPE is part of the subscription fee and the service operator is at the same time distributor of the devices. On the other hand, the CPE manufacturer can distribute the CPEs directly to a CPE vendor.
3. The content provisioning model can be divided into three parts. In the vertical bundling model content is provided by a service operator that purchases wholesale content from various providers, distributes it directly to end-users through a portal, and bills them. The bit-pipe model is used for the provision of content to subscribers by third parties that use the service operators' network capacity. In this model the service operators earn money through the end-users' use of data, not through the offer of content. In the capacity reseller model for content a third party also uses the network capacity of service operators to provide content to its subscribers. But unlike in the bit-pipe model a part of the service operator's network capacity is resold to the third party and the billing services are conducted by the service operator on behalf of the third party that in turn has to pay for the use of capacity and the billing services.

Al-Debei and Avison (2011), in their analysis of MNO business models, find that in most studies only business model components are listed, including a high-level and brief description. The components are considered from different points of view and every researcher focuses on a part of the whole. Furthermore, the business models are researched at different levels, e.g.

from services level view or from organisational level view. Moreover, no consistent terminology is used in the various definitions of business models. According to Prabhu, Arora and Mishra (2018), MNOs have to develop realistic strategies and decide on the best-fitting business models for them, having regard to their targeted markets and customers and capabilities. In this way, MNOs can survive and concentrate on steady improvement, meeting the challenges and threats they have to overcome to achieve and secure efficient performance.

It can be summarised that, according to Ballon (2007), a telecommunication business model consists both of control and value parameters. Camponovo and Pigneur (2003) state that it consists of the five components, value proposition, target customers, business partners, core activities and revenue flows. Ghezzi, Cortimiglia and Frank (2015) define customer relationship, content commercialisation and innovation, as well as infrastructure management as the three focus areas to concentrate on. According to Al-Debei and Avison (2011), a business model framework for telecommunication companies consists of value proposition, value network, value architecture and value finance. Kaleelazhicathu et al. (2014) distinguish service provisioning model, CPE distribution model and content provisioning model. In light of the above, it is clear that there are many possible forms a MNO business model could take. However, none of the definitions above is seen as comprehensive and capturing all aspects of MNO business models. If these varying definitions are combined, a MNO business model could consist of the components value and content proposition, target customers and business partners, core activities, such as infrastructure management and service provision, and revenue flows. However, as the telecommunication market is expected further to change and it is not known whether all these business model components will be part of a future MNO business model, this is identified as a gap and further research in this area is required. Understanding which components are important for a MNO business model is crucial to this research project in answering RQ3, which focuses on the look of a potential future MNO business model. In this section the baseline for the research is further extended and improved. However, to answer the question how a future MNO business model might look like, further research is required.

The goal of subsection 2.2.3.1 is to provide a general overview of the definition of the term ‘business model’ and what a business model consists of. Insights into MNO business models are given. To secure understanding is important for this research as it provides the basis to RQ2 and RQ3.

2.2.3.2 Theoretical Framework on Business Model Innovation and its Application at MNOs

In this subsection a theoretical framework of what BMI is is explained and the meaning of BMI for MNOs illustrated.

2.2.3.2.1 Application of Business Model Innovation

MNOs may not rest and rely heavily on their currently implemented business models in order to stay competitive in the market. A change of business model is a viable option to cope with new challenges and exploit new technologies to stay profitable in a competitive environment. Accordingly, this subsection focuses on the application of business model innovation.

Chesbrough (2010) represents the opinion that the economic value of an invention is unclear until it is commercialised through a business model. If another company finds a business model that is better suited to a given innovation or technology, this company will be able to realise a higher economic value from it than the original inventor. Therefore, it is crucial for companies to be capable of innovating their business models, ideas and technologies. The downside is that many companies have to overcome significant barriers before a new business model can be implemented. One of these barriers is the conflict between a business model that is already in place for a given technology and a business model that is required to capture the value of a new, emerging technology. Tools to overcome the barriers are available but are not enough. Companies have to experiment with their business model and have to identify internal leaders that manage the change. New markets have to be tested with new possible characteristics of a business model to foster a faster learning than the rest of the market and to generate data that can promote the change process. Simultaneously the efficiency and effectiveness of the present business model has to be maintained during the implementation of the new one until it takes over completely. Rouse (2015) declares that the digital age fosters the need for BMI since technology has changed the way companies act and operate their businesses. Lifecycles of business models have become shorter and to achieve financial success innovations are necessary. Furthermore, a more globalised world also intensifies the need for new business models in order to compete with rivals and to grow. According to Rouse (2015), an alignment of the business objectives and the IT department is required to improve processes in the whole organisation. The result is that CIOs and IT executives are very important to the identification of technology that maximises the success of BMI. According to Amit and Zott (2012), to achieve growing revenue and improved profit margins, companies innovate existing processes and products by investing a lot of effort. This effort is expensive and highly time-consuming while often an upfront investment, e.g. for R&D, in specialised resources or new plants is required. This is all done not knowing the outcome of these investments. For this reason more and more companies consider BMI to be an alternative or regard it as a complementary process together with process and product innovation. Upsides of BMI are that an underused source of future value generation can be used, the replication of a new business model for competitors can be really difficult and BMI can be a very powerful competitive tool. It can take place in three ways:

1. Novel activities, e.g. through forward or backward integration, can be added to the existing business model (content)
2. Activities can be linked in novel ways (structure)
3. One or more parties performing any of the activities can be changed (governance)

In increasing the chances of development of the right business model according to the situation the major value drivers are novelty, lock-in, complementarities and efficiency (Amit and Zott, 2012).

Efficiency means transaction efficiency as one of the most important value drivers and suggests that the efficiency of a transaction increases as soon as there is a decrease in costs per transaction. Hence a greater transaction efficiency means lower costs per transaction and a higher value of it. This can, for example, be achieved by decreasing information asymmetry, enabling a more informed and faster decision process, lowering distribution costs or improving inventory management. Complementarities means that a bundle of goods provides more value than the overall value of all goods taken separately. A company is a complementor to another company if the products of both companies together are more valued by the customers than the single products on their own. It may be expected that complementarities increase value through the enablement of increased revenue. Lock-in prevents customers and strategic partners from migrating to a competing company and in this way creates value through increased transaction volume and a higher willingness to pay. Switching costs, brand name, and trust between the parties help to increase the lock-in of others. The relationships between efficiency, complementarities and lock-in strengthen these value drivers. Novelty may be defined as the introduction of new production, distribution or marketing methods, as well as new products or services. But a new way of doing business is also a novelty. Value can e.g. be created by the connection of previously unconnected parties or the elimination of inefficiencies in processes through innovative methods (Amit and Zott, 2001). In connection with Schumpeter's (1942) idea of creative destruction, Amit and Zott (2001, p. 511) suggest that innovation, in the context of a business model, not only refers to "products, production processes, distribution channels, and markets, but also to exchange mechanisms and transaction architectures". They further state that BMI can disrupt existing industries and their structures, and that BMI is a serious threat to firms.

Whereas Amit and Zott (2012) specify four value drivers as increasing the chances of determining the right business model, Girotra and Netessine (2014) explain that business models consist of major decisions that influence revenue, costs and risks, and BMI is a change of these decisions. The questions considered are:

- What are the offers?

- When are decisions made?
- Who makes decisions?
- Why are the specific decisions made?

Successful changes in the framework of these decisions will positively influence revenue, costs and risk. They further highlight that it is hard for companies to be systematic about the process without a framework within which to identify opportunities for BMI, resulting in the situation where many miss the opportunity inexpensively to increase their profitability and productivity. This approach differs from that taken by Amit and Zott (2012). On the other hand, Lindgardt et al. (2009) have a different opinion and state that BMI is a possible way to renew a competitive advantage and growth in a challenging environment characterised by shorter business model lifecycles, new emerging global competitors, migration of assets and activities to low-cost countries, growing risk due to increasing interconnectivity and emerging social and ecological constraints. BMI must therefore be cultivated systematically, be sufficiently supported and explicitly managed. When two or more of these six elements, namely target segments, product or service offers, revenue model, value chain, cost model, and organisation are reinvented to provide value in a new way, innovation becomes BMI. Especially in times of instability BMI helps companies to find a way out of intense competition, when e.g. product and process innovations can easily be imitated by competitors. Furthermore, it can assist in finding disruptions that demand new competitive approaches. The average premium earned through BMI is more than four times greater than the premium earned through product and process innovation. Moreover, returns based on BMI are more sustainable. To realise the advantages it has to be kept in mind that there are also common pitfalls, e.g. portfolio bloat, failure to scale up, pet ideas, isolated efforts, fixation on ideation, internal focus or historical bias.

Osterwalder and Pigneur (2010) illustrate tools that help to classify existing business models in order to make them comparable as well as to create new business models. One of these tools is the Business Model Canvas, which supports the design and idea generation process. It is based on nine basic building blocks: customer segments, value proposition, channels, customer relationship, revenue streams, key resources, key activities, key partnerships and cost structure. In addition, they characterise techniques to design business models like customer insights, ideation, visual thinking, prototyping, storytelling and scenarios. Teece (2010) states that the initiation of BMI is best conducted by the company itself and not forced by the market or external events. The defined model should not be fixed but adaptable to new situations. In this connection it has to be considered that a fitting business model is seldom found at the first attempt but usually through trial and error.

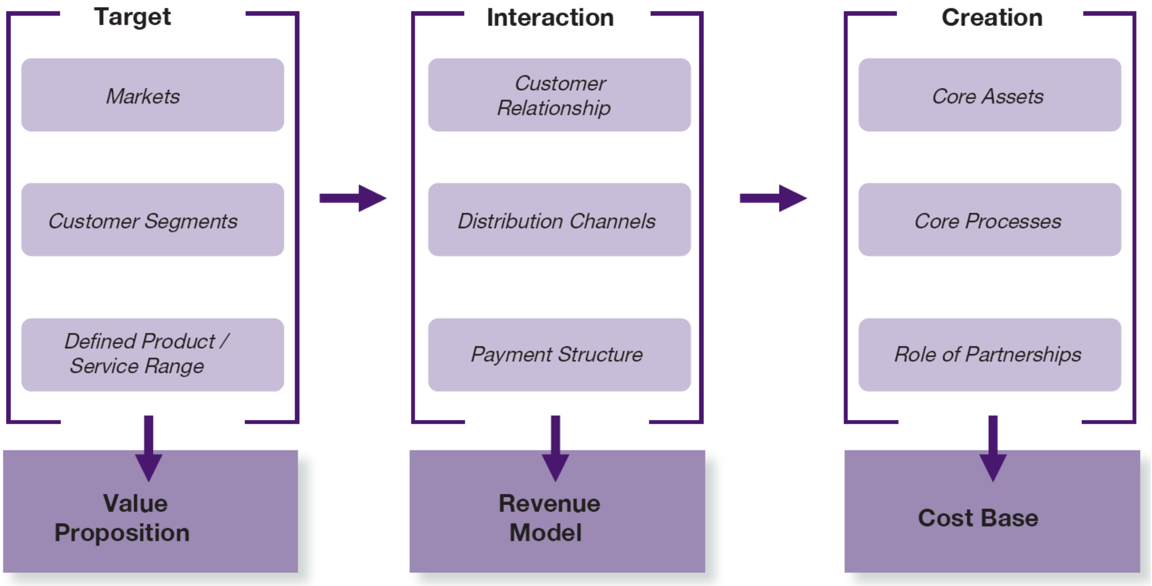
Companies like Apple or Google are examples of highly successful disruptive BMI that not only shapes the structures of the industry they work in, but also inspire other companies to imitate their business model and to invest effort in further innovation. Gambardella and McGahan (2010) further state that business model innovating companies have the chance and potential to lead in new knowledge-exchanging industries and have greater opportunities to develop a solid basis, which can be used to long-term competitive advantage than the rest of the market. The research of Zott and Amit (2007) shows that business model design that is centred on novelty positively affects the performance of the company. They also find that this positive relationship remains stable. Novelty refers to new ways of executing exchange between parties and can be achieved e.g. through connection of formerly unconnected parties by using new ways to link them or new transaction mechanisms. Besides novelty as critical to business model design, they identify efficiency. A business model design that is efficiency centred supports the achievement of transaction efficiency, aiming at lower transaction costs for all participants. Their research indicates that it may be counterproductive to design both novelty and efficiency centred business models. According to them switching costs for a company's customers, suppliers and partners are higher if the degree of novelty of the business model is also higher.

Summarising this subsection, differing definitions of BMI are presented. Chesbrough (2010) states that the economic value of an invention is unclear until it is commercialised through a business model. Hence it is crucial for companies to innovate their business model. Nevertheless, there is a conflict between the business model in place and that needed to capture value of a new, emerging technology. Rouse (2015) states that business model lifecycles have become shorter and BMI is necessary to financial success. According to Amit and Zott (2012), there are three ways for BMI: change in content, structure or governance. Major value drivers are novelty, lock-in, complementarities and efficiency. While Girotra and Netessine (2014) state that BMI is a change of offer, decision time, decision responsible and decision reasons, Lindgardt et al. (2009) regard BMI as a possible way to renew a competitive advantage and develop in a challenging environment. If at least two of the six elements target segments, product or service offers, revenue model, value chain, cost model, and organisation are reinvented to provide value in a new way, it is considered to be BMI. Overall, the advantages of successful BMI are generation or renewal of a long-term competitive advantage, promotion of growth, improvement in profit margins and transaction efficiency, market disruption, and improved overall performance. Given this, the importance of BMI to companies' future development and growth can be seen. As these advantages of BMI were developed in an industry-agnostic way, they could also be applicable to MNOs. To conclude, BMI is also of great importance to MNOs. Accordingly, the next subsection focuses on the importance of BMI to MNOs.

2.2.3.2.2 Business Model Innovation at MNOs

MNOs have to be willing to adopt new business models and provide new services to compete directly with internet players in certain areas, e.g. video or mobile advertising. Building platform business models and generating new capabilities through merger, acquisition or partnership are viable options. Verizon e.g. focuses on the development of new business models that are based on platforms. SK Telecom likewise fosters a platform model focused on lifestyle enhancement, advanced media and IoT services (GSMA Intelligence and CAICT, 2016). As MNOs are mostly large organisations artificial barriers to innovation build up and the time-to-market for new products can be several months. Hence the incremental need to take certain risk with an innovation-focused culture, which is cross-functional, creative and error-tolerant, is imminent. For the creation of new value new technologies can be used. The creation of new business models is inevitable to monetising on the goods and services provided. These must serve the interests of the MNOs as well as enable the maximum value to customers. Therefore, not only is offer of classical telecommunication services crucial but also the innovation of third-party offers by increasing the contemporary coverage of their business model. To achieve this status, challenge to currently implemented business models and their understanding of MNOs' role is necessary to be able constantly to innovate business models. As the business models of telecommunication companies are under pressure and seem to crumble as their business environment is evolving and they have to face the ongoing threat of OTT providers as well as other competitors, many MNOs have accessed new fields of operation. Participation in these markets shows that MNOs are looking for BMI that helps them to improve their current situation in the market, even if this means a huge change in their current business model. Capgemini thus developed a business model with three interlinked dimensions to identify where telecommunication companies made efforts to innovate their business model (Schön, Zimmermann and KVJ, 2011). Figure 16 shows this model.

Figure 16: Framework of a typical MNO Business Model (Schön, Zimmermann and KVJ, 2011)



The dimensions shown in figure 16 are 'target', 'interaction' and 'creation'. Changes that MNOs have already conducted in the dimension 'target' are the change of their core value proposition, while they realised the need for an expansion of their footprint. Hence MNOs have entered new markets like the reselling of energy and gas agreements, smart metering services, or direct advertisement on customer devices. Also, a change to flat-rate models from formerly used mobile broadband pricing plans has taken place, while another trend has been tiered pricing based on downloads or bandwidth. Additionally, changes in the dimension ‘interaction’ have taken place, e.g. to offer a discount if customers dig the last part of a trench to their home themselves, which would be expensive for the telecommunication company. Innovative methods of payment have also been introduced and most telecommunication companies not only offer their main but also low-cost brands by launching their own MVNOs. Moreover, some customers allow MNOs to send them targeted advertising in exchange for free messaging and telephony. There have also been changes in the creation of service telecommunication companies offer through the outsourcing of huge parts of their network operation to equipment vendors or the simplification of complex support systems. Another approach is the reduction of cost through intelligent networks that reduce power consumption (Schön, Zimmermann and KVJ, 2011). Kallio, Tinnilä and Tseng (2006) show a possibility for economic outcome through the management of data traffic functionalities by creating preferred routes for those companies that are willing to pay for faster network connection speed for their customers. Another possibility they demonstrate is the billing using a SIM card, without having to use a credit card. In this way, telecommunication companies would rent their technological assets and capabilities to third parties that develop and manage a business model on them.

Summarising this subsection, it can be seen that understanding of the nature of BMI for MNOs differs. While some regard the building of platform business models and the generation of new capabilities through merger, acquisition and partnership as BMI, others understand the innovation of third-party offers as BMI. MNOs innovated their business models in the past e.g. by reselling of energy and gas agreements, smart metering, direct advertisement, change to flat-rate models, discount offers, innovative payment methods, launch of own MVNOs, outsourcing of parts of their operations, and introduction of intelligent networks. Looking at the current situation of MNOs it can be seen that the BMI they have conducted so far has not had the desired effect on their economic situation. Moreover, some actions regarded as BMI by MNOs are not BMI in its original sense but can be considered to be cross-selling or an increase in their overall service offer. This subsection has further examined the role of innovation for MNOs. Given the information in the literature, the importance of BMI for MNOs' future regarding development and growth cannot be clarified to its full extent as it is only indicated that its role is crucial. It is vital to understand BMI's role in MNOs in order to be able to judge whether an engagement in this topic should be fostered. Nor does the literature provide enough background to show what future MNO business models will look like. Therefore, this is another research gap that needs to be bridged. These research gaps form the baseline for the first parts of RQs 2 and 3.

2.2.3.3 Strategic Management View

As with discussion of theory of innovation, disruptive innovation and components of business models, the strategic management view may not be neglected when BMI is examined, as it is through strategic management that the growth of companies is planned and strategic advantage over competitors secured. Therefore, in this subsection the three strategic management views of industry based view, institution based view (IBV) and resource based view (RBV) are depicted (strategy tripod).

The industry based view is one view of the strategy tripod, derived from the competition patterns in the USA in the 1970s, and focuses mainly on a market analysis using Porter's five forces (entry barriers, threat of substitution, bargaining power of buyers, bargaining power of suppliers and rivalry among industry incumbents). It suggests that a company gets in a position that is less vulnerable to Porter's five forces and that the degree of competitiveness largely determines a company's performance (Porter, 1980). This was criticised often due to its lack of attention to context (Peng et al., 2009). Also, due to newer concepts the focus of this subsection is mainly on the other two views.

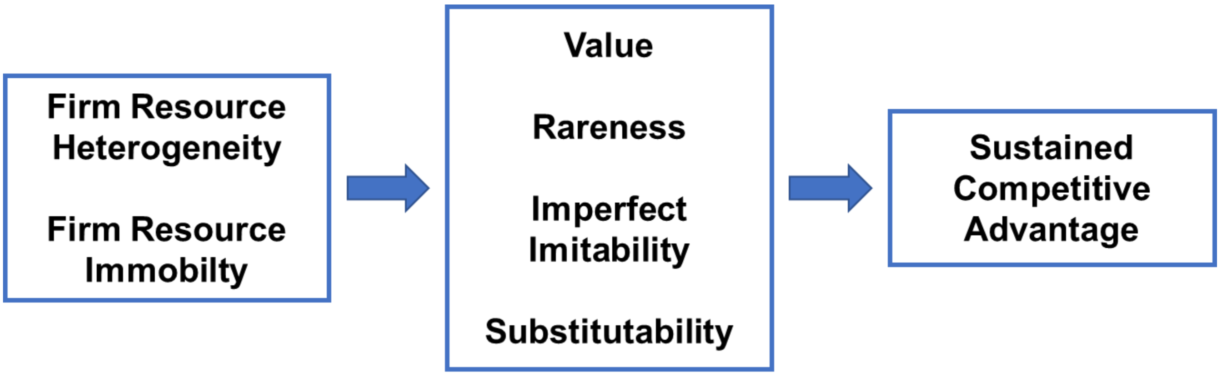
2.2.3.3.1 Institution based View

The intention of the IBV, often regarded as a third leg of the strategy tripod and the most recent strategic management view in the tripod, is to overcome the criticisms concerning the lack of context of the industry based view and the RBV. Due to this lack, a new theoretical perspective, the IBV, had to be developed to overcome these drawbacks. The goal of institutions is to reduce uncertainty in the market for the various actors by providing binding norms and rules, and by defining the legal boundaries. The IBV suggests the possibility of beating competition in a non-market area where informal factors are of great value if a company is unable to distinguish itself or prove as cost leader in its market. It adds that not only are the five forces of Porter and the firm-specific capabilities (compare subsection 2.2.3.3.2) to be taken into account, but also the influences of formal and informal factors. Furthermore, institutional forces can explain differences in performance of companies. For analysis of the IBV, formal and informal factors have to be examined. Formal factors include law, regulations and rules, while informal factors concern norms, culture and ethics (Peng et al., 2009). Scott (1995) adds the regulative, normative and cognitive pillars to support these dimensions. Palthe (2014) developed a conceptual model of the influence of regulatory (policy, work rules), normative (work norms, habits), and cognitive (beliefs, values) elements on organisational change. The "regulative element emphasizes conformity to *legal* systems (…). The normative element stresses the *moral* bases (…) and the cognitive element emphasizes *cultural* legitimacy" (Palthe, 2014, p. 61). The IBV states that the behaviour of companies is more than just a response to pressure imposed by markets, but also a product of the institutional context. It suggests that social legitimacy, being either regulatory, normative or cognitive, should be regarded as an input factor fostering organisational change in combination with other resources that are necessary to the process of change. It further states that not everything that happens is intended and that not all outcomes are the products of decision processes. Regulatory elements are often associated with rapid and episodic change, while normative and cognitive elements are often associated with long-term and continuous change (Palthe, 2014).

2.2.3.3.2 Resource based View and dynamic Capabilities

The RBV investigates the connection of the internal characteristics of a company and its performance to develop a competitive advantage. It assumes that the strategic resources controlled by companies are distributed heterogeneously in the industry. It also assumes that the resources are not perfectly mobile across the companies and because of this heterogeneity can last longer. In the RBV implications of these assumptions are used to analyse sources of sustained competitive advantage. To have the potential to provide sustained competitive advantage a resource must have certain properties: value, rarity, inimitability and non-substitutability (VRIN) (Barney, 1991). The framework of RBV is shown in figure 17.

Figure 17: Framework of RBV (Barney, 1991)



The RBV suggests that successful firms are distinguished from unsuccessful by firm-specific capabilities (Peng et al., 2009).

The theory on dynamic capabilities (DC), which is based on the RBV and was mainly developed by Teece, Pisano and Shuen, is "especially relevant in a Schumpeterian world of innovation-based competition, price/performance rivalry, increasing returns, and the 'creative destruction' of existing competences" (Teece, Pisano and Shuen, 1997, p. 509). The term 'dynamic capabilities' is used to stress the exploitation of internal and external competences that are firm-specific in order to address changing environments. 'Dynamic' means the ability to renew competences to reach congruence with a changing business environment. 'Capabilities' means the role of strategic management in adapting, integrating and reconfiguring internal and external organisational skills, resources and competences in order to meet the changing environment's requirements. Hence DC mirror the ability of an organisation to achieve innovative forms of competitive advantage. This competitive advantage lies in a company's organisational processes shaped by the company's asset position and the paths that are available to the company (Teece, Pisano and Shuen, 1997). According to Eisenhardt and Martin (2000, p. 1105), "dynamic capabilities are a set of specific and identifiable processes such as product development, strategic decision-making, and alliancing. (…) they have significant commonalities across firms (popularly termed 'best practice')." They suggest that DC are more homogeneous and substitutable than is usually assumed. DC are a source of competitive advantage, but not of competitive sustainable advantage, in their view. They further state that the implication of these commonalities is that DC are equifinal. Thus, companies can develop these capabilities starting from various points, taking different paths. The potential for long-term competitive advantage lies in the early, more astute and more fortuitous use of DC than is demonstrated by competitors with the intention of creating a resource configuration that provides such an advantage. Thus, the resource configuration and not the DC themselves provide the long-term competitive advantage. Nevertheless, DC are a prerequisite of it (Eisenhardt and Martin, 2000). Another definition of DC is provided by Barreto (2010, p. 271): "A dynamic capability is the firm's potential to systematically solve problems, formed by its propensity to sense opportunities and threats, to make timely and market-oriented decisions, and to change its resource base". He also states that the DC approach is still young and the proliferation of definitions has produced a certain degree of confusion that can hinder more effective progress in this field. Thus, a consolidation of these concepts is required. According to Teece, Pisano and Shuen (1997), DC can generally be regarded as the drivers, creating, evolving and recombining resources into new sources of competitive advantage. Nevertheless, DC do not by themselves provide a long-term competitive advantage, but the resource (re-)configuration does.

Summarising the strategic management views, in the light of BMI, IBV and RBV may not be neglected as they can be used as a baseline for BMI in terms of strategic management. The IBV can assist in reducing uncertainty through binding norms, rules and regulations and through the definition of legal boundaries. It can also help in beating competitors in a non-market area and be a valuable distinguishing factor. Nevertheless, it acknowledges that outcomes are not invariably based on decision processes. The RBV can be a way to identify resources and their configuration for the creation of sustainable competitive advantage, which is a goal many companies strive for. However, the RBV is criticised for its lack of context. The IBV again helps in overcoming this lack of context and helps to integrate specific formal and informal elements to create further advantages. Nevertheless, as explained above, it also has its downsides. In particular DC may be regarded as an important factor in future competition and markets with uncertain future development. Companies which are active in an innovation-based market with strong price/performance rivalry and where internal and external competences have to be exploited to cope with market changes have to renew competences and adapt, integrate and reconfigure organisational skills to deal with the changing environment. DC is here regarded as a source of competitive advantage. It supports companies in solving problems, in sensing opportunities and potential threats, in making market-orientated decisions, and in changing the resource base. To do all this and to be able to achieve the required outcomes, new business models could be required. In light of the preceding discussion it can be seen that DC offer many potential advantages to companies. These advantages are not industry-specific and therefore DC is seen as important for MNOs.

The goal of this section is to provide an overview of innovation. Therefore, the theory of innovation is discussed as well as disruptive innovation. A focus is also laid on BMI, including business modelling, theory of BMI and its application at MNOs, as well as strategic management views. To have a general overview and understanding of innovation and related topics is important to further exploration of what it takes to position MNOs in a changing telecommunication market. Accordingly, this section focuses on the respective RQs, namely RQ2 and the first part of RQ3. Given the literature and information on innovation, a first overview and understanding are enabled. Nevertheless, to get a more precise and up-to-date picture of the role of innovation for MNOs, the most relevant innovation dimension for MNOs, and what a future MNO business model could look like, these topics have to be further examined.

2.3 Software Robotics

In this section the literature on software robotics is summarised. The first subsection (2.3.1) explains concepts of software robotics, such as RPA, ML, DL, and AI, in order to provide an overview of the technologies and their overall possibilities. The following subsection (2.3.2) concentrates on the application possibilities of software robotics at MNOs. Focusing on these topics the baseline for the provision of a framework that guides MNOs to innovate their business model and identifies relevant and irrelevant parameters of their current business models in order to reach organisational sustainability is further extended. This section is important in the research as the emergence and use of software robotics not only currently influence MNOs but are expected to be a decisive factor in MNOs' future because, if such technologies are used, reframing of the existing business model has also to be considered. Thus, an adequate understanding of the respective technologies and especially the possibilities of their application are required. In sum this section focuses on a part of the third objective of this research, namely the role of software robotics for MNOs, their future business model and a future telecommunication ecosystem.

Brynjolfsson and McAfee (2011) state that a technological revolution is ongoing that causes a rise in productivity and a decline in the need for human workforce at the same time. This is enabled by an increasing speed of automation. According to a study conducted by Gartner's analyst Tornbohm (2016), the requirement for employees in business shared-service centres will be reduced by 65% due to automation and AI. According to Frey and Osborne (2013), about 47% of US workers are at risk of losing their jobs due to automation over the two decades following their research. Acemogul and Restrepo (2017) cite sources stating that over the next two decades between 45% of US workers are at the risk of redundancy due to automation, while 57% of jobs in OECD-countries are at risk. The Bank of England also estimates that up to 15 million jobs in Britain are at risk due to robots within 20 years from 2015 (Elliott, 2015). Lowes et al. (2016) add that software robotics helps companies avoid the huge investment costs of technology transformation initiatives, in enabling business growth without the accompanying increase in operating costs, in deriving more value for operations that are already outsourced, and in creating product, process and business model innovation.

2.3.1 Software Robotic Concepts

This subsection explains software robotics, consisting of RPA and Intelligent Automation, which in turn is used as an umbrella term in this work for technologies like AI, ML, and DL, and related concepts. Advantages and disadvantages of software robotics are discussed. In this way, an overview of the technologies and their possibilities is provided.

2.3.1.1 Robotic Process Automation

RPA means the use of software to automate tasks formerly performed by humans, especially in the back office, on computers. The actions of a user are mimicked by the software. RPA is mainly used in the automation of routine tasks, but the technology is further developing to support the automation of more complex and sophisticated processes. Many business process outsourcing (BPO) providers and other organisations have already deployed RPA and created a virtual workforce. As the tasks formerly undertaken by employees are performed by software robots there is no need to hire new staff if more or new tasks have to be accomplished in a company as there is enough free capacity after the implementation of RPA (Barnett, 2015). On the other hand, the staff formerly covering the respective processes can handle non-routine tasks that the software cannot process, like intelligent decision-making (Willcocks, Lacity and Craig, 2015). Barnett (2015) states that if the transaction volume of the RPA-covered processes has to be increased, it is easy almost instantly and without training to implement additional software that covers the new transactions. The replacement of human operators with robotics and without redeployment of employees leads to staff reduction and cost savings that can partially be passed on to customers. According to Forrester (2017b), the cost savings enabled by the reduction of workforce lead to lower expenses of e.g. recruitment, training, office space and equipment. Furthermore, Barnett (2015) finds that while simple scripting tools are sufficient to automate simple processes, RPA supports the definition of a more enhanced logic. The decisions made by software robotics are often based on rules and depend on access to underlying data from different sources. The functionality to apply the logic to the gathered data enables the support of more complex processes. This ability again fosters the development of more sophisticated RPA platforms that are able to use AI or platforms for analytics further to support the decision-making process.

According to CFO (2017, pp. 6–7), automation through RPA "is most beneficial for processes with a high degree of repetitive and predictable tasks, such as order management, invoicing and invoice reconciliation, payment and cash management, fixed asset accounting, closing/closing policies, accounts payable exception processing, chart of account maintenance, and tax reporting". However, there are many ways companies use RPA, for example, as an integration tool due to its proximity to building an Application Programming Interface (API), as supplements for employees' activities, as a replacement of employees, as an intermediary solution to another IT development for three to five years, or as a strategic step towards a company's digital transformation. Another advantage of RPA is its integration that is typically non-disruptive to the IT infrastructure and that no or almost no IT integration is needed (CFO, 2017). Justice (2016) says that if a company considers the use of RPA, the reframing of the underlying strategy and business model has to be taken into account as RPA's main focus is not only cost cutting but also the creation or maintenance of an advantage. The goal should be among other things digitalised business processes while manual activities will be eliminated. According to Lacity and Willcocks (2015), many knowledge workers spend much time doing things like the extraction of data and moving massive amounts of data between two systems, because typical automated systems like Enterprise Resource Planning (ERP) and CRM are not able to cover processes end-to-end. To relieve them of such highly repetitive routine tasks and enable them to focus on more interesting work RPA can be deployed. Willcocks, Lacity and Craig (2015) state that especially industries that are highly competitive, like the telecommunication sector, are under pressure to contain their costs. At the same time, the balance between cost efficiency and service excellence, business enablement, flexibility, security, compliance as well as scalability has to be maintained. The possibility they identify to meet these goals is RPA, which can optimally be used for high-volume, rule-based, standardised and stable processes. The optimal characteristics identified above are confirmed by Forrester (2017a) and CFO (2017). The latter adds the characteristic of significant human intervention in the respective processes and also the possible benefits to legacy systems.

Lacity, Willcocks and Craig (2015a) provide evidence that some RPA adopters have automated 35% of their back-office transactions. As benefits from implementing RPA they include decreasing costs, higher process efficiency, better regulatory compliance, improved speed, reliability, error reduction and higher customer satisfaction. Forrester (2017b) adds that the latter can contribute to lower churn rates and better revenue opportunities, like better chances of cross- and upselling, as well as faster time-to-market. According to Willcocks, Lacity and Craig (2015), further benefits of RPA use are that robots can be instructed very quickly, that costs radically decline after their adoption, and that pressure is taken off departments, e.g. back offices. Additionally, the workload of the IT department is lowered and high-quality results are enabled in a short time. In table 2 the results of three analysed companies that introduced RPA are presented.

<table>
<tr><th></th><th># processes automated</th><th># RPA transactions per month</th><th>Business Value</th><th>ROI</th></tr>
<tr><td>Telefonica O2</td><td>35% of back office (15 core processes)</td><td>400,000 to 500,000</td><td rowspan="3">Faster delivery
Better service quality
Higher compliance
Unbeatable scalability
Strategic enablement
FTE avoidance
FTE redeployment
FTE savings</td><td>650% to 800% 3-YR</td></tr>
<tr><td>Utility</td><td>35% of back office</td><td>1 million</td><td>200% 1-YR</td></tr>
<tr><td>Xchanging</td><td>14 core processes</td><td>120,000</td><td>30% per process</td></tr>
</table>

Table 2: RPA Value delivered in specific Client Case Studies (Willcocks, Lacity and Craig, 2015)

Objects built with RPA can be reused, meaning that an object can not only be used in one but theoretically countless processes (Willcocks, Lacity and Craig, 2015). In further research Lacity and Willcocks (2016) state that the positive outcomes of RPA are mainly savings in Full Time Equivalents (FTE), accomplishment of more work with fewer resources, increased service quality and service delivery speed, as well as better satisfied employees, who may concentrate on more interesting and judgemental tasks with partially more social interaction, and a flexible and multi-skilled virtual workforce. They add that RPA meets IT requirements concerning security, scalability, auditability and change management and provides its workforce 24/7. The software can be deployed on the enterprise's IT infrastructure to ensure integrity, compliance and service continuity.

When the barriers to RPA adoption further fall, there will be more teams in which staff and software robots work together to reach their goals, each performing tasks to which they are ideally suited (Lacity and Willcocks, 2015). For example, software robots could extract, consolidate and prepare data, while staff base their judgements on the input thereby provided (Lacity, Willcocks and Craig, 2015b). Willcocks, Lacity and Craig (2015) further state that over time the focus will shift from the automation of structured data over unstructured patterned to unstructured patternless data. Until this state is reached RPA will probably be able to handle dynamic processes and decision-making tasks.

CFO (2017), like most other sources, identifies the streamlining of processes, improvements in accuracy as well as increases in employees' productivity as hard-dollar benefits enabled by RPA. Additionally, it is stated that customer satisfaction can be improved by RPA as more transactions are handled without error or human intervention. Moreover, information on performance data, e.g. average handling times per transaction, total number of exceptions and completed transactions are provided, helping to identify areas that can be improved. The payback on investment in RPA is typically less than one year, meaning that after this time the company already starts to gain money from its investment. This is also caused by the cost of a software robot that can be as little as one third of the price paid for an offshore and as little as one fifth of the price of an onshore employee. RPA is not only used to reduce headcount and save costs but also to deploy employees to more significant tasks, increase process speed and ensure compliance. Scheer (2017) identifies further advantages of RPA, like the possibility for specialist divisions to define, steer and execute RPA projects on their own with help of consultants and IT experts and without programming effort. This is enabled by the architecture of most RPA tools consisting of a graphical user interface that is used to automate processes mainly by using a drag-and-drop functionality as well as making some clicks and keyboard entries, which do not need additional programming experience. A further advantage is the gapless documentation of all actions taken by a robot and the consistent quality of its work. Despite the cost savings, a survey conducted by Forrester (2017a) found that the generation of new revenue, like debt collection or reduction of cycle times for order-to-cash processes, and improvements in customer experience, like reduction of average hold time annoying customers, are fostered by RPA. Forrester identified one disadvantage of RPA, the delay in much needed modernisation of IT systems as RPA conducts existing processes with less labour instead of improving the existing systems. Companies not engaging in digital processes face competitive disadvantages avoided by companies fostering digitalisation. Respondents to Forrester's survey stated that RPA will help improving back-end operations and increasing productivity. Overall, improvements in customer experience, operation excellence and front-end as well as back-end activities are expected. According to Forrester's (2017a, p. 4) research, in 2018 “RPA-based digital workers (i.e. robots) will replace or augment 311,000 office and administrative positions and 260,000 sales and related positions.” Moreover, it is expected that RPA will include more and more AI the next few years, enabling RPA to fulfil more intelligent tasks.

According to further Forrester research (Le Clair, 2018), it will become harder to find processes suitable to RPA as the most promising processes will probably become automated at the beginning of RPA adoption. Accordingly, RPA must become smarter. The solution to this is the inclusion of AI components in software robots based on RPA. For example, text mining can be used to extract text structures from unstructured text passages in data sources like email to make them actionable by RPA. Process mining can also be combined with RPA to create heat maps that support bot behaviour.

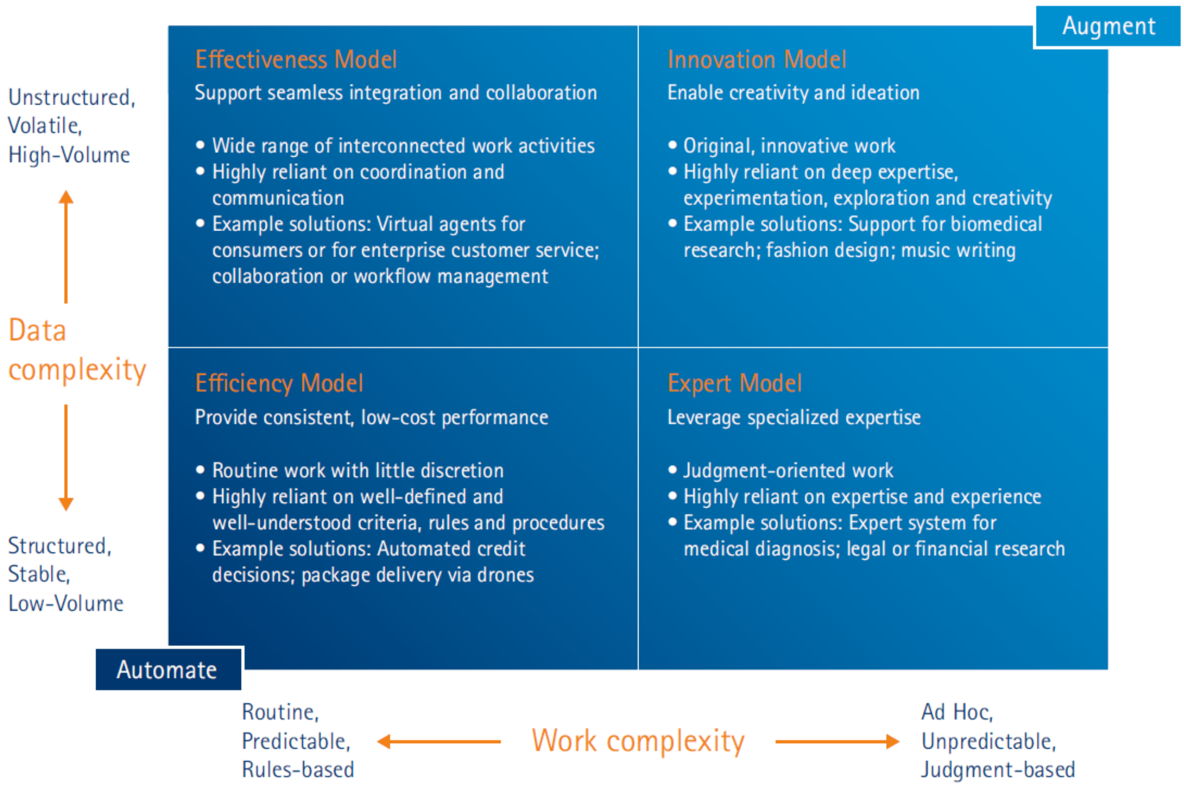
Summarising this subsection, RPA is the use of software to automate tasks that were formerly performed by humans. It is mainly used for the automation of processes that are highly repetitive, predictable, rule-based, standardised and stable. Advantages of RPA include a possible reduction in cost, intermediary solutions to other IT developments, non-disruptive integration, elimination of manual activities, higher process efficiency, improved transaction speed, higher process reliability with fewer or even no errors, higher security, consistent work quality as well as the provision of a 24/7 robotic workforce. A disadvantage is a delay in much needed modernisation of IT systems.

2.3.1.2 Intelligent Automation

According to Bataller and Harris (2016, p. 6), AI consists of several technologies enabling information systems to sense, comprehend and act. To achieve this, “computers are enabled (1) to perceive the world and collect data; (2) to analyse and understand the information collected; and (3) to make informed decisions and provide guidance based on this analysis in an independent way.” Moreover, AI is able to learn from experience and change its decision process and behaviour in light of experience. This feature, which is distinctive of all types of true AI, is called ML and does not need hard-coded rules. PwC (2017, p. 7) defines AI as “the ability of a computer or a computer-enabled robotic system to process information and produce outcomes in a manner similar to the thought process of humans in learning, decision making and solving problems. By extension, the goal of AI systems is to develop systems capable of tackling complex problems in ways similar to human logic and reasoning.” In short, AI systems learn from experience, use this learning to reason, recognise images, solve complex problems, understand language and its nuances, and create perspectives.

Figure 18, developed by Bataller and Harris (2016), helps in identifying the type of AI needed for certain tasks. While tasks that are positioned close to the upper-right part of the matrix are likely to use AI to augment human capabilities, those positioned closer to the bottom left part of the matrix are more likely candidates for work automation.

Figure 18: Types of Artificial Intelligence (Bataller and Harris, 2016)



Through the use of methods of AI a robot can understand natural language and recognise and interpret structured and unstructured data. Robots can also possess cognitive learning capabilities. With these characteristics and features robots can be deployed to automate even more complex business processes than RPA. In these cases the reduction of costs is no longer the main focus, but rather the creation of further benefits by taking over additional tasks. An example for this is chatbots holding dialogue with customers to arrange meetings or identify customer preferences (Scheer, 2017). These AI-based chatbots are assisted at first by humans and learn from their intervention. When they have been trained chatbots are able to run autonomously. Sophisticated chatbots can listen to speech, understand natural language and respond to queries using a human-like simulated voice, e.g. in the customer support service. An example of such a chatbot is Amazon's Alexa, which is a software robot that understands certain concepts and is programmed for conversation to find out its user's intent. Google, for example, developed Parsey McParseface, a robot to parse sentences, which is able to identify parts of sentences, like verbs, objects and subjects as well as other building blocks with an accuracy of up to 94% (Azoff, 2017). As shown above, robots can perform tasks formerly reserved to humans using AI. Examples of the use of AI to generate higher acceptance of AI are the successes of Deep Blue in playing chess, IBM Watson at playing Jeopardy, as well as AlhpaGo in playing Go (Scheer, 2017).

ML, meaning learning from experience, is considered a part of AI. Shown many input-output-cases, the system learns the connections between the inputs and outputs and is thus able to generate the correct output if a new, unknown input is provided. Thus, the system learns to forecast on available data, using methods like statistical regression analysis or artificial neuronal networks, based on the human brain. During the training phase of the ML software, which can be supervised or unsupervised, in the former case it is assessed by humans if the output data from the software fits the input data (Scheer, 2017). In the unsupervised case structured data are observed and the software robot tries to identify patterns and provide information on these (Berruti et al., 2017). If a net of multiple layers is built increasingly to improve the results, the procedure is called DL. It is intended to connect learning based on causal understanding and experience in the field of AI (Scheer, 2017). DL has also helped in recent years to improve the capabilities of AI (Azoff, 2017). It is intended for more complex tasks and mimics the human brain structure through neural networks. Its systems are e.g. able to recognise patterns and objects or to describe images in natural language (Bataller and Harris, 2016). Deloitte's estimation was that already by 2017 more than 300 million smartphones, which equals more than one fifth of sold units in this year, had on-board neural network ML capabilities (Deloitte, 2017a). A ML or DL platform that is combined with natural language generation could, for example, help in processing structured performance data to enable leaders to improve their decisions (Berruti et al., 2017). Already in 1991 it was expected that "an automatic telephone interpretation system will transform a spoken dialogue from the speaker's language to the listener's automatically and simultaneously. Creation of such a system will require developing various constituent technologies: speech recognition, machine translation and speech synthesis" (Jennings et al., 1991, p. 555).

AI that is included in RPA, also known as Intelligent RPA software, is already in use at some large banks to support in portfolio management and compliance processes. In addition, natural dialogue between robots and humans can be conducted at customer service to identify the problems customers face, support them, or forward them to the human agent responsible. Concerning statistical analyses, correlations between revenue, category, sales area, sales agent, price and amount can be calculated and shown independently of human intervention to depict relations and inconsistencies (Scheer, 2017).

Brynjolfsson and McAfee (2014) discuss the transformative effects of ML and AI, and characterise the two sides of their impact as bounty and spread. Bounty means the benefits that technology provides to people, whereas spread is defined as inequality caused by the new technology. Ford (2016) adds that information technology like AI will increase income inequality and causes declining wages as well as minimal purchasing power. Bruckner, Zeilinger and Dietrich (2012) add that the number of processes that require analysis and insight, allowing control beyond the strict application of rules, is increasing. Automatic and flexible decision-making based on challenging conditions, like lacking prior knowledge of data, incomplete, missing or contradicting data, or increasing amounts of information, becomes the main challenge for future automation. The approach to deal with this challenge is to learn from human capabilities as humans are able to handle all problems that occur more or less well but usually better than software robotics. To reach this state is of vital interest to many companies as it supports them in competition and development.

Levesque and Lakemeyer (2008, p. 869) define Intelligent Automation or cognitive intelligence as “the study of the knowledge representation and reasoning problems faced by an autonomous robot (…) in a dynamic and incompletely known world.” They state that it is very unlikely that software robotics knows everything that it might, but while it starts with an incomplete knowledge, this knowledge will increase, the more information the software acquires. One fundamental question regarding Intelligent Automation is the relationship between numerically measuring uncertainty and logically representing incomplete knowledge. Samulowitz, Reddy and Sabharwal (2014, p. 3) define a cognitive algorithmic framework in another way by stating that it has the following properties:

1. “it integrates knowledge from (a) various structured or unstructured sources, (b) past experience, and (c) current state, in order to reason with this knowledge as well as to adapt over time;
2. it interacts with the user (e.g., by natural language or visualisation) and reasons based on such interaction; and
3. it can generate novel hypotheses and capabilities, and test their effectiveness.”

Intelligent Automation, unlike RPA, is suited to more complex tasks, like the finding of patterns in a huge amount and variety of data. An example of such a software is IBM Watson, which is e.g. programmed for cancer diagnosis, in which an extremely complex task has to be fulfilled. Watson has an interface capable of processing natural language and the top answers it gives are ranked according to confidence intervals. In addition, Watson can show how the answers were found. Adoption of Intelligent Automation is more expensive than RPA as it is able to cover highly complex tasks that are more difficult to programme. Implementation could sometimes cost several million dollars. It is expected that in the near future adoption will be more focussed on RPA than on Intelligent Automation as the underlying costs are known and the business value can be seen in a short time and is well understood (Lacity and Willcocks, 2016).

As a benchmark for this kind of sophisticated automation the Turing test can be applied, at least for processes in which software robots interact with humans. If a person cannot tell if he/she has an interaction with another person or a machine, it is assumed that the machine or software has a certain degree of intelligence. This is especially interesting as it is for all the world to see that software robotics' role in human interaction is increasing and for certain interactions intelligence is required. Therefore, researchers develop theories of cognition to enable software robotics intelligently to interact with people. In short, Intelligent Automation "describes this human-like level of intelligence by the ability of robots to solve the same problems that humans can solve by thinking" (Aly, Griffiths and Stramandinoli, 2017, p. 154).

Most researchers concentrate on the advantages of this technology but there are also disadvantages that have to be considered when software robotics are used, like the loss of knowledge if knowledge workers are replaced by software and no documentation of their knowledge and experience exists. Thus, research has further to explore this field.

There are several advantages of AI software, like continuous learning, 24/7 availability, faster and deeper understanding to be further explored by humans, learning that is forwarded from one to all AI systems in the network as well as work hierarchies to enable the steering of several or many less intelligent robots by more intelligent AI software. In general, the opportunities provided by AI include greater automation, faster processing, improved decision-making and forecasting, higher efficiency, elimination of human error, higher human performance through AI assistance, lower costs through replacement of humans, high and fast scalability, as well as the generation of new jobs in the development, training, maintenance, improvement and supervision of AI software (Azoff, 2017). Moreover, more customer self-service (Infosys, 2017), as well as new services and business models are enabled by AI, besides the overall enhancement of operational effectiveness (Omdia, 2020b). Among the top use cases of AI are predictive analytics (49%), IT automation (35%) and customer service (29%) (Omdia, 2020b).

But there are also challenges that may not be neglected, like resistance of employees and a cultural change, threat of labour-intensive jobs as well as management and professional jobs, lack of empathy of AI, threat of companies not moving as fast as competitors with AI, race for talent, as well as the rapid evolution of the technology (Azoff, 2017). Moreover, missing skills in the workforce to meet these demands, data issues, costs of AI solutions, implementation challenges, and measuring value for the business are further hurdles (Omdia, 2020b). Bataller and Harris (2016) also list the unease of many people about human-like capabilities, integration with other technologies as well as the new development paradigm – training, coaching and supervising instead of developing the software - as challenges associated with AI. According to KPMG International (2016), Manning states that the adoption of AI leads to a higher demand for labour. Autor states that there will be less need for basic transaction activities, as automation increases. In his opinion the number of staff increases as the costs of running a company are reduced through automation as more branches can be opened. Bessen advances the argument that the deployment of AI has a demand-boosting effect. Omdia (2020b) states that AI is the technology in which the highest management of companies is most interested, with 36% perceiving it as critical and 54% as very important to their digital strategies. Hence it is expected that the adoption rate of AI will further increase over the next few years, given the backing of higher management and that AI will in future play an increasingly important role in companies.

Summarising this subsection, AI consists of several technologies that enable information systems to sense, comprehend and act. It is the ability of an information system to process information and produce outcomes in a manner similar to the thought processes of humans in learning, decision-making and problem solving. When AI systems learn from experience and change decision processes and behaviour in light of their experience, this is considered to be ML. If a net of multiple layers is built increasingly to improve results, the procedure is called DL. Advantages of Intelligent Automation include its understanding of natural language, recognition and interpretation of structured and unstructured data, automation of complex business processes, imitation of the human brain structure, continuous learning, 24/7 availability, deepening of understanding, learning that is shared by AI systems, improved decision-making, and elimination of error. High costs as compared with RPA, loss of knowledge due to the replacement of knowledge workers, threat to labour-intensive as well as management and professional jobs, unease of integration with other technologies, resistance of employees, and cultural changes can be regarded as disadvantages.

Summarising subsection 2.3.1, the use of software robotics not only leads to a situation in which business processes are handled in an automatised way but also to the collection of numerous data in a standardised format. The goal of companies applying software robotics should not only be to automatise processes and cut costs, but also profitably to use the generated data (IRPA, 2016). ML and DL especially are powerful tools used for the management of large amounts of data e.g. to make predictions and provide suggestions based on data sets. While ML is mainly used for predictive analytics, further developed AI goes beyond pure prediction and makes suggestions to realise benefits (Kibria et al., 2017).

In this subsection, definitions of RPA, AI, ML and DL are given, as well as a general overview of the technologies and the respective capabilities. Advantages and disadvantages of the technologies are identified. This is important in this research because the influences that software robotics can have on companies are illustrated, showing how crucial they are to their future. At the same time, a further baseline for answering RQ1, RQ3 and RQ4 is laid. The baseline for the specific use of software robotics at MNOs is also provided.

2.3.2 Software Robotics at MNOs

In this subsection application possibilities of software robotics at MNOs are picked out as a central theme, along with benefits to MNOs through software robotics. In this way, an overview of the technology's effect on MNOs is provided.

McKinsey (2017) states that AI has rewritten telecommunication companies' winning formula as MNOs can achieve tremendous cost savings and a breakthrough capital intensity, while at the same time increasing their scale, through newest software, hardware and management practices are tailored to the digital age. According to KPMG (2018a), AI is seen as a strategic imperative at telecommunication CEOs. 52% of the respondents to their study stated that they had already launched AI implementations, while 23% had started AI pilots. A further 24% had already used AI to automate processes. The main purposes of the implementation of AI at telecommunication companies are revenue growth, improved customer experience, a higher agility for the organisation, improved data analyses, higher governance, better risk management, and increased productivity. A study conducted by Infosys (2017) of telecommunication companies found that 31% of study participants expected a competitive advantage to be secured by the adoption of AI. They were therefore investing in Big Data automation, predictive analytics and expert systems to drive AI, as telecommunication companies had huge amounts of data that could be mined for insight. At the same time, this amount of data was increasing through new data generated by customers and by OTT services that used their networks. Moreover, 59% were investing in ML, while 43% invested in neural networks. In addition, 30% had already invested in interactive voice response technology. The reasons for the deployment of AI solutions are mainly competitive advantage (31%), particular business, operational or technical problems (20%), and executive-led decision (19%). The expected benefits from the use of AI to telecommunication companies are cost savings, automated processes and tasks, more informed business decision-making, increases in productivity, revenue and innovation, expansion of employee knowledge and skill, faster resolution of business problems, faster delivery of new products and services, ability to identify new revenue streams, ability to design and test new ideas with customers, and the attraction of new talent. Figure 19 presents the data sources available to MNOs for Intelligent Automation.

Figure 19: Data Sets and Sources available to MNO for AI (Kibria et al., 2017)

	Internal Data	External Data
Structured Data	Network-related: Technical-fault, link availability, network latency, backhaul status, connection set-up time, drive-test, data-plane traffic flow statistics, control-plan protocol and interface, traffic (by type, by application), data, deployment, sensor data Subscriber-related: Handset data, customer account data, usage history, calling-pattern locations, mobility patterns, etc.	Demographic data, mapping data (terrain, in-building, etc.), public data (traffic, weather)
Unstructured Data	Call centre transcripts, text-messages, personal assistant data, etc.	Social media data – Facebook, Twitter, online forums, text documents, Google+, blogs, e-mails, video, etc.

According to Azoff (2017), the wider application of AI to various branches, e.g. telecommunications, was expected as well as its combination with analytics for Big Data. As examples Azoff lists the management of telecommunication networks by AI:

- Orchestration: AI could assist in accurately predicting network usage and trends, leading to improvements in network health and user experience.
- Software-defined network controller: AI could help in controlling the traffic in telecommunication networks, enabling and allowing efficient routing of traffic to minimised network outages and faults.
- Analytics: AI could help to understand user behaviour and thus the marketing department could base their pricing on the AI's analyses as well as develop service plans to ensure customer satisfaction (Azoff, 2017).
- Network optimisation: AI could be used to optimise the configuration of telecommunication networks, based e.g. on traffic and user behaviour, which is especially relevant to self-optimising networks, which are a vital pillar to 5G networks (Azoff, 2017; Comarch, 2019).
- Network deployment: AI could be used further to improve network deployment by predicting traffic patterns and forecasting user trends. (Azoff, 2017)

Guibao, Yubo and Jialiang (2017) state that through the use of AI MNOs would be able to include on-demand services in their networks for special users and also energy-saving goals could be attained. Furthermore, with AI a stronger security protection could be enabled and network attacks could be detected earlier because of behavioural analysis that is based on ML. A further huge advantage would be the support of AI in designing, operating, maintaining, and managing the telecommunication network and services. Kibria et al. (2017) state that AI is able to assist in uncovering unknown properties of wireless networks, in identifying correlations and anomalies invisible to inspection, and in suggesting novel ways to optimise network deployment and operation. This can be achieved through Big Data analytics that can be used in performing predictive and proactive network maintenance. McKinsey & Company (2017) find that MNOs are able to adjust their networks automatically according to the demand change over a day or a certain period, meaning that the cells' capacity can be adjusted according to traffic patterns, time or weather conditions. With new real time data even the increase or decrease in network usage can be predicted and hence the capacity needed can be matched accordingly and preventively. According to KPMG (2018b), data analyses in combination with AI provide important information to improve the performance of mobile networks, which supports MNOs in creating a positive user experience. Strategy& (2015) states that MNOs are able to optimise their networks through data analytics by developing a better understanding of the relationship between customer behaviour and network use. According to Telefónica (2018), data analytics and AI can be used to find out at which sites regular shortages occur, e.g. due to heavy use. Furthermore, MNOs can simulate the real use of mobile radio at certain sites by aggregating customer data. With this and further understanding MNOs are able to invest goal-orientated in their network. Bain & Company (2019) confirm the need for MNOs to invest in software robotics. They have a huge amount of data, which is often fragmented and not used to its full extent. Through effective use of this data, greater understanding of customers and their behaviour are enabled, and even a 360-degree view of them can be created. Moreover, software robotics support in the provision of personalised products. KPMG (2018b) adds that in the customer services area intelligent chatbots are already introduced at several MNOs to support call centre agents and answer standard questions. While these chatbots communicate mainly by text-based means nowadays, they are likely to be replaced by those that are capable of using natural language due to included AI.

Almato (2016) stated that at Deutsche Telekom software robots based on RPA already handled several business processes, like contract change or termination. According to Lacity, Willcocks and Craig (2015a), Telefónica UK had by 2015 automated more than 35% of its transactions using RPA. Already by April 2015, Telefónica UK had deployed more than 160 robots, which monthly processed between 400,000 and 500,000 transactions in 15 core processes. It was forecasted to enable a ROI between 650% and 800% within the first three years of application, while the payback period was only 12 months. This was enabled inter alia by reducing handling times of several processes from days to minutes. Also, chase-up calls to customers were reduced by more than 80%. Moreover, scalability is increased, as the robots in use can be doubled almost instantly if needed. Overall, hundreds of FTEs were either saved or redeployed by RPA. Telefónica UK used RPA e.g. to insource services they formerly outsourced. In this way, a higher level of control as well as high cost savings were enabled.

Generally, the use cases of RPA for MNOs are not as special and exclusive as those of AI, ML or DL. This is mainly because Intelligent Automation is used for more industry-specific and company-individual tasks, while RPA can be used for general tasks that are relevant to many industries and companies. Therefore, the general application possibilities of RPA are regarded as fitting for MNOs (compare subsection 2.3.1).

Summarising this subsection, it is clear that many MNOs already use RPA, AI, ML and further automation technologies. These provide advantages and support MNOs e.g. by generating cost savings, automating processes and tasks, making more informed decision, increasing productivity, and faster resolving of business problems. Application possibilities of software robotics at MNOs are e.g. AI-managed network orchestration, software-defined networks, network optimisation, energy savings, stronger security protection, network attack detection, network adjustments and increase in performance of mobile networks. Generally, the advantages of using software robotics at MNOs are established. Thus, the second part of RQ1, the role that software robotics play in MNOs, is addressed and an indication of its answer based on the literature is given.

The goal of this section is to provide an overview of software robotics. Accordingly, the concepts of software robotics, meaning RPA, ML, DL, and AI, are illustrated, including the possibilities they generally offer. Software robotics' application possibilities at MNOs are depicted. To have a general overview and deeper understanding of software robotics, their application possibilities, as well as advantages and disadvantages are important to exploration of what it takes to position MNOs in a changing telecommunication market. The literature provides an overview and understanding of software robotics. The current use of software robotics at MNOs is described in detail. Nevertheless, the full picture of software robotics' current role at MNOs, as well as software robotics' possible role in future MNO business models and a future telecommunication ecosystem could not be provided and are therefore identified as research gaps that need to be bridged. These research gaps form the baseline for the second parts of RQs 1 and 4.

Due to the possibility closely to connect software robotics with Big Data and BI, and due to the respective advantages of this combination, the next section focuses on Big Data, BI and the link between these concepts.

2.4 Data Insights

In this section the knowledge in the literature in terms of data insights, which is used as an umbrella term for Big Data and BI, is summarised. Subsection 2.4.1 explains the concept of Big Data and its application possibilities at MNOs, to give an overview of the technology and the opportunities it provides for MNOs. The second subsection (2.4.2) concentrates on the concept of BI and BI's application possibilities at MNOs. An overview of the technology and its implications for MNOs are offered. In the third subsection (2.4.3) the link between Big Data, BI and software robotics is further strengthened. Due to the focus on Big Data, BI, and their linkage to software robotics, the baseline for the provision of a framework that guides MNOs to innovate their business model and identifies relevant and irrelevant parameters of their current business models in order to reach organisational sustainability is further extended. This section is important to the research as Big Data and BI not only influence MNOs currently but are expected to be an important factor in MNOs' future, as these technologies are expected to be a crucial part of future business models. Moreover, in order to deal with the masses of structured and unstructured data generated by legacy systems, call centres, software robotics, and many other sources, and to get the greatest possible benefit from these data, it is important to get a deep understanding of these technologies and their possible applications. Concluding, this section focuses on a part of the third objective of this research, namely the role of BI and Big Data for MNOs and in their future business model.

2.4.1 Big Data

This subsection explains what Big Data is and its concepts by defining the term, and providing an overview of its advantages and challenges, as well as the possibilities it provides. The use of Big Data at MNOs is illustrated.

According to Miller (1994), humans face severe limitations concerning the amount of information they are able to receive, process and remember. The human mind is believed to be able to keep about seven items of information in the short-term memory. As we are able to keep only this small amount of information, there is the need to deal with huge amounts of information, like Big Data, in other ways.

The amount of data is growing and the type of data can be differentiated in video, image, audio, as well as text and numbers. The growth in data was fostered by several trends and will persist. The trends consist of the growth of traditional transaction based data, the expansion of multimedia content, the steadily growing popularity of social media as well as the proliferation of sensors and IoT (GSMA, 2020; Manyika et al., 2011). Also MNOs face the challenge of processing an enormous amount of data to generate the knowledge they need to get a competitive advantage (Insani and Soemitro, 2016).

2.4.1.1 Concept of Big Data

Magoulas and Lorica (2009) define Big Data as a status when the requirements of size and performance for data management become design and decision factors concerning the implementation of a data management and analysis landscape. According to a study conducted by the McKinsey Global Institute (Manyika et al., 2011), the term Big Data “refers to datasets whose size is beyond the ability of typical database software tools to capture, store, manage, and analyse. This definition is intentionally subjective and incorporates a moving definition of how big a dataset needs to be in order to be considered big data (…) (They) assume that, as technology advances over time, the size of datasets that qualify as big data will also increase” (Manyika et al., 2011, p. 1). This definition includes variations of dataset sizes in different sectors as the common sizes of typical datasets vary strongly in different sectors. Snijders, Matzat and Reips (2012) also describe the term Big Data as loosely defined and identify it as sets of data that are too large and complex to work with using a standard statistic-software. According to strategy& (2013, p. 10), “The eventual goal of big data is to combine and correlate every information source to generate a holistic, transparent, end-to-end view of all the interactions every individual customer or household has with the operator.”

Big Data is one of the core topics of Magoula’s and Lorica’s (2009) research as the amount of data is steadily increasing, e.g. through digitalised business processes or the use of smart devices. The use of this data leads to more knowledge in the topic of research, like a company’s activities and behaviour. For example, Google is able to detect the outbreak of flu in a certain region up to ten days faster than the Centre for Disease Control and Prevention solely by monitoring the increase in searches for terms related to that flu. Fast collection of data and their conversion to information grants competitive advantage to companies.

According to Deloitte (2015), Big Data brings value to decision-making and enables more accurate insights that may foster competitive advantage and better cost structure.

Global data volumes originating in smartphones, sensors, websites (Bughin, Chui and Manyika, 2014), company internal sources, like CRM and ERP systems, log files, documents, as well as images and videos (Deloitte, 2015), and other sources are doubling faster than every two years. These vast amounts of data are used by companies through their analytical tools to customise products and services by creating smaller consumer clusters, so-called consumer microsegments. If companies try to keep up with the development speed of their home market, a definition and development of a Big Data plan is crucial and should be one of their top priorities (Bughin, Chui and Manyika, 2014).

According to the McKinsey Global Institute (Manyika et al., 2011), Big Data can be used in various ways, e.g. in the improvement of a company's performance management through the possibility to access data in timely manner, for research and experimentation through the use of advanced analytics of huge data sets, for micro-segmentation by using behavioural data, for the automation of knowledge work and for the creation of new business models that use data from a company's core operation and monetise them. In a survey conducted by Barth and Bean (2012) it was found that the companies surveyed have high hopes for the outcome of advanced analytics, but at the same time they do not have the capabilities necessary to exploit their own Big Data. While 85% of the organisations questioned have Big Data initiatives in progress or at least planned, only 15% regard their access to data as adequate or more than adequate, while 17% assume their ability to use data and analytics in terms of transforming their business at world class level. A further study proved that companies that base their decision-making on Big Data have a 5-6% higher output and productivity than their peer group (Brynjolfsson, Hitt and Heekyung, 2011). This is supported by Magoulas and Lorica (2009) who state that those companies that handle Big Data best gain a competitive advantage and are able to improve their product and service offers. Manyika et al. (2011) extend the above, stating that not only are productivity and competitiveness of companies enhanced through Big Data, but also a substantial economic surplus is created for customers and a significant value for the world economy is built. Because of the broad applicability of Big Data, the world will probably face a wave of innovation, productivity, growth and also new methods for competition and value capturing. The research conducted cited seven findings:

1. Data have swept into every industry and business function and are now an important factor of production, while the biggest potential for value creation is in the developed economies.
2. Big Data create value not in one way only but through the creation of transparency, the enablement of experimentation to discover needs, expose variability and improve performance, the segmentation of populations to customise actions, the support of the decision-making process with algorithms and the innovation of new business models, products and services.
3. For individual companies the use of Big Data will become the basis of competition and growth (Manyika et al., 2011).

   A trend already visible is that the value generated by Big Data is accruing to the leading users and first movers at the expense of those who reacted too slowly (Brynjolfsson, Hitt and Heekyung, 2011). Taking a company's future as well as the current trends into account, leaders and those who want to be leaders have to use and foster their company's Big Data competences. This will take time but lead to a significant competitive advantage for the present and future. Big Data also help identifying new growth perspectives and creating new categories of companies.

4. The use of Big Data will support new waves of growth in productivity and consumer surplus, having the potential for an improvement in efficiency and effectiveness.
5. Some sectors will have bigger gains based on Big Data than the rest.
6. There will be a shortage of talent leading to constraints in the realisation of value from Big Data. This shortage will mainly be in people with a deep understanding of statistics and ML.

7. Several issues will have to be covered to enable the full potential of Big Data. These include data policies, technology and techniques, organisational change and talent, access to data, as well as industry structure (Manyika et al., 2011).

Although Big Data is a manifold topic that grows fast and is not easy to capture, it can be applied in most fields of work. A huge potential can be identified in real-time monitoring and transparency, experimentation to inform business decisions, micro-segmentation and customisation, closed-loop decision-making, automation of knowledge work, and business modelling based on data (Chui et al., 2013). This potential is not solely be found in large companies but also in government agencies and start-ups as the size of a company does not directly correlate to the size of the challenges presented by Big Data. In addition, the role of data becomes more important to a company's strategy. Big Data focuses not only on the analysis of data and achieving the required knowledge but also on the acquisition of data, through sensors, systems, internet and other sources, as well as data management in its centre to enable easy access and fast creation of reports and analyses (Magoulas and Lorica, 2009). Manyika et al. (2011) state that data have become an important factor in production besides physical assets and human capital. The ongoing intensity with which companies are generating and collecting information will be one of the main reasons for further growth in data volume. This is the reason why Big Data have a non-negligible potential to generate value for companies and their customers.

The collected data also present some challenges. Big Data, which can originate in various sources such as social media networks, connected devices, call data records or billing information, are usually unstructured and account for about 80% of total stored data. Hence the data need to be structured in order to make them usable and enriched with additional information to make them more valuable in knowledge generation and in analyses that can be performed with BI (compare subsection 2.4.2). As the speed with which data are generated is very high and to secure value from current data, the data processing time needs to be as short as possible to enable up-to-date information and findings. Also data complexity can present a great challenge due to the lack of a standard format for data storage (Deloitte, 2015). According to Amaze (2015), it has to be considered that the pure collection of data is of no great value to a company. Only the conversion and interpretation of the data enable companies to use the findings to their benefit.

Summarising this subsection, Big Data are sets of data that are too large and complex to work with using standard database software and tools. It can lead to more useful knowledge and improve a company's performance management, as well as enable micro-segmentation and customisation, real-time monitoring, transparency, automation of knowledge work, and business modelling. One challenge of Big Data is that the required data are usually unstructured and need to be structured. Moreover, the available data needs to be enriched with additional information to make them more valuable. A further requirement is the deletion of personal data, which has to be in accordance with laws, while these data are assumed to have the biggest value to a company. These challenges require a huge resource input.

2.4.1.2 Use of Big Data at MNOs

According to Wireless Week (2018), data can be regarded as the new currency for MNOs as the CAGR of the data-driven telecommunication analytics market is expected to grow by nearly 49% between 2015 and 2020, accounting for $ 7.6 billion yearly. Through their business MNOs have access to huge amounts of data, like "customer profiles, device data, network data, customer usage patterns, location data, apps downloaded, clickstream data" (Cloudera, 2015, p. 1). MNOs are convinced that Big Data will help them to meet their business objectives, speed growth and improve efficiency and profitability. They identified customer retention, segmentation and targeting, network optimisation and planning, as well as upselling and internal promotions as the most benefiting applications of Big Data. Among possible use cases of Big Data for MNOs are customer experience management (e.g. predictive churn analytics and customer journey analytics), network optimisation (e.g. network investment planning and real-time network analytics), operational analytics (e.g. revenue leakage and cyber security), and data monetisation (e.g. IoT and M2M analytics) (Cloudera, 2015). Deloitte (2015) lists further Big Data use cases for MNOs, like call drop analysis, which includes continuous monitoring of networks for disruption to resolve disruption in the beginning, network analytics to enable a faster reaction to potential risks and failures, and churn prediction, which will prevent the loss of customers to competitors by using predictive models to identify customers that are likely to change as well as their reasons and provide a countermeasure to keep them. Also, customer segmentation, e.g. value segmentation, identification of high-value and long-term customers, as well as identification of potential customers are possible use cases. Deloitte (2015) adds that Big Data help MNOs to prepare their networks for future demands by taking advantage of existing information in order to make their networks more robust, optimise them and make them scalable. Routing and service quality can be increased by analysing network traffic. Through Big Data understanding the customer in detail is made easier. Additionally, it facilitates the definition of the right KPIs and thus enables MNOs to understand customer experience. Information gained can be used in customer call centres to provide more elaborate answer to customer requests and problems, allay concerns faster, or detect fraud. Marketing campaigns can also be tailored more accurately to individual customer groups, and issues of bigger user groups can be discovered and handled more easily. As results, improved customer service as well as customer satisfaction can be expected, alongside a decrease in churn. In the case of network infrastructure management, Big Data can be used for real-time deep packet inspection for traffic routing optimisation as well as for cellular network performance measurement. IBM (2012) and IBM (2013) add to this list the possibility for the marketing department to provide location-based services, meaning the enablement to provide relevant and timely promotional offers and services to customers, based on their location, and get social media insights, e.g. to get a fast feedback on marketing campaigns, products and services in order to increase advertising effectiveness, brand reputation, product sales or post-sale satisfaction. Another advantage of Big Data is the possibility to anticipate the needs of customers during customer service interaction, known as ‘next best action’. This enables sales agents to improve the quality of their service, solve the customer’s problems faster and even increases the probability of sale of a new service or product to the customer. Thus, it supports increasing revenue and profit as well as customer satisfaction, while churn is reduced. According to GSMA Intelligence and CAICT (2016), with the emergence of IoT, and the exponential growth of machine data that are transferred using MNOs' infrastructure, another source of Big Data exists that provides an opportunity for MNOs in the development of new services and applications, for example smart city initiatives.

There are two ways a MNO can follow in terms of Big Data analytics: the bottom-up and top-down approaches. In the latter MNOs define the targets they want to achieve and problems to be resolved, and determine which data sets have to be used for the desired outcome. It delivers incremental benefits but is challenging to conduct. In most cases it does not deliver surprising results. In the bottom-up approach MNOs already have access to huge amounts of data and use these to get insights. It provides a more transparent view, e.g. concerning network performance, customer behaviour and resource utilisation. It can also bring new opportunities for MNOs. Based on network and subscriber data, Big Data analytics can, for example, produce analytics concerning subscriber profiles, perspective and mobility patterns, as well as traffic profiles, resource allocation strategies, optimal cell placement, and advanced load balancing (Kibria et al., 2017).

Big Data supports the optimisation of routing and quality of service through real-time network traffic analysis. It helps to identify fraud by analysing call data records, to modify subscriber calling plans immediately through call centre agents, to tailor marketing campaigns to single customers or customer groups, and to use customer insights to develop novel products and services. Moreover, anonymous customer information and findings based on use data can be sold to third parties (strategy&, 2013). McKinsey and Company (2016) add that through the application of advanced analytics MNOs are able better to predict customer behaviour, leading to a potential enhancement of effectiveness of capex planning (up to 30%) and an improvement in network profitability. Customer retention and target upselling can also be improved. By focusing on advanced analytics MNOs can become leaner and more agile, while complex decisions are made quickly.

Summarising this subsection, specific sources of Big Data for MNOs, like customer profiles, device and network data, as well as location-based data, are depicted. Possibilities to apply Big Data at MNOs are illustrated. For example, Big Data can be applied for customer retention, segmentation and targeting, network optimisation and planning, cross- and upselling, data monetisation, churn analysis, fraud detection, tailored marketing campaigns, as well as the development of new services and applications in the IoT area.

Summarising subsection 2.4.1, the concept of Big Data including its definition, as well as its advantages and challenges are explained. Potential sources of Big Data, and the possibilities it generally provides to companies and particularly to MNOs are illustrated. It further addresses RQ1, focusing on the role of Big Data in MNOs. An impression of current usage of Big Data at MNOs is provided, which is important information for the further research as it forms the baseline that needs to be extended. Nevertheless, the literature provided no concrete information about the role of Big Data in future MNO business models.

2.4.2 Business Intelligence

This subsection explains BI, defines its attendant concepts, and provides an overview of its advantages and challenges, as well as the opportunities it provides. The use of BI at MNOs is described.

In order to anticipate change and take decisions not reactively but proactively, managers of MNOs and other companies need information. Through BI the conversion of data, e.g. Big Data, into useful information is supported, resulting in better decisions. Companies are enabled to stay ahead of their competitors by more quickly basing decisions on more accurate information (Pareek, 2007). A second reason for the need of BI is the trend towards bigger data. Hence the consolidation of multiple data sources is required. For this and for the possibility to deal with all this data and receive outcomes of their sheer amount, BI systems are needed (Jou and Ng, 2013).

2.4.2.1 Concept of Business Intelligence

According to Elena (2011), BI is a computer based technology used to analyse mostly internal and structured business data, which enables an historical, current and predictive view of underlying business operations. The functions are mainly retrieving, analysing and reporting data, as well as data mining and predictive analytics to support the decision-making process in a company using data from a data warehouse or a data mart. Generally, BI can be used for measurement, analytics, reporting, collaboration and knowledge management. Lia (2015) states that a BI platform has the following four levels: operational systems, staging, data warehouse and BI tools levels. The data from the operational systems provide e.g. data on customers, solutions, pricing and services. The data needed for the BI systems comes from different sources, like contract systems, invoices or customer traffic, and is usually available as Big Data. Olaru (2014) states that BI is intended to assist in the detection of significant events, discovery of new business scenarios, and the prediction of business situations. It further helps in monitoring trends, evolving and adapting quickly to new situations, and making intelligent decisions. According to Benhima et al. (2013), the main purpose of BI systems is the provision of the right information to support the decision-making process in a timely manner.

The focus of BI systems is not only on the past and present but also the future. Therefore, statistical and predictive analytical techniques, like predictive modelling, simulation and forecasting, have been added to the traditional BI methods, like reporting and analysis, leading to the possibility to predict the future with a certain probability. While in former times BI systems were used for the collection and integration of data, the new data challenge concerns the volume, variety and velocity of data. Not only internal but increasingly external data, e.g. from the internet, is used, and also unstructured data is integrated, which was not the case in earlier years. The combination of internal and external data leads to new potential in the use of BI (Jou and Ng, 2013). The five basic tasks for a BI system are the collection, evaluation and analysis of data, as well as the storage and dissemination of intelligence (McLeod and Schell, 2004). Summarising, the excelling use of BI is the transformation of data to information and the transformation of information to knowledge (Leung et al., 2013). BI systems are designed for the improvement of performance, the identification of opportunities and threats, as well as for an increase in efficiency and a reduction in costs. A benefit is the support in the definition of strategies, the search for opportunities, and identification of problems (O'Brien and Kok, 2006). “The business intelligence industry is going through a time of incredible change. Predictive analytics, high volume data, unstructured data, social data, mobile, consumable analytics, and data visualisation are all examples of demands and capabilities that have become critical within just the past few years, and growing at an unprecedented pace” (Jou and Ng, 2013, p. 3).

Thus, it is absolutely necessary to use this large volume of data effectively to make good and strategic decisions for the company’s success in a competitive market. The already large and growing volume of data is caused by the decline of storage costs leading to the situation in which companies store more data in greater detail in all available formats. BI systems enable users to make sense of this huge amount of data more efficiently and to base decisions on it. The recently emerging trends will transform the use of BI. These trends are faster business, better software and bigger data. As stated above, the challenges are volume, velocity and variety of data. Volume means that there are more data available and stored in greater detail to provide more insights. This volume is generated e.g. by employees and customers, through the use of smartphones and tablets or connected sensors. The term ‘velocity’ stands for the fact that on the one hand data are collected faster; and on the other hand, time required for their analysis is reduced, sometimes nearly to real-time, while in the early days of BI analysis of data could take several days. As stated above, the variety of data changed over time. In former times the used data were structured, trusted and internal. Nowadays a wider range of data needs to be analysed to provide more information. The variety of data available can be classified as structured and unstructured, trusted and non-certified, internal and external, as well as fact and opinion (Leung et al., 2013).

One driver of BI implementation is the possibility of enabling various groups to analyse data in different ways according to their needs, and to enable them to fulfil their tasks more efficiently, given the information made available through their analyses. Other drivers are support in understanding data more quickly, leading to better and faster decisions that result in the achievement of business goals, an increase in effectiveness and efficiency in the organisation, improved accessibility as well as acceleration of the data flow, and the possibility to redefine existing and eliminating old processes, and creating new capabilities (O'Brien and Kok, 2006).

Summing up this subsection, BI is defined as a computer-based technology used to analyse internal and external, structured and unstructured data, which enables an historical, current and predictive view of business operations. Its main functions are retrieving, analysing and reporting data, as well as data mining and predictive analytics. Its purpose is to support the decision-making process. It further supports in detecting significant events, discovering new business scenarios, and monitoring trends. It may be stated that BI is needed and a prerequisite to translation of Big Data into knowledge that can be used e.g. to make better decisions, track competitors, and conduct analysis.

2.4.2.2 Use of Business Intelligence at MNO

Through the use of BI in the sense of advanced analytics, MNOs can determine the capital investment that is likely to produce the most value in their network. They can also determine when and where overloads in their network will occur and which customers will most likely and severely be affected. Having this information they can see how much an upgrade of their network would improve customer satisfaction and increase customer profitability (McKinsey & Company, 2017). Bidin and Yunus (2017) state that among the main reasons for telecommunication companies to implement BI are customer acquisition, fraud detection and analysis, churn analysis, generation of client profiles, benefit maximisation, improvement of decision-making, improvement of customer relationship and service quality, as well as administration of resources. Sun Microsystems (2005) adds improvement of response times, traffic analysis, as well as product affinity and bundling as further reasons. Business Objects (2005), a vendor of BI software, states that BI improves revenue and profit through acquiring and retaining high-value customers, reduces costs because of more effective management, automates compliance, and improves customer loyalty due to higher quality and better service delivery. Lorenzo, Peters and Robskovsky (2002) state that BI helps companies by analysing the causes for product failure, identifying the top customers, and analysing customer behaviour on which models for attrition, acquisition, retention and growth are created. According to Gilad and Gilad (1988), companies are better in tracking competitors, analysing markets, developing profitable products, determining potential merger or acquisition candidates, and monitoring technological developments through BI programs. O'Brien and Kok (2006) state that taking into account that the margins of telecommunication companies are under high pressure due to the highly competitive market and telecommunication companies want to enjoy sustainable profits, the use of BI systems could be a solution leading to sustainable or even increasing profits through the possible competitive advantage it provides. Moreover, high-value customers can be retained, costs can be saved through a more effective management, and decision-making improved based on BI. According to International Engineering Consortium (2000), strategic decision support is often regarded as the cornerstone of BI. Its capabilities can e.g. be seen in the development of simple reporting capabilities allowing the measurement of key performance metrics, like average sales per hour and average talk time in call centres, campaign performance and customer segment lifetime value, as well as customer satisfaction. Moreover, they can be seen in the development of complex reporting capabilities allowing detection of problems as well as discovery of new opportunities, like market and competition assessment, strategy and pricing as well as customer segmentation, and in the development of statistical models to predict customer needs and behaviour, e.g. in regard to the likelihood of customers buying a new product and generating high profits. In addition, scoring and segmentation, as well as campaign assignment and management are further benefits of BI.

Summarising this subsection, various possibilities for the application of BI at MNOs are identified. For example, BI can be used to project how much a network upgrade would improve customer satisfaction and increase customer profitability at MNOs. It can also be used for fraud and churn analysis, revenue and profit improvement, cost reduction, customer behaviour and market analysis, tracking of competitors and improvements in the decision-making process.

Summarising subsection 2.4.2, the concept of BI including its definition, as well as its advantages and challenges are offered. The possibilities it provides to companies in general and to MNOs in particular are illustrated. It further addresses RQ1 focusing on the role of BI for MNOs. An impression of current use of BI at MNOs is provided, which is information important to this enquiry as it forms the baseline that needs to be extended. Nevertheless, the literature provided no concrete information about the role of BI in future MNO business models.

2.4.3 Linking Big Data, Business Intelligence and Software Robotics

This subsection focuses on making the link between Big Data, BI and software robotics more explicit and thus highlighting the importance of the combined use of these technologies for this research.

ML and AI are regarded as powerful emerging tools in the management of large amounts of data, especially regarding the conduction of predictions and provision of suggestions based on the data sets. While ML is used for predictive analytics, AI is used for prescription of plans and suggestions with the intention of realising benefit (Kibria et al., 2017). In this case the link between ML, AI and Big Data is in making predictions and providing support based on data sets, as the sole use of Big Data alone without the integration of ML and AI is not supposed to deliver results of the same quality as with the integration of ML and AI.

According to Arthur D. Little (2018a), Big Data and especially its right implementation is a prerequisite to ML's unfolding its full potential. If this is correctly done, ML will strongly support MNOs in monetising their data. On the other hand, Arthur D. Little (2018b) states that the full value of Big Data can be realised by using ML. Thus, these two technologies are strongly interdependent. The potential of Big Data can best be used if the focus of a company is on gathering data, recognising its hidden value locked in the data, and using ML to transform this hidden value into measurable value for the business. In this way, growth faster than a company's competitors and cost savings are enabled. Datameer (2018) and DISYS (2015) confirm the importance of Big Data for ML, as Big Data fosters ML and, thus progress in the development of AI is faster. Moreover, AI will become more accurate, the more data it gets. Concluding, Big Data is a crucial prerequisite to ML and AI. Atoyebi (2018) sees the biggest advantages in the combination of Big Data with ML in facilitating customer segmentation, making targeting feasible and effective, fostering predictive analysis, and providing foundations for risk analysis and regulation. Another emerging topic is IoT, which is forecasted to generate amounts of data too huge for humans to process, so AI will have to take over a significant role in analysing and interpreting the data (Azoff, 2017). This is a further example of the need of AI to cope with Big Data.

UiPath (2017) states that RPA is invaluable to the interpretation of Big Data because RPA can gather data from disparate systems and provides analytical capabilities. Moreover, RPA generates Big Data, and through the combined use of both technologies problems in processes can be identified and solved. Additionally, RPA is able to transfer raw data into understandable bits that can be used for decision-making. In this way, these technologies together make it easier for companies to achieve knowledge of their customers, business processes and market trends.

As data complexity, which is inter alia generated by IoT-devices but also due to the vast variety of data sources and structures (internal, external, structured and unstructured), imposes a great challenge due to the lack of a standard format for data storage (Deloitte, 2015), RPA can be used to transfer the generated data into a predefined data storage format to make the data processable for further applications like Big Data and BI. Moreover, RPA can be used to transfer the data not only in one but in various data formats, depending on the target database.

The use of advanced analytics, meaning BI and ML, has already helped MNOs to achieve performance improvements. This can be clustered in four main areas: (1) reduction of support costs, e.g. operational efficiency and infrastructure operation optimisation, (2) increase in customer use, e.g. cross- and upselling as well as pricing, (3) more profitable acquisition of customers, e.g. retail distribution and marketing mix modelling, (4) and management of customer value, e.g. churn prevention as well as fraud and credit management. For example, with advanced analytics and ML MNOs have a better chance to understand the reasons for churn. By identifying the potential churners, MNOs can target them through product campaigns and further action to retain them (McKinsey & Company, 2016).

Furthermore, Big Data is the baseline for emerging technologies, like chatbots. The feedback on information quality given to a system can improve its overall intelligence. The models currently in place will develop and improve as more data are available. Combining data from different sources can even enhance this effect (Magoulas and Lorica, 2009). In this example, the connection between Big Data and chatbots, which need AI and ML capabilities depending on the scope of their work, is illustrated.

A topic that is not yet covered in the literature is the generation of data through software robotics and its company-wide use. For example, a chatbot used in the customer service area can conduct customer interaction in natural language. For the interaction itself but also for the natural language AI as well as ML and DL are needed. The whole interaction can be interpreted by AI and the important parts of the discussion, like triggers, actions, reactions or buzzwords, can be saved in the correct context to several databases with various formats using RPA. Due to the amount of customer service interaction, the amount of data generated can be regarded as Big Data as it is too complex to be handled with standard software and as it is rapidly increasing. Having all the data stored, various departments can analyse them using BI-capabilities to make decisions based on the generated data. This is only one example of a possible combined use of these technologies.

Another, more general, example is the conversion of unstructured data, retrieved e.g. from social media, into structured data by RPA. RPA can then load these structured data in a data warehouse designed for Big Data, while additional information on social media data is added using AI. In the end, all the information can be integrated in BI to enable more sophisticated decisions.

The above explains the capabilities and functionalities of software robotics in combination with Big Data and BI. If Big Data is regarded in connection with software robotics it can be seen that the data needed in order to be described as Big Data can easily be generated or manipulated using software robotics. A huge advantage of using data generated through software robotics for Big Data is that software robotics is able to generate data in an amount and quality that formerly did not exist as the data were e.g. not documented in a system at all. Hence, software robotics may be regarded as an enabler of data generation needed for Big Data. A big advantage for participants in a market is that they have access to data they formerly generated and that they can use these data to generate value and information. New market entrants do not have the same chance and are therefore at a disadvantage in terms of the available data.

Summarising this subsection, the link between Big Data, BI and software robotics is shown in several examples from the literature but also those not yet covered in it were defined. The importance of these technologies on their own but especially in combination is further explained. Nevertheless, the available information covers the link between Big Data, BI and software robotics only to a certain degree and there is no special focus on it in terms of MNOs. Therefore, further research on the link between Big Data, BI and software robotics is required.

The goal of this section is to provide an overview of data insights. Thus, the concepts of Big Data as well as BI are delineated including their definitions, their advantages and challenges, as well as the possibilities they generally provide. Their use at MNOs is depicted. The link between Big Data, BI and software robotics is shown. To have a general overview but also deeper understanding of Big Data and BI, as well as their interconnection with software robotics is important to the exploration what it takes to position MNOs in a changing telecommunication market as Big Data, BI and software robotics may have a significant influence on MNOs' future. Based on the available literature and information, an overview and understanding are enabled. Especially the current use of Big Data and BI at MNOs was addressed. However, the full picture of Big Data's and BI's current role at MNOs and whether the information provided through these technologies is used in the best possible way to improve MNOs' market situation could not be answered in literature. Big Data's, BI's, and software robotics' role in future MNO business models and whether they will be central components cannot be properly determined using the literature. These research gaps form a further baseline for the second parts of the RQs 1 and 3.

2.5 Conclusion

This chapter provides findings in the literature concerning the goal of this work. The aim is to provide a framework within which MNOs are guided to innovate their business model for organisational sustainability by exploring key aspects based on the contextualised 'Innovation Landscape Map' of Pisano and by developing an industry-specific, new transition model grounded on the same. Therefore, the three objectives were defined (I) to show the contemporary situation in the telecommunication market for MNOs as well as to develop the look of a future MNO business model and telecommunication ecosystem, (II) to depict the role of innovation for MNOs as well as the implication of Pisano's 'Innovation Landscape Map' on MNOs, and (III) to illustrate the role of BI, Big Data and software robotics for MNOs, their future business model and a future telecommunication ecosystem.

While the literature provides a good and deep understanding into the first objective, it is insufficient to fully achieve the first objective and not up-to-date for this research. Regarding the second objective, the literature provides valuable information, which is also insufficiently comprehensive for this research. In terms of the third objective, through the literature first indications could be suggested. However, these indications are not sufficient to reaching the research aim. Thus, the information provided in the literature review is taken as baseline on which further research on this topic is based.

A framework is suggested within which the overarching research question is answered: What does it take to position MNOs in a changing telecommunication market?

Pisano's (2015) ILM is the central theory that guides the thesis and is therefore central part of the conceptual framework. The conceptual framework further consists of technology, opportunities, challenges and constraints that describe the telecommunication ecosystem in which Pisano`s (2015) ILM operates. In this way, first context regarding MNOs is brought to this generic framework on the basis of the literature. The conceptual framework is shown in figure 20.

Figure 20: Conceptual Framework

3 Research Methodology

In this chapter the required philosophical and research approach as well as research method and design to bridge the gaps that were identified in the literature review are defined, discussed and explained.

The method of data collection to get information for filling the gaps identified in the literature review is discussed in order to enable the fulfilment of the overall research aim. In the philosophical approach (3.1) ontology and epistemology are outlined. Both terms are defined and approaches of both are explained, before the position adopted in this work is stated and justified. Section 3.2, research approach, focuses on induction and deduction and the comparison of these as well as on the decision which research approach is most fitting for this research project. Section 3.3 discusses the mono research method. The research method is defined, explained and justified. The research instrument is then discussed. In the research design (3.4), the data collection procedure and the respective data analysis are described as well as checks for research validity and reliability. In section 3.5, the position on research ethics adopted in this work is stated. In the last section (3.6), the conclusion is provided.

3.1 Philosophical Approach

In this section the terms ‘ontology’ and ‘epistemology’ are defined and their approaches are discussed, focusing on objectivism and subjectivism for the ontological approach and on positivism, realism and interpretivism for the epistemological approach. At the end of this section, the position on ontology and epistemology adopted in this work is stated and justified.

3.1.1 Ontology

Ontology is “concerned with the nature of reality. (…) this raises questions of the assumptions researchers have about the way the world operates and the commitment held to particular views” (Saunders, Lewis and Thornhill, 2007, p. 108). The two views, objectivism and subjectivism, are accepted by many researchers as producing valid knowledge (Saunders, Lewis and Thornhill, 2007). Mathison (2005) states that ontology is concerned with the nature of being and existence, and is a branch of Metaphysics dealing with properties and relations of existence that are fundamental. It can be regarded as the basis to the formulation, description and analysis of the world's phenomena. It covers questions such as "What is existence? What does it mean to say that an object exists? What are an object's properties, and how are they related to the object? When does something cease to exist?" (Mathison, 2005, pp. 285–286). According to Bryman (2012, p. 32), ontology is "concerned with the nature of social entities".

Ontology's central topic is whether social entities are considered to be social constructions that are built by perceptions and actions of social actors (subjectivism) or as objective entities with an external reality to social actors (objectivism) (Bryman, 2012). According to Saunders, Lewis and Thornhill (2007, p. 108), objectivism "portrays the position that social entities exist in reality external to social actors concerned with their existence. (…) subjectivism, holds that social phenomena are created from the perceptions and consequent actions of those social actors concerned with their existence".

Hereinafter, objectivism and subjectivism are discussed in order to identify the ontological approach best fitting for the research project.

3.1.1.1 Objectivism

Objectivism means that "social entities exist in reality external to social actors" (Saunders, Lewis and Thornhill, 2007, p. 108). Bryman (2012, p. 33) uses other words to describe objectivism, stating that it "asserts that social phenomena and their meanings have an existence that is independent of social actors". Hence, social phenomena and categories used in discourse have an existence that is independent of actors. Social phenomena are external facts and cannot be influenced (Bryman, 2012).

Cohen, Manion and Morrison (2007, p. 10) add that the philosophical basis for an objectivist is realism, meaning that “the world exists and is knowable as it really is”. They further state that the respective research is focused on a (quasi) experimental validation of theory using the abstraction of reality, mainly through mathematical models or quantitative analysis as method.

3.1.1.2 Subjectivism

Subjectivism means “that social phenomena are created from the perceptions and consequent actions of social actors. (…) this is a continual process in that through the process of social interaction these social phenomena are in a constant state of revision” (Saunders, Lewis and Thornhill, 2007, p. 108). In order to understand actions of social actors, the researcher has to explore the subjective meanings that motivate these actions. Reality is regarded as socially constructed. Individuals can have different interpretations on situations they are confronted with. They perceive situations in different ways due to their own view of the world. The individual’s actions and social interactions are influenced by these different interpretations. Hence individuals interact with the environment and try to make sense of it by interpreting events and their meanings. Because of this behaviour, others may see actions as meaningful in terms of socially constructed interpretations. To Conclude, the researcher has to try to understand the subjective reality of the individuals that are studied to understand their motives and make sense of their actions (Saunders, Lewis and Thornhill, 2007).

Cohen, Manion and Morrison (2007, p. 10) add that the philosophical basis of a subjectivist is idealism, meaning that “the world exists but different people construe it in very different ways”. Moreover, research is conducted to search for meaningful relationships and to discover their consequences for action. This is done through the representation of reality with the goal of comparison. Language as well as meaning are analysed (Cohen, Manion and Morrison, 2007).

3.1.2 Epistemology

According to Saunders, Lewis and Thornhill (2007), epistemology is a branch of Philosophy concerned with study of the nature of knowledge. It also covers the question what constitutes acceptable knowledge in a given field of study, which matches the definition of Bryman (2012). Mathison (2005) adds that epistemology is further concerned with limits and sources of knowledge. Its prevalent question is what constitutes knowledge. The main issue “is the question of whether the social world can and should be studied according to the same principles, procedures, and ethos as the natural sciences” (Bryman, 2012, p. 27).

Epistemology can be divided in an objective and a subjective position. The objective position concerns the collection of facts and their analysis based on objects that are real, e.g. machines, cars and computers, because they have an existence that is separate from the existence of the researcher. Due to this separation, the data collected are assumed to be less open to bias and more objective than the ones of the subjective positions (Saunders, Lewis and Thornhill, 2007). This position affirms that it is important to imitate the natural sciences and is associated with positivism as an epistemological position (Bryman, 2012).

The subjective position concerns studying, for example, feelings, attitudes and opinions, which are social phenomena that have no external reality. It is not possible to see, measure or modify them like machines, cars and computers. The data presented are often shown in a narrative, rather than in tables or statistical data, which is preferred in the objective position. While the objective position refers to positivism, the subjective position refers to interpretivism (Saunders, Lewis and Thornhill, 2007).

Hereinafter, positivism, realism and interpretivism / constructivism are discussed in order to identify the epistemological approach best fitting for the research project.

3.1.2.1 Positivism

Positivism assumes that the "social world exists externally, and that its properties should be measured through objective methods" (Easterby-Smith, Thorpe and Jackson, 2008, p. 331). Guba (1990) adds that reality is driven by natural laws and mechanisms that are unchangeable and knowledge of these is summarised as time- and context-free generalisation. It is a dualist or an objectivist epistemology and no interference of the researcher is allowed, while a distant posture has to be adopted. Researcher and investigated object are assumed to be independent. Values and biasing factors are excluded from research as they influence the outcome. Guba and Lincoln (1994) state that the methodology of positivism is experimental or manipulative and used for the verification of hypotheses using mainly quantitative methods. Wong (2014) sums up that findings are considered to be true if an hypothesis is verified.

Easterby-Smith, Thorpe and Jackson (2008) add that positivist research focuses on hard data more than on opinion and that it looks for regularities in obtained data to produce generalisations from specific examples for a greater population similar to those of natural science. They further summarise that research progress is made through "hypotheses and deductions", "Concepts need to be defined so that they can be measured", "Units of analysis should be reduced to simplest terms", generalisation is achieved through "statistical probability" and "Sampling requires large numbers selected randomly" (Easterby-Smith, Thorpe and Jackson, 2008, p. 59).

3.1.2.2 Realism

Realists represent the position of a concrete and external world. Progress of science is only possible through observation having a direct correspondence with investigated phenomena. Scientific laws are regarded as absolute once they are discovered. (Easterby-Smith, Thorpe and Jackson, 2008). Saunders, Lewis and Thornhill (2007) state that realism is regarded as what is shown by the senses and that this is the truth. The existence of objects is independent of the human mind. Bryman (2012, p. 29) confirms the “commitment to the view that there is an external reality to which scientists direct their attention”.

Realists state that only one reality but several perceptions of it exist. It is a modified dualist or an objectivist epistemology. The researcher is as objective as possible, while being a part of the research. The researcher is neither isolated, nor passionate during the research. Nevertheless, the researcher aims to be value-aware because being value-free is not possible. (Wong, 2014).

3.1.2.3 Interpretivism / Constructivism

Easterby-Smith, Thorpe and Jackson (2015) regard social constructionism, constructivism and interpretivism as equivalent. This view is adopted by the author.

Interpretivism is a contrasting epistemology to positivism. It subsumes the view of people who regard the natural scientific models for studying the social world as critical. Interpretivists state that the matter of subject in social sciences (meaning mainly people) differs from that of natural sciences. Hence, another reasoning and research procedure is necessary to reflect and highlight the distinctiveness of humans than at positivism and realism (Bryman, 2012).

According to interpretivists it is essential for researchers to acknowledge and understand that differences exist between humans in their role as actors in a social environment. The difference between research with people and objects is stressed. All humans behave differently and their social roles are interpreted according to the researcher’s set of meanings. The social world is interpreted by the researcher including actions of others, with whom the researcher interacts. This interpretation causes adjustment in the researcher’s meanings and actions. The researcher’s task is to enter the research subject’s social world and understand its world form the subject’s point of view (Saunders, Lewis and Thornhill, 2007).

The interpretivist takes a subjectivist position, as subjectivity is imposed on humans due to the human nature and as it is the only way to unlock constructions made by humans. Subjective interaction with individuals is regarded as the only way to access the realities that only exist in the research subjects' minds. Hence, the epistemological approach is subjectivist as researcher and research subject are combined in one entity and the research results are created through the interaction between these (Guba, 1990). Guba and Lincoln (1994) state that this means also that the values of the researcher influence the research itself. Findings are generated in the course of research. The method of interpretivism is dialectic due to the dialogue required between researcher and research subject and the researcher has to become a 'passionate participant'. “The final aim is to distill a consensus construction that is more informed and sophisticated than any of the predecessor constructions” (Guba and Lincoln, 1994, p. 111). Concluding, the data collection process is qualitative and the complexity of views is looked at by the researcher rather than narrowing meanings down to few ideas (Creswell, 2014).

Wong (2014) adds that in this view, truth is subjective and based on the way individuals perceive reality.

Easterby-Smith, Thorpe and Jackson (2008, p. 59) sum up that “The observer is part of what is being observed”, “Human interests are the main drivers of science”, “Explanations aim to increase general understanding to the situation”, research progresses are achieved by “gathering rich data from which ideas are induced”, “Concepts should incorporate stakeholder perspectives”, “Units of analysis may include the complexity of 'whole' situations”, generalisation is achieved through “theoretical abstraction” and “Sampling requires small numbers of cases chosen for specific reasons”. Cohen, Manion and Morrison (2007) also note that interpretivism uses small-scale research that is non-statistical as well as subjective and that its specifics are interpreted by a researcher who is personally involved in the research. The focus is on understanding actions and meanings rather than causes.

3.1.3 Position adopted in present work

As this research project concerns the generation of a framework to support MNOs in defining a new busines model that facilitates future growth, development and sustainability, a theory has to be built of how MNOs can accomplish this. Therefore, a detailed and close understanding of the overall research context is required.

Ontology

A core of the subjectivist ontology is the analysis of meanings, which is needed to get profound understanding of the thoughts of individuals. Individuals can interpret situations they are confronted with in different ways, meaning that every individual has his/her own view of the world, and these different points of view are of utmost interest to secure. In this project, in-depth knowledge from individuals is required to understand their subjective position. This knowledge provides information that is not yet covered in the literature and rich information from individuals is estimated to be more valuable than less detailed information from a larger group. Through the information provided from knowledgeable individuals more and deeper insights are expected. Additional goal-orientated information is enabled also through guiding the information flow in the required direction. This helps in answering the research questions and the respective identified research gaps. Thereby, it is of high importance to get different points of view, which is expected to be possible through a subjectivist ontology as every individual has his/her point of view that differs from that/ those of others and each situation is interpreted differently by single individuals that give situations different meanings. Through an subjectivist ontological approach it is expected that the required information for this research is provided. In a subjectivist ontological approach meaningful relationships are searched for, which is also important for this research project, which aims at analysing the meaning of subjective interpretations. Thus, a subjectivist ontology is chosen for this work.

Epistemology

The subjectivist epistemology aims at studying opinions, which are regarded as social phenomena without an external reality, meaning that they cannot be measured or modified like machines and that they cannot be regarded as hard facts. Moreover, it is rather unusual and not value-adding to present the data in a table or statistics. It is crucial that the researcher acknowledges the different behaviour of humans and their social roles and that the interpretation of information is conducted according to the researcher's set of meanings. For this research, the opinions and individual points of view of people are required, which have no external reality and which cannot be measured like machines. The different behaviour of people and their social roles are expected to be interpreted individually by the author by trying to adopt their point of view. The results are not expected to be presentable in tables or statistics in a meaningful way, which is the reason that a narrative to show the results is required. Furthermore, not a broad view of many individuals is required but the informed view of several individuals that are highly engaged in the topic, which is gained through in-depth interview. Through the informed views of engaged individuals, information which is not yet covered in the literature can be generated and thus rich and deep insights are expected. In this way, goal-orientated information to answer research questions and bridging identified research gaps are expected. To get a deeper insight into those individuals' points of view, a personal interaction (dialectic) with them led by a 'passionate participant' is required, which is enabled through in-depth interviews (compare subsection 3.3.3) within the framework of this research project, meaning that the researcher has to get directly involved in the research. The explanations and interpretations of the information aim at increasing general understanding of the research topic. Thus, a subjectivist epistemology, namely the interpretivist one, needs to be adopted.

3.2 Research Approach

In this section, firstly, qualitative and quantitative research are compared before a closer look is taken at deduction and induction. After explanation of the stated approaches, the position in terms of qualitative and quantitative research as well as deduction and induction adopted in this work are outlined.

3.2.1 Qualitative and quantitative research

According to Jick (1979), qualitative and quantitative research methods should not be regarded as rival but complementary. Easterby-Smith, Thorpe and Jackson (2008) distinguish qualitative and quantitative research methods by stating that qualitative methods involve "collecting data that is mainly in the form of words", while quantitative data "involves data which is either in the form of, or can be expressed as, numbers" (Easterby-Smith, Thorpe and Jackson, 2008, p. 82). Saunders, Lewis and Thornhill (2007) define both terms in greater detail. They state that quantitative methods are regarded as techniques of data collection (e.g. questionnaire) or procedures of data analyses (e.g. graphs or statistics) that generate or use numerical data. In contrast, qualitative methods are regarded as techniques to collect data (e.g. interview) or procedure for data analysis (e.g. data categorisation) that generate or use non-numerical data. Qualitative data not only includes words but also to pictures, video or sound. Wong (2014) adds that quantitative research is based on presenting statistical information and therefore statistical analysis is required. Conclusions are drawn or hypotheses tested using numerical evidence. Links between two or more variables are identified. Often large numbers are required for quantitative research and statistical levels of significance can be generalised. Quantitative research has an explanatory nature and tries to answer questions of 'what',' who', 'how much' and 'how many'. By contrast, qualitative research tries to answer questions of 'why' and 'how' and is exploratory in nature. Edmondson and McManus (2007) add that 'how' and 'why' questions are particularly well answered in unexplored research areas by research that builds theory. Wong (2014) states further that qualitative research does not focus on statistical analysis but on the collection of rich information that is gained from a small number of people or organisations. It is rather concerned with subjectively constructed topics than with objectively determined ones. Qualitative research is used when full understanding of a certain situation by a few people is more valuable than the partial understanding of many. It is acknowledged that the few people are not representative but nevertheless have more information than a great mass of people, if the few people are specialised or very knowledgeable in the field of research. While quantitative research is used to test theory, qualitative research is used to build theory.

Bryman (2012) summarises the characteristics of quantitative and qualitative research, as in table 3.

Quantitative research	**Qualitative research**
Numbers	Words
Point of view of researcher	Points of view of participants
Researcher distant	Researcher close
Theory testing	Theory emergent
Static	Process
Structured	Unstructured
Generalisation	Contextual understanding
Hard, reliable data	Rich, deep data
Macro	Micro
Behaviour	Meaning
Artificial settings	Natural settings

Table 3: Contrasts between quantitative and qualitative Research (Bryman, 2012)

Hoepfl (1997) summarises the following characteristics that are prominent in qualitative research:

- Natural settings as data sources through observations, description and interpretation
- Researcher as human instrument for data collection
- Mainly inductive data analyses
- Interpretive character to discover the meaning of events for individuals
- Idiosyncratic and unique features of each case

In order to be able to provide a framework guiding MNOs to innovate their business model and reaching organisational sustainability profound information is needed that can only be provided by a few knowledgeable persons, with a researcher that is competent in the topic. It is of utmost importance that the individuals understand the situation including context and complexities to its full extent. It is of higher value to this research project to have rich insights from a few people than partial and less informed insights from many people. These insights cannot be presented as pure numbers or data points as they are more complex and need to be described in words. As this research project focuses a possible future business model for MNOs, no quantitative data is available to test a hypothesis as is done in quantitative research. The research aims to answer 'why' and 'how' questions and is exploratory as an unexplored research area is focused on and a theory will be generated. Concluding, rich and deep data are required to enable the necessary insights and enable a contextual understanding, which are provided through the points of view of knowledgeable individuals through a qualitative method.

3.2.2 Deduction and Induction

Deduction and induction are two antithetical research approaches that are analysed in this subsection in order to identify the more fitting approach for the research project.

Deduction

Deduction is used to test theories and is mostly used in natural science because in natural science laws are regarded as the basis for explanation and enable the anticipation of phenomena. In deductive research, a theory is developed that is the subject of the corresponding test (Saunders, Lewis and Thornhill, 2007).

According to Robson (2002) deductive research is conducted in five steps:

1. Deduction of an hypothesis from a theory
2. Expression of the hypothesis in operational terms
3. Testing of the operations hypothesis
4. Examination of the inquiry outcome
5. Modification of the theory referring to the findings if necessary

Bryman (2012) adds a sixth step, 'revision of theory', which is an inductive step as the implications of the findings are fed back to the theory.

The revised theory is then verified by repeating all the steps and thus ensures reliability (Gill and Johnson, 2002; Saunders, Lewis and Thornhill, 2007). One characteristic of deduction is that it tries to explain relationships between variables if these are causal. Another characteristic is the collection of quantitative data. Furthermore, controls that allow us to test an hypothesis are necessary (Gill and Johnson, 2002). Deduction also fosters the independency of the researcher from the observed object. Concepts need to be operationalised, meaning that a quantitative measurement of facts is enabled, and reductionism is used as a principle, meaning that problems are better understood by reducing them to their simplest possible elements. To enable generalisability the selection of a big enough sample is important (Saunders, Lewis and Thornhill, 2007).

Induction

Induction is used to build theories and to get an impression of what is happening as well as to get a sound understanding of a problem's nature. The researcher tries to make sense of collected data by analysing them, which results in the formulation of a theory. In contrast to deduction, theory follows data at induction. An advantage of the inductive approach is that it enables understanding the way in which individuals interpret their social world, which is not part of the deductive approach that tries to make a causal link between variables without understanding the individuals' interpretation of their social world. Induction uses a less structured approach than deduction as this might enable alternative explanation (Saunders, Lewis and Thornhill, 2007).

Inductive research is concerned with contexts in which events take place. Hence a small sample is more appropriate than is the case with the deductive approach. Concluding, in inductive research, a qualitative approach is more likely than a quantitative to build theory and a variety of methods can be used to collect the required data to enable different views of phenomena (Easterby-Smith, Thorpe and Jackson, 2008).

Creswell (2014) lists the following steps in inductive research in a qualitative study:

1. Gathering of information in e.g. interview or observation
2. Asking of open-ended questions of participants or recording of fieldnotes
3. Analysis of data to cluster themes or categories
4. Looking for broad patterns, generalisations or theories from themes or categories
5. Statement of generalisations of theories from past experience and literature

Table 4 opposes the deductive and inductive research approach and provides an overview.

Deduction	**Induction**
Scientific principles	Gaining an understanding of the meanings humans attach to events
Moving from theory to data	Close understanding of the research context
Need to explain causal relations between variables via analysis	Explanation of subjective meaning systems and explanation by understanding
Generation and collection of quantitative data	Generation and collection of qualitative data
Application of controls (physical or statistical) to ensure validity of data and to allow testing of hypotheses	Flexible structure to permit changes of research focus as the research progresses
Operationalisation of concepts to ensure clarity of definition	Realisation that the research is part of the research process
Highly structured approach to ensure replicability	Minimally structured

Necessity to select samples of sufficient size in order to generalise conclusions	Use of smaller samples and less concern with the need to generalise
Researcher independence of what is researched	

Table 4: Comparison of Deduction and Induction (Gill and Johnson, 2002; Saunders, Lewis and Thornhill, 2007)

Position adopted in this work

This research project concerns the generation of a framework which will support MNOs in the definition of a new business model that facilitates future growth, development and sustainability. This means that a theory has to be built on how this can be accomplished by MNOs. Therefore, a sound understanding of MNOs' current situation and the opposing challenges is required. Hence the researcher is required to make sense of collected data through its analysis and ultimately formulate a theory, which in this case is a framework. It is required that the theory follows the data and not vice versa as no existing theory has to be validated but a new one has to be generated. To achieve this, a close understanding of the interpretation of individuals' social world is a prerequisite, which is also the reason that qualitative data is expected to be most promising to this research. At the same time, alternative explanations have to be taken into account and have to be accepted. Concluding, an inductive research approach is chosen for this research project.

3.3 Research Method

In this section differences as well as strengths and limitations of mono research method and triangulation are first outlined. This is followed by an explanation of case studies, which are used as research method, including definition, design, strengths and weaknesses and the researcher's role in its conduction. At the end of this section, the in-depth interview is introduced as research instrument.

3.3.1 Mono Research Method and Triangulation

It is possible to use one or more methods in a research project. While with a mono method either a qualitative data collection technique in combination with a qualitative data analysis procedure or a quantitative data collection technique in combination with a quantitative data analysis procedure is used, in multi method research combinations of qualitative and quantitative data collection and analysis are possible (Saunders, Lewis and Thornhill, 2007; Tashakkori and Teddlie, 2010).

Eisenhardt (1989) suggests the combination of multiple data collection methods in theory building research to enable triangulation, which increases the substantiation of constructs and their validity. Jick (1979, p. 602) states that triangulation means that "organizational researchers can improve the accuracy of their judgments by collecting different kinds of data bearing on the same phenomenon". Also according to Jick (1979), triangulation could increase the validity of the research. This is a topic discussed among researchers. Shih (1998) states that through triangulation results are not confirmed but rather broader insights are enabled.

As the use of triangulation increases the validity of the research and the researcher's accuracy of judgements can be improved using different sorts of data, while at the same time sound understanding can be enabled, the author uses triangulation in his research. It is enabled by additional information from further sources, e.g. companies, literature, related research projects or readily accessible documents, that refer to the research questions that are answered by the experts during the in-depth interview (compare subsection 3.3.3) and that support the author in verifying the interviewees' answers and finding the truth. It is assumed by the author that the answers of the interviewees show their opinions and expectations. Nevertheless, probing them through further information will help in verifying their responses.

This research project focuses on the future of MNOs and tries to make a suggestion concerning a possible future business model for MNOs. As predictions concerning the future cannot be tested and no reference model exists that can be tested quantitatively to prove a certain situation or state in the future, a qualitative approach has to be chosen to determine which MNO business models could be possible in the future and why. As already stated, the main data sources for the research are in-depth interview (compare subsection 3.3.3) and through additional data sources the interview data are verified (triangulation). Hence, a mono-method qualitative approach is used.

3.3.2 Case Study as actual Research Method

As stated before, the research is conducted using a mono method qualitative approach, namely a case study, to build theory. Other research methods, such as action research, experiment, grounded theory, survey, quasi-experiment and narrative, were critically evaluated regarding their fitness for this research but were inferior compared with case study. Therefore, in this subsection 'case study' is defined and the rational reason for choosing this research method is presented in detail. Detail of the structure of a case study approach is illustrated, before the design of the cases and strengths and limitations of case studies are presented. Thereafter the role of the researcher in a case study is discussed.

3.3.2.1 Definition

According to Yin (2009), case studies can be seen as rich descriptions of a phenomenon or of a particular instance of a phenomenon that usually rests upon various data sources and are especially preferred if 'how' and 'why' questions are addressed, if the researcher has only little control of the researched events and if a contemporary phenomenon that has a real-life context is research subject. Compared with quantitative research, many more variables that are of interest are available than data points. This method becomes especially relevant if in-depth descriptions of a phenomenon are required. These phenomena can be of individual, group, organisational, political, social and related nature. They are used e.g. in psychology, sociology, anthropology, social work, business education, nursing, political science, community planning and economics if complex social phenomena are desired to be understood. Shaw (1978) adds that case studies focus on problems, are small-scale and can be regarded as entrepreneurial endeavours. Merriam (1998) states that a reason for selecting case study as research method could be its uniqueness as it is able to reveal knowledge concerning a phenomenon that otherwise would not be accessible. According to Eisenhardt and Graebner (2007), the central point of case study is the use of cases to develop a theory inductively. The theory is built by recognition of patterns of relationships in and across the cases. Therefore, the cases' logical arguments have to be considered. Case studies focus on the rich, deep, real-world context that is outstanding for the phenomenon, while, for example, laboratory experiments regard the phenomenon separate from its context through isolation. While theory built from cases inductively produces new theory from data, deductive testing of theory tests the theory by using data. As the built theory is based on empirical data, the likelihood of generating accurate, interesting and testable theory is high. Eisenhardt (1989) states that in case studies the focus is on understanding dynamics that are present in single settings. Yin (2009) adds that they can consist of single or multiple cases and have numerous levels of analysis. They can have an embedded design, meaning that they consist of multiple analysis levels in a single study. Eisenhardt (1989) adds that it is even possible to combine various data collection methods, e.g. interview, questionnaire, observation.

A case study approach is especially appropriate when the topic is new or not much relevant research has been conducted, meaning that the phenomenon is only little known. Moreover, a case study is the right approach if current perspectives are regarded as inadequate due to little empirical substantiation or if they are in conflict with each other or with common sense. Case study research can be pertinent if findings in another study, e.g. one that tests theory, suggest that a new perspective is required. In addition, case studies are appropriate to building theories based on topics with no literature or empirical evidence. Also, if existing theory is considered to be inadequate, case studies can generate the desired novel theory (Eisenhardt, 1989). Merriam (1998) adds that case studies are especially interesting if the researcher's interest is in understanding, discovery and interpretation and not predominantly in hypothesis testing.

In order to develop a framework for BMI for MNOs with regard to their sustainability rich and deep descriptions based on various data sources are required. In addition, several questions of ‘how’ and ‘what’ have to be answered to come to the required information and understanding which lead to the framework for MNOs which this work aims at. Many variables and kinds of information are pertinent for the researcher and not only specific data points. Also, the research project concerns economics, namely MNOs, a possible future business model for them as well as a possible future ecosystem, which is not only regarded as complex but also as desired to be understood. The research can be described as focused on a specific and defined problem, while having a small scale as not a high number of people is required to provide high-level insights but rather a smaller number with proven in-depth knowledge. The goal is to develop a framework within which MNOs can innovate their business model, which is expected to be built on patterns across cases. The research topic is relatively new and only little research has been conducted on a possible future business model for MNOs when scientific standards and procedures are taken into account. Deep insights enabled by a case study approach are expected to give the answers to how MNOs' business models have to be adapted for their survival, taking the adoption of software robotics as well as BI and Big Data into account and which innovation dimension is most pertinent to MNOs. To conclude, case study is chosen as research method for this work.

3.3.2.2 Case Study Structure

According to Eisenhardt (1989) a case study can be structured as follows and is comparable with the structure given by Yin (2009), who states that at the beginning a sound literature review has to be conducted in order to define research questions and objectives.

- Getting started: In accordance with Eisenhardt (1989), at the beginning the research question was defined by the author to avoid getting overwhelmed by the volume of data. The research question was changed during the research. The author followed the rule that research that builds theory will be begun with no theory in consideration as preordained perspectives can cause bias and therefore limit the findings. Moreover, research will be based on a strong grounding in the literature (Eisenhardt and Graebner, 2007). The research design describes the logic that links the data that was collected to the initial questions. It can be seen as a logical plan defining the way from the start to the goal. Especially the study's questions, the unit of analysis and the criteria for the interpretation of findings are important components of the research design and were defined in the beginning. A good case study design maximised the quality of the research. Therefore, construct validity, internal validity, external validity and reliability were taken into account in accordance with Yin (2009) (compare subsection 3.4.2).

- Selection of cases: In this theory-building case study cases were not chosen for statistical but theoretical reasons. Hence, a random selection of cases was not preferable in accordance with Eisenhardt (1989). Pettigrew (1990) adds that cases, e.g. extreme situations and polar types, should be chosen as only a limited number of cases is usually available that can be studied. In these extreme situations or polar types, a transparent observation of the process of interest is possible. In accordance with Eisenhardt and Graebner (2007, p. 27) cases were "sampled for theoretical reasons, such as revelation of an unusual phenomenon, replication of findings from other cases, contrary replication, elimination of alternative explanations, and elaboration of the emergent theory" by the author. As suggested by Yin (2009) cases concerned entities. The case, also called 'unit of analysis', could also have been a country's economy, an industry, a policy or trade connections between countries (compare subsection 3.3.2).
- Crafting instruments and protocols: Among possible data collection methods are observation, archival sources and interview, which was chosen for this research. Through the use of several data collection methods triangulation was possible in accordance with Eisenhardt (1989) (compare subsection 3.3.1). Especially qualitative data can be useful to understand a theory that underlies a relationship or to suggest a theory directly, which is relevant in this research in conformity with Jick (1979). If more

than one investigator participates in the research, confidence in findings can be increased. In this way, cases can be viewed from different perspectives. (Eisenhardt, 1989). Due to the setting of this research project, only one investigator was allowed to participate. The case study "protocol contains the instrument but also contains the procedures and general rules to be followed (…). A case study protocol is desirable under all circumstances, but it is essential if you are doing a multiple-case study" (Yin, 2009, p. 79). The author used a case study protocol containing the instrument as well as procedures and rules. It consisted of an overview of the case study project, field procedures, questions to be asked and a guide to the case study report. The protocol helped the researcher to stay focused on the topic of his research in conformity with Yin (2009) (compare subsection 3.4.2).

- Entering the field: An advantage of case study used to build theory is the overlapping of data analysis and collection. Therefore, fieldnotes were taken as they are an important instrument to foster this overlap. The overlapping not only gave the researcher a head start on the analysis but also made the data collection more flexible as adjustments during the data collection process were enabled, e.g. additional cases, data sources and questions for interview. In this way, advantage of opportunities that occurred in certain situations could be taken in conformity with Eisenhardt (1989).
- Analysis of data: This is considered to be the heart of case study that builds theory and it is driven by a huge volume of data (Eisenhardt, 1989). As Pettigrew (1990, p. 281) puts it, the huge amount of data can cause a "death by data asphyxiation". In accordance with Pettigrew (1990) the author coped with this issue by analysing the data from the single cases, at the beginning, which included detailed notes that were pure description but necessary for insight generation. In conformity with Eisenhardt (1989) this provided the chance for the author to reach high familiarity with the cases and this in turn facilitated cross-case comparison. Cross-case patterns were of interest and several available strategies for them were followed:

  - Selection of categories of dimension and looking for within-group similarities and intergroup differences
  - Selection of pairs of cases and listing of similarities and differences between each pair
  - Division of data in dependence on data source

  If a pattern is identified by one strategy and verified by another, the finding is considered to be better grounded and stronger. Yin (2009) adds that several ways of linking data to proposition are available, e.g. pattern matching, time-series analysis or logic models. It is necessary to combine the data as a reflection of the initial propositions in the analysis. In this research pattern matching was used (compare subsection 3.4.3).

- Shaping hypotheses: In this step the data from each case was compared with the emergent framework to assess the fit of the framework and the case data. The researcher constantly compared theory and data to get to a theory that fits the data as closely as possible. This was done in an iterative process. Such a close fit is necessary to building a good theory as it uses the new insights as advantages and enables yield of a theory with empirical validity (Eisenhardt, 1989). The underlying logic of the iteration is to treat the various cases as a series of 'experiments' with each case either confirming or disconfirming the emergent theory (Yin, 2009). "When a relationship is supported, the qualitative data often provide a good understanding of the dynamics underlying the relationship, that is, the 'why' of what is happening" (Eisenhardt, 1989, p. 542).
- Enfolding literature: Comparison of the emergent theory with the existing literature is important for two reasons. Firstly, confidence in the findings of the research is reduced if conflicting theses covered in the literature are ignored. Secondly, conflicting literature can be regarded as an opportunity for development of the research topic as it forces researchers to be more creative in their thinking than they otherwise might be (Eisenhardt, 1989). This approach was followed by the author and as a result, deeper information and understanding was attained. Moreover, through comparison with

existing literature the internal validity and generalisability of the research were enhanced. Comparison is also important as findings were often based on only a few cases and linking these findings to the existing literature again increased the internal validity of the research in conformity with Eisenhardt (1989) (compare subsection 3.4.2).

- Reaching closure: When theoretical saturation was reached, the researcher stopped adding cases. Normally the number of cases is determined before the data collection process begins. As no ideal number of cases exists, four to 10 cases are considered to work well. Having fewer than four cases can render difficult the building of a complex theory. More than 10 cases can cause a too great complexity and a too high a volume of data (Eisenhardt, 1989) (compare sub 3.3.2.3 and 3.4.1). Despite the number of cases considered to work well, the author conducted 13 interviews as theoretical saturation was not reached with less cases.

3.3.2.3 Single-Case and Multiple-Case Studies

For the design of the cases there are several possibilities. There can be single- or multiple-case design, which can either be holistic or embedded.

A single-case approach is regarded as comparable with a single experiment in terms of its justification. A single-case design is used if the case represents a critical case. A single-case can challenge, extend or confirm theory. It is used if the case is extreme or unique. Moreover, single-case design is used for representative or typical as well as revelatory and also for longitudinal cases (Yin, 2009). Hence it is typically used to exploit opportunities for exploring a significant phenomenon (Eisenhardt and Graebner, 2007). Yin (2009) further states that a problem single-cases can face is that it turns out that they are not the cases they were first thought to be. To minimise misrepresentation and increase access to the required evidence, careful investigation of the candidate case is needed. If more than one unit of analysis is used in a single-case, e.g. subunits, it is regarded as embedded, otherwise as holistic. A holistic design is used if no subunits are available or the underlying theory is itself holistic. Holistic designs present the problem that the case study may be abstract without sufficiently clear data. Another problem is that the nature of the study may shift during the study. An embedded design helps in focusing on the research but also has its pitfalls, like focusing on a subunit and failing to return to the larger unit of analysis.

While in large-scale deductive studies based on quantitative data numerical tables are used to summarise analyses and present empirical evidence, this is normally not possible with case studies as they usually consist of rich qualitative data. In single-case studies the qualitative data is often presented as a comprehensive narrative. This narrative is combined with quotations of the participants and further evidence that supports the information. Moreover, the information is intertwined with theory to prove the connection between emergent theory and empirical evidence (Eisenhardt and Graebner, 2007).

In a multiple-case design evidence from a plurality of cases is considered to be more compelling and more robust but more resources and time are needed than is the case in single-case design. Multiple-case studies should follow a replication logic. Each individual case in a multiple-case design can either be holistic or embedded. This depends on the type of phenomenon as well as the research questions (Yin, 2009). A multiple-case design is regarded as having a higher validity and reliability and is better grounded than single-case design (Eisenhardt and Graebner, 2007). A multiple-case design normally provides a stronger basis for the building of theory (Yin, 2009). According to Patton (1990, p. 184), “There are no rules for sample size in qualitative inquiry”. As stated above by Eisenhardt (1989) the adding of cases should be stopped when theoretical saturation is reached. Four to 10 cases are considered to be sufficient considering that no ideal number of cases is known. Eisenhardt and Graebner (2007) and Yin (2009) add that multiple-case studies create a more robust theory due to their grounding in varied empirical evidence. Eisenhardt (1991) states that multiple cases enable comparison and thus the researcher is able to clarify if an emergent finding is idiosyncratic of a single case or characteristic of most or all cases. Eisenhardt and Graebner (2007) state that, additionally, multiple-case studies enable broader exploration of research questions and foster a theoretical elaboration. Moreover, also the propositions have a deeper grounding due to varied empirical evidence. According to Bryman (2012), especially multiple-case studies are considered to be important to understand causality.

While a case can be comprehensively described and shown in a single-case study, this is not feasible with multiple-case studies as the text would balloon and the theory would be lost. Hence, the researcher has to pay attention to the volume of the written and convey the emergent theory as well as the empirical evidence to support the theory at the same time. One way to do this is to develop the theory in single sections that are connected, where each section is based on evidence. Each part of the theory is supported by evidence of several cases. As it is not constructive to support each theoretical proposition with every case in the written text, tables summarising the evidence from the cases can be used to prove the depth and also the detail of the empirical grounding (Eisenhardt and Graebner, 2007).

For this research project, a multiple-case design is superior to a single-case design as it alone provides reliable information, while supporting the development of theory. This is pertinent to this research project because rich information is required for the insights that are needed for the generation of a theory. It is analysed that the information gathered in a single-case design would not be sufficient to build this theory. Moreover, more than one case needs to be considered to create a reliable theory that has validity and reliability for a market and not only for a single company. This research does not focus on a single MNO but on the entirety of MNOs as necessary to advancing valid and reliable theory for MNOs in general. Evidence from multiple-case design is more robust, which is relevant if a strong theory shall be built. The theory shall generally be for MNOs and have practical relevance. Hence, the evidence has to be robust for a strong theory, which can be realised using a multiple-case design. To be able to realise the benefits of a multiple-case design, cases are added until theoretical saturation is reached.

In order to get rich and deep information from the multiple cases and as more than one source of information exists per case that can add value to the research, an embedded approach is followed. This provides the opportunity to get information and understanding from different sources on the same case and therefore the risk is minimised of getting incomplete or biased data. Reliable data for the single cases can be attained. In this work an embedded multiple-case approach is adopted.

In light of the findings of the single cases in the multiple-case design a cross-case analysis is performed to get from the theoretical insights on the single case level to a higher level of abstraction (compare subsection 3.4.3).

3.3.2.4 Design of the Cases

As stated above a multiple-case approach is chosen for the research. In focus are four cases with differing contexts. The approach is embedded as several sources of information per case are integrated.

<u>Theory and research aim</u>

The aim is to provide a framework within which MNOs are guided to innovate their business model for organisational sustainability by exploring key aspects based on the contextualised 'Innovation Landscape Map' of Pisano and by developing an industry-specific, new transition model grounded on the same.

<u>Research questions and related interview questions</u>

<u>RQ1</u>: How can the contemporary situation in the telecommunication market for MNOs be described and how and why do BI, Big Data and software robotics have an impact on MNOs?

Interview questions for RQ1:

- How can MNOs' current situation be described and which are MNOs' biggest economic challenges?

- How will MNOs react and develop regarding trends, like digitalisation, increasing data traffic, IoT and M2M, and regarding drivers, like Big Data?
- How can BI and Big Data support MNOs regarding profitability and future growth?
- How are BI and Big Data currently used at MNOs?
- What influence can software robotics have on MNOs?
- How can software robotics support MNOs regarding profitability and future growth?

RQ2: How and why does innovation impact MNOs' future development and what is the implication of Pisano's 'Innovation Landscape Map' on MNOs?

Interview questions for RQ2:

- Which new technologies have a high priority for MNOs and why?
- How important is innovation and especially radical innovation for MNOs' future development and why?
- Which innovation dimensions besides routine innovation are the most relevant and influential ones for MNOs and why?
- Which innovation dimensions are crucial for MNOs' future regarding development and growth and why?
- How does business model innovation influence MNOs?
- How does business model innovation influence MNOs' development and growth?

RQ3: What could a future MNO business model look like and how and why will BI, Big Data and software robotics have an impact on it?

Interview questions for RQ3:

- How could a future MNO business model look like and what components could it consist of?
- What could be the core service of MNOs in future?
- How could MNOs adapt their business models in order to face (future) trends and demands of customers?

- What are the shortcomings of current MNO business models that have to be overcome for their further development and what parts of current MNO business models should still be applied in the future?
- What role will BI and Big Data play in MNOs' future business models?
- What role will software robotics play in MNOs' future business models?

RQ4: What could a future telecommunication ecosystem look like and how and why will software robotics have an impact on it?

Interview questions for RQ4:

- How could a future telecommunication ecosystem look like?
- Which components could a future telecommunication ecosystem consist of?
- What of today's telecommunication ecosystem will possibly not exist any longer in the future and what will possibly still exist in future?
- Which companies (up- and down-stream) are expected to be still part of the ecosystem?
- Which role will software robotics play for MNOs in a new ecosystem?
- Which role will software robotics play in a new ecosystem in general?

A comprehensive overview of the relation of research questions and interview questions is offered in chapter 4.

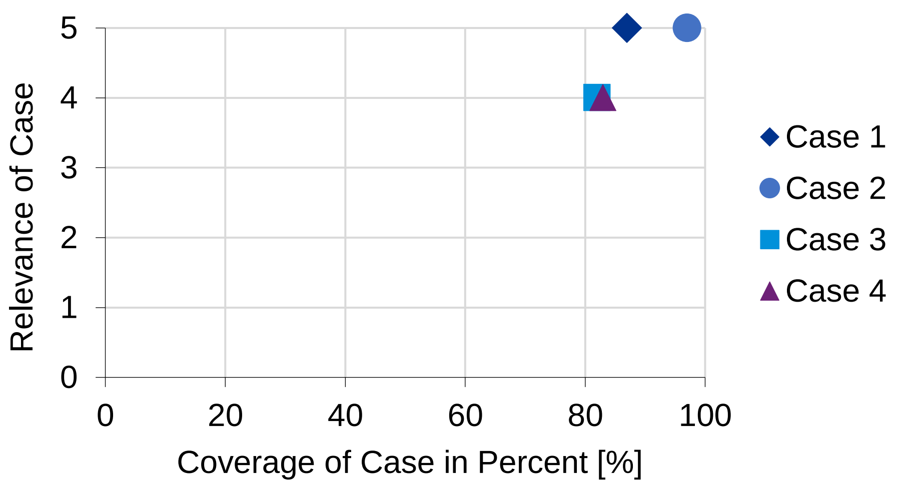
Cases

- Case 1: MNOs with international focus or national subsidiary of a MNO with international focus
- Case 2: Consulting companies with specialisation in MNOs and Intelligent Automation and / or RPA
- Case 3: Intelligent Automation providers with specialisation in MNOs
- Case 4: RPA providers with specialisation in MNOs

These four cases are selected to enable research that is as complete as possible. Every single case is connected to MNOs as a basis for the research. In Case 1 MNOs are in focus, which includes the companies' strategy on BMI, Big Data, BI, RPA and Intelligent Automation, to get a sound understanding of their point of view and expectations. Case 2 covers consulting companies and other external parties that have a strong connection to MNOs and provide external information from their point of view concerning the combination of software robotics with Big Data and BI in the light of BMI for MNOs. In Cases 3 and 4 the focus is on Intelligent Automation and RPA providers that cover the technologies they offer their clients but also have a strong connection to MNOs. In both cases the connection of software robotics and Big Data as well as BI and their respective influence on MNOs are examined in detail. The commonalities of the four cases enable their comparison.

Each case covers other aspects and views necessary to the research at different depths to enable a detailed and valuable analysis. It has to be taken into account that not all four cases are considered to be equally suitable to answering all research questions and all interview questions in the same detail and from the same perspective. Cases 1 and 2 are regarded as more relevant than the others to answer the research questions as interviewees from both cases are professionally not only concerned with MNOs but also with software robotics. Moreover, their answers are expected to be better informed than those of Cases 3 and 4, which are nevertheless reliable as informed by knowledge of MNOs and software robotics. Case 3 is believed to be less relevant than Cases 1 and 2 to the information that will be gained. It is thought that Intelligent Automation providers are highly proficient in the capabilities of their technologies and also MNOs. A further consideration is that they are not expert in and do not cover certain topics, like BMI at MNOs and future telecommunication ecosystems, to the same degree as MNOs and consulting companies. Although RPA as technology is not as comprehensive and advanced and does not provide as many possibilities as Intelligent Automation, the interviewees of RPA providers are not only knowledgeable in RPA but also Intelligent Automation, as this is partially included in their software. Therefore, it is believed that their relevance is the same as that of Case 3. Overall, Cases 3 and 4 are expected to be less informative than Cases 1 and 2 as the interviewees are professionally not mainly concerned with MNOs but with software robotics as a product they offer. Hence it is expected that their answers are not as well grounded as those of Cases 1 and 2 concerning MNOs. However, although the knowledge of Cases 3 and 4 is expected to be inferior to that of Cases 1 and 2 concerning MNOs, it is nevertheless believed to be very good and directly relevant to this research. Concerning Intelligent Automation and RPA it is expected that they have the highest possible knowledge concerning the technology and its capabilities. Summarising, figure 21 gives an overview of the relevance (the higher the number, the higher the relevance) as well as the coverage (the higher the percentage, the higher the coverage of interview questions) of each case according to the interviews conducted, showing that Cases 1 and 2 are more significant for this research project than Cases 3 and 4. Nevertheless, all cases are regarded as pertinent, informative and important, and are required for an comprehensive understanding and a high quality outcome of the research. Despite the differences in the coverage of the interview questions of the single cases, all cases were able to answer all research questions on their own.

Figure 21: Overview of Importance and Coverage of Interview Questions per Case



Unit of analysis

As no general and binding definition of the term ‘unit of analysis’ is available, each of the four cases is covered by several interviewees who are regarded as representative of their organisation. It is believed that these knowledgeable staffs possess the knowledge of employees of the same company or those in the same professional field.

3.3.2.5 Strengths and Weaknesses

In this subsection selected strengths and weaknesses, challenges and limitations of case study are discussed and evaluated for this research.

The following strengths are associated with case study and realised in this research:

- Case studies are capable of generating a novel theory. This was enabled by reconciling evidence across cases as well as between cases. Also, comparison with reliable findings in the literature was fostered in accordance with Eisenhardt (1989).
- The generation of theory with less bias of the researcher than with incremental studies was enabled by following defined procedure as well as ethics and standards, while documenting the data generation and evaluation in accordance with Eisenhardt (1989).
- The theory resulting from this research is highly likely to be reliable as its process is so closely tied to evidence as the generated theory is refined and confirmed through iteration that it is very likely that empirical observations are consistent with the emergent theory in conformity with Eisenhardt (1989).
- This research focuses on a topic that has not been covered in the same detail or with the same focus in the past and is therefore considered to be independent of pre-existing literature or former empirical observation. Case study is appropriate to new research areas where existing theory is considered inadequate in conformity with Eisenhardt (1989).

- Overlapping of data analysis and collection was fostered in this research, which enabled the researcher to adapt the data collection process when new opportunities arose in accordance with Eisenhardt (1989).
- In this research contexts as well as respective causes and effects were considered in gathering and analysing data as well as generating findings in conformity with Cohen, Manion and Morrison (2007).

Besides the listed strengths weaknesses, challenges and limitations to case study are to be acknowledged. Some are here listed, including the way the author dealt with them in hope of their elimination and minimisation, while trying not to affect the integrity of the research findings:

- Empirical evidence can cause overly complex theory if it is used too intensely. The author focused strongly on the predefined topics and stayed within the frame of the four defined cases. The rich data that do not add value to this research nor provide important insight into the research project were not added to theory. In this way, a richly detailed theory with too great a complexity concerning the overall perspective was omitted, while keeping a certain parsimony in mind in conformity with Eisenhardt (1989).
- The research focused on MNOs which operate all over the world, in combination with software robotics as well as BI and Big Data, so that the theory is neither too narrow nor idiosyncratic in accordance with Eisenhardt (1989).
- To cope with the challenge of reviewers misunderstanding the used method or regarding other methods as superior the case study is described in detail. The advantages of case study are explained to demonstrate its application to this research in conformity with Eisenhardt and Graebner (2007).

  Objectivity is sought in this research conducting the four cases examined. In each case several interviewees are asked to provide qualitative information. Because of this, the result is expected to be as objective as possible and to have no or only minimal bias. As qualitative research is not focused on hypothesis testing, no large scale is needed (Eisenhardt and Graebner, 2007).

- As this research focuses on theory building and not theory testing and therefore theoretical and not statistical sampling is required, no huge amount of participants is required in accordance with Eisenhardt and Graebner (2007).
- In order to cope with a potential lack in rigour, a detailed plan of how to gather the qualitative data was made, resulting in a systematic procedure of data gathering in accordance with Yin (2009). As multiple persons are interviewed and the interviews are recorded and transcribed, access to the data is always possible. Moreover, multiple data sources reduce the probability as well as the seriousness of a possible bias to a minimum.
- Statistical generalisation is no goal of this case study but analytic generalisation with more than one case is in conformity with Yin (2009). Case studies are generalisable to a "theoretical proposition and not to populations and universes. In this sense, the case study (…) does not represent a 'sample', and in doing a case study, your goal will be to expand and generalize theories (analytic generalization) and not to enumerate frequencies (statistical generalization)" (Yin, 2009, p. 15).

3.3.2.6 Role of the Researcher

Compared with other research methods the demands of a case study as well as an in-depth interview in terms of the intellect, ego and emotions of the researcher are far greater because the procedures of data collection are not standardised and routine (Yin, 2009). In accordance with Yin (2009) the researcher is well-trained and experienced in order to generate a high quality case study as the researcher is in continuous interaction with the data collected. When unexpected opportunities for further enquiry occurred, the researcher was able to use them and take an advantage of them. Moreover, the researcher was able to take sufficient care to not get biased. The researcher asked the appropriate questions and interpreted them, was a good listener, adaptive and flexible to take advantage of new situations and opportunities, has a firm grasp of the issue that is studied and is unbiased as well as sensitive and responsive in terms of contradictory evidence (Yin, 2009).

3.3.3 In-depth Interview as Research Instrument

3.3.3.1 Definition

Interviews are regarded as helpful in generating rich data for a case study (Bryman, 2012). They are most closely associated with interpretivist research and the "ontological position suggests that people's knowledge, views, understandings, interpretations, experiences, and interaction are meaningful properties of the social reality" under investigation (Mason, 2002, p. 63). Mason (2002) suggests that an in-depth interview is an interactional dialogue, an informal style (relatively), a topic-centred approach and the belief in contextual knowledge. Lewis-Beck, Bryman and Liao (2004) add that semi-structured interviews are relatively open, flexible and interactive. They are intended to provide the participants' perspectives, experience, perceptions, interpretations and understandings.

The participants "can include organizational actors from different hierarchical levels, functional areas, groups, and geographies, as well as actors from other relevant organizations and outside observers such as market analysts" (Eisenhardt and Graebner, 2007, p. 28).

In in-depth interview the researcher is the main research instrument (Granot, Brashear and Motta, 2012). In this role the interviewer can be a smart, adaptable and a flexible instrument and respond to arising situations with the required skill, tact and understanding (Seidman, 2006). During interviews it can be beneficial to listen more and talk less, ask follow-up and clarification questions and remain silent while the interviewee needs time to reflect (Granot, Brashear and Motta, 2012).

In-depth interview relies on multiple sources in order to provide a picture that is as complete as possible. Normally, these intense interviews are conducted with a small number of interviewees in order to explore their perspectives in detail. The sample of the interviewees is chosen to best represent diverse stakeholders and their opinions (Boyce and Neale, 2006). Patton (2002, p. 244) states that the “Sample size depends on what you want to know, the purpose of the inquiry, what’s at stake, what will be useful, what will have credibility, and what can be done with available time and resources. (…) In-depth information from a small number of people can be very valuable, especially if the cases are information rich. (…) the size of the sample depends on what you want to find out, why you want to find it out, how the findings will be used, and what resources (including time) you have for the study”.

According to Given (2008), in-depth interview is one of the most common data-collection methods in qualitative research and is characterised by participants that talk in detail about the topic the researcher is investigating, excluding questions that are predetermined, focused and lead to short answers. As the researcher has some control of the direction of the interview as well as its content and the interviewees are free and able to steer the interview in new directions, in-depth interviews are often also called semi-structured.

Bryman (2012) states that semi-structured interview focuses more on interviewees’ perspectives and shows a greater interest in their point of view than structured interviews. Access to what interviewees regard as important and relevant is provided. It is flexible and especially fitting if rich and detailed answers are sought.

Lewis-Beck, Bryman and Liao (2004) state that another characteristic of semi-structured interviews is their flexible and fluid structure. Given (2008) adds that no extensive list of questions needs to be prepared but the researcher must know the major domains that are to be discussed by the interviewee and be able to test how these domains refer to the investigation topic. Nevertheless, the researcher prepares several open-ended questions. Semi-structured interviews are focused on the topic that is researched, the interviewees’ experience and the investigator’s testing of this experience by asking appropriate questions.

By contrast, in structured interviews participants answer a list of predetermined questions. In unstructured interviews no such questions are used. Given (2008) and Lewis-Beck, Bryman and Liao (2004) state that before a semi-structured interview begins, the researcher should prepare an interview guide that is specific to the research topic and contains the relevant questions or the topics to be focused on. The researcher may but is not obliged to follow this guide and may move forwards or backwards depending on responses. To ensure validity of the research, leading questions have to be avoided.

In-depth interviews are selected as research instrument for this research for several reasons. As a case study research is conducted, rich and deep information and data are required, which are enabled in in-depth interview. A close association with the interpretivist research approach is given, while the interviewees' knowledge, understanding, points of view, interpretation and experience are crucial inputs. To get the required information, an open and flexible dialogue in a relatively informal style regarding a predefined topic is required. This is also characteristic of in-depth interview. The inclusion of organisational participants from differing hierarchical levels and with different functions, as well as the inclusion of externals, such as consultants, is enabled by this research instrument. Furthermore, the interviewer has the possibility to react skilfully, tactfully and with understanding, while at the same time being able to ask follow-up questions for more information and for clarification. Also, the inclusion of multiple sources of information for the provision of a picture as complete as possible is an advantage of in-depth interview. Additionally, rich and valuable insights into the perspectives of interviewees are enabled, which is a requirement for this work. Given these findings, in-depth interview is regarded as the best choice of research instrument for this research.

3.3.3.2 Strengths and Weaknesses

In this subsection, selected strengths and weaknesses, challenges and limitations of in-depth interview are discussed and evaluated for this research.

The following strengths are associated with in-depth interviews and realised in this research:

+ Semi-structured interview was used as it provides in-depth information without anticipation of results, unlike structured and unstructured interview (Given, 2008), and as it offers richer information than other data collection methods, e.g. surveys (Boyce and Neale, 2006), which is most valuable for the generation of a resilient theory.
+ Its advantage to gather rich data in a highly efficient way was also used for this research in conformity with Eisenhardt and Graebner (2007).
+ Adhering to ethical standards and not influencing interviewees in an improper manner are requirements for ethical research. This was realised in conducted in-depth interviews, which are considered to be more ethical than other kinds of interview in accordance with Lewis-Beck, Bryman and Liao (2004).
+ Sticking as closely as possible to data and insights generated by each case enabled completeness of understanding of each case without standardisation of data across cases in conformity with Lewis-Beck, Bryman and Liao (2004).
+ The author created a pleasant atmosphere during the interview and conducted the interview at the time that best suited the interviewees to make them feel more comfortable than is usual with other research methods, e.g. surveys, in accordance with Boyce and Neale (2006).
+ The rich information gained from the interviewees were used for the generation of a more detailed and holistic understanding of the research topic in conformity with Granot, Brashear and Motta (2012).

Some weaknesses are here listed, including the way the author dealt with them in hope of their elimination and minimisation, while trying not to affect the integrity of the research findings:

- Interviewers should be appropriately trained to conduct interviews. In his job as consultant the researcher regularly conducted interviews. Although these had a different scope, the researcher used what he has learned for the interviews in this research. The researcher trained for these interviews in the pilot study conducted before the actual data collection. Open questions were asked and leading questions avoided. This was done in accordance with Boyce and Neale (2006).

- Interviews provide only a limited opportunity for interpretation by the investigator as in recalling an experience no replication of an actual observation or provision of information concerning intentions or motive is enabled. (Given, 2008).

  Within the scope of the interviews only limited replication of experience was expected and required as the research is predominantly focused on the future.

- Due to the researcher's experience in conducting interviews the articulation of experience as well as the ability to ask the right questions to foster more detailed discussion were not limited in accordance with Given (2008).
- In the interviews, the points of view of different people were investigated. The research is about an economic topic, so no very personal and sensitive questions were asked. There was no close personal relationship between the researcher and the interviewees in conformity with Lewis-Beck, Bryman and Liao. (2004).
- In accordance with Eisenhardt and Graebner (2007) the interviewer limited bias by interviewing various highly knowledgeable persons with diverse perspectives
- The researcher is aware that interviews can be time-consuming and therefore made a detailed plan to provide an overview and estimation of the time needed to conduct, transcribe and analyse the interviews in conformity with Boyce and Neale (2006). As the research was limited in time, a clear timeframe was given, which the researcher sticked to.
- As this research focuses on theory building and not theory testing, theoretical sampling with a small sample and not statistical or random sampling is relevant in accordance with Eisenhardt and Graebner (2007).

3.4 Research Design

In this section the data collection procedure that is followed to acquire the necessary information is outlined. A view on the validity, reliability and assurance of those is stated. A description of the data analysis that follows the data gathering in an iterative process is then presented as well as an explanation of the pilot study conducted before the data collection process began.

3.4.1 Data Collection Procedure

Participant profile

Several interviews were planned per case and candidate interviewees identified using personal contact, contacts of contacts and literature. Only experts in the researched areas and highly knowledgeable persons with a proven record in the fields of this research were chosen and invited to participate. The increasing theoretical saturation could be seen from interview to interview not only between the single interviews but also between the single cases by comparing the newly gained information with the information gained from previous interviews. Saturation increased over the number of interviews conducted and when it reached its peak, no further interviews were added because additional responses from interviewees were not regarded as contributing to evidence of the research.

Participant contact

In each case possible interviewees were identified and contacted by e-mail or phone. As several interviews per case were to be conducted, in a first step four possible interviewees per case were contacted, because the interviewer expected that 25% - 50% of the recipients would decline to take part in the research. After the decline rate per case for the first invitations was known, further candidates, identified before, were contacted and invited. This procedure was repeated for each case until theoretical saturation for each case was reached. The selected participants did not have a personal relationship to the interviewer but were partially known due to previous or current work for the author's employers.

Participant profiles

MNO Case Interview 1: Senior Innovation Manager: The Senior Innovation Manager works at a leading global MNO which exists for over 25 years in its current form and employs over 200,000 people. The interviewee has over seven years of experience in the telecommunication sector and over three years in software robotics. This person was selected due to high engagement in innovation at MNOs, including software robotics and further areas.

MNO Case Interview 2: Project Manager: The second interviewee of the MNO case works at a leading international MNO that is over 25 years in operation and has more than 200,000 employees. The interviewee was chosen due to the high engagement in innovation topics, such as software robotics including implementation of these technologies, at MNOs and having over seven years of experience in telecommunication and over four years in software robotics.

MNO Case Interview 3: Director: The Director is employed at a leading global MNO that exists for over 95 years and employs more than 100,000 people. The interviewee was chosen due to its experience in telecommunication, which is over 13 years, and also due to over two years of deep experience in software robotics. The interviewee is also responsible for corporate strategy.

Consulting Company Case Interview 1: Manager: The Manager works at a management consulting company focusing on Germany that is over five years in operation with more than ten employees and has a strong record in introducing software robotics to companies. The interviewee has more than three years of experience in telecommunication and software robotics. Due to many software robotics projects at diverse MNOs and formerly working for a MNO, the interviewee is deeply knowledgeable in both areas and was therefore selected.

Consulting Company Case Interview 2: Senior Manager: The second interviewee is employed at a leading management consulting company with global focus that is in operation for over 30 years. The company employs more than 200,000 people. The Senior Manager has more than ten years of experience in the telecommunication sector and more than four years in software robotics. This long experience with MNOs and the management of diverse software robotic projects at MNOs qualified this person for the interview.

Consulting Company Case Interview 3: Partner: The Partner is employed at a globally working management consulting company which is among the leaders in its field, employs more than 200,000 people and is in operation for over 30 years. The interviewee provides more than 20 years of experience in the telecommunication sector as well as in software robotics. The interviewee was chosen due to outstanding experience and knowledge about MNOs and software robotics.

Consulting Company Case Interview 4: Partner: The fourth interviewee also works at an internationally leading management consulting company with over 30 years in operation. The company has more than 250,000 employees. The Partner has more than eight years of experience in the telecommunication sector and more than four years in software robotics. The interviewee was chosen due to the long experience with MNOs and the conduction of diverse software robotics projects.

Intelligent Automation Provider Case Interview 1: Partner Manager: The Partner Manager works at one of the biggest cloud computing and web service providers with a global focus that is in operation for over ten years and employs more than 10,000 people. As Partner Manager the interviewee is mainly focused on software robotics, with more than five years of experience. The long experience with software robotics and respective application areas independent of a predefined industry made the researcher choose this interviewee.

Intelligent Automation Provider Case Interview 2: Client Executive: The Client Executive is employed at a globally working renowned IT and consulting company existing for over 100 years and employing more than 350,000 people. The interviewee’s experience with the telecommunication sector lasts over 20 years and the experience with software robotics over four years. This outstanding experience in the telecommunication market in combination with software robotics experience has made the interviewee the ideal candidate.

Intelligent Automation Provider Case Interview 3: Lead Architect: The third interviewee works at a leading IT and consulting company with global focus, employing over 350,000 people and being in operation for over 100 years. As Lead Architect the interviewee gathered over three years of experience with MNOs and over six years with software robotics. Especially the deep knowledge about intelligent automation made this person an invaluable interviewee.

RPA Provider Case Interview 1: Senior Manager: The Senior Manager works at an international RPA software provider which is one of the four market leaders with over 2,000 employees and over 15 years in operation. The interviewee has over six years of relevant experience in the telecommunication market and over eight years of experience in software robotics. This person was chosen due to deep knowledge in the telecommunication sector and even deeper knowledge in software robotics.

RPA Provider Case Interview 2: Sales Executive: The second interviewee also works at an international RPA software provider that in turn is one of the four market leaders, too. The company has over 2,000 employees and exists for over ten years. The Sales Executive gathered over 20 years of experience in the telecommunication area and over four years in software robotics. The outstanding knowledge of the telecommunication market in combination with software robotics knowledge made the interviewee an ideal candidate.

RPA Provider Case Interview 3: Director: The Director is employed at one of the four leading RPA software providers with global focus, over 500 employees and over 15 years in operation. The interviewee was selected because of over four years of experience in the telecommunication area and over six years of experience in software robotics.

Interview process

The interviews were planned to last 35 to 45 minutes to address the research topics, of which each has several respective interview questions, and were conducted as one-to-one interviews. The researcher focused on the central questions but varied in the questions as new opportunities occurred or important topics needed further discussion. Thus, the flexibility needed to get further information was sustained and used if necessary and possible. The interviews began with a short introduction of the interviewer and the research topic. The researcher then stated why the interviewee had been chosen to be part of the research. The expected duration of the interview was stated and the interviewees received the information that they might terminate the interview at any time and need not answer questions that they do not wish or are not at liberty to answer. They were asked to approve that the interviews be recorded and transcribed afterwards. They were also told that they might withdraw the given information at any time, meaning that the interview might not be used by the researcher and all gathered data would be deleted. The interviews were conducted in German as preferred by interviewees and translated into English by the researcher afterwards.

Time planning of interviews

A pilot study had been planned for May 2019 in order to identify potential changes that had to be made to the research questions and the interview procedure, as well as to test the suitability of the questions. Potential changes were expected to concern the planned interview time and questions. The changes were planned to be made directly after the pilot study had been conducted and analysed. After making the amendments, it was planned that the identified prospective interviewees were to be contacted in order to agree a time for interview. It was expected that their responses would be received within a month. The interview period was planned to last until end of August 2019.

Interview utilities and data security

All interviews but one were, for several reasons e.g. to save time and money, conducted on the telephone. For most people it is more convenient than a meeting in person and personal bias can be decreased or even excluded. Recording of interviews was made possible using special call recording software for mobile phones. In one case proximity made face-to-face interview convenient. This interview was also recorded using a special software for mobile phones. The recordings were then sent to cloud storage and separately saved on a flash drive. A notepad was used during the interviews.

3.4.2 Validity and Reliability

Four tests are commonly used to judge and prove the quality of qualitative research in social studies. These tests are also relevant to case studies as they are one form of qualitative research. Although ‘validity’ and ‘reliability’ are not the only terms used in qualitative research to judge and prove a research’s quality, they are widely used in science, e.g. by Yin (2009) as one of the most important scientists in social research focusing especially on case study research design and methods.

Construct validity is used to identify the correct operational measures concerning the concepts that are studied. It is argued that case study researchers can fail to develop a sufficiently operational set of measures. Judgements that are used in the data collection can be subjective. It is not granted that all interviewees understand the questions they are asked (Yin, 2009). In accordance with Yin (2009),to cope with these possible shortcomings, the researcher used several sources of evidence and establish a chain of evidence.

Internal validity in case studies is concerned with making inferences as case studies require them when events are not directly observed. Hence, based on interviews or other evidence the researcher will make an inference that a given event is the result of an earlier event. In this research internal validity is mainly reached through pattern matching, building of explanation and addressing rival explanations during the data analysis in conformity with Yin (2009). Hoepfl (1997) sees internal validity in naturalistic research as credibility. While conventional researchers postulate and test relationships, the naturalistic researcher acknowledges multiple realities and tries to represent them adequately. In accordance with Wong (2014) internal validity was ensured by probing during the interview and good listening skills for in-depth analyses.

External validity is “defining the domain to which a study’s findings can be generalized” (Yin, 2009, p. 40) and concerns the overall problem to know if the findings of a study can be generalised beyond the case study. Critics of case study argue that single cases do not offer a profound basis for generalisation. Case study research relies on analytic generalisation, where the researcher tries to generalise the results of his study to a broader theory. In accordance with Yin (2009) the likeliness that results are accepted is higher for multiple-case studies than for single-case studies as support for findings and theory is provided through direct replication, which is the case with this research project. ‘Transferability’ is the term used by Hoepfl (1997) for external validity in qualitative research. In naturalistic research, transferability means the degree of similarity between the research situation and the situation to which the transfer is to be made. As the researcher cannot define the transferability of the findings to new situations, he will provide sufficient data so that readers of the research can decide if the findings are useful and applicable to the new situation. In this research the author made information that is as detailed as possible available in conformity with Hoepfl (1997)

<u>Reliability</u> requires that the study can be repeated by another researcher and the repetition leads to the same results. Minimising error and bias may, in small measure, assist duplicability and repetition. To achieve reliability of the research the author documented the procedures that were followed in the case study using a case study protocol for documentation in conformity with Hoepfl (1997). In fact the case study protocol is important to a study’s repetition. (Yin, 2009). A case study database was also used to help in coping with this shortcoming. The reliability issue was further addressed by making the research as understandable as possible and always bearing in mind anyone trying to replicate the research only by using the documented information and instructions in accordance with Yin (2009). Therefore, a detailed description of the philosophical approach, the research approach, the research method and the research design is made available to enable replication of the study. Hoepfl (1997) refers to this test as dependability concerning qualitative research. It grants stable measurements over time and within a certain time period. An inquiry audit can be used to examine the research process as well as its product to ensure consistency.

Besides the four tests stated by Yin (2009), Hoepfl (1997) adds an additional criterion to judge and prove the quality of qualitative research, namely confirmability. While conventional research, which focuses mainly on quantitative measures, is relatively value-free and objective, qualitative research relies on interpretation, is value-bound and subjective. However, some researchers argue that subjectivity is not the correct term and neutrality would be better fitting as it focuses on findings and neutral researchers try to be non-judgemental and to report findings in a balanced way. To prove neutrality the author makes raw data available through the transcribed interviews as suggested by Hoepfl (1997).

3.4.3 Data Analysis

According to Wong (2014), the basis for theory building is formed by analysing collected data, through which prior theory can be confirmed or disconfirmed.

For analysis of qualitative data no guidelines are established, unlike quantitative data (Eisenhardt, 1989; Wong, 2014). Eisenhardt (1989, p. 539) also states that "Analyzing data is the heart of building theory from case studies". In accordance with Eisenhardt (1989) within-case analysis as a key step that supports the researcher in coping with a huge amount of data was used. Through within-case analysis a close familiarity with each single case was built. In this way, it was possible to identify the patterns that each case discloses before a generalisation of patterns across the cases was considered. Moreover, cross-case analysis was accelerated by gaining familiarity with each single case and started after within-case analyses in order to search for patterns, while looking at the gathered data in different ways. Eisenhardt (1989) lists three tactics for good cross-case comparison that were used in this research: (I) selection of categories and looking for within-group similarities and differences; (II) selection of pairs of cases and listing similarities and differences between the single pairs; (III) division of data by data source. Because of these cross-case tactics the researcher did not rely on first impressions and was able to go beyond them by using structured and diverse ways of looking at the data. The advantage is that the likelihood of a reliable theory that fits closely with the data is increased. Moreover, the probability of capturing "novel findings which may exist in the data" is increased (Eisenhardt, 1989, p. 541). As data collection and the respective analysis overlapped in this research, it was possible to use new information from the analysis for the next data collection and make adjustments in conformity with Eisenhardt (1989).

To analyse qualitative data coding is essential, or in other words: “Coding is analysis” (Miles and Huberman, 1994, p. 56). As stated above, analysis is review of a set of fieldnotes, in this research transcribed interviews, but also their significant subdivision. During this subdivision, also called open coding, the relations between single parts, also called ‘bits’ or ‘chunks’, were kept intact. This means differentiation and combination of retrieved data and the reflection made about this information. Codes are tags and labels that were used to assign units of meaning to descriptive information gathered during the study. They were assigned to words, phrases and sentences and could be category labels. The words themselves were not the most important information but their meaning and significance in the given context are. The codes were needed to organise the words, phrases and sentences. These parts were categorised for easy access and were clustered in segments that refer to a research question or topic. The parts and categories of codes were compared and linked for a systematic analysis process (axial coding). Clustering and displaying condensed parts built the basis for the later drawing of conclusions in accordance with Miles and Huberman (1994).

Through cross-case analysis differences and similarities between cases could be explained. Through coding and clustering patterns could be identified in conformity with Wong (2014).

NVivo, software that supports qualitative data analysis and enables organisation and analysis of themes, was selected. The selection is based on the ability of NVivo to take notes and support the analysis of the conducted and transcribed expert interviews. NVivo supports the reliability of the research as access to the analysed data can be granted to everyone requiring it. Moreover, it supports replicability and traceability in the system and enables comparison of the various cases.

To ensure consistency between the emerging topics of the literature review and the data analysis a word frequency list for the literature review was created with the most common stemmed words for comparison with the word frequency list for all conducted interviews using NVivo. In this way, it could be seen if important topics are covered in the literature review as well as in the interviews. The lists are included in the appendix.

3.4.4 Pilot Study Adjustments

A pilot study was carried out to refine the data collection plans regarding the planned time as well as the procedures and questions. Its purpose was to support the researcher in developing relevant questions and – if necessary – provide conceptual clarification of the research design. A pilot case can provide additional information on the field of research. It will ensure and increase validity and reliability of the research. Therefore, a pilot study was conducted.

As a result of the pilot study the planned duration of the interviews was adjusted to 45-60 minutes. Another change was that a copy of the ILM was provided to the interviewees via e-mail before the interviews began. A further interview question was added, which was found to provide additional relevant input. Also, an interview question was split into two parts in order to be easier to understand and answer. The pilot study was conducted in July 2019.

3.5 Research Ethics

Research ethics help with the conduct of research if people are involved. They provide guidelines and rules for the researcher. Ethical concerns may occur during planning of the research, seeking access to participants, as well as during data collection, analysis, reporting and storage. Ethics may be interpreted as appropriateness of behaviour of the researcher in relation to the rights of the research subjects. They are moral principles and standards guiding moral choices (Saunders, Lewis and Thornhill, 2007). According to Saunders, Lewis, and Thornhill (2007), ethical issues that can arise during research can be clustered to particular research stages, such as research design, data collection, data processing and storage, as well as data analysis and reporting.

In these stages, key principles in research ethics have to be met. These are to avoid harm and stress, respecting dignity, ensure informed consent and voluntary participation, the right to withdraw partially or completely, protecting privacy, ensuring confidentiality, protecting anonymity, avoiding deception, avoiding conflict of interest, preserving honesty and transparency, avoiding false reporting of research findings, and ensuring data protection as well as protection of vulnerable groups (Allmark et al., 2009; Aluwihare-Samaranayake, 2012; Easterby-Smith, Thorpe and Jackson, 2008; Orb, Eisenhauer and Wynaden, 2001; Saunders, Lewis and Thornhill, 2007). USW's ethical framework, law and rules, such as the Data Protection Act, have to be followed.

This section aims to provide proof that this research complies with ethical standards as defined in the literature and by USW. Also, applicable law is considered. This research follows the principles mentioned above and is approved by USW's Research Committee of the Graduate Research Office, which provides ethical standard and guideline for research. The Research Committee was informed in advance so that it could intervene if anything in the research proposal did not meet USW's ethical standards.

As already indicated, no vulnerable people or group nor sensitive topic was part of this study. Stress was avoided by offering the interviewees a date and time for the interview that was most convenient to them and by not using pressure to get answers but by staying calm and giving them the required time for their answers. Also, it was intended to conduct a second interview if time ran out during the first, so that interviewees did not have to hurry in their answers. Embarrassment was not seen as an ethical issue as no personal or misleading questions were asked. Nor was anxiety regarded as a major issue. Confidentiality was ensured to all participants no matter whether they participated. The interviews were designed to avoid discomfort of the interviewees at any time as they were free to choose the date and time for the interviews and were offered all information they needed and wanted before the interviews started. Overall, the interviewees were given information when the researcher first contacted them to provide a first overview and information. Therefore, they knew about the research and its background, approximate duration, research topic and scope, interview process, nature of the research, and confidentiality before they agreed or disagreed to participation. In seeking their approval of the planned conditions and circumstances and their consent to participation, informed consent and voluntary participation was ensured. The avoidance of harm was targeted by not researching an emotionally intense topic. Enough time was planned for the interviews to be able to show the interviewees respect by honouring their free and voluntary decision to participate in the research as well as treating them with dignity and showing gratitude. The interviewees were told that they are allowed to interrupt or postpone the interview at any time without any negative consequence and without providing a reason. Moreover, it was repeatedly stated that interviewees might withdraw their given answers partially or completely at any time during and after the interview. There was no intention to gather private information due to the focus of this research and by not asking private questions. In case of revealed private information, it was not used in the research and made unrecognisable in the transcripts. From the first confidentiality to all participants as well as all prospective participants and not to share confidential data with other people was ensured. Therefore, not only were confidentiality and anonymity ensured when getting in contact with potential interviewees the first time but also at the beginning of the interview as well as when thanking them for their participation at the end or after the interview. Anonymity was further ensured by not showing the interviewees' names or initials in the transcribed interviews but only a 'R' for 'respondent'. Conflict of interest was avoided by not letting the research be influenced by third parties or making promises to interviewees in exchange for information or anything else. Honesty was ensured by remaining honest about the goals of the research, participants' contribution and the planned process. Objectivity was maintained by collecting data accurately and fully and making it available in anonymised form.

Potential ethical issues were addressed as stated above. Therefore, the research can be regarded as straightforward and ethically not problematic.

3.6 Conclusion

This chapter defines the approach that is followed to collect the data required to reach the research aim. From an epistemological point of view a subjectivist approach, namely the interpretivist one, is adopted. Also from an ontological perspective a subjectivist approach is followed. As theory will be generated in this research project and therefore a close understanding of the research context is required, an inductive research approach is chosen. As research method a qualitative approach, case study, is applied in a mono method setting. Case studies are conducted in an embedded multiple-case approach with four cases, namely MNOs, consulting companies, Intelligent Automation providers and RPA providers. The data are gathered in semi-structured, in-depth interviews conducted with experts. The data are analysed starting with within-case analyses followed by cross-case analyses. Overall, reliability and validity are ensured. Before data collection began, a pilot study was carried out in order to identify possible shortcomings and adjust the data collection process if necessary. The research focuses on potential ethical issues at all time.

The data collection is carried out before the gathered data are analysed and discussed in the next chapters.

4 Analysis

This chapter focuses on the analysis of the data that were gathered from the conducted expert interviews, which were clustered in four cases, namely MNOs, Consulting Companies, Intelligent Automation Providers and RPA Providers. All four cases cover the research topic to its full extent. The interviews were conducted in order to collect reliable data that answer the RQs.

In this chapter the data collection process is first summarised. Summary of the conducted interviews is then performed and main findings stated guided by identified themes.

Four topics were addressed during the in-depth expert interviews to be able to answer the corresponding RQs.

Market situation: contemporary situation of the telecommunication market including economic challenges and relevant technological drivers and trends

IQ1: How can MNOs' current situation be described and which are MNOs' biggest economic challenges?

IQ2: How will MNOs react and develop regarding trends, like digitalisation, increasing data traffic, IoT and M2M, and regarding drivers, like Big Data?

IQ3: How are BI and Big Data currently used at MNOs?

IQ4: How can BI and Big Data support MNOs regarding profitability and future growth?

IQ5: What influence can software robotics have on MNOs?

IQ6: How can software robotics support MNOs regarding profitability and future growth?

While the situation of the telecommunication market is mainly covered by journals (Al-Debei and Avison, 2011; Benhima et al., 2013; Bohlin, 2007; Changwei, 2012; Du Preez and Pistorius, 2002; Fernández and Usero, 2009; Kallio, Tinnilä and Tseng, 2006; Krämer and Wohlfarth, 2017; Weber, Haas and Scuka, 2011), conference papers (Balon and Liau, 2012;

Banović-Ćurguz and Ilišević, 2017; Becot et al., 2010; Chang and Tang, 2010; Frisanco, 2010; Wulf, Zernekow and Duser, 2010) and consulting companies (Deloitte, 2017b; EY, 2015; McKinsey & Company, 2017; Schön, Zimmermann and KVJ, 2011; Taga et al., 2010), other perspectives on this topic have also to be investigated to get a complete picture. Therefore, this topic had to be further addressed. MNOs' reaction with regard to trends and drivers is only casually covered by Banović-Ćurguz and Ilišević (2017), Benhima et al. (2013), Bohlin (2007), Changwei (2012), Cisco (2016), Deloitte (2017b), Du Preez and Pistorius (2002), EY (2015), Frisanco (2010), GSMA (2017), as well as GSMA Intelligence and CAICT (2016), meaning that its current implications are identified and not how MNOs can and will probably react. The same applies to economic challenges, which are covered by Al-Debei and Avison (2011), Balon and Liau (2012), Becot et al. (2010), Chang and Tang (2010), Du Preez and Pistorius (2002), European Commission (2013), EY (2015), Fernández and Usero (2009), Financier Worldwide (2014), GSMA Intelligence and CAICT (2016), Kallio, Tinnilä and Tseng (2006), Krämer and Wohlfarth (2017), McKinsey & Company (2017), Schön, Zimmermann and KVJ (2011), Statista (2016), Taga et al. (2010), Weber, Haas and Scuka (2011), Whitehead et al. (2011), and Wulf, Zernekow and Duser (2010). However, the intention was to get richer, more accurate and recent information by addressing this topic as part of the expert interviews. The influence of BI and Big Data as well as software robotics on profitability and growth is only partially covered, as many authors focus mainly on what these technologies can be used for internally (Almato, 2016; Azoff, 2017; GSMA, 2017; Guibao, Yubo and Jialiang, 2017; Kibria et al., 2017; KPMG, 2018b; strategy&, 2015; Sun Microsystems, 2005; Telefónica, 2018).

Innovation and ILM: innovation dimensions for development and growth

IQ7: Which new technologies have a high priority for MNOs and why?

IQ8: How important is innovation and especially radical innovation for MNOs' future development and why?

IQ9: Which innovation dimensions besides routine innovation are the most relevant and influential ones for MNOs and why?

IQ10: Which innovation dimensions are crucial for MNOs' future regarding development and growth and why?

IQ11: How does business model innovation influence MNOs?

IQ12: How does business model innovation influence MNOs' development and growth?

The topic of new technologies is covered by Brynjolfsson and McAfee (2014), Christensen (2002), Drucker (1985) and (1998), Krämer and Wohlfarth (2017), Pisano (2015), and Schön, Zimmermann and KVJ (2011). Their research can be regarded as a baseline, but does not provide information that is rich and deep enough for this research. A relationship between the innovation dimensions of the ILM and their meaning for MNOs could not be revealed, as Pisano (2015) mainly focuses on its general applicability and meaning, and not specifically for MNOs. Amit and Zott (2001) and (2012), Chesbrough (2010), Gambardella and McGahan (2010), Girotra and Netessine (2014), Lindgardt et al. (2009), Rouse (2015), as well as Zott and Amit (2007) provided the baseline for the influence BMI can have on companies, which should be made more specific for MNOs in interview.

Future MNO business model

IQ13: How could a future MNO business model look like and what components could it consist of?

IQ14: What could be the core service of MNOs in future?

IQ15: How could MNOs adapt their business models in order to face (future) trends and demands of customers?

IQ16: What are the shortcomings of current MNO business models that have to be overcome for their further development and what parts of current MNO business models should still be applied in the future?

IQ17: What role will BI and Big Data play in MNOs' future business models?

IQ18: What role will software robotics play in MNOs' future business models?

Al-Debei and Avison (2011), Deloitte (2017b), McKinsey & Company (2017), Schön, Zimmermann and KVJ (2011), and Zernekow and Duser (2010) cover the topic of future MNO business models only to a certain extent. What the main service of MNOs in a possible future telecommunication ecosystem could be is not covered sufficiently. Even if a possible future MNO business model is depicted in these papers, the way to reach the required state is not or only vaguely provided, meaning that current shortcomings that should be overcome and possible adaptions as well as further required parts of the current business models are not sufficiently stated. Moreover, the roles of BI and Big Data as well as of software robotics in MNOs' future business models are only thematised to a minor degree.

Future telecommunication ecosystem

IQ19: How could a future telecommunication ecosystem look like?

IQ20: Which components could a future telecommunication ecosystem consist of?

IQ21: What of today's telecommunication ecosystem will possibly not exist any longer in the future and what will possibly still exist in future?

IQ22: Which companies (up- and down-stream) are expected to be still part of the ecosystem?

IQ23: Which role will software robotics play for MNOs in a new ecosystem?

IQ24: Which role will software robotics play in a new ecosystem in general?

As with future MNO business models, the future telecommunication ecosystem is only covered to a certain extent, by GSMA (2017) and GSMA Intelligence and CAICT (2016). Nor is the topic of what of today's telecommunication ecosystem will possibly exist in the future and what will vanish covered to a sufficient extent for this research. Moreover, the role of software robotics in such an ecosystem is not yet covered. Therefore, it had to be included as part of the RQs, in order to be able to answer the overall research aim.

Table 5 provides an overview of the connection between RQs and interview questions.

Research Question	Interview Question
RQ1: How can the contemporary situation in the telecommunication market for MNOs be described and how and why do BI, Big Data and software robotics have an impact on MNOs?	**IQ1**: How can MNOs' current situation be described and which are MNOs' biggest economic challenges?
	IQ2: How will MNOs react and develop regarding trends, like digitalisation, increasing data traffic, IoT and M2M, and regarding drivers, like Big Data?
	IQ3: How can BI and Big Data support MNOs regarding profitability and future growth?
	IQ4: How are BI and Big Data currently used at MNOs?
	IQ5: What influence can software robotics have on MNOs?
	IQ6: How can software robotics support MNOs regarding profitability and future growth?
RQ2: How and why does innovation impact MNOs' future development and what is the implication of Pisano's 'Innovation Landscape Map' on MNOs?	**IQ7**: Which new technologies have a high priority for MNOs and why?
	IQ8: How important is innovation and especially radical innovation for MNOs' future development and why?
	IQ9: Which innovation dimensions besides routine innovation are the most relevant and influential ones for MNOs and why?
	IQ10: Which innovation dimensions are crucial for MNOs' future regarding development and growth and why?
	IQ11: How does business model innovation influence MNOs?
	IQ12:How does business model innovation influence MNOs' development and growth?
RQ3: What could a future MNO business model look like and how and why will BI, Big Data and software robotics have an impact on it?	**IQ13**: How could a future MNO business model look like and what components could it consist of?
	IQ14: What could be the core service of MNOs in future?
	IQ15: How could MNOs adapt their business models in order to face (future) trends and demands of customers?
	IQ16: What are the shortcomings of current MNO business models that have to be overcome for their further development and what parts of current MNO business models should still be applied in the future?
	IQ17: What role will BI and Big Data play in MNOs' future business models?
	IQ18: What role will software robotics play in MNOs' future business models?
RQ4: What could a future telecommunication ecosystem look like and how and why will software robotics have an impact on it?	**IQ19**: How could a future telecommunication ecosystem look like?
	IQ20: Which components could a future telecommunication ecosystem consist of?
	IQ21: What of today's telecommunication ecosystem will possibly not exist any longer in the future and what will possibly still exist in future?
	IQ22: Which companies (up- and down-stream) are expected to be still part of the ecosystem?
	IQ23: Which role will software robotics play for MNOs in a new ecosystem?
	IQ24: Which role will software robotics play in a new ecosystem in general?

Table 5: Overview of RQs and Interview Questions

4.1 Summary of the Data Collection Process

In July 2019 the pilot study took place. After minor adjustments to the expert interviews, the data collection process was carried out beginning in July 2019 over a period of seven months until January 2020. The transcriptions of the interviews were done from September 2019 until January 2020, in parallel to the interview process. At the same time, the interviews were translated.

A total of 13 interviews were conducted, where three interviews were conducted each with MNOs, Intelligent Automation providers and RPA providers. Only with consulting companies were four interviews conducted. All interviewees were selected according to their professional background, experience and knowledge. The experience during the interviews was that after three and four interviews per case theoretical saturation was reached as no new knowledge was gained. Therefore, the interview process was stopped. The average experience the interviewees have of MNOs and the telecommunication market was about 10 years, average experience of software robotics about six years. During the seven-month period of expert interview, more than 827 minutes (13,78 hours) of interview material were recorded. The shortest interview lasted 41 minutes, 25 seconds, while the longest took 1 hour, 59 minutes, 48 seconds. The average duration of the interviews was 63 minutes, 37 seconds.

The information received from the interviewees differed from case to case but also partially within the cases as the interviewees have different backgrounds and focus areas, despite their deep knowledge of telecommunication and / or software robotics. Identifying and convincing suitable interviewees from the consulting area was fairly easy, unlike interviewees from MNOs. One MNO interviewee was a direct contact known to the author, and to engage further prospective interviewees from MNOs, the author’s direct contacts helped by connecting the author to their suitable contacts. To find interview partners from RPA providers as well as Intelligent Automation providers, tier three and tier four contacts were needed, meaning that for tier 4 the contacts of contacts of contacts of direct contacts of the author were approached in order to find sufficiently knowledgeable experts. While the information received from MNOs was often based on the plans of their company and in-depth knowledge, the input received from consulting companies was based on their experience in serving various MNOs and on their general overview of the telecommunication and adjacent markets. RPA providers and Intelligent Automation providers also provided valuable input that was not only based on their understanding of their respective technologies but also on their broad and deep knowledge of the telecommunication market. In comparing the four cases it is seen by the author that consulting companies, RPA providers and Intelligent Automation providers are the least biased of all cases as they are not directly affected by the market. However, the interviewees from MNOs were understood to answer with only limited bias as they adopted an overarching perspective during interview.

Table 6 provides an overview of the meta data per interview by stating each interview’s case, indication of company, years of company existence, number of employees, position of respondent, years of experience of telecommunication and software robotics, reason for selection of the interviewee, as well as type, date and duration of the interview.

No.	Case	Company / institution	Years of existence (in current form)	Employees	Position of respondent	Years of experience in telecommunication	Years of experience in software robotics	Reason for selection	Type of interview	Date	Duration
1	MNOs	Leading global MNO	> 25	> 200.000	Senior Innovation Manager	> 7	> 3	Highly engaged in innovation topics, e.g. software robotics, at MNO	Telephone	19.09.2019	1h, 06min, 14s
2	MNOs	Leading global MNO	> 25	> 200.000	Project Manager	> 7	> 4	Highly engaged in innovation topics, e.g. software robotics, at MNO	Telephone	15.11.2019	58min, 42s
3	MNOs	Leading global MNO	> 95	> 100.000	Director	> 13	> 2	Long experience at MNO and responsible for corporate strategy.	Personal	26.09.2019	49min, 04s
4	Consulting Companies	Management consulting company with focus on Germany	> 5	> 10	Manager	> 3	> 3	Deep knowledge regarding MNOs as well as software robotics.	Telephone	19.08.2019	1h, 11min, 05s
5	Consulting Companies	Management consulting company with global focus	> 30	> 200.000	Senior Manager	> 10	> 4	Long experience with MNO as well as software robotics.	Telephone	03.07.2019	56min, 26s
6	Consulting Companies	Management consulting company with global focus	> 30	> 200.000	Partner	> 20	> 20	Outstanding knowledge and experience regarding MNOs and software robotics.	Telephone	17.09.2019	48min, 38s
7	Consulting Companies	Management consulting company with global focus	> 30	> 250.000	Partner	> 8	> 4	Multiple years of experience with MNOs as well as software robotics.	Telephone	08.11.2019	41min, 25s
8	Intelligent Automation Providers	Cloud computing and web service provider with global focus	> 10	> 10.000	Partner Manager	-	> 5	Great knowledge of software robotics and its application areas.	Telephone	05.12.2019	46min, 00s
9	Intelligent Automation Providers	IT & consulting company with global focus	> 100	> 350.000	Client Executive	> 20	> 4	Experienced in the telecommunication market as well as in software robotics.	Video conference	27.11.2019	1h, 28min, 52s
10	Intelligent Automation Providers	IT & consulting company with global focus	> 100	> 350.000	Lead Architect	> 3	> 6	Deep knowledge regarding intelligent automation.	Telephone	13.01.2020	55min, 00s
11	RPA Providers	RPA software provider with global focus	> 15	> 2.000	Senior Manager	> 6	> 8	Long experience with MNO and deep knowledge regarding software robotics.	Telephone	24.09.2019	1h, 59min, 48s
12	RPA Providers	RPA software provider with global focus	> 10	> 2.000	Sales Executive	> 20	> 4	Outstanding knowledge of telecommunication market and long software robotics experience.	Telephone	29.10.2019	59min, 59s
13	RPA Providers	RPA software provider with global focus	> 15	> 500	Director	> 4	> 6	Deep knowledge regarding RPA and experience with telecommunication market.	Telephone	17.10.2019	1h, 05min, 40s

Table 6: Interview Overview

To prove the quality of the research the following four tests are considered:
In order to ensure construct validity, multiple sources of information are used (four cases with a total of 13 expert interviews as well as corresponding literature) in accordance with Yin (2009).

Internal validity is reached through pattern matching using the defined codes and nodes as well as by building explanation by revision and refinement. Rival explanations are considered (Yin, 2009). It was further ensured by probing during the interview (Wong, 2014).

External validity is provided by adoption of a multiple-case study, which increases the likelihood of acceptance of results (Yin, 2009). The possibility of transference of findings to a new situation is increased by provision of rich and deep data - readers of the research can decide if the findings are useful and applicable to the respective new situation. This again increases external validity (Hoepfl, 1997) and is granted by making the interviews available upon request.

Reliability is increased by using a case study protocol for documentation. The issue of reliability is also addressed by having in mind that someone must be able to replicate the research in knowledge of the documented information and instructions and thus giving as much information as possible, e.g. detailed description of the philosophical approach, the research approach, the research method and the research design (Hoepfl, 1997; Yin, 2009).

4.2 Analysis of Interviews

In the following, the steps of the data analysis are described. The interviews, which were recorded with special software for smartphones, were transcribed using Microsoft Word. To distinguish interviewer and interviewee their initials were used for analysis and discussion reasons. The initials of the interviewee were later changed to ‘R’ for ‘Respondent’ to ensure anonymity. After an interview had been transcribed it was translated into English and uploaded to NVivo 12 for clustering and further analysis. The word-frequency list for the literature review was compared with that for all interviews using NVivo. Only the words ‘future’, ‘providers’, ‘time’ and ‘components’ were among the top topics of the interviews, but not among the top in the literature review (the lists are in the appendix).

The coding structure originally bases on the overall research aim. The research aim builds the foundation for the creation of the objectives that are to be achieved in this research. Based on the objectives research questions were defined, which were checked positively in terms of their validity in the literature review. In this way, research gaps were identified, which led to the definition of initial codes (stage one) building the baseline for analysing the transcribed expert interviews. Coding was done in a two-stage approach using NVivo. In the second stage, coding of the transcribed expert interviews was conducted. The relevant parts of the interviews were attached to labels that were previously identified. By coding the interviews, the initially defined coding structure of stage one was confirmed but it was realised that the coding structure had to be extended by creating new codes based on the information from the interviews. New codes identified during coding of the interviews were transferred for usage for all interviews. This was done until all interviews were coded. During the subsequent analysis, which was based on the codes defined in the two-stage approach and interview data, themes were developed. These themes address the RQs and thus also the gaps in literature. As these themes were developed before describing the in-depth interviews, the analysis of conducted interviews is structured according to the identified themes. Figure 22 shows the defined codes and themes.

Figure 22: Defined Themes and Codes

Technology
A1: 5G – technology & use cases
A2: Cloud
A3: Cyber security
A4: Data insights
A5: eSports
A6: Innovative services
A7: IoT
A8: Smart home, buildings and city
A9: Software robotics
A10: Infrastructure

Opportunities
B1: Customer centricity
B2: Globalisation
B3: M&A
B4: Mobile workforces
B5: Operational efficiency
B6: Partnering

Challenges & Constraints
C1: Business environment
C2: Changing customer needs
C3: Competition
C4: Corporate culture
C5: Data
C6: Innovation cycles
C7: Investment
C8: Market saturation
C9: Regulation
C10: Resources
C11: Training
C12: Security

Innovation
D1: Coinnovation
D2: Business model innovation
D3: Innovation dimensions

Ecosystem
E1: Future telco ecosystem
E2: Non-applicable parts
E3: Applicable parts
E4: Changes in landscape

<u>Technology</u>

Regarding 5G's technology and uses cases (A1), literature and interview data were relatively similar with the difference that only literature focused on VR and AR. Cloud (A2) as well as smart home, buildings and cities (A8) were not identified as relevant topics by interviewees but by literature. This was unexpected to the author, who expected cloud and smart services to be more popular with interviewees as these topics get much attention in literature and in MNOs' daily business. Regarding cloud technology, the literature covered diverse aspects such as streaming, cloud infrastructure and network virtualisation. If it comes to smart home, buildings and cities services were in focus as well as low-carbon future in terms of traffic management, urban lightning and parking. Cyber-security (A3) was covered by both sources similarly, which is also true for eSports (A5) and IoT (A7). Data insights (A4) was covered much stronger and with more diverse views about possibilities it provides by interviewees. Those possibilities revolve around forecasting, binding customers, cost reduction, pattern recognition and data-driven business. Also advantages in combination with software robotics were a major issue. This was expected by the research as the people chosen for the interviews are professionally focusing on technology, which is often closely related to data insights. Innovative services (A6) are covered in literature and by interviews in great detail, but interviewees came up with topics literature does not cover, such as provision of software robotics components, logistics and building specialist departments for realising trends. Software robotics (A9) is covered by both parties. However, the interviewees covered much more aspects of the respective technologies. Among these aspects are analytics, decision making, cost reduction, process quality, automation, but also resources and advantages in combination with BI and Big Data. This was not unexpected as the interviewees focus strongly on these technologies in their daily work. Infrastructure (A10) as a relevant technology is only covered by interviewees in a detailed and diversified way. Interviewees focused on infrastructure provision, smart pipes, network slicing, data connection and new data transmission possibilities.

Opportunities

While customer centricity (B1) was of less importance in literature, it was highly important for interviewees focusing on many more aspects of it, such as making customers the centre of actions, individualised customer approaches and support as well as customer well-being. While the great coverage in interviews was expected, the low coverage in literature was unexpected by the researcher as most MNOs make customers their centre of actions. In contrast, globalisation (B2) and mobile workforces (B4) including remote working only played a minor role for interviewees, while being important in literature. As due to COVID remote working spread to an increasing number of employers and employees, the author expected this topic to be covered by interviewees. The topic M&A (B3) is covered by both parties in a similar way. Operational efficiency (B5) was similar to both but interviewees focused on the advantages a combination of software robotics with BI and Big Data can provide, which was expected as they are professionally concerned with these technologies. Regarding partnering (B6), literature focuses only on selected aspects, while interviewees provide a much more complex and complete picture including partnerships with infrastructure providers, other MNOs, service providers, data companies, institutions, hardware manufacturers and specialised service providers besides start-ups. This was unexpected to the researcher who expected that partnership would be much stronger covered in literature.

Challenges & Constraints

Literature and interviewees covered the topics business environment (C1), competition (C3), culture (C4), investment (C7), market saturation (C8), regulation (C9) and trainings (C11) equally comprehensive. While literature identified data (C5), with huge amounts of fragmented, unstructured and unused data, and innovation cycles (C6) including rapid evolution of technology and poor rates of innovation as challenges, these were not covered as challenges by interviewees but as opportunities that support MNOs. In contrast, interviewees identified more aspects to challenges with resources (C10) than literature, such as thinking outside the box, efficient networking and optimal effectiveness and efficiency. Changing customer needs (C2) consisting of issues around customer acquisition, support, loyalty and contact, were much stronger covered by interviewees than by literature. This was unexpected by the author, who expected that literature would cover this topic at least to the same extent as the interviewees. Security (C12), excluding data protection, was only covered by interviewees. They focused on attacks on networks in a direct as well as indirect way, such as power shortages.

Innovation

Regarding innovation both, literature and interviewees, covered comparable aspects because for innovation much general information is available in literature and MNO-specific parts were added by interviewees. Mainly covered by interviewees was cocreation and coinnovation (D1). The same codes were used for BMI (D2) and innovation dimensions (D3), although the specific information was added by interviewees.

Ecosystem

As the literature does not provide information on a future telecommunication ecosystem, the codes had to be developed completely based on interview data. Therefore, codes for the look of a future telecommunication ecosystem (E1), non-applicable parts (E2) as well as applicable parts (E3) of the current ecosystem for a future one and potential changes in the landscape (E4) had to be added. It was unexpected by the researcher that the potential look of a future telecommunication ecosystem was not covered in literature including relevant parts and possible changes in the landscape.

In the following subsections, the single interviews are summarised and important statements are cited. The identified themes from the analysis were used as a guiding structure. The author's opinion is not part of this analysis and only the input provided by the interviewees is stated to reduce bias.

What interviewees said about the themes 'technology' and 'opportunities' is relevant for all four RQs. Interviewees' opinion on challenges and constraints relates to RQ1 and RQ3. Their point of view in terms of innovation is important for RQ2, RQ3 and RQ4, while the theme 'ecosystem' is relevant for RQ4. While figure 23 provides an overview of relations between the five identified themes and RQs, figure 24 shows the relations between objectives, RQs, interview questions and themes.

Figure 23: Relations between Themes and RQs

		RQ1	RQ2	RQ3	RQ4
Themes	T	X	X	X	X
	O	X	X	X	X
	C	X		X	
	I		X	X	X
	E				X

Figure 24: Relations between Objectives, RQs, Interview Questions and Themes

Objective
O1: To show the contemporary situation in the telecommunication market for MNOs as well as to develop the look of a future MNOs business model and telecommunication ecosystem.
O2: To depict the role of innovation for MNOs as well as the implication of Pisano's 'Innovation Landscape Map' on MNOs.
O3: To illustrate the role of BI, Big Data and software robotics for MNOs, their future business model and a future telecommunication ecosystem.

Research Question	Interview Question	Themes T	O	C	I	E
RQ1: How can the contemporary situation in the telecommunication market for MNOs be described and how and why do BI, Big Data and software robotics have an impact on MNOs?	**IQ1**: How can MNOs' current situation be described and which are MNOs' biggest economic challenges?	X		X		
	IQ2: How will MNOs react and develop regarding trends, like digitalisation, increasing data traffic, IoT and M2M, and regarding drivers, like Big Data?	X	X			
	IQ3: How can BI and Big Data support MNOs regarding profitability and future growth?	X				
	IQ4: How are BI and Big Data currently used at MNOs?	X				
	IQ5: What influence can software robotics have on MNOs?	X				
	IQ6: How can software robotics support MNOs regarding profitability and future growth?	X	X	X		
RQ2: How and why does innovation impact MNOs' future development and what is the implication of Pisano's 'Innovation Landscape Map' on MNOs?	**IQ7**: Which new technologies have a high priority for MNOs and why?	X	X			
	IQ8: How important is innovation and especially radical innovation for MNOs' future development and why?				X	
	IQ9: Which innovation dimensions besides routine innovation are the most relevant and influential ones for MNOs and why?				X	
	IQ10: Which innovation dimensions are crucial for MNOs' future regarding development and growth and why?				X	
	IQ11: How does business model innovation influence MNOs?				X	
	IQ12: How does business model innovation influence MNOs' development and growth?				X	
RQ3: What could a future MNO business model look like and how and why will BI, Big Data and software robotics have an impact on it?	**IQ13**: How could a future MNO business model look like and what components could it consist of?	X	X		X	
	IQ14: What could be the core service of MNOs in future?	X	X		X	
	IQ15: How could MNOs adapt their business models in order to face (future) trends and demands of customers?	X	X	X	X	
	IQ16: What are the shortcomings of current MNO business models that have to be overcome for their further development and what parts of current MNO business models should still be applied in the future?	X	X	X		
	IQ17: What role will BI and Big Data play in MNOs' future business models?	X			X	
	IQ18: What role will software robotics play in MNOs' future business models?	X			X	
RQ4: What could a future telecommunication ecosystem look like and how and why will software robotics have an impact on it?	**IQ19**: How could a future telecommunication ecosystem look like?				X	X
	IQ20: Which components could a future telecommunication ecosystem consist of?	X				X
	IQ21: What of today's telecommunication ecosystem will possibly not exist any longer in the future and what will possibly still exist in future?	X	X			X
	IQ22: Which companies (up- and down-stream) are expected to be still part of the ecosystem?					X
	IQ23: Which role will software robotics play for MNOs in a new ecosystem?	X				X
	IQ24: Which role will software robotics play in a new ecosystem in general?	X				X

4.2.1 Technology

Interviewee 1: A strong focus is lain on the topic technology, which is crucial to future success. Data are becoming more and more important, especially when it comes to BI and Big Data. Software robotics are seen as the core of future profitability and growth. In particular, the combination of software robotics with BI and Big Data is expected to provide a completely new level of quality, business excellence, reporting and steering. Due to the low latency required for gaming, the MNO infrastructure is of utmost importance.

"There are also tendencies to invest a lot more in the future and to purchase additional technologies in order to safeguard them. This runs very strongly via incubation and accelerators. You have to get involved in technologies at an early stage in order to realise the advantages." – Interviewee 1

The technologies with the most significant influence on MNOs are 5G, IoT, automation and software robotics both in the short and long term. Concerning software robotics especially the advantages for analytics are highlighted, which can only be realised if existing silos are broken open. As important topics for the future, blockchain, sustainability, gamification, mobility concepts and autonomous cars are also identified. Trends have to be spotted early using a combination of software robotics, BI and Big Data, which are regarded as an overall enabler of transparency and quality. Software robotics are the prerequisite to survival in the market and they have to be applied internally, e.g. for processes, and externally, e.g. as conversation chatbots. The topic data sovereignty will become imperative.

Interviewee 2: For the identification of trends and their assessment in terms of action and development, own departments and board areas are required, which illustrates their importance. This identification is based also on the topics BI and Big Data, which are immanent as they open up new business areas like smart home. 5G is at the centre of MNOs' interest and the expectation of other parties regarding the network expansion is that it will be achieved in two to three years. An enabler of this timeline and to be competitive is software robotics. In future there will be no processes without software robotics, which will be inevitable for development and growth.

"And of course you need software robotics for this. This is of course a major driver behind it. But at the end of the day, they are the initial agents for me being able to expand and build the network quickly in order to be competitive." – Interviewee 2

"In the end, software robotics will be the factor why I can build everything in two years and why I can get into the market quickly, and it will tell me where I need to go in, or make it easier for me to say if I should go in." – Interviewee 2

Gaming, autonomous driving and telemedicine are also identified as influential technologies on which MNOs should focus and on which new business models can be based. The core business is expected to be telecommunications and the internet in the short and medium term, and for B2B customers probably also in the long term. In a longer term, a business model can also be based on the possibilities provided by 5G, as it allows clustering of networks, meaning that the bandwidth offered to the customer can be determined depending on a variety of variables. Also own content will be offered, like the broadcasting of sport events. Revenue will not solely be generated by provision of infrastructure alone but be driven by use cases using the infrastructure, which will be taken as granted.

"Just concerning 5G, I have now gained a third dimension in addition to the speed and latency, I can now also cluster, how fast internet I actually give the customer, so what kind of bandwidth he gets, on which fast line he gets his network." – Interviewee 2

Not only the provision of mobile data but also the provision of the performance and speed are regarded as future core services as they build the baseline for technologies like autonomous driving and telemedicine.

<u>Interviewee 3</u>: The market situation is regarded as positive as the demand for MNOs' services is increasing and essential to private and business customers. The current core service of MNOs is data connectivity and will be data connectivity for the next five years. With the help

of software robotics customer experience will be raised to a completely new level. The improved customer experience leads to lower churn and thus to higher profitability. Foremost, software robotics will be required in the network technology area to set up an intelligent network for a virtualised core, e.g. with DC management and dynamic antenna design. Next generation networks of mobile (5G) and fixed (fibre) technology are currently of highest importance to MNOs. The introduction of 5G in particular leads to the emergence of further technologies that help fully to exploit the potential of 5G, like edge computing, smart networks and core virtualisation, which enables network slicing. These are all closely connected to the use of software robotics, which enables and improves these technologies. In future the monetisation of data and telecommunication services in the B2B area will be based on SLAs and for individual customers it will be based on the network bandwidth they contracted through slicing, which will be influenced by available technology, hardware and software. In the B2B business software hosting and IoT, for which Narrow Band and LTEM is required, will be an essential topic. For private customers cloud will be part of a future business model as well as related topics like cloud PC and cloud gaming. Thus, services are shifted towards software, cloud and streaming. Nevertheless, the future business model will to a large extent be comparable with the current one over the next ten years. Certain facets, like network sharing, change the business model only to a certain degree. Building campus networks will also be a part of future business models, to enable a better use of automation technologies in factories. Big Data are currently and will remain essential to MNOs and their fast-changing business. Especially in the retention of customers it is crucial to use churn prediction mechanism, loyalty mechanisms and the data proactively to satisfy customers by improving their experience.

“We have an incredible amount of value destruction because we are constantly losing customers and have to win new ones.” – Interviewee 3

“This is first of all our primary data treasure and the data warehouse serves to bring our customer experience to the top.” – Interviewee 3

Interviewee 4: Data communication is becoming more crucial to people and companies and is regarded as critical infrastructure as well as a critical success factor in the digital economy. Therefore, MNOs' business models are not currently nor in the medium term threatened. This is also true as there are no new competitors due to high infrastructure investment. 5G is the most influential hardware technology, and is already at least partially implemented in some countries, like Belgium and The Netherlands, while others, like Germany and France, lag behind. Another hardware technological change is that from hard disks to RAM, which enables faster access times and a faster analysis of larger amounts of data in a given time. From the software side the most influential technology is software robotics because it can support companies in nearly all areas. Regarding trends, MNOs try to apply the latest technology, increase the bandwidth of their network and decrease marginal costs. M2M is an area in which MNOs strongly focus on and start a lot of activity to participate with innovations together with partners. BI and Big Data are used in many areas, in part to bind customers. Future business models will be based e.g. on BI and Big Data, as seen in the example of Nuremberg's public transport or used for infrastructure planners or traffic flow management, meaning that existing data are used to open up new business areas. AI and ML are regarded as great technologies for future profitability and growth of MNOs as long as policy is not short-term. These technologies and the data-driven business models based on them are expected to be responsible for not inconsiderable revenue in 10 to 15 years (>10% in Europe, ~20% outside Europe). Platforms will be more important in 20 years and the core service will be mobile data in Europe and adjacent service outside Europe, e.g. customer profiling or movement profiles. Maybe the overland cable will diminish and be replaced by other technologies.

Interviewee 5: Growing bandwidths through LTE and 5G enable more and better service and current business models will be enhanced by new technology.

"Basically, I think that the existing ones must first of all continue to exist, but will be enriched and expanded by new technologies." – Interviewee 5

Regarding trends like 5G, MNOs prepare and position themselves as well as possible, as this technology is a prerequisite of IoT and the respective data analyses as well as of autonomous driving. As the amount of data will increase, e.g. through IoT, autonomous driving, networked houses, so will the importance of BI and Big Data irrespective of the business area by making better forecasts, improving data analytics and facilitating the creation of new products. Moreover, anonymised data can be sold. Thus, MNOs can grow and become more profitable because of BI and Big Data. Especially in the combination with software robotics BI and Big Data realise their potential even better by supporting the decision-making process or the analysis of huge amounts of data. Software robotics will generally help in making processes faster and increasing overall quality.

A future business model will focus on providing services and information, such as movement profiles or shopping behaviour, to other businesses. Also, the exchange of information and connection of devices will increase, leading to new business models revolving around data analysis and autonomous driving. BI and Big Data will be essential to a future business model for analysis and predictive maintenance. The same is true of software robotics, e.g. to reduce time to market; but also in the support of BI and Big Data analysis and products based on such analysis, software robotics will be of utmost importance. Nevertheless, the future core service of MNOs is expected to be the transmission of data in different ways, meaning mobile and fixed line.

<u>Interviewee 6</u>: As technology of the highest importance transmission technologies are listed, mobile as well as fixed line. Through these, bandwidth is provided and it can then be enriched with additional services. Software robotics is of great importance and is mainly used to optimise processes, e.g. better allocation of technicians, unlike at Google or Amazon, where they are used to evaluate user behaviour and transfer findings to new business models.

Regarding trends, such as M2M and IoT, MNOs push these topics and focus, for example, on the building of campus networks in the B2B market. The strategy is to tackle the B2B business with reasonable prices for classical services and realise additional services in the B2B area.

The same is true of the B2C market, e.g. through the provision of IP-television and additive services. Existing and coming trends are also approached through partnering, e.g. in the smart home area through combinations of devices and connectivity.

A business model focusing on MNOs' competence in the area of networks could be built by managing cyber technologies, access mechanisms and associated risks before content can be imported to the network, so that MNOs become a security instance. With such and other components the existing business model can be secured and even strengthened. Hence managing a large portfolio and network access are crucial tasks for MNOs.

Big Data is used for analytics to identify complementary business models which are most suitable to additive services in the B2B and B2C area. BI and Big Data will be integral and crucial parts of future business models and will have grown significantly. They will be taken for granted and prerequisite in future. The same is true of software robotics, which influences MNOs' profitability and growth and has a strong impact on them. In future, it will not be as much in the foreground as today and will focus more on supporting services.

Interviewee 7: Concerning hardware, sensor technology for IoT has a high priority for MNOs as it is required e.g. in autonomous driving. A prerequisite of certain IoT application areas, such as autonomous driving, is 5G, which is also a highly influential technology for MNOs. Moreover, analytical systems that support collection and evaluation of data, e.g. to ensure cyber security, and software robotics, which make processes faster and support a more individualised service delivery to customers and can provide greater flexibility and less maintenance effort, are important for MNOs.

Software robotics support profitability by analysing masses of data. Through new algorithms and DL the evaluation of much more data than before is possible in order to generate insights and understanding and create decision based on them. It is expected that the combination of BI and Big Data with software robotics will lead to further advantages but that they will still be regarded separately.

A future business model will be much more connected and more devices that communicate with each other will be connected as well. Topics like autonomous driving and IoT will be important and MNOs are the key to its success, due to their infrastructure and network quality. So, the provision of the infrastructure and a functioning network will be their key task and the key service of MNOs. Moreover, value-added services, also regarding network optimisation, will be in the focus as well as the provision of services, e.g. to build industrial networks. Hence their role as service providers will become more important besides the provision of infrastructure. MNOs could become a full-service consulting company.

Big Data are expected to become more decisive in future because they are evolving in terms of algorithms and application areas, while BI is expected to stay as important as it currently is as only few developments are made.

"Big Data more important, BI equivalent. (…) Because BI is simply a basic topic."
– Interviewee 7

RPA is expected to become a commodity and AI, ML and DL will stay important topics that will continue to develop.

Interviewee 8: Regarding Big Data MNOs are already developing strategies to use the data they have in a profitable way, as they have a huge amount of customer data that is currently not used in the best possible way. BI and Big Data can significantly influence MNOs' profitability and growth. BI especially supports concentrating on the crucial topics, because BI helps to gather the most important KPIs from various business areas, makes them easy to understand and evaluate, which fosters better decision-making and better response to business trends. Big Data are decisive if business departments are to be able to do something with the created knowledge. Often data scientists are required to evaluate and prepare data for management to make decisions on trends and identified issues.

Software solutions for call centres are among the most important technologies for MNOs. They can be used e.g. for digitisation, meaning that calls are transcribed to text, based on speech recognition, and even translated or forwarded from software that leads to connection with a human agent if no input is provided in a certain time or the caller requests it.

"But in the end, you can digitise the whole subject of call centres completely, with transcripts, translations, speech to text recognition et cetera." – Interviewee 8

On the hardware side, 5G is the technology most directly relevant to MNOs as they will not only have to deal with a massive increase in devices in their net, e.g. due to autonomous driving or IoT, and transferable data, but also with the preparation of data processing.

Software robotics will play an important role in future MNO business models and there will be many application possibilities for it, e.g. in disaster prevention. For example, this can be achieved by a MNO's taking note that many of its users are in one region, e.g. a football stadium, and noticing that many of them are suddenly moving in one direction. In this case a conclusion would be drawn that there is a problem and remedy provided, e.g. that the emergency exits be opened automatically. This service could be offered to public administrations or football stadia. As soon as a potential benefit to users or customers is identified, an additional service can be offered. Moreover, software robotics supports the use of user data and securitisation of a competitive advantage. Software robotics will have major influence on companies and their business models.

Big Data will strongly support business models in driving innovation based on available data e.g.by improving products, increasing customer proximity and finding better solutions together with customers.

<u>Interviewee 9</u>: 5G and the respective network are one of the most influential technologies at the moment and open new ways to offer services, e.g. in the field of biotechnology or remote doctor visits. MNOs should not make their own inventions in these fields but be an integral part of these business areas as platform enablers in cooperation with the respective associations. The provision of services, e.g. platforms, that are detached from MNOs' infrastructure could be the basis of a future MNO business model. In general, 5G provides the possibility to offer additional services and generate added value, e.g. regarding IoT, to MNOs. Trends are a focal

point of MNOs. For example, smart home provides great possibilities to offer normal or bundled services partially even in cooperation with hardware manufacturers. Also, topics concerning autonomous driving, public transport and mobility services are important trends in which MNOs are already investing. However, inventing new services is not seen as being MNOs' core service but the provision of the respective platforms.

"But platform enablers, (…) this could well be a topic for MNOs." – Interviewee 9

BI and Big Data will support MNOs' growth and profitability by decreasing costs as well as with error and predictive analysis. Moreover, through BI and Big Data profound information and knowledge can be extracted on which new business models can be based. Software robotics is a crucial technology to provide additional as well as authentication services, to increase customer loyalty and win customers, in proactive problem identification and network maintenance, and to decrease costs and increase competitiveness. Software robotics' influence on MNOs is regarded as great and they help in increasing profitability. Full potential can be realised by combining BI, Big Data and software robotics to analyse structured and unstructured data and make decisions based on the information provided by them.

Data analysis in general is regarded as another vital topic when it comes to most important technologies, e.g. for analysis of user behaviour. Given the data MNOs have, data-driven services and the respective knowledge and information, personalised services or specialised advertising can be offered.

"They get so much data that data-driven services can be offered for insights and other values." – Interviewee 9

Overall, MNOs can do more in the field of data analysis and respective services than they do nowadays using structured and unstructured data, meaning text, video or the spoken word. Data analysis and respective services have a lot of potential to create innovation and added value. However, MNOs' main service will be data connectivity.

Interviewee 10: 5G has a high priority for MNOs as it enables real-time data transfer which can, for example, be used for remote surgery. AR and VR also rely on 5G just like the gaming market. In addition, software robotics have a high priority for MNOs.

Software robotics strongly influence MNOs, e.g. in the four application areas (I) virtual assistance, e.g. in call centres, (II) expert assist system, e.g. for intelligent search functionalities or as RPA bots or natural language processing, (III) image recognition as well as (IV) predictive maintenance and analytics, e.g. for the analysis of churn. MNOs shift from the provision of pure telecommunication services to the provision of data. The huge amount of data they have could be anonymised, prepared and offered to other companies. Software robotics will become more important and is required for MNOs to stay in the market. If software robotics is not applied, MNOs will become smaller and lose importance.

BI and Big Data can support MNOs' profitability and growth through typical use cases, e.g. churn analysis, recommendation systems and predictive models. The more data they have, the more insight can be generated. BI and Big Data will be essential parts of future MNOs business models and without them no business will be possible. Their role will become increasingly important. However, their added value is not always measurable.

"In certain areas, MNOs will find that it will not be possible to operate without these technologies any more. That means they must and will use them." – Interviewee 10

The combination of BI, Big Data and software robotics is crucial to MNOs as for ML and DL huge amounts of data are needed. As data increase they have a larger input for ML and DL. However, these data could be integrated in a uniform platform, which would facilitate a greater value from the data and improve the application areas of software robotics.

MNOs' core service will be the provision of infrastructure as well as data-driven services, but also other services are expected.

Interviewee 11: 5G is a high priority topic for MNOs. However, MNOs earn their money not only by the provision of standard services like mobile and fixed networks but also by many supplementary services. Another high priority topic is digitisation, which is connected to the innovation of existing business models. Digitisation as a high priority for MNOs is the reason for some MNOs' building 'test cities' to test new technologies, the technologies' capabilities and use cases based on them.

MNOs concentrate on trends and see their core service not only in the provision of fixed line and mobile networks, such as 5G, but also in the provision of additional services based on these technologies. Thus, they concentrate on autonomous driving, where data are transferred and provided through 5G in real time. In this area MNOs invest to be able to offer value-adding services. 5G is also a trend topic due to the possibilities it enables in IoT, e.g. for surgery robots that need real-time transmission of data.

"I can't afford that larger machines running somewhere, perhaps at surgeries, where surgery-robots work, do not react in real time but with delay." – Interviewee 11

BI and Big Data are regarded as important trends MNOs have to foster. The trend for MNOs regarding these technologies is seen in the cloud business to centrally store, process and work with the data to draw conclusions. However, it is not expected that MNOs do this only with their data but also for customers and thus provide service based on it. Therefore, a fast infrastructure with sufficient bandwidth is required to transport the data fast enough. They could compare themselves with Google and Amazon in this case but have the advantage of owning the infrastructure and being closer to the customer. BI and Big Data are expected to play a huge role in collecting, preparing and analysing all the generated data, e.g. from autonomous driving or IoT, and to make the results available to customers, e.g. in the form of new services.

Software robotics has a great influence on MNOs as it is a patch technology that can close existing gaps, connect unconnected systems, make work more efficient and is business-, not IT-driven if the issue in question is not too complex and not too closely connected to IT. Moreover, it helps to realise savings, which can influence the income statement. Software robotics will be more important in future MNO business models, e.g. for the automation of tasks, generation of insight or communication with customers.

"I think that's in the highest interest: RPA combined with self-learning systems." – Interviewee 11

A future MNO business model is expected to be characterised by a mobile, e.g. 5G and 6G, a fixed-line network, and a network infrastructure in which new algorithms are used to handle the huge amount of data. For data connections, fixed line will mainly be used by businesses, while private households will use mobile services. Telephony over fixed line is expected to disappear as mobile is used for communication. Although the infrastructure will be an integral part of a future MNO business model, there will not be much growth and MNOs will focus more on additional services, like cloud offers.

To reach such a future business model MNOs need to increase their flexibility, speed and scalability, which can be achieved with software robotics, and invest more in automation. The adoption of new business models will have to be faster. However, field service and technicians are expected to stay, because they are e.g. responsible for maintenance services of antennae and building of stations.

There will be two future core service of MNOs. Operating the infrastructure will be an ongoing core service of MNOs in order to offer customers connectivity. Dealing with customer data to generate additional services and benefits will be the other main service which is offered together with partners.

Interviewee 12: Important factors influencing MNOs are additive services and IoT. Big Data are also very important to MNOs and the available data has to be used and marketed. For example, movement data of customers can be used to create profiles and trends can be identified on which new business models can be created. The available data can also be significant for advertising and marketing, and created profiles can be sold. Overall Big Data and BI are applied to work predictively and thus e.g. to bind customers, create forecasts and analyses, create new products and services and get the most out of customers.

Software robotics has a big influence on MNOs, especially in the execution of processes, e.g. in call centres or to handle problems or contracts.

The interviewee cites the network infrastructure as most influential technology and critical to MNOs. The available bandwidth and latency do not always offer the capacity and quality required for the implementation of new business models of customers. Therefore, improvement of the network infrastructure is of utmost importance to offering higher capacity, faster transport and lower latency.

"(…) the infrastructure, i.e. making the network infrastructure more intelligent and making it more capable is a very, very important point." – Interviewee 12

Interviewee 12 expects a future MNO business model to be based on the provision of communication and data services as well as applications. The provision of data analyses and anonymised information on customers are viable options for MNOs. In general, technology should not always be in the foreground but, depending on the case, the connection to the customer should be the central focus.

To achieve a future MNO business model software robotics has to be applied and the right resources that are able to think outside the box are required. Moreover, a willingness to shift from the pure provision of infrastructure to that of services that build on this infrastructure is required, even if this means that the infrastructure is no longer monetised, although infrastructure is still a permanent prerequisite for MNOs.

"I believe the infrastructure is not a service that can be monetised in the future, but everything that is on top, everything that is innovative applications." – Interviewee 12

<u>Interviewee 13</u>: BI and Big Data are essential topics for MNOs as they support the winning and binding of customers, e.g. through analyses to make specific offers to individuals and companies that in turn increase customer loyalty. In this way, new products and services can also be developed. The more data are available to MNOs, the more they can do with them and the deeper is the information they get.

“If the data management doesn't work, if the data can't be processed through analysis so I can get results that I can reuse in the market, then I think every telecommunication company is lost.” – Interviewee 13

Software robotics are also crucial to MNOs and are, for example, used in market observation. It is one of the most influential technologies for MNOs. Therefore, MNOs invest heavily in this topic that needs much knowledge to be implemented, especially regarding Intelligent Automation. In the end, these technologies support MNOs in their daily work if MNOs can identify the added value software robotics provide when implemented. RPA is of less importance than several years ago if it is regarded on its own. If it is seen in combination with workflow management and Intelligent Automation capabilities, it also belongs to the most influential technologies for MNOs. Software robotics are also essential to future MNO business models as MNOs need it to stay in the market. They could continue without applying software robotics for a certain time but would then become less relevant, as e.g. costs cannot be decreased like at other MNOs that use software robotics. Also, more employees would be necessary to cover forthcoming processes, if software robotics is not used. Moreover, innovation will in future be based on software robotics.

“It's not like it's just a hype and then it's over. This is really a quantum leap in my point of view.” – Interviewee 13

Autonomous driving and related topics, such as mobility concepts, car sharing and autonomous taxis, are of utmost importance not only to the automotive sector but also MNOs.

A future MNO business model will be characterised mainly by the provision of telecommunication services using mobile and fixed network. MNOs will act as infrastructure providers. However, regarding their private customers, MNOs will have the data control in their hands and will be in direct contact with them, which is not expected to be the case with all business customers.

4.2.2 Opportunities

Interviewee 1: A strong focus is lain on the topic partnering, which is crucial to future success. Open standards and platforms are also key to success. Trends like digitisation and IoT are currently very important for MNOs, because due to topics like ‘real-time’ and ‘quality of service’ an increase in productivity is expected as well as more time for employees to focus on creative tasks, such as strategic matters.

Interviewee 2: Software robotics, which will be even more important in future, is crucial as it ensures competitiveness, e.g. through identification of white spots, making processes faster and cheaper and automating them, proactive customer approaches and prediction models. However, a mind shift is needed fully to apply these technologies. The number of employees required will drastically fall as, due to technical change, many groups will no longer be required as processes and tasks can be handled by software robotics.

MNOs are not expected to build their core business on 5G use cases as these are realised by smaller and faster companies. Nevertheless, MNOs will partially participate in those use cases due to their own R&D teams as well as partnerships with these companies. The topic partnerships will become even more crucial to future business models than it is now. The market will mainly be approached by partnerships. MNOs offer the infrastructure and the partners provide the services.

Interviewee 3: Efficiencies are increased for all processes based on available data. Software robotics further increases those effects by optimising existing processes and models, e.g. in customer winback. Software robotics will become crucial to business models’ optimising forecasts, automating and optimising processes, and to saving costs, e.g. of network maintenance. They also enable the required change and support MNOs to become leaner and more focused on the essentials. In general, software robotics is regarded as vital to continued existence.

In future a further market consolidation could occur, not perhaps between MNOs, but it is possible that a hardware manufacturer takes over a MNO. Partnering in the network area will become more important, e.g. to cover sparsely populated regions, than developing and sharing services together.

Interviewee 4: On average telecommunication providers become fewer because of an ongoing consolidation. Software robotic is mainly used to streamline processes, cut costs, improve the profit margin and tackle demographic change, and in so doing improves understanding of process, e.g. number of bookings, time spent or number of documents. Software robotics are mainly implemented for efficiency reasons. BI and Big Data will be used for cross-selling by analysing customers or working together with advertisers. In this way, Facebook-like effects can be created by offering apps that bring customers together and create lock-in effects. Given this, churn might drop and further potential future business models can be built.

Interviewee 5: Software robotics in combination with orchestration and workflow solutions is regarded as high priority for MNOs, because with it the complexity of business processes can be reduced and processes can be automated. Moreover, the freed capacity of employees can be used for more value-adding tasks and growth is enabled. It is expected e.g. that customer support will be automated using chatbots and AI, while the customer is still in the focus. Automation is already to a certain degree achieved but MNOs are lagging behind.

Partnership and cooperation will be more crucial to combining services and bringing them to the market together. Overall, cooperation with other companies will be decisive, so that MNOs can focus on their core tasks.

Interviewee 6: Partnering is a valuable market approach, e.g. in the smart home area through combinations of devices and connectivity. Generally, trends are approached through partnering. Data gathered in cooperation with car manufacturers can be used in weather forecast, which in turn can help in the calculation for required spare parts. These complementary business models are used to generate margin on top, also by differentiating, and are greatly needed to earn the money that is in turn required for further investment in infrastructure or further business areas. Also, software robotics influences profitability and growth, not only by optimising processes or conducting analysis, but also by supporting service delivery to customers by creating profiles to provide additive services.

"This means that we will be able to recognise the dynamic nature of the business models more clearly and will use this technology to a greater extent." – Interviewee 6

A future business model is expected to be more integrated, meaning that partnership and cooperation will be much more in the focus than today. For example, close collaboration with railway or energy providers could become more important.

Interviewee 7: BI and Big Data are essential for profitability and growth as they provide valuable information on relevant topics, e.g. who the customers are and how to address them. In this way, also differentiation from competitors is possible, e.g. through individual customer approaches and individualised tariffs. Moreover, the collected data can be refined and sold.

Interviewee 8: At the latest in one or two years, every MNO will try to use the existing trends in the market to their advantage. As soon as they see their competitors applying a trend, they access the respective area too and try to get their share. They all are working on the definition of the right strategy for this.

AI helps companies stay competitive in the market, e.g. as it supports provision of good services and faster response times, which leads to winning customers. It also enables closer customer proximity through data analysis, especially when Big Data are combined with AI and ML. It frees employees to do more significant tasks. Software robotics not only helps to increase profitability by optimising processes but also by increasing employees' efficiency by taking out repetitive tasks.

The main service of MNOs in future could be the preparation of customer data to provide them added value, e.g. special offers based on local proximity. Furthermore, customer data will be essential to bind customers and create lock-in effects. This will be strongly supported by Big Data and software robotics.

Interviewee 9: Good connectivity and additional services are regarded as a prerequisite for customers. The network is regarded as the decisive factor in customers' deciding on the one MNO or another one. In future MNOs' business models will have to be adjusted to an increasingly older population and MNOs should foster business models that focus on the older generation while not leaving the younger behind, because there will be a huge market in older people and they are seen as having more money available than the young, especially if it comes to the provision of services like elderly care. Therefore, the offer of solutions should mainly be directed to older people. Hence an easy interface to interact with technologies and services, which also creates a lock-in effect, is crucial.

"I would look at the demographical change as an example. What will the population look like in 20 years? Keyword: increasingly older population." – Interviewee 9

MNOs have to develop ideas to have access to customers in non-metropolitan areas, which does not mean that shops have to be built in every village. Cooperation will become more important in future business models, e.g. building masts and using the infrastructure together with other MNOs.

The main task of MNOs is expected to be to make the lives of their customers easier, while the main service will be data connectivity together with improved customer experience, that can become even better depending on the service level that is paid for.

BI, Big Data and software robotics will be a prerequisite to business models as they are needed e.g. to deal with and analyse large amounts of unstructured data, a task which cannot be performed manually, and repetitive activities. Chatbots will become better and more important than they are now and greatly support customer service, e.g. partially replacing hotlines. Overall, software robotics is crucial to increase customer loyalty, win customers and to decrease costs.

Interviewee 10: MNOs are investing in existing and forthcoming trends. To test new projects, services and use cases, they release minimum viable products. If these minimum viable products work, MNOs have to pursue them.

Lawfully sharing and combining data with other companies would be a good way to get more information to generate deeper insights into their customers' behaviour and requirements and to develop further models.

Interviewee 11: MNOs offer additional services among others to increase customers' loyalty. Customer service will be central to MNOs' service and will be as automated as possible. BI and Big Data mainly help MNOs with forecasting and analytics, to know the customers better and get more information of them even from unstructured data if software robotics are taken into account to support the possibilities BI and Big Data offer. Additionally, they strongly help in noticing trends and creating new products based on the available data.

Software robotics' great influence on MNOs can be seen in making work more efficient. It further supports in the processing of structured and unstructured data. Specifically at MNOs, chatbots can be used to listen to the spoken word, structure data and process them. In addition, employees can be freed to cover more demanding tasks. However, especially RPA changes from the pure automation of rule-based processes to a learning system that supports decision-making. The biggest advantages can be realised when combining BI and Big Data with software robotics.

A great part of future MNO business models will concern partnerships, e.g. for the creation of applications, for hosting or the operation of systems. MNOs are not seen to be innovative if they do not work together with other companies. Also, mergers and acquisitions are expected in the European market if allowed by the control authorities

Interviewee 12: Regarding trends, MNOs have to be absolutely open and try to adopt the trends if they fit as every new trend can be a reason to win new customers or to bind them, which can increase revenues. The connection to the customer and their wellbeing should be the central focus. Also, the areas of health care or care of the elderly, supported by technology, are feasible options, while sticking to data protection and compliance. They are seen as highly profitable because people are willing to spend a lot where their health is concerned. In the care area MNOs could be platform providers to connect people and service providers, such as doctors or hospitals, but they could also directly offer services. When it comes to platform provision, offering platforms for virtual classrooms and lectures are good possibilities for future business models too. Platforms and other services could be offered in cooperation with partners to realise even greater benefits and get a better market standing, especially in new business areas. In future partnerships will be more in the focus of MNOs and MNOs' main services will revolve around partnerships to provide services to their customers.

Through software robotics processes can be improved, e.g. through cognitive recognition or support of decision-making or provision of background information. They support profitability and growth by decreasing costs of and required time of processes as well as improving processes in general. The biggest advantages can be realised when combining software robotics with BI and Big Data. Overall, software robotics is expected to play a big role in future MNO business models as it supports e.g. process automation, monitoring, and freeing employees to focus on more value adding tasks.

Interviewee 13: Dealing with existing and forthcoming trends has to receive more attention and become a part of the corporate strategy, which some MNOs deal with by having special departments that focus on such topics. Especially compared with MNOs in Asia, European and American MNOs are technologically behind. Therefore, partnerships with Asian MNOs can help in securing competitive advantage regarding products and services that are coming to Europe and have already been implemented in Asia.

To achieve a future MNO business model much more automation has to be realised and software robotics have to be introduced in many areas to a greater extent, e.g. administration and call centres, to foster operational efficiency. Moreover, all white spots in the landscape have to be covered with MNOs' networks in order to be able to realise the whole benefit a 5G network provides. In new business models direct customer contact will be personal. In addition, partnerships will become more important to early identification of trends, e.g. in Asia, and implementing them at an early stage in other areas, e.g. the EU. In this way, competitive advantage can be secured and the market accessed faster with new services and products. This will ultimately be decisive to growth.

4.2.3 Challenges and Constraints

Interviewee 1: MNOs are in a very fast-developing, complex market with high cost pressure and steadily increasing customer demands. Competition not only from other MNOs, but also MVNOs and OTT providers, which were formerly underestimated, is increasing. Central problems cited include strict regulation and a lack of creativity. Culture has to change and bureaucracy to be reduced.

In recent years the topics ‘user experience’ and ‘customer journey’ have not been in the focus of MNOs as they should be.

“The topics user experience and customer journey have been underestimated. And they didn't build intuitive things either.” – Interviewee 1

Existing silos are still an obstacle that has to be overcome and abolished. To increase profitability costs have to be cut and maybe FTE reduced, which can be realised e.g. with software robotics. Nevertheless, social partners have to be involved and confirm plans for automation before these are executed. Also, the monetarisation of software robotics is a challenge. The interviewee expects a consolidation of the market and states that there is a possibility for MNOs to become pure network operators. Therefore, they must be more visionary and creative to tackle this.

“Actually, they must be visionary, also in terms of employees, culture and the ecosystem, and show added value (…).” – Interviewee 1

Interviewee 2: MNOs are currently in a good position in the market although strict regulation and law, e.g. Data Protection, make the adoption of technologies like software robotics in some countries difficult. The securitisation of a reasonable ROI is a problem due to high investment costs and long payback times as MNOs are not allowed to build their network where it is most profitable for them but they have also to cover unprofitable spots. Market entry barriers are becoming lower, as the implementation of hardware is much faster than in earlier years. Nevertheless, the costs of the network setup are still high. However, this can lead to new competitors in a relatively short time. A decline of fixed line telephony can be seen and the same is expected for mobile communication due to the increase in mobile data. Competitors are not only other MNOs, MVNOs and OTT providers, but also big players like Google. The challenge of turning data into value and revenue is still present. The costs of mobile data are expected to drop comparable with the costs of SMS, MMS and telephony.

Interviewee 3: The telecommunication market is facing challenges as, for example, sales growth is limited and high regulatory pressure is felt, preventing large sales leaps. The business model is highly capital intensive, especially when new technology circles, such as 4G or 5G, are started. Competition of MVNOs is also increasing. Customer service is not done to the extent possible.

Interviewee 4: It is a very mature market with only limited growth, small margins and relatively stable profits. The increase in the amount of data is seen as a challenge because it puts MNOs' infrastructure to its limits as the construction takes time and is cost-intensive. Moreover, the risk to security of supply of electricity is thematised, because power failure can have severe consequences when a part of the network is down and leads to huge data losses due to the tendency to save data in Random Access Memory (RAM). This has to be tackled by backup concepts and failure recovery systems. As further challenges, the huge price pressure on the market as well as data protection and regulatory risks are mentioned. The data treasure MNOs possess cannot be used to its full extent in countries like Germany due to strict data protection law. In China and the USA this is less restrictive as they are allowed to work with the available data, which means that they have more possibilities to use software robotics to exploit these data. As an example of the use of user data for a business model, Nuremberg's public transport system is given as it was optimised using motion profiles of mobile phones. However, hardware manufacturers are MNOs' competitors in this business area and want to use also the gathered information in terms of motion profiles.

“Especially in China the telecommunication companies are blessed with a huge, gigantic amount of data. There, too, of course, they are logically leaders in the field of artificial intelligence and machine learning. Simply because they simply have this data available as the raw material of the 21st century.” – Interviewee 4

In general, the business model of MNOs is threatened not only by OTT providers, which can possibly make MNOs’ business model irrelevant, e.g. WhatsApp, and MVNOs, but also by innovations like satellite networks that provide coverage for mobile networks. They are not yet a big threat but this may change. The biggest challenge, however, will be presented by regulation of the generation and provision of data. Especially as data are seen as the raw material of the future, they are also of utmost importance for future business models. Overall, MNOs’ corporate culture does not promote change.

Interviewee 5: The market is characterised by great cost pressure and increasing competition, e.g. through OTT providers, which leads to the adoption of automation technology. A further challenge MNOs have to face is the scarcity of skilled staff. In a future business model landline cables will be less important or even diminish.

Interviewee 6: The market is seen as highly regulated and inflexible, at least in Europe where MNOs are not allowed to handle data in the same way others countries are allowed to. If MNOs were to get more freedom in this respect, as in other countries like the USA or China, they could take a big step forward and support the technological brand of European companies. Moreover, their business is highly investment-driven by new technologies. As greatest challenges to MNOs high investment and strict and partially outdated regulation are presented, which prevent MNOs from being more profitable.

“(…) finding a clean balance between investment and profitability is the biggest economic challenge under the regulatory conditions we currently have.” – Interviewee 6

Interviewee 7: The market situation of MNOs is described as difficult because MNOs have to pay attention to not getting degraded to pure infrastructure providers. The problem they face is that they provide the services customers use but customers do not notice MNOs’ service but rather the services that are provided by others, like Google's Android or Apple, using the MNOs' infrastructure. MNOs have to leave this situation to deliver value-added services.

"(…) they provide a service but are not in the customer's living room or on the customer's mobile phone." – Interviewee 7

A huge challenge they have to face is infrastructure investment, especially with 5G on the rise. Another obstacle is the demographic change and the overaged workforce at several MNOs. Furthermore, strict regulation and market requirements MNOs have to deal with are another big challenge.

MNOs can survive without BMI if they stay cheap. However, if this is the path they choose, they will lose their significance. This also results from competition and low margins. In conclusion, they have to innovate their business model in order to stay important and survive.

Interviewee 8: The creation of profit based on the available data is difficult and MNOs have to be prepared and well positioned in terms of Big Data in order to not be overtaken

Interviewee 9: The market is competitive and to compete MNOs have to become more cost-effective and efficient because if services are comparable, the provider of the cheaper service is usually chosen. MNOs also face political and social problems, e.g. regarding radiation smog, as well as strict regulation.

The interviewee states that the network infrastructure, which should be the responsibility of the state, like highways, should be separate from the service provider or stronger regulation and law should be introduced to secure a defined minimal service available everywhere. The biggest economic challenge is network expansion, especially in light of 5G roll-out in the hotspots, while 4G is still being rolled out.

Interviewee 10: One of the biggest challenges to MNOs is that they must simultaneously be data companies and innovators. Regarding Big Data, many MNOs are still in the analysis phase and the creation of predictive models is not yet present despite the huge potential they have due to their large data treasure. To use the available data better an improved preparation of the data would be required.

"Unfortunately, the building of predictive models is currently still completely absent, although this has a huge potential, especially for MNOs with their incredibly large data treasure. It is a shame that this potential is not being exploited." – Interviewee 10

Interviewee 11: The interviewee sees the market as very fragmented, with a few big and many small players, and states that Europe has too many MNOs, which is the reason for which mergers and acquisitions are expected if allowed by the control authorities. In the USA, by contrast, only four large players are in the market for over 300 mn people.

"Well, Europe has far too many MNOs. It is very likely, that there is an aggregation at some point." – Interviewee 11

Due to the many market participants in Europe, there is strong competition and huge cost pressure in the market. The cost pressure is further increased through investments in 5G.

Strict regulation, intervention and legislation, e.g. regarding roaming costs, are listed as big economic challenges which lead to a decline in revenue. Another challenge is binding existing and winning new customers, especially in saturated markets like Europe, which increases the competitive pressure as customers from other MNOs have to be persuaded to switch. MNOs have to face huge investment in new technologies, such as 5G. A further obstacle MNOs face is the huge number of applications and systems in use that need to be consolidated and standardised. The challenges of becoming more efficient and being more flexible to changes in the market or changing customer demands are obstacles MNOs have to overcome.

If MNOs become purely infrastructure providers in the future, this could even be their end. The market is expected to consolidate, but at least several players will stay in every market.

Interviewee 12: The market is not characterised by cutthroat competition but competition exists and is based on the provision of added value to customers, enabled by trends, technologies, innovation, leaner services and processes as well as automation. Added customer value increases revenue, and customer acquisition is less important than getting more revenue from existing customers through value-adding services. Competition with OTT providers is ambiguous as they can support MNOs in attracting customers but can also take away parts of MNOs' revenue.

"I think that would have been a very double-edged sword. (…) In principle, these OTTs are the value-added services that bring exactly these customers up to the bandwidth of the MNOs." – Interviewee 12

Productivity is seen as the biggest economic challenge because MNOs have to increase productivity for greater competitiveness. Another big economic challenge is the infrastructure, which is highly critical and in which huge amounts have to be invested.

<u>Interviewee 13</u>: The telecommunication market is characterised by increasing competition, e.g. through providers outside the classical telecommunication business, and MNOs are in a dangerous position. A great cost pressure is on the MNOs that have to reduce costs to increase their margins and profits in order to have enough money for prospective investment, e.g. in new network infrastructure for 5G. Moreover, flat rate models, additional services, e.g. video-on-demand or streaming, and cheap offers are demanded by customers. No new MNOs are entering the market, which is highly regulated. The highly competitive environment, cost pressure and high infrastructure investments due to the roll-out of 5G are the biggest economic challenges MNOs have to face.

4.2.4 Innovation

<u>Interviewee 1</u>: According to the interviewee, MNOs should focus on a mix of the innovation dimensions of the ILM as existing legacy and production systems exist that have to be maintained and therefore not everything can be done in a completely new way.

However, the topic of architectural innovation is especially thematised in combination with software robotics and partnerships, which is a consistent topic in this interview, but also regarding 5G and edge computing. Architectural innovation is expected to be the most important dimension of future development and growth as it can help in shaping the market to one’s likes.

Radical innovation is regarded as important for MNOs, with regard to the gaming market, which is a new topic to many MNOs and is a multiple billion euro market. Additionally, IoT is identified as a highly important radical innovation topic. However, radical innovation is seen as a little less important than architectural innovation if it comes to future development and growth.

A strong focus is lain on the topic partnering, which is crucial to future success. A future business model has to revolve around customer centricity and concentrate on start-ups, creation of marketplaces and the promotion of co-creation and co-innovation. Therefore, the right mindset is required.

<u>Interviewee 2</u>: Innovation is essential to MNOs’ development as their portfolio is very likely to change radically. MNOs must secure themselves through new business models that are based on innovation and will apply different business models, e.g. for gaming, and hope that at least one is successful.

The interviewee states that all innovation dimensions are relevant to MNOs and a healthy distribution is vital to success. Especially new business models that will emerge and be based on 5G are located in the area of architectural innovation. Nevertheless, MNOs are not expected to open up this field on their own but in partnership with other companies.

The future market of MNOs includes markets that are not yet in focus and handled by other industries, like heath care and autonomous driving. These markets will be influenced and processed by MNOs. This is identified as radical innovation.

<u>Interviewee 3</u>: Innovation of the business model is not seen as vital to MNOs’ survival. The interviewee states that the sole provision of data connectivity services using a smart pipe is sufficient and enables attractive margins. After the frequency auction in Germany this business model is secured for the next 20 years in Germany. To attain the desired business model the

whole sales side has to be radically transformed to mirror the desired product portfolio. A new business model is connected with fewer shops and more online business, fewer employees and the outsourcing or automation of processes that do not foster differentiation. This will all be started and done on the existing business model to create a new one that strongly bases on the former. The sale of usage data or movement data has been tried before and did not bring the expected monetary results. That is the reason for which this is not expected to be part of future business models.

Architectural innovation is very important in the light of 5G through which new B2B business models and opportunities can be created, e.g. connected factories. In this case a monetisation based on data packets is not constructive but rather monetisation based on service. However, this innovation dimension is not regarded as vital to MNOs.

Disruptive innovation is also regarded as important, although developing new business models on existing technologies is very difficult and characterised by high risk of failure. This is the reason for many MNOs to see this as experiments for BMI. Here the focus is on considering what others have established in the market and building partnerships with them.

Radical innovation is seen as a required routine as it belongs to the daily business of MNOs. Nevertheless, it is critical to MNOs and has to be kept evolving. Routine innovation is a prerequisite that has to be present at all times.

Interviewee 4: BMI has a great influence on MNOs' development and growth, especially regarding architectural innovation. MNOs have to focus on data-driven business models.

"And MNOs simply have to think about how they can get involved, make their own offers or simply remain competitive by price or other means. So this is more of a threat to the existing, than really the chance to do something big yourself now. Except for data-driven models." – Interviewee 4

In general, prices of network use might drop massively, even to zero, in exchange for user data that may be processed by MNOs. To come to this status the current business model can stay almost as it is, as long as infrastructure investment is high enough to secure competitiveness, and customers and their demands are in focus.

Radical innovation is the most important innovation dimension because the high capital commitment and very long innovation cycles at MNOs lead to the situation where they have to investigate how to leverage their infrastructure in the best possible way to make profit and invest sensibly in the next infrastructure generation.

Architectural and disruptive innovation are seen as less important as MNOs are strictly bound to the business model due to the infrastructure investments, which limits the possibilities of creating new business models. Also, the existing IT systems do not favour changes in the business model. Nevertheless, small additions to the existing business model are made from time to time but ultimately fail because the corporate culture does not promote change.

Routine and disruptive innovation are expected to be obsolete to MNOs in 20 years, although disruptive innovation was only seen as less important before, while radical and architectural innovation will remain and have the greatest impact on MNOs.

“I would say that in 20 years the complete left side (of the ILM) is obsolete. (…) That means, apart from the radical innovation, only architectural innovation remains (…).” – Interviewee 4

<u>Interviewee 5</u>: Innovation is of high priority to MNOs as life cycles are getting shorter and due to this amortisation periods must become shorter. Accordingly, trends and innovation have to be watched.

“(…) I have to keep a constant eye on new topics and must keep up with these trends.” – Interviewee 5

BMI is not perceived as crucial in the next years as sovereignty over networks and regulation secure the current business models quite well, which is why MNOs are expected to continue. Nevertheless, current business models will be enhanced by new technology.

A change from routine innovation to another innovation dimension may not be too fast because not all customers might be able to follow. However, the business model has to be innovated in order to react to changing customer requirements.

Architectural innovation is regarded as important and can already be seen in a cloud-based and modular infrastructure with an environment in which a customer pays exactly for its required use and where up- and downscale upon demand is possible.

Disruptive innovation is regarded as less important, while routine innovation is important in a transitional period, in which a change from radical to architectural innovation will take place.

Interviewee 6: Innovation is regarded as important at MNOs, which is the reason for their testing new technology and making them applicable not only in their home market but also outside. This is a topic in which MNOs are highly involved. However, MNOs are not seen as disruptive or radical in what they do, nor in comparison with other industries, e.g. automotive. Nevertheless, they invest a lot in start-ups and try to include them in their business models, but this inclusion is not radical. To summarise, MNOs are testing much, evaluate the tested and integrate it partially.

Radical innovation is the most important innovation dimension for MNOs as they already try to use their current business model and enhance it with further services. But in general, a mix of the dimensions is important.

"(…) we try again and again to expand services around the existing business model with additional additive components." – Interviewee 6

Interviewee 7: Architectural innovation is regarded as the most important innovation dimension for the future as through it completely new services can be offered, based e.g. on the new 5G network. Routine innovation is regarded as standard. Disruptive innovation is seen as difficult and not fitting for MNOs. Radical innovation has currently the greatest impact on MNOs because with the new 5G network their existing business model is leveraged.

"Telcos are always in the area of routine innovation, are currently entering the area of radical innovation and the goal should be architectural innovation in order to be as well positioned as possible." – Interviewee 7

Interviewee 8: Without innovation MNOs will in time become irrelevant. Innovation and topics of ML are crucial to their development, e.g. to customer authentication in shops.

The combination of software robotics with Big Data will support not only the generation of knowledge and information and in improving processes but also in the creation of innovation-encouraging company cultures.

Interviewee 9: Disruptive Innovation is regarded as an important innovation dimension for MNOs, while generally all innovation dimensions besides architectural innovation are important. Disruptive innovation is required as MNOs have to create new business models, not only based on selling cell phones or telephony services, because of competition and possible market entries. Hence BMI is crucial to MNOs.

Routine innovation is regarded as a standard that has to stay because if a MNO changes too fast its business model or technical components, it could be that many customers leave. Moreover, it protects MNOs' core business. The interviewee sees problems for MNOs in realising architectural innovation. Radical innovation will be especially important in future development and growth and is even more important than disruptive innovation. This is the reason for which MNOs are already investing in new technology in order to be stronger in the field of radical innovation. Overall, disruptive and radical innovation will help MNOs to grow.

Interviewee 10: MNOs regard innovation as extremely important as there are many suppliers pushing into the market to compete with MNOs through niche services or products. Through innovation MNOs can position themselves to advantage against these competitors. They could also integrate these suppliers.

Radical innovation is regarded as the most relevant innovation dimension for MNOs in the light of blockchain, quantum computing and 5G. These new technical components are used in existing but new business models are also built on them. Hence architectural innovation is vital to MNOs.

Disruptive innovation is seen as more important to start-ups than MNOs. Nevertheless, it is very important to development and growth. If start-ups create a disruptive innovation and introduce it to the market, MNOs can introduce it as well, even in an optimised way, or buy the innovator to introduce it themselves. In this way, disruptive innovation has a great impact on MNOs, even if it is not their own invention. But ultimately a disruptive innovation becomes standard over time and is thus dragged down to routine innovation.

Summarising, the left side of the ILM, meaning routine and disruptive innovation, is regarded as the existing, while the right side, consisting of radical and architectural innovation, is where innovations are seen.

The interviewee states that MNOs, especially the large, will be able to survive without BMI as they have many assets, such as infrastructure and data. Given this, they can stay important and essential without BMI. However, without BMI they will not be able to grow. They are more likely to become smaller. Therefore, BMI is regarded as vital to MNOs' development and growth.

The change to a future MNO business model has to be conducted with a vision of what should be achieved. MNOs have constantly to focus on their main business but have to foster improvements which are based on innovation.

Interviewee 11: Radical innovation is regarded as an important innovation dimension for MNOs as it supports MNOs in generating profit through new technological components such as 5G or software robotics, without changing existing business models.

Architectural innovation is seen as very important too and in close relation to radical innovation, because if new technologies are used at MNOs, e.g. 5G, new business models are also required to realise all benefits from it. Moreover, architectural innovation is regarded as a prerequisite to MNOs' continued existence. In the area of autonomous driving and IoT they could not only build the network infrastructure but offer additional services on which a new business model can be based.

"(…) in any case they would have to go in the area of architectural innovation in order to have any right to exist at all." – Interviewee 11

Innovation of existing business models is seen as mandatory, e.g. to foster digitisation. Innovation and especially BMI are seen as very important to MNOs as competitive pressure and restrictions increase. Due to BMI, new business areas, which are mainly based on data, can be accessed before others reach it and therefore a competitive advantage can be secured. BMI can also be realised through partnerships but is expected to be rather in the mobile than the fixed-line area.

<u>Interviewee 12</u>: Innovation is regarded as an essential topic for MNOs as it helps in winning and retaining customers, which in turn is beneficial to revenue and profitability.

Routine and disruptive innovation are seen as important to a certain extent as they support MNOs in recovering costs.

Radical innovation is very important for MNOs because with new technological components and the existing business model MNOs are able to decrease costs, e.g. with the change from analogue phones to IP-telephony.

Architectural innovation is regarded as crucial to MNOs and a basic topic. MNOs already apply it to retain and win new customers as well as to increase their revenue and save costs. However, MNOs have to be courageous to work in this dimension and do something completely different from what they did before.

BMI is essential to MNOs' development and growth. MNOs need not only to fulfil customers' demands: they also have to come up with new ideas and new business models to answer trends and innovation to remain important for their customers.

<u>Interviewee 13</u>: MNOs have to focus on innovation and to be fast in bringing new products to the market. Generally, innovation is essential to MNOs. Especially regarding organic growth,

the focus is on innovation and innovative strength. Without innovation, MNOs are expected to lose importance. Also in future, MNOs will continue to focus on innovation to find new business models.

"(…) with all the flat rates and all the offers that are flooding the market, it's crucial whether I come up with innovations today or whether I just follow the trends. If I do the latter, then I'm definitely out." – Interviewee 13

Disruptive innovation is seen as very important to MNOs as many are familiar with this innovation dimension and focus on it by trying to use their available technical components and creating new business models around it.

Architectural innovation is an innovation dimension crucial to development and growth and can partially be seen in MNOs that build strong partnerships or buy other companies in order to get new technical components which are used to build new business models. MNOs can then further expand and grow.

4.2.5 Ecosystem

Interviewee 1: The core service of MNOs will be to support their customers during their whole life individually with services, e.g. banking, smart living, smart mobility, socialising and gaming. Regulation and control can strongly influence the market and ecosystem.

Interviewee 2: Software robotics will be essential in future to identify customers' needs and also to a telecommunication ecosystem in which participants are even more closely connected than they are today. It will have an important role in prediction, collaboration, execution of tasks and finding solutions. For example: if a person wants to cook a certain meal, he/she tells the refrigerator, which checks the ingredients list, compares it with the stored items, and orders the missing items directly for delivery on the day the meal is to be cooked. This involves e.g. MNOs, software robotics providers, refrigerator producers, recipe platform providers, supermarkets and delivery services. The MNO is in the middle of process as the infrastructure provider but can also be the provider of the software robotics component. The overall ecosystem will not change to a great extent, but cooperation will become more intensive.

Interviewee 3: An overall change of the current telecommunication ecosystem is not expected.

"I don't see the ecosystem changing completely right now." – Interviewee 3

Interviewee 4: It will be harder to position oneself with a unique selling proposition. Software robotics will have a great influence on the future ecosystem, e.g. at the change of importance from providing services to end customers to providing them to institutional customers.

Regarding hardware providers no big change is expected as this area is already consolidated and only a few are left. Regarding the downstream area, cooperation will become more important, e.g. with Netflix or Flinkster or app developers, as many product innovations are expected. A growing partner network and expanding portfolio will be the biggest drivers.

Interviewee 5: The core of a future ecosystem will be cooperation with other companies, so that MNOs can focus on their core tasks. At the same time, the ecosystem will grow due to new players with new services, new apps and ideas. The landline for telephony will not be used any more, as communication is switched to IP and is supported by smart assistants like Alexa. Furthermore, satellite and cable television will be reduced due to video-on-demand services and IP-television. Software robotics is expected to be an integral part of a future ecosystem but will become a standard, because it will become easier to use and faster to apply.

Interviewee 6: In a future ecosystem, cable operators are expected to disappear as they become part of bigger telecommunication companies. In general, a Europeanisation of MNOs in terms of regulation is expected, leading to a focus on several large MNOs and the disappearance of niche players. The number of content providers will increase, but MNOs will not be a part of content provision.

Partnerships could be established that allow MNOs to participate in the success of other companies that build their businesses on MNOs' network infrastructure and rely highly on it.

Software robotics will play a crucial part in a future telecommunication ecosystem and be an integrated component, but will be seen as natural and not be in the focus they are today.

Interviewee 7: In a future ecosystem the topic of partnerships and alliances will become more important where added value can be realised for the involved parties. For the provision of a complete service, not only the infrastructure but also the services using the infrastructure are decisive. MNOs will transform to full-service providers in partnership with other companies to deliver the required services to private as well as B2B customers, e.g. industrial automation or IoT, from one source.

Television, its adjunct services and the respective industry will play a minor role as consumption of videos, movies or series changes rapidly as viewers not only prefer to watch them on their smartphone than on television but also the transmission is via internet connection and not classical fixed line. Fixed networks are also expected to disappear as well as companies that are not prepared to respond flexibly to changing conditions.

AI is expected to have a high importance to a future ecosystem, e.g. in the common market approach of partnering companies, in call centres or in the overall service offer.

Interviewee 8: In a future telecommunication ecosystem software robotics and Big Data are expected to be used for data analysis, contract negotiation and compliance issues. They will help quickly to analyse contracts and prepare cooperation. M&A will become faster due to software robotics. Furthermore, searching, clustering and preparing huge amounts of data and making sense of them as well as digitising documents and the recognition of inconsistencies will be important application areas.

Interviewee 9: MNOs could enter the logistics area in a future ecosystem and build strong partnership with existing providers. Strong cooperation with large retail chains could be part of a possible future ecosystem. Generally, the boundaries between companies become blurred as, for the provision of value-added services, strong partnerships are required. Software robotics will help with the integration of services in the ecosystem, minimise problems and accelerate integration. A future telecommunication ecosystem is expected to be based on the capabilities of software robotics.

Interviewee 10: A future ecosystem will be strongly influenced by the topics ‘shared economy’ and ‘open source economy’, which is expected to increase. It is understood by the interviewee that the exchange of data will increase as well as communication, also between companies. Based on partnerships, new services will be offered. The market will be characterised by strong competition and great opportunities for MNOs as they have a huge amount of data, e.g. through calls and voice messages, that can be used to their advantage, what they are not doing currently.

It could be that chip and SIM card manufacturers will break away in a future telecommunication ecosystem as cards can directly be installed by smartphone manufacturers. Moreover, mergers are expected in the future, especially large companies buying start-ups, as well as new players, among which service providers will be those that use the infrastructure of MNOs. However, not many structural changes are expected in the ecosystem.

“I think a lot will be merged and consolidated in the future. There will be many new players in the market.” – Interviewee 10

Software robotics will be essential in a future telecommunication ecosystem and become more important since based on ML and data-driven innovations. It will be present in all possible application areas, from retail to communication.

Interviewee 11: A future telecommunication ecosystem will mainly be characterised by close partnerships and cooperation, e.g. in developing applications or products or offering cloud services. MNOs’ role in such partnerships will mainly be the provision of the required infrastructure as well as providing access to the huge number of customers and analyses of the customers they have.

Big changes in the upstream and downstream companies participating in a future ecosystem are not expected. However, fixed-line business will decrease.

Software robotics will play an essential role in a future telecommunication ecosystem as many of today’s jobs are expected to be replaced by automation solutions. But also for the connection of different systems or the provision of cloud services software robotics will be required.

Interviewee 12: A future telecommunication ecosystem will be characterised by partnerships and cooperation, e.g. with power suppliers, public utilities, education or medical institutions for telemedicine or platforms. The ecosystem will not be based purely on technology and applications but will provide for the wellbeing of customers and their everyday life. MNOs will change from telecommunication providers to service companies that are connected with many partners.

A big structural change of the ecosystem is not expected, except that fast companies will eventually take over the slow that are not able to adapt in time. Therefore, in future ecosystems a focus on innovation and quick decisions will be decisive.

Software robotics will play an essential role in a future telecommunication ecosystem through the connection of market participants. It will support the creation of platforms, finding partners for new cooperation and also in providing services faster together with partners.

Interviewee 13: In a future telecommunication ecosystem competition for available frequencies between MNOs and car manufacturers that want to build their own network for autonomous driving could exist. In general, a future ecosystem will revolve around partnerships and cooperation, where companies work together much more closely to provide products and services. This is expected between two or more MNOs, especially from different countries, and between MNOs and other companies.

This chapter summarises the data collection process and the conducted interviews ordered according to identified themes which provide the required information for this research. Before the data collection started, a pilot study took place. Based on it, minor adjustments were carried out and the data collection process was started. A total of 13 interviews were conducted with representatives of the four clusters ‘MNOs’, ‘consulting companies’, ‘Intelligent Automation providers’, and ‘RPA providers’. Overall, theoretical saturation was reached. To prove quality of research, construct validity, internal validity, external validity, and reliability are ensured. All four cases cover all interview questions and thus cover the research topic to its full extent.

5 Discussion

In this chapter the results of the analyses are discussed. Therefore, in section 5.1 within-case analyses are conducted in order to compare the single interviews of each case. The structure of the within-case analyses is according to the identified themes. In this way, commonalities and differences between the single interviews of each case will be identified in order to get more accurate information than is available from only one interview per case. At the end of this section, the single cases' responses to each research question are stated as a result of the within-case analysis. In section 5.2 a cross-case analysis is then performed to compare the key statements and findings of the interviews. The cross-case analysis will help in providing different points of view on the research topic by comparing the single cases and thus identifying commonalities and differences between the cases, taking the RQs as organisational structure. In the following section (5.3), a modified conceptual framework populated for the telecommunication industry based on literature, insights from conducted interviews and inside knowledge of the researcher is examined. In the last section (5.4), conclusion, the chapter is summed up.

5.1 Within-Case Analyses

In the following, the within-case analyses for the four cases are performed using identified themes as guiding structure. The key statements are elaborated and, if possible, confirmed by the literature. Statements of the author are included, if applicable, for interpretation and analysis purposes. Afterwards, interviewees' responses per cases and theme are combined to provide each cases' answer to the research questions.

5.1.1 Technology

<u>MNOs</u>

All three interviewees agree that 5G, software robotics and analytics are the technologies of the highest priority for MNOs. 5G is e.g. required for IoT, automation or in general for mobile connectivity, software robotics to ensure competitiveness, improve forecasts and for optimisation, and analytics to identify white spots and approach customers proactively. The topic blockchain is covered by interviewees 1 and 2 but without precise example on how to use it. This could be because blockchain is a fairly new topic for MNOs and not many use cases have been identified. As long as there is no specialist identifying what this technology could do for MNOs, they are aware of this technology but unable to secure its benefit to the full extent.

Mobile and cloud gaming were identified as an important trend by all interviewees as no single platform is yet established and it has a potential of billions of euros. It is especially interesting to MNOs as high bandwidths and low latency are required for it. Currently all companies of the three interview partners are investing and researching in this area. The trend of gaming is supported by statements of Banović-Ćurguz and Ilišević (2017). Autonomous driving including mobility concepts (interviewees 1 and 3) and IoT including M2M (interviewees 1 and 3) are further trends in the focus. Those are confirmed by GSMA Intelligence and CAICT (2016), EY (2015), Deloitte (2017b) and Schön, Zimmermann and KVJ (2011). All these trends strongly focus on the availability of a fast network, fibre as well as 5G. One possibility for focusing on them could be the hype in terms of 5G and the chase for creative use cases in order to justify it not only for business customers but also for private customers.

Big Data is a driver, recognised as essential by all interviewees because they see the big opportunities that are associated with it. MNOs are aware that they have trillions of records that contain valuable information that can be used inter alia in the creation of new business models (interviewee 2) and improvement of current processes, while a third-party monetisation is no longer in focus. (interviewee 3).

The importance and application of software robotics will increase in the next few years and significantly influence business processes (interviewees 1 and 2). This is also confirmed by Deloitte (2017b). It has to be kept in mind that in future companies will be more dependent on software robotics providers as these have the know-how, and the more that is done using software robotics, the less know-how is with employees.

Regarding future MNO business models, infrastructure is a topic covered by all interviewees. While interviewee 1 states that MNOs could become pure network operators, which would be a loss scenario, interviewee 3 states that this would not be bad because the margins for infrastructure providers are attractive and this will probably be the business model of the next ten years. Interviewee 2 regards infrastructure as a prerequisite to all things to come but does not identify it as the core of a future business model, as the revenue based on it is expected to develop as that of SMS, MMS and telephony. However, for the next 10 to 15 years the provision of infrastructure will be decisive for business customers as they need it for their business models. Osterwalder and Pigneur (2002), and Ghezzi, Cortimiglia and Frank (2015) confirm that a firm's architecture, in this case the infrastructure as deliverer of value, is a critical part of a company's business model. This is further supported by Kallio, Tinnilä and Tseng (2006) as for a faster network connection, which results from a newer infrastructure, a higher willingness of customers to pay is expected. Agreeing with interviewee 2, Ballon (2007), and Ghezzi, Cortimiglia and Frank (2015) suggest that a focus on the provision of new services and the commercialisation of content are also decisive. In the opinion of the author infrastructure will be of utmost importance in the next few years as it is the distinguishing feature of the networks of competitors. However, as stated by interviewee 2, the main focus is expected to be on use cases and services as the infrastructure could be regarded as given and equivalent between single providers.

For business customers several services are expected to be provided, e.g. the connection of their factory, provision of software robotics components or the installation of campus networks (interviewees 2 and 3). As to private customers, interviewee 3 states that software robotics will help in identifying customers' needs and will also be a driver of future success due to nearly limitless implementation possibilities which can be identified and made available by MNOs. This is confirmed by Ghezzi, Cortimiglia and Frank (2015), Kallio Tinnilä and Tseng (2006), as well as Osterwalder and Pigneur (2002) who state that the delivery of value in combination with product innovation has to be in the focus. Moreover, this change to a new business model can only be successful if the right people are employed and the company has vision. Having the right employees is interpreted as having people who are not only skilled, motivated and eager to learn new things, but who also have the right mindset for potential change.

Concerning the future core service of MNOs the interviewees are of divergent opinion. Interviewee 1 states that the best approach is to accompany customers throughout their life and assist them with respective individualised services, e.g. gaming, banking and living. Interviewees 2 and 3 state that infrastructure and data connectivity will be the main service as it is the prerequisite of further technology e.g. of autonomous driving, telemedicine and IoT. This will be enlarged and fostered by use cases built on it as well as software robotics. Interviewee 3 further states that for business customers MNOs could act as service providers and build up company-based campus networks as a main service. Above all, BI and Big Data are expected to be enablers of such a future business model.

Consulting Companies

Interviewees 4, 6 and 7 agree that 5G, due to its connectivity and bandwidth, in combination with the respective use cases, like IoT, is among the topics of the highest importance for MNOs. Another high priority topic is software robotics, which can be used e.g. in combination with analytics for automation purposes (interviewees 4, 5 and 7). Overall, the importance of software robotics is increasing, as confirmed by Deloitte (2017b), as it is easier to scale up with these technologies. The topics 5G, analytics and software robotics were given the same priority, in how often they were addressed by the interviewees. Other technologies with high priority were not discussed. The reason for this might be that consulting companies are highly engaged in these areas at MNOs, as they help in finding use cases for 5G, improving analytic capabilities and implementing software robotics.

5G and the respective bandwidth are regarded as important trends by interviewees 4, 5 and 6 as they enable nearly real-time communication with low latency that is the prerequisite for the connection of various devices, e.g. at IoT or autonomous driving (interviewee 5). Also for M2M communication 5G is regarded as a trend as it not only opens new business areas for MNOs (interviewees 4 and 6) but also fosters partnerships with hardware and app providers (interviewee 4). The importance of 5G for trends like IoT, M2M and autonomous driving are confirmed by Deloitte (2017b), EY (2015), GSMA Intelligence and CAICT (2016), as well as Schön, Zimmermann and KVJ (2011). However, many application possibilities that are hyped together with 5G do not need the functionalities 5G provides but could also be realised with other technologies (interviewee 6). It is understood that the interviewee refers to M2M communication, which, for example, in the case of predictive maintenance would also be possible with much slower connection speeds and lower bandwidth than offered by 5G. A further trend that is regarded as essential is the provision of additional services, which should be fostered and on which new business models can be built (interviewee 6). The requirement to provide new services is supported by GSMA Intelligence and CAICT (2016), Ballon (2007), and Kallio, Tinnilä and Tseng (2006).

Big Data are regarded as a further important trend by interviewees 4, 5 and 6. The amount of data will steadily increase (interviewee 5) and existing data can be used in analytics to create new business models (interviewees 4 and 6), as was done for Nuremberg’s public transport or can be done for car manufacturers or infrastructure planners

For a future MNO business model interviewees 5, 6 and 7 see the network infrastructure as central component. On the one hand, it is the prerequisite for communication and exchange of information between people or independent devices (interviewees 5 and 7). On the other, 5G and subsequent technologies are preconditions of technologies like autonomous driving and IoT (interviewee 7). In this case 5G may not only be seen as enabler of autonomous driving but autonomous driving might be an area in which MNOs build a new business model (interviewee 5). When it comes to infrastructure, its security and access management are also crucial to MNOs, which is another reason for which infrastructure is in the focus of future MNO business models (interviewee 7), especially in the B2B business, which is expected to grow (interviewee 5). The importance of MNOs' infrastructure is confirmed by Ghezzi, Cortimiglia and Frank (2015), as well as Osterwalder and Pigneur (2002) as it delivers value to companies and the speed of a newer infrastructure, here 5G, results in customers' increased willingness to pay, which supports the emergence of autonomous driving and IoT according to Kallio, Tinnilä and Tseng (2006). While IoT and autonomous driving are the most cited use cases of 5G, it is expected that MNOs will identify additional application possibilities to promote 5G even further.

The area of data analytics is expected to be an integral part of future business models (interviewees 4 and 5) that strongly contributes to MNOs' revenue, e.g. by offering data-driven services and motion- or position-based services mainly for B2B customers who want to get more knowledge about their customers (interviewee 4). The importance of data-driven services and analytics is confirmed by Deloitte (2017b), GSMA Intelligence and CAICT (2016), and Kallio, Tinnilä and Tseng (2006).

Interviewee 5 states that a future business model has strongly to focus on automation and more intelligence, inter alia in logistics and provisioning, in order to stay competitive. This priority of automation and intelligence is also acknowledged by Infosys (2017), KPMG (2018b), McKinsey & Company (2017), as well as Schön, Zimmermann and KVJ (2011). According to interviewee 6, BI and Big Data will be integral parts of every future business model and they will greatly increase in significance. However, interviewee 7 limits the relevance of BI as it mainly helps in standardised and basic topics, and there are only few developments. Nevertheless, interviewee 7 adds that this makes software robotics even more relevant.

Interviewee 7 is of the opinion that MNOs should develop more in the direction of full-service providers that offer their own and adjunct services out of one hand. Interviewee 4 adds that a future business model is expected to revolve around data-driven services, if changes to the current one have to be made, as data are seen as raw material of the 21st century. The relevance of data-driven services is confirmed by Deloitte (2017b), GSMA Intelligence and CAICT (2016), and Kallio, Tinnilä and Tseng (2006). However, interviewee 4 also states that MNOs' business models need not change as they are well positioned as long as their investment in infrastructure are on a high level. It is understood that reliance on the existing business model as long as high investment continues is only possible at the beginning of an innovation cycle because it is then that most investment in infrastructure is applied. Investment then decreases until the next innovation, e.g. 6G or 7G, comes, which means that this strategy only works for a certain time. On this view the business model has then to be changed, which justifies a focus on BMI and potential future business models.

Considering the future core service of MNOs, the interviewees are of differing opinion. Interviewees 4 and 5 state that data transfer using mobiles, which is expected to increase strongly, or fixed line will be the heart of MNOs' future services. Interviewee 4 qualifies his statement by limiting this to Europe. Both interviewees further see data analytics and related services, like movement profiles or user behaviour in certain areas, as a main business area for MNOs, a view again qualified by interviewee 4 to a relevance mainly to MNOs outside Europe. By contrast, interviewees 6 and 7 are of the opinion that a functioning infrastructure and network will be the core business of MNOs in combination with adjunct services, like the building of campus networks or offer of security services. Security and data protection topics are confirmed as crucial by Guibao, Yubo and Jialiang (2017) who also state that software robotics will have an integral role in them. Also, more content will be part of MNOs' future core service.

<u>Intelligent Automation Providers</u>

All three interviewees agree that 5G has high priority for MNOs, not only because of the infrastructure construction and the expected connectivity but also due to the increase in devices in their network and the respective data including this data's processing, the real time data transfer, which supports topics like mobile gaming or remote surgery, and the possibilities provided by AR and VR. It is understood that 5G is listed as a high priority topic by Intelligent Automation interviewees as it is an omnipresent topic not only for MNOs but also for them, because with 5G they are able to focus on and realise many more use cases with their software solutions. Thus, 5G is also of high importance to them as they will be able to offer more and broader services as soon as this technology is available.

As a further highly important technology all three interviewees add software robotics, as it can be implemented and support in call centres to lead, transcribe, translate or analyse dialogue. Moreover, software robotics can be used as virtual assistant, expert assist system, e.g. for intelligent search or as RPA bots or for natural language processing, for image recognition, as well as for predictive maintenance and analytics, e.g. regarding churn, user behaviour, personalised advertising and to create innovations and added value for customers to increase their loyalty. It was expected by the author that software robotics would be listed as a high priority topic as the interviewees work in this industry and see that, besides MNOs, many other industries also ask for their services and solutions. Therefore, they know the topic and its importance to market participants pretty well.

Interviewees 8 and 10 agree that Big Data are very important to MNOs and that MNOs should use the potential they have to a greater extent than currently. Strategies to use the available data in profitable ways have to be developed and MNOs have to position and prepare themselves if they do not want to be overtaken.

Telemedicine is identified as an important trend (interviewee 9 and 10), because through 5G remote surgery is enabled by controlling robots over a long distance, meaning that the surgeon has not to be in the same room, area or even country as the patient. Remote doctor consultation is enabled by the new technology. MNOs do not have to be the inventor of these services but can be the providers of the platforms and start associations with the respective associations. It is understood that the two cases of remote doctor consultation and surgery are not regarded as equally complex and demanding, because the former only needs a relatively stable internet connection and delays are not expected to cause harm, while remote surgery requires not only a very fast but highly stable internet connection with near zero delay.

Interviewee 9 regards IoT as another major trend but it has to be further investigated how this can be more important and beneficial not only for B2B but also for B2C. IoT as trend and topic with impact on MNOs is acknowledged by GSMA Intelligence and CAICT (2016) and Deloitte (2017b). Moreover, smart home is crucial as many new services can be offered, partially in cooperation with device manufacturers, as well as the topics of mobility concepts and driving assistance, according to interviewee 9. Interviewee 10 adds the trend of mobile gaming, which is becoming more important to people and growing strongly. The trend of mobile gaming is acknowledged by Banović-Ćurguz and Ilišević (2017).

According to interviewee 10, MNOs will be service- and data-driven companies in the future. This is confirmed by interviewee 9 who adds that even the provision of such services detached from MNOs' infrastructure could be an option. The importance of data and data-driven services is confirmed by Deloitte (2017b), and Kallio, Tinnilä and Tseng (2006). MNOs could have a stake in the area of autonomous driving, at least through their infrastructure. The importance of autonomous driving and IoT is confirmed by GSMA Intelligence and CAICT (2016), and Kallio, Tinnilä and Tseng (2006).

Interviewee 9 states further that software robotics will be an integral part of future business models. This is confirmed by Almato (2016), Azoff (2017), Guibao, Yubo and Jialiang (2017), Infosys (2017), Kibria et al. (2017), KPMG (2018b), McKinsey & Company (2017), strategy& (2015), as well as Telefónica (2018).

Concerning the future core service of MNOs, the three interviewees agree and see the topics of data analytics, data-driven services and services in general as MNOs' core service in order to provide added value to their customers and to improve their customer interaction, e.g. through easy reachability, suggestions and good knowledge of customers' individual demands. Customer satisfaction can be increased in this way. Interviewees 9 and 10 add that the provision of infrastructure and the respective connectivity will also be a main service of MNOs in future. The importance of data-driven services is confirmed by Deloitte (2017b), and Kallio, Tinnilä and Tseng (2006), while the importance of customer topics is confirmed by Camponovo and Pigneur (2003), Ghezzi, Cortimiglia and Frank (2015), and Osterwalder and Pigneur (2002). The importance of MNOs' infrastructure is confirmed by Ghezzi, Cortimiglia and Frank (2015), and Osterwalder and Pigneur (2002) as it delivers value to companies.

RPA Providers

Interviewee 11 cites 5G and basic infrastructure as decisive of the market, while interviewee 12 highlights the importance of added customer value to the generation of a higher revenue. The importance of a good infrastructure is confirmed by Banović-Ćurguz and Ilišević (2017).

Big Data is seen as an important topic by all three interviewees. Interviewee 11 states that MNOs especially are predestined for this topic as they provide the basic infrastructure for the transmission of data if Big Data are worked with in cloud solutions for customers, while interviewee 12 highlights the possibilities Big Data provides, such as creation of anonymous profiles that can be sold, used for advertising or marketing, or for the identification of trends so that respective business models can be built. All three interviewees see a big advantage in BI and Big Data in the area of forecasting and analytics to create insights on customers and processes as well as to improve customer service, but they also see potential in the creation of new services and products that provide additional value and are individualised for customers. The impact of Big Data on MNOs is confirmed by Deloitte (2017b). It is understood by the author that such a strong focus is on the topics BI and Big Data because RPA providers' solutions can inter alia support improvement in the outcome of these technologies and thus these topics are part of the interviewees' business and daily work.

Interviewees 11 and 13 agree that software robotics is among the most influential new technologies for MNOs because, for example, RPA helps in the processing of structured and unstructured data, while Intelligent Automation uses chatbots in customer contact to interact with customers, record and transcribe exchanges and analyse these. Both interviewees agree that the combination of RPA with Intelligent Automation enables even bigger benefits. Software robotics' importance to MNOs is confirmed by Azoff (2017), Bruckner, Zeilinger and Dietrich (2012), and Scheer (2017). Interviewee 12 regards the network infrastructure as a high priority topic for MNOs as the network is a decisive factor in speed, capacity and latency when it comes to data transmission, which is acknowledged by Banović-Ćurguz and Ilišević (2017), and it is also seen as prerequisite to new business models. Interviewee 13 acknowledges the importance of the network infrastructure and stresses its significance for the automotive sector that is closely engaging in autonomous driving. Additionally, interviewee 13 sees a high potential for MNOs in the area of autonomous driving as well as adjunct services. It was expected by the author that software robotics would be listed as a high priority topic as the interviewees work in this industry and see that, besides MNOs, many other industries also ask for their services and solutions. Therefore, they know the topic and its importance to market participants pretty well.

All three interviewees agree that MNOs have to be open to forthcoming trends and that MNOs have to pay attention to them. Interviewee 13 adds that dealing with trends has to be corporate strategy. Interviewees 11 and 12 stress that not only is participation in trends crucial to MNOs' survival but also the provision of additional services based on these trends. Interviewee 11 identifies autonomous driving and M2M as major trends for MNOs regarding which they should not only focus on the provision of connectivity, speed and bandwidth but also on adjunct services. Moreover, telemedicine, e.g. surgery, is a trend topic for MNOs. Interviewee 12 stresses the importance of IoT as an important trend. The importance of 5G to trends like IoT, M2M and autonomous driving is confirmed by Deloitte (2017b), EY (2015), GSMA Intelligence and CAICT (2016), as well as Schön, Zimmermann and KVJ (2011), while the requirement to provide new services is noted by GSMA Intelligence and CAICT (2016), Ballon (2007), and Kallio, Tinnilä and Tseng (2006).

A future MNO business model will be based on the provision of infrastructure including mobile and fixed line services to ensure good services for end customers (interviewees 11, 12 and

13). Interviewee 11 modifies this stating that the fixed line will mainly be used by business customers for data transmission, while data transmission for private users will mainly be done over mobile connections. Interviewee 13 adds that MNOs will be responsible for the infrastructure but others will use the infrastructure to provide their own services. The requirement of a sufficient infrastructure is confirmed by Banović-Ćurguz and Ilišević (2017), while the overall decline of fixed line is supported by Schön, Zimmermann and KVJ (2011). The use of MNOs' infrastructure and the possible connected threat is acknowledged by Schön, Zimmermann and KVJ (2011), Becot et al. (2010), and Du Preez and Pistorius (2002). It is understood by the author that in the statement of interviewee 11, that fixed line will mainly be used by business customers for data transmission, only the commercial use of the fixed line is meant, as the pure transmission of private customers' data using the mobile network would be very uneconomical and, in the end, data are always transported at least partially using fixed line, usually fibre cables in the earth. Therefore, the fixed line is also necessary and important to mobile customers.

Interviewees 11 and 12 further state that not only the provision of infrastructure but also the ensuring of enough capacity, speed and a low latency as well as its revision with new technologies, e.g. 6G or 7G, are major factors in future MNO business models. Both interviewees see additional services, such as cloud, platforms for e-learning or virtual classrooms, or services in the medical and health areas, as major factors in future MNOs. Putting the customer at the centre of action is supported by Camponovo and Pigneur (2003), Ghezzi, Cortimiglia and Frank (2015), and Osterwalder and Pigneur (2002). GSMA Intelligence and CAICT (2016), Ballon (2007), and Kallio, Tinnilä and Tseng (2006) acknowledge the provision of new services as crucial to MNOs.

All three interviewees agree that MNOs have to concentrate more on network infrastructure in a future business model, especially during the roll-out of new technologies like 5G. The importance of MNOs' infrastructure is confirmed by Ghezzi, Cortimiglia and Frank (2015), and Osterwalder and Pigneur (2002) as it delivers value to companies.

5.1.2 Opportunities

MNOs

Interviewee 3 stresses that Big Data and BI are crucial for analyses and forecasts, and also relevant to binding customers through e.g. improved customer experience and loyalty that in turn reduces costs (interviewees 1 and 3). The importance of improved customer experience and its connections to revenue and costs is confirmed by Banović-Ćurguz and Ilišević (2017); and Benhima et al. (2013).

Software robotics is regarded as inevitable for MNOs' future as they make processes faster, cheaper and various problems can be addressed (interviewee 3). All three interviewees agree that software robotics will greatly support analysis and decision-making, will greatly help to cut costs and improve processes of run-time, quality and costs e.g. by taking over tasks formerly performed by employees who are then free to work on more creative topics. All these advantages are confirmed by Azoff (2017), Bruckner, Zeilinger and Dietrich (2012), and Scheer (2017).

According to all three interviewees the combination of software robotics with BI and Big Data is inevitable as e.g. new levels of quality and planning are enabled, new business areas can be identified and revenue can be increased. Moreover, the huge amount of data, which is part of Big Data, is a prerequisite of AI and ML.

A further important topic for future business models is partnering and cooperation, which all interviewees regard as essential. Therefore, MNOs have to invest in start-ups and new technologies at an early stage not to be left behind and to have a good overview of the associated complexity of new trends. This is only possible with the help of partners, be they small or big. Partnership is expected to be based on infrastructure, which is provided by the MNOs, and services, which come from partners, e.g. Netflix or Spotify. But partnerships will also be present at MNOs building networks together in areas that are not profitable if approached alone. The importance of partnerships is likewise confirmed by Ballon (2007), Camponovo and Pigneur (2003), GSMA Intelligence and CAICT (2016), as well as Osterwalder and Pigneur (2002).

To achieve a future business model, adaptions to the current have to be made and shortcomings abolished. Software robotics needs to be introduced to make processes leaner and cut costs. Shops and employees, e.g. in the field service, have also to be reduced and online business has to be fostered. A complete restructuring has to be undertaken (interviewees 2 and 3). The cost aspect is also confirmed by Osterwalder and Pigneur (2002), Lindgardt et al. (2009) and Schön, Zimmermann and KVJ (2011).

The customer must be central to all action and has to be cultivated in light of data (interviewee 2). The importance of good customer relation is confirmed by Camponovo and Pigneur (2003), Ghezzi, Cortimiglia and Frank (2015), and Osterwalder and Pigneur (2002). To reach this state the existing silos in the companies have to be torn down and internal cooperation has to be started with less opposition and bureaucracy (interviewee 1). Organisation as a central topic is confirmed by Bouwman, Haaker and Faber (2005). Furthermore, the one-size-fits-all approach has to become an individual approach to single customers. The monetisation of mobile data has also to be tackled (interviewee 3). This is confirmed as a central requirement by Johnson, Christensen and Kagermann (2008).

Software robotics will play a central role in a future business model, improving e.g. energy efficiency in the network and bringing intelligence to it. It is essential to competition (Interviewee 1) and without it a new network cannot be built in two years and future processes will probably not run (interviewee 2). It is required to learn customers' needs and concerns and to provide new business models for the economy (interviewee 2). Without the integration of software robotics no player will be able to survive. Even if big leaps on the sale side will not come, through software robotics the cost side can be optimised so that a network can be built even without higher revenue (interviewee 3). These reasons for considering software robotics to be crucial to future MNO business models are confirmed by Almato (2016), Azoff (2017), Guibao, Yubo and Jialiang (2017), Infosys (2017), KPMG (2018b), McKinsey & Company (2017), as well as Telefónica (2018).

<u>Consulting Companies</u>

All four interviewees agree that BI and Big Data have huge potential for profitability and growth through the creation of new products, one of which could be the reselling of anonymised data the way Facebook or Google do it. That the volume of data is increasing is confirmed by GSMA (2017), and GSMA Intelligence and CAICT (2016), while its high impact on MNOs is confirmed by Deloitte (2017b). Moreover, interviewees 4, 5 and 7 agree that these technologies help greatly in making more accurate and better forecasts, provide more and deeper insights into customers behaviour that help to approach customers individually with individualised products, and support in finding new ways of making business. Interviewees 4 and 6 add that BI and Big Data help MNOs to bind customers, which in turn fosters profitability because less money has to be spent on winning them back. The importance of increasing customer experience and thus binding them is acknowledged by Banović-Ćurguz and Ilišević (2017).

The importance of software robotics is increasing, as confirmed by Deloitte (2017b), as quality is improved, processes are executed faster, maintenance effort is reduced and employees are freed to cover more productive tasks, which leads to growth (interviewees 4, 5, 6 and 7). The advantages of software robotics are confirmed by Azoff (2017), Bruckner, Zeilinger and Dietrich (2012), and Scheer (2017). However, interviewee 4 criticises that especially RPA does not keep up with what was promised. The criticism of RPA is understood to originate in the promise of some RPA providers that their solutions would reach break-even within three months of implementation, which in many cases was improbable if an automation potential had not been identified before the promise was made.

Interviewee 6 states that software robotics are mainly used to optimise existing processes and not to analyse user behaviour and create new business models based on the evaluation as Google and Amazon do. It is understood that optimisation of processes is in point here, because MNOs currently use the respective technologies primarily for such tasks, although there are more promising and value adding possibilities that could be approached with software robotics. Interviewees 4, 6 and 7 agree that software robotics greatly support analytics as well as the decision-making process.

Software robotics will be crucial to future business models as it minimises time to market, automates tasks and reduces complexity of certain processes (interviewee 5). This is confirmed by interviewee 7, who adds that software robotics will influence employees, their skills or replaceability. Interviewee 6 adds that the technology will be integral to business models in future and the focus will be less on the technology itself than on the services it supports. Interviewee 4 agrees that software robotics are of great importance to future MNO business models and believes that they are at the centre of interest in the identification and creation of new business models. These advantages and reasons for software robotics' importance to future MNO business models are confirmed by Almato (2016), Azoff (2017), Guibao, Yubo and Jialiang (2017), Infosys (2017), Kibria et al. (2017), KPMG (2018b), McKinsey & Company (2017), strategy& (2015), and Telefónica (2018).

The combination of software robotics with BI and Big Data will become more important in future because through the connection of these technologies analyses, reports and decisions can be further improved, trends can be identified earlier and more accurately, and new offers can be created more swiftly and efficiently to generate additional revenue (interviewees 5, 6 and 7). However, the influence of BI in such a combination is regarded as limited when it comes to reports as these are usually standardised (interviewee 7). Interviewee 4 is of the opinion that the beneficial short-term effects of such a combination are currently overrated.

5G is regarded as a trend that fosters partnerships with hardware and app providers (interviewee 4). The offer of new in addition to MNOs' core services is strongly necessary to a future MNO business model, also in partnership with other companies (interviewee 6). Even free subscription for customers in exchange for their data that may be refined and resold could be a viable option (interviewee 4). The importance of partnerships is supported by Ballon

(2007), Camponovo and Pigneur (2003), GSMA Intelligence and CAICT (2016) and Osterwalder and Pigneur (2002).

To achieve a future business model, several parts of current business models should be adapted and shortcomings abolished (interviewee 5). Tariffs and tariff structures that are no longer required as they are outdated should by stopped, even if there are contracts with customers that would have to be terminated if customers are not willing to migrate to newer contracts. In this way, older burdens can be abolished and innovation promoted (interviewee 6). A strong focus on innovation for future business models is supported by Ghezzi, Cortimiglia and Frank (2015), Osterwalder and Pigneur (2002), Pisano and Teece (2007), and Rouse (2015).

According to interviewee 5, a future business model has to focus on automation and intelligence among others in the area of customer support. The gravity of customer centricity is covered by Camponovo and Pigneur (2003), Ghezzi, Cortimiglia and Frank (2015), and Osterwalder and Pigneur (2002). More partnerships should be closed to combine services and enter the market in cooperation, which is acknowledged by Ballon (2007), Camponovo and Pigneur (2003), GSMA Intelligence and CAICT (2016), and Osterwalder and Pigneur (2002).

In a future business model, BI and Big Data are expected to play an even bigger role, e.g. in the evaluation of user behaviour or prediction of required maintenance (interviewee 5). Especially Big Data is expected to evolve as new algorithms are created and business departments are able to use them without professional assistance (interviewee 6). These technologies even help in identifying new business models and providing cross-selling potential (interviewee 4).

Intelligent Automation Providers

The market offers great opportunities if MNOs use the data that are available to them more effectively (interviewee 10). If MNOs do not only concentrate on the collection and analysis of data in terms of Big Data but start with the generation of information and knowledge, predictive models can be built and the huge potential can be realised. To reach this, data have to be prepared better (interviewees 8 and 10). Interviewee 10 adds that cooperation with other companies and sharing anonymised data with them would lead to more valuable data that could provide more information with which better knowledge and models could be developed. It is seen that especially Intelligent Automation providers that have to deal with data as their core business are aware that MNOs do not use the data treasure they have to its full extent. The author understands sharing of data with other companies to generate more knowledge as valuable and very important to MNOs' future development. However, MNOs should first of all generate and realise the knowledge and benefits that are included in the data they currently own before entering a possibly even more complex area.

All three interviewees agree that BI and Big Data will greatly support forecast and analysis. Interviewee 8 stresses that especially BI helps companies in concentrating on the most important topics and pulling together the most relevant KPIs from different business areas to make them evaluable and understandable as a baseline for decisions and reactions on trends in the market. Regarding Big Data interviewee 8 adds that it strongly depends on business departments and whether they can work with the knowledge gained from Big Data or if data scientists are required, who assist evaluation and preparation of results and decisions for management. Interviewee 10 adds that use cases based on BI and Big data have to be implemented, e.g. for churn analysis, recommendation systems, predictive models or to get insights into user behaviour and address them better, for example with discount models. Interviewee 9 states additional use cases, like error and predictive analysis, are required and says that BI and Big Data support profitability by decreasing costs and enable a more precise customer segmentation to make more fitting personalised advertising. At the same time, new business models can be built based on the available data. BI and Big Data help in binding customers as the generated insights help to create new applications and better user interface, to promote improved interaction with customers and customer proximity (interviewee 8). The beneficial effect that Big Data has on MNOs is confirmed by Deloitte (2017b), while customers experience's importance to MNOs is highlighted by Banović-Ćurguz and Ilišević (2017), and Benhima et al. (2013).

Software robotics will have a great influence on MNOs as it can ensure competitiveness in the future, e.g. through improving customer interaction in call centres, increasing customer proximity, and generally in supporting and preparing data analyses, e.g. for proactive network maintenance. In addition, the automation of repetitive tasks, such as password resets and authentication, are great application possibilities for software robotics. Moreover, software robotics makes processes more efficient with higher quality, e.g. in call centres with automated analyses or intelligent chatbots, and thus reduces costs (interviewees 8 and 10). However, according to interviewee 9, MNOs have to position themselves better in the area of software robotics. It is understood that the interviewees have good insight into relevant application possibilities of software robotics at MNOs as this is part of their professional competence. The use cases may not be regarded as applicable to any MNO as they can be interpreted rather as overarching to get a certain idea of which areas could be relevant to software robotics. Concerning concrete use cases the available data, automation goals and expected results of MNOs have to be considered. Software robotics' merits are confirmed by Azoff (2017), Bruckner, Zeilinger and Dietrich (2012), and Scheer (2017).

Interviewees 9 and 10 agree that the combination of BI and Big Data with software robotics is essential because especially for ML and DL huge amounts of data are needed. Moreover, the amount of available data is steadily increasing and to be able to analyse these structured and unstructured data and generate knowledge the combination of these technologies is required. Interviewee 10 further says that even more and deeper information and knowledge can be realised when data are merged on a uniform data platform. The increasing amount of data is acknowledged by GSMA (2017), and GSMA Intelligence and CAICT (2016).

Interviewees 9 and 10 expect future MNO business models to be characterised by partnership and cooperation. Interviewee 10 mentions cooperation in light of sharing anonymised data with other companies to get more information, more valuable knowledge and to develop models.

Interviewee 9 states that partnerships are especially important when new topics, such as biotechnology or remote doctor consultation are broached, when MNOs can participate as platform enablers in cooperation with the respective institutions. Also regarding smart homes, cooperation with device manufacturers is seen as beneficial to MNOs. Generally, partnerships are valuable for value-added service offers (interviewee 10). The importance of partnerships is also stressed by Ballon (2007), Camponovo and Pigneur (2003), GSMA Intelligence and CAICT (2016) and Osterwalder and Pigneur (2002).

It is stated by interviewee 9 that a future MNO business model will mainly concentrate on older people, as they promise a higher profit than the younger generation that may not be left behind. It is understood by the author that the older generation not only includes people that are in receipt of a pension or have health issues but also those above the average age of the population. The decisive criterion is to address a group as large as possible that has comparable needs and is in a certain situation and is at the same time willing to spend more money on services that make their lives easier and on health services than is a younger generation.

To achieve such a future business model the current business model has to be adapted and shortcomings abolished. Therefore, MNOs should enter new fields of business with new products, also in cooperation with partners, and focus more on their customers, e.g. by having greater and higher quality interaction, not only sending the monthly invoices. Policies better suited to approaching prospective customers and those in non-metropolitan areas are required to increase the market share. Interviewee 10 states that partnerships need to be fostered and that their importance will increase. New services that are the result of partnerships need to be offered. MNOs must be brave enough to implement projects that they have tested successfully. The importance of partnerships is acknowledged by Ballon (2007), Camponovo and Pigneur (2003), GSMA Intelligence and CAICT (2016), and Osterwalder and Pigneur (2002), while the importance of customer centricity is confirmed by Camponovo and Pigneur (2003), Ghezzi, Cortimiglia and Frank (2015), and Osterwalder and Pigneur (2002).

According to all three interviewees, BI and Big Data will play a crucial role in future MNO business models. Interviewee 8 states that every company already applies Big Data at the moment and generates more data every day. Those that focus on that data will be the ones to introduce innovation, which is essential to improvement of products and increase in customer proximity. However, the right culture has to be created that encourages innovation. Companies that apply such technologies will have competitive advantages over those that do not or only to a minor degree. Interviewee 9 confirms this and adds that BI and Big Data are especially important to MNOs' future business model of profitability and growth, e.g. provision of analyses, innovation and added value based on available data. BI and Big Data also help with the identification of further new business models. Interviewee 10 adds that there are departments at MNOs that will not be able to do business without these technologies. The further we look into the future, the more important BI and Big Data appear.

All interviewees agree that software robotics will be essential to future MNO business models. Interviewee 8 stresses its importance to data preparation and analyses to provide customers with the greatest possible added value and additional service. Moreover, competitive advantages can be secured. Interviewee 9 adds that deep and comprehensive analyses of unstructured data and the automation of repetitive activities will not work without software robotics. Both interviewees 9 and 10 conclude that software robotics has to be used in order to stay in the market as otherwise MNOs would become smaller and lose importance. Software robotics' advantages and the reasons for which it is essential to future MNO business models are confirmed by Almato (2016), Azoff (2017), Guibao, Yubo and Jialiang (2017), Infosys (2017), Kibria et al. (2017), KPMG (2018b), McKinsey & Company (2017), strategy& (2015) and Telefónica (2018).

<u>RPA Providers</u>

Interviewees 11 and 12 state that customer centricity, including winning customers, customer loyalty, retention and getting the most value from customers is a focal point in the market. The wellbeing of MNOs' customers has to be at the heart of MNOs' actions. BI and Big Data support binding and retaining customers to get the most value of the business relationship. The importance of customer centricity is confirmed by Camponovo and Pigneur (2003), Ghezzi, Cortimiglia and Frank (2015), and Osterwalder and Pigneur (2002).

According to interviewees 11 and 12, software robotics has a great impact on MNOs, especially regarding process automation, pattern recognition and decision-making, e.g. in call centres. It further supports the generation of savings and driving down costs by shifting employees to more significant tasks for which otherwise new employees would have been recruited. All three interviewees highlight the importance of software robotics to processes, because the technology enables not only their automation but helps in cases of peaks that cannot be handled manually. According to interviewees 11 and 12, software robotics reduces process times of the tasks it is designed for, meaning that e.g. inquiries are handled faster and products can be introduced faster to the market. They conclude that the biggest beneficial effects can be reached through a combination of software robotics with BI and Big Data as they are supplementary technologies. The advantages of software robotics are confirmed by Azoff (2017), Bruckner, Zeilinger and Dietrich (2012), as well as Scheer (2017). It is understood by the author that RPA providers' opinion on the importance of software robotics to MNOs may be regarded as comprehensible, as RPA providers are highly knowledgeable about the technology and have deep understanding of application possibilities at MNOs. However, it has to be considered that they could also want to stress the importance of this topic as they work in this field and want to convince others of its benefits.

All three interviewees agree that partnership and cooperation are a decisive factor in future MNO business models as they support MNOs' growth. MNOs will develop applications and software with partners and bring them to the market together. Also offering hosting services and the operation of systems will be done in cooperation. Moreover, cooperation with medical institutions, power suppliers, public utilities and other companies is feasible. Additionally, cooperation with other MNOs, especially Asian, will increase as they are seen as trend setters for trends that can be applied in other countries. Therefore, it is important to be involved at an early stage to have a head start. The importance of partnerships is also highlighted by Ballon (2007), Camponovo and Pigneur (2003), GSMA Intelligence and CAICT (2016) and Osterwalder and Pigneur (2002).

Interviewees 11 and 13 expect that a consolidation will take place in the market, leading to a reduction in existing providers that are seen as too numerous. Moreover, a future MNO business model will revolve around new products and content, with which MNOs want to bind customers. In future, autonomous driving and related services will be a huge area that will greatly influence MNOs, which could be good but also bad for MNOs as a declassification to pure network providers could happen (interviewee 13). Also, data analytics based on customer data will be essential to MNOs for the creation of new services and identification of possible new business models. The benefits, e.g. generation of new capabilities, through a market consolidation are supported by Al-Debei and Avison (2011), and GSMA Intelligence and CAICT (2016).

To prepare for such a future MNO business model several aspects of the current business models have to be changed. Customers should be even more in the focus of MNOs' actions but many interactions with customers, such as in call centres but also in administration, have to be based on software robotics that handle inquiries to free employees for more value-adding tasks (interviewees 11, 12 and 13). This is supported by Camponovo and Pigneur (2003), Ghezzi, Cortimiglia and Frank (2015), and Osterwalder and Pigneur (2002).

Interviewee 12 states that the provision of infrastructure is a prerequisite to MNOs' survival but MNOs may not expect to make money with it in future as it will be regarded as given by customers. Therefore, a concentration on services and applications that build on this infrastructure is required for profit generation (interviewees 11 and 12). Hence the right people to bring up new ideas and fulfil the requirements are needed. These have to think outside the box and may not only be knowledgeable in one topic but have to possess an overview over many relevant topics. On the other hand, employees whose jobs have been automated need to be trained for other jobs so that their knowledge is not lost to the company (interviewees 12 and 13). Amit and Zott (2012) confirm that having the right people is crucial to any business. Overall, innovation has still to be an integral part of future MNO business models (interviewee 13). Field services, such as troubleshooting and technicians, as well as IT and other areas will remain essential to future MNOs business models (interviewee 11). Innovation as an essential to companies' development is confirmed by Drucker (1998), Pisano and Teece (2007), Rouse (2015), and Schumpeter (1934).

Interviewees 11 and 12 agree that the provision of services besides the infrastructure will be a part of MNOs' future core business. These services can be provided with partners, e.g. regarding music or video streaming or platform provision. The decisive point is to provide added value to customers and to make interesting offers. Interviewee 11 also highlights the importance of infrastructure as the core of MNOs actions and of service offers from many other companies. This core also enables access to MNOs' customers and without the core MNOs' access would be lost. Thus, it has to remain. Partners as an important factor in business models are highlighted by Ballon (2007), Camponovo and Pigneur (2003), GSMA Intelligence and CAICT (2016), and Osterwalder and Pigneur (2002), while the importance of the infrastructure is acknowledged by Ghezzi, Cortimiglia and Frank (2015), and Osterwalder and Pigneur (2002).

BI and Big Data will play an important role in a future MNOs business model, not only in collecting data that are generated e.g. through communication, autonomous driving or IoT, but also in combining and evaluating them, promoting understanding that can provide the baseline of further services (interviewee 11). The importance of autonomous driving and IoT is confirmed by GSMA Intelligence and CAICT (2016), and Kallio, Tinnilä and Tseng (2006).

Software robotics will also be essential to future MNO business models as it saves costs, makes processes faster and automates them, and helps in the generation of knowledge, information and new business models. MNOs are also expected to face problems regarding quality, performance and cost if they do not apply software robotics in their future business models to a high degree as more processes, regulation and law are expected to be incorporated, which is more cost intensive, slower and probably of diverging quality if done by employees (interviewees 12 and 13). That software robotics is essential to MNOs is confirmed by Almato (2016), Azoff (2017), Guibao, Yubo and Jialiang (2017), Infosys (2017), Kibria et al. (2017), KPMG (2018b), McKinsey & Company (2017), strategy& (2015) and Telefónica (2018).

5.1.3 Challenges and Constraints

MNOs

The market situation is regarded as positive by one interviewee (interviewee 2), who states that MNOs are in a good position, as long as they are not compared with global players like Amazon or Google. The situation was seen as, on the one hand, difficult due to forthcoming and existing challenges and, on the other hand, positive due to the increasing demand and necessity of MNOs' services, by interviewee 3, which is supported by GSMA (2017). The overall focus is on growth markets, like South Asia, China and the USA, while Europe is not uninteresting but harder to approach as it is very fragmented. The market situation might be interpreted in different ways as one respondent works for a MNO that already had a complete network before its privatisation, while the other one works for a MNO that had to build the network from scratch, meaning that they did not get a head start. Moreover, their international focus is not identical, which is another reason for varying assessments of the market. However, interviewee 3 modified the opinion by referring to the overall market situation of all MNOs based on the services they provide.

Regarding competition, not only are OTT providers (interviewees 1, 2 and 3) such as Google and Facebook identified and described as a not insignificant threat, as they could enter the market fairly fast and offer services free, but also MVNOs. Balon and Liau (2012), Becot et al. (2010), Du Preez and Pistorius (2002), European Commission (2013) as well as Schön, Zimmermann and KVJ (2011) identified the competitive environment consisting e.g. of OTT providers and MVNOs as a major threat, too. All interviewees identified the threats of big global OTT players, but these were not explained in detail as no insights on their plans are available and only assumptions of the interviewees could be made. High cost pressure (interviewees 1 and 3), due e.g. to high infrastructure costs, in combination with customers' demand for high performance and greater service leading to better user experience and a better customer journey, are identified by interviewee 3. Infrastructure and investment in it (5G, fibre, backbone) are cited by interviewees 1 and 2 as one of the biggest economic challenges due to the long pay-off time as networks are not only built where they are profitable but also have to be built in less profitable areas. The high infrastructure investment cost is also brought up by Banović-Ćurguz and Ilišević (2017), while regulation as a big challenge is thematised by GSMA (2017) and EY (2015). This is probably one of the main challenges as MNO business is and always has been relatively capital-intensive. This is especially true as the 4G network was only launched a few years ago in several countries and implementation is not yet complete and 5G is currently implemented at the same time, meaning that even higher costs occur than in implementation of only one network. The concern of shortening technology cycles is confirmed by EY (2015). This has to be seen in the light of the recently conducted frequency auctions in several countries, which led partially to multi-billion euro prices that are a heavy burden to MNOs which lack the capital to invest in the required new infrastructure.

It is realised by MNOs that Big Data are not yet in the state they could and should be, as data silos are hard to break open (interviewee 1). The concern of not using the available data to their full extent is confirmed by Deloitte (2017b), and Kallio, Tinnilä and Tseng (2006).

<u>Consulting Companies</u>

Concerning the market situation a diversified picture is drawn by the interviewees from consulting companies. They differ strongly on what are the most important aspects of MNOs' market situation. The overall diversified picture of the market situation and the different focal points of the interviewees might come from their different professional backgrounds prior to and even in the companies they work for, different hierarchical positions and different ages.

Interviewees 4 and 5 see the competition as growing, which is in accordance with Balon and Liau (2012), Becot et al. (2010), Du Preez and Pistorius (2002), European Commission (2013), and Schön, Zimmermann and KVJ (2011), while interviewees 4 and 7 focus on customers, stating that MNOs are not close enough to their customers (interviewee 7) and that customer acquisition is hard (interviewee 4). The importance of a good customer experience, which also includes being close to the customers, is highlighted by Banović-Ćurguz and Ilišević (2017) and Benhima et al. (2013). The topic of customer acquisition and retention was expected to be crucial to MNOs as many of their customers are willing to change their provider if they receive a better offer for the services they need. As winning back customers is generally more expensive than acquiring new ones or binding them, special attention is paid to this topic. Besides these commonalities, the interviewees focus on different topics. Interviewee 4 describes the current IT systems and to a certain degree also the corporate culture as well as being tied to the infrastructure as obstacles to fast BMI and that MNOs' current business model is threatened by competitors. The threat to their business model, which is regarded as fragile, is confirmed by Kallio, Tinnilä and Tseng (2006). Interviewee 5 focuses on the great cost pressure, which is also listed as a major challenge by interviewee 4, and increasing costs for customer support in combination with a growing portfolio, while innovation and the expansion of the infrastructure need to be fostered. The high cost pressure is confirmed by European Commission (2013) and the requirement for infrastructure investments is supported by Banović-Ćurguz and Ilišević (2017). That innovation needs to be fostered is also focused on by EY (2015), stating that MNOs have poor rates of innovation.

Three interviewees (4, 6 and 7) regard regulation as a major challenge to MNOs as it is perceived as strict, e.g. in terms of data protection or charges, and constitutes risk to MNOs. It also hinders MNOs from entering business areas in which they would like to participate, such as a greater use of data, which is allowed in certain countries, like China or the USA (interviewee 4), while regulations are partially outdated. The severeness of regulation is also confirmed by GSMA (2017) and EY (2015). The topic of regulation was also expected to be listed as major obstacle as consulting companies advise e.g. legal authorities that are responsible for regulation and thus have respective knowledge. However, consultation of legal authorities and the provision of services to MNOs are normally conducted in different business departments of consulting companies. It is understood that as the interviewees are in business departments that provide special consulting services to MNOs and not legal advice, strict regulation is criticised and not defended. The author understands that with strict regulation not only that of the EU but also state-specific, e.g. allowing network access to competitors, are meant.

A further big challenge is the infrastructure, which is also seen from different points of view. Interviewee 4 sees the challenge in a massive increase in the amount of data that could push the infrastructure to its limits and the long time that is required to build further infrastructure, which is of course connected to high costs (interviewees 4, 6 and 7). Those high costs are not only connected to infrastructure investment but, in the author's view, also to the high costs of respective frequency auctions in several countries that in combination with decreasing revenue from roaming charges, which were completely abolished in the EU, can lead to reduced profitability. Interviewee 6 recognises the problem that MNOs provide the infrastructure and others build their business model on it without paying MNOs adequately for the use.

In general, television is regarded as becoming less important and it is believed that business models that build on it will eventually disappear at MNOs as more is done using internet and smart devices than television and its fixed programme (interviewee 7). If possible, legacy infrastructure, e.g. in IT, should be removed or exchanged with newer.

Intelligent Automation Providers

The market situation is characterised by strong competition (interviewees 9 and 10). Strong competition is acknowledged by Balon and Liau (2012), Becot et al. (2010), Du Preez and Pistorius (2002), European Commission (2013), and Schön, Zimmermann and KVJ (2011). Interviewee 9 adds that great cost pressure is present in the market, as is confirmed by the European Commission (2013), and that MNOs have to be more cost-effective and efficient, which improvement could also be reached by cooperating with competitors where this is feasible and reasonable. One decisive factor for customers for or against a MNO is the available customer support, which is generally not seen as good. A good customer experience is confirmed as important by Banović-Ćurguz and Ilišević (2017), and Benhima et al. (2013). Interviewee 9 further states that regulation should be stronger to provide a countrywide good network coverage. Data protection is a crucial topic MNOs have to strongly keep in mind and focus. Regulation and data protection are supported by GSMA (2017) and EY (2015). Regarding the network infrastructure, cooperation could be beneficial to MNOs to cover uneconomical areas, which are seen as being not covered well enough now, by building masts together. Partnership is confirmed as an important factor to companies' success by Ballon (2007), Camponovo and Pigneur (2003), GSMA Intelligence and CAICT (2016), and Osterwalder and Pigneur (2002).

Big economic challenges are regulation, as confirmed by GSMA (2017) and EY (2015), social acceptance and legal challenges as the network infrastructure of 5G has to be more dense because the range is shorter than the range of 4G, which is mainly a problem in cities and villages, while it is not expected to be a problem near motorways. The infrastructure itself is also a challenge as 4G is not yet rolled out everywhere and at the same time the roll-out of 5G has to be started, at least in hotspots like metropolitan areas or near motorways and railways, which leads to high costs (interviewee 9). 4G that is not rolled out countrywide may be understood with regard to countries like Germany that are still implementing 4G, especially in rural areas. However, it is not true for all countries that 4G is not completely rolled out. The requirements for infrastructure roll-out and its connection to high investment is supported by Banović-Ćurguz and Ilišević (2017).

<u>RPA Providers</u>

All three interviewees agree that the market situation is characterised by competition inter alia from OTT providers. Interviewee 11 states that this can mainly be seen in the European market, which is fragmented due to its many providers and completely different from that of the USA. However, consolidation is expected to decrease competition. By contrast, interviewee 13 believes that the market is becoming more and more competitive. Strong competition in the market is confirmed by Balon and Liau (2012), Becot et al. (2010), Du Preez and Pistorius (2002), the European Commission (2013), and Schön, Zimmermann and KVJ (2011). The author understands that interviewee 11 means a possible consolidation of the market would only lead to a reduction in competition between MNOs. However, e.g. in Germany, consolidation of the market, when Telefónica Germany bought E-Plus, did not lead to a reduction in competition. Moreover, it is interpreted that the increase in competition, as stated by interviewee 13, not only focuses on MNOs but is evident also between app providers and hardware manufacturers.

Interviewees 11 and 13 further describe the high cost pressure as characteristic of the telecommunication market, which is based on strong competition, as well as the need for an infrastructure with good coverage, high speed and good quality. Moreover, MNOs focus on the systems they have in use, IT and digitisation in general. The high cost pressure is confirmed by the European Commission (2013), while the need for a good infrastructure is acknowledged by Banović-Ćurguz and Ilišević (2017). The need for digitisation is confirmed by GSMA Intelligence and CAICT (2017). It was expected by the author that the focus of RPA providers would be on topics like systems, IT and digitisation as RPA providers work in this area and support MNOs in optimising these topics.

As biggest economic challenges interviewees 11 and 12 list investment in the roll-out of 5G which is critical to MNOs, and strong competition to bind existing and win new customers. High cost pressure, regulation and legislation as well as high investment costs in IT systems are seen as additional major challenges (interviewee 11). Interviewee 13 confirms that the market becomes more and more regulated. The requirements of infrastructure roll-out and its connection to high investments are confirmed by Banović-Ćurguz and Ilišević (2017) and the challenge presented by regulation is confirmed by GSMA (2017) and EY (2015). Strong competition is acknowledged by Balon and Liau (2012), Becot et al. (2010), Du Preez and

Pistorius (2002), European Commission (2013), and Schön, Zimmermann and KVJ (2011), while the European Commission (2013) also confirms high cost pressure. It is understood by the author that the high investment costs in IT systems are mentioned as this is a starting point from which RPA providers may offer their services to MNOs, which can decrease investment costs.

5.1.4 Innovation

<u>MNOs</u>

Routine innovation is regarded as a prerequisite to MNOs survival.

Disruptive innovation is only thematised by interviewee 3 who states that it has not worked so far, although his company has given it several tries. Hence, they follow a partnering approach in this case.

Radical innovation is regarded as daily business by interviewee 3, while interviewee 2 states that they are already working in this area, which is important to them.

Architectural innovation is regarded by all three interviewees as extremely important to MNOs as it supports B2B business, e.g. connected factories, and the development of new business models together with partners based on new technologies like 5G. The common development of business models fosters the sharing of risk as MNOs alone are not always capable of entering this field. Moreover, MNOs are expected to shape the market when they act in this early enough. Interviewee 3 adds that although it is important, it is not vital to MNOs, but without its application sales opportunities are lost. As this statement regarding 'vital' is made by interviewee 3 referring to a timeframe of five years, the author understands that BMI is not the main focus of the next five years because in this time it is not vital to MNOs. However, if the future after five years is contemplated, this position has to be reconsidered.

Although architectural innovation is the dimension all three focused on the most, interviewees 1 and 2 state that in the end a mix of all dimensions will be required. This is regarded by the author as reproducible. Nevertheless, as the questions asked regarding the innovation dimensions concerned the future as well as profitability and growth, and architectural innovation was the most promising topic for the interviewees, it is interpreted as the most important innovation dimension for MNOs.

Despite the innovation dimensions the MNOs focus on, interviewee 3 states that the core business is and will be data connectivity. This opinion is supported by Kaleelazhicathu et al. (2014) who state that connectivity is the central value of MNOs and the centre of their service provision. Granted this, it may be assumed that the importance is not only of architectural but also routine innovation. However, BMI is not seen as prerequisite to future survival. Interviewee 2 stresses that the search for future business models is vital and thus his company is investing in diverse business models identified as potentially future-proof. GSMA Intelligence and CAICT (2016) suggest that the development of new business models is prerequisite to participation in in the race for increasing revenue and benefit. The need for new business models is also confirmed by Fernández and Usero (2009) who state that is it required to cope with changing conditions.

According to interviewee 1, in a future MNO business model co-innovation and cooperation have to be increased, which is connected to a mind shift. Therefore, a gainful approach is required. The partnership and cooperation aspects are confirmed by Ballon (2007), Camponovo and Pigneur (2003), GSMA Intelligence and CAICT (2016), and Osterwalder and Pigneur (2002). Amit and Zott (2012) agree that having the right people is crucial.

<u>Consulting Companies</u>

MNOs should focus more on innovation as it is not sufficiently considered right now (interviewee 5).

Routine innovation is experienced as a standard that will stay important and has to evolve (interviewee 5 and 7).

Disruptive innovation is not regarded as a dimension that fits for MNOs as they would have to create a new business model based on what they already have, which is not seen as their core competence (interviewee 7). Interviewee 4 sees disruptive innovation as unimportant because MNOs do not have many opportunities to create a new business model based on what they have in their portfolio. They tried it in the past, and are still trying today, but the outcome was not as good as expected.

Radical innovation is seen as important by interviewees 4, 5 and 6. Interviewee 5 regards it as a step from routine innovation towards architectural innovation, while interviewees 4 and 7 recognise it as the logical choice for MNOs referring to 5G and MNOs' infrastructure as they use their existing business model for the monetisation of new technical components. This is confirmed by interviewee 6, who states that the additional services based on new technical components are in the focus of MNOs.

Architectural innovation is seen as essential for MNOs by interviewees 4, 5 and 7 as through 5G new services and new business models are enabled and growth and future development can be secured (interviewee 7). Architectural innovation will mainly be driven by leveraging data to build a new business model, e.g. sale of data or cross-selling (interviewee 4).

Only interviewee 6 is of the opinion that a mix of the innovation dimensions will be decisive. It is not shown which innovation dimension is the most important for MNOs in this interviewee's opinion as they are not weighted. Interviewee 4 states that only the right side of the ILM will be relevant to future development and growth, meaning radical and architectural innovation. Interviewees 5 and 7 state that MNOs start at routine innovation, which is important for a transition period, enter the field of radical innovation and have the goal to come to architectural innovation in order to become future-proof. Therefore, radical innovation and architectural innovation are regarded as the most important innovation dimensions for MNOs.

In general, innovation is seen as crucial to MNOs' keeping up or even creating trends and investing in new topics (interviewee 5). Therefore, MNOs engage closely in new topics, test, evaluate and integrate them in their business models if they fit (interviewee 6). BMI does not have huge importance for MNOs in the short run but will be more relevant in future regarding B2B business (interviewee 5). Interviewee 7 opposes this position, stating that MNOs have to foster BMI if they want to compete in the market in future. Interviewee 4, on the other hand, sees a threat that BMI of other companies poses to MNOs. Therefore, MNOs have to start alliances with those companies or focus on their own BMI which should be based on data-driven services. The need for BMI is confirmed by Fernández and Usero (2009), as well as GSMA Intelligence and CAICT (2016), who state that it is required for future revenue and to cope with a changing environment.

<u>Intelligent Automation Providers</u>

In general, trends and innovations are regarded as important to MNOs and they are greatly interested in participating in them and creating strategies, before implementing them and having their share (interviewees 8 and 10). It was expected by the author that interviewees from the Intelligent Automation case would regard trends and innovation as important because they work in innovation and support it in their daily business. They have a vested interest in innovation.

Routine innovation is regarded as standard and has to be present any time to protect MNOs' core business. It is also expected by customers (interviewee 9). Interviewee 10 also regards routine innovation as always present if only because relevant disruptive innovation by start-ups can ultimately become routine innovation at MNOs.

Disruptive innovation is seen by interviewee 10 as more important to start-ups and less important to MNOs, although they still have to invest in it, while interviewee 9 regards it as directly relevant to MNOs because if these do not focus on disruptive innovation, others will, which could be dangerous for MNOs. Thus, MNOs have to work in the area of disruptive innovation to come up with new business models. However, interviewee 10 states that disruptive innovation is very important to MNOs' development and growth, even though it is always shifted to routine innovation after a certain time.

Radical innovation is seen as important to MNOs by interviewees 9 and 10 as it focuses on new technical components, such as blockchain and quantum computers, which are also important to architectural innovation. In the author's opinion this may be interpreted as meaning that radical innovation is an interim step towards architectural innovation. Interviewee 10 even regards it as innovation dimension with the greatest influence on MNOs besides disruptive innovation. Interviewee 9 regards radical innovation as more important than disruptive innovation, as it fosters development and growth by providing new possibilities based on new technical components.

Architectural innovation is seen as crucial to MNOs by interviewee 10, while interviewee 9 considers it to be less important.

Interviewee 9 summarised the given statements and regards all innovation dimensions besides architectural innovation as important to MNOs. However, in light of the given statements it can be suggested that radical innovation has the highest importance for MNOs, followed by disruptive innovation, which is regarded as a little less important.

Innovation is crucial to MNOs as they cannot compete without (interviewee 8). Interviewee 10 adds that innovation is extremely important to allowing MNOs to position themselves well in the market and defend against competitors.

BMI is a prerequisite to MNOs if MNOs plan to develop and grow. They may be able to stay in the market without BMI due to their available assets and infrastructure but they are expected to become smaller and less competitive if they do not focus on BMI (interviewee 10). The importance of BMI for future revenue and growth is supported by Fernández and Usero (2009), and GSMA Intelligence and CAICT (2016).

<u>RPA Providers</u>

Interviewees 12 and 13 stress the importance of innovation for the market, e.g. in leaner services and processes or automated processes, as well as innovative strength to react quickly to new situations. That innovation is essential is acknowledged by Drucker (1998), Pisano and Teece (2007), Rouse (2015) and Schumpeter (1934).

Routine innovation and disruptive innovation are regarded as standard topics for MNOs, e.g. to recover costs (interviewee 12).

Disruptive innovation is regarded as very important for MNOs, especially at the beginning of their business as it supports keeping up with competitors and in ensuring performance. Therefore, it is of highest interest (interviewee 13). Interviewee 12 sees it as crucial to future development and growth as it fosters rethinking of the current business model and finding ways to build business models based on existing technical components. This could also be feasible in cooperation with partners. The importance of partnerships is supported by Ballon (2007), Camponovo and Pigneur (2003), GSMA Intelligence and CAICT (2016), and Osterwalder and Pigneur (2002).

Interviewees 11 and 12 state that radical innovation has a high importance to MNOs because the use of new technical components in an existing business model can lead to reduced costs and the possibility to offer new value adding services to customers. This is seen in light of 5G and further software technologies (interviewee 11). The importance of customer experience and related topics is highlighted by Banović-Ćurguz and Ilišević (2017) and Benhima et al. (2013).

Architectural innovation is seen as important to MNOs as new technologies and respective new business models can help to win customers, retain existing customers and increase the overall revenue per customer, e.g. in the area of IoT (interviewee 12). The importance of the combination of new technologies, such as 5G, and the respective new business models, e.g. for IoT and autonomous driving, is confirmed by interviewee 11, who further states that not only is the main service, based on architectural innovation, of high interest but also the provision of additional services in cooperation with partners. Interviewee 12 further states that architectural innovation is a basic topic which is necessary to MNOs but these have to be courageous to be in this field. Interviewee 13 agrees that architectural innovation may be pursued with partners, even if these have to be bought by MNOs. The importance of customer centricity and related topics is highlighted by Camponovo and Pigneur (2003), Ghezzi, Cortimiglia and Frank (2015), as well as Osterwalder and Pigneur (2002), while the importance of partnerships is highlighted by Ballon (2007), Camponovo and Pigneur (2003), GSMA Intelligence and CAICT (2016) and Osterwalder and Pigneur (2002).

The author understands architectural innovation to be the most important dimension in the opinion of the RPA providers, not only in the present but also for MNOs' future development and growth, as it is the only innovation dimension upon which all three interviewees are agreed.

Innovation in general is a topic essential to MNOs, according to all three interviewees. They can be innovative when they take new paths and do not only focus on their existing business and business model but consider what could be possible. They position themselves positively in the market and get new customers. Therefore, innovation is a key to organic growth. MNOs should focus more on the generation and implementation of innovation than on following existing trends that they have not applied from the beginning. The importance of innovation is confirmed by Drucker (1998), Pisano and Teece (2007), Rouse (2015) and Schumpeter (1934).

BMI is seen as very important by interviewees 11 and 12 as it supports MNOs in securing their market position and staying competitive. If MNOs were not to innovate their business model, their response to new topics and trends would be slower and in some cases these could not be answered at all, which could lead to a loss of importance of the respective MNOs. The need for BMI is confirmed by Fernández and Usero (2009), as well as GSMA Intelligence and CAICT (2016) who state that BMI is required for future revenue and to cope with a changing environment.

5.1.5 Ecosystem

MNOs

Concerning a future telecommunication ecosystem interviewee 3 raises the possibility of consolidations in the market between equipment manufacturers and MNOs, where the manufacturers are the ones that could buy other companies. The overall benefits, e.g. generation of new capabilities, through merger or acquisition is supported by Al-Debei and Avison (2011), and GSMA Intelligence and CAICT (2016). All three interviewees agree that a future telecommunication ecosystem will be even further characterised by partnership and cooperation, be it to share risk or research new technology using incubation and accelerators (interviewee 1), or secure earlier access to new technology or to limited but required resources, e.g. splicing services (interviewee 2), or to provide hardware and service from one single source (interviewee 3).

Interviewee 2 expects fixed line telephony to decline further, just as mobile telephony, which will have direct effects on upstream and downstream companies as well as MNOs. The decline in the classical fixed line business as well as mobile voice is confirmed by Schön, Zimmermann and KVJ (2011).They did not, however, cover the effects of these on the ecosystem.

Interviewee 1 adds that data sovereignty over the whole ecosystem will become more important, especially regarding customer data, and that more diverse services than today will be required to keep customers happy. Interviewee 1 expects that competition will increase in the ecosystem through OTT providers' building their own network requiring hardware to create it, while interviewee 2 speculates that new competitors will enter the market but without high investment in the network by using networks of their competitors. Interviewee 1 expects that hardware will become a commodity, being an enabler, and a future ecosystem will mainly focus on software and platforms, while interviewee 3 expects no complete change of the ecosystem.

All three interviewees agree that software robotics will play an important role in a future ecosystem, but regulation and control may not be diminished (interviewee 1). The influence of law and regulation is confirmed by EY (2015), GSMA (2017), and Kallio, Tinnilä and Tseng

(2006). Interviewee 2 adds that software robotics will be the decisive factor in the ability to build a reliable network in only two years, despite the many dependencies and involved companies, and in fast market access in cooperation. It will help in prediction and also in performance improvement. Interviewee 3 adds that software robotics will become increasingly important, especially in the network technology applied to create a more intelligent network. Also for connectivity, processor technology, image post-processing, face ID or object recognition, software robotics will be crucial to the ecosystem, let alone autonomous driving and autonomous drones.

Consulting Companies

For a future telecommunication ecosystem partnership and cooperation are regarded as immanent by all four interviewees as they provide the possibility to increase overall value, provide a full-service, promote networks and enter the market with new or complementary products, which can be done e.g. in the automotive or energy industry, or at gamification and payment services. Respective products of such cooperation could range from data analytic services based on collected IoT information, to smart home service and hardware offers, apps with enhanced content and specialised weather forecasting for spare-part providers and insurance, to many more additional services. The importance of partnerships is acknowledged by Ballon (2007), Camponovo and Pigneur (2003), GSMA Intelligence and CAICT (2016), and Osterwalder and Pigneur (2002). It is expected that hardware providers will become more important and influential (interviewees 4 and 6), although it is preferred by MNOs to become more independent of them (interviewee 6).

Interviewees 4, 5 and 7 agree that landline and fixed network providers are not expected to be part of a future ecosystem because of the ongoing switch to IP, the increasing adoption of flat rate data services, which make mobile and landline telephony unnecessary, and new transmission possibilities like laser technology. The decline in mobile and landline telephony is acknowledged by Schön, Zimmermann and KVJ (2011). Moreover, classic satellite or cable television are not expected to be a central part of a future ecosystem due to video-on-demand services that will require increasing amounts of data that cannot be transferred using an old infrastructure and due to changes in consumption. However, it could happen that classic fixed-line providers will be integrated into bigger MNOs (interviewee 7). Merger and acquisition and their benefits are confirmed by Al-Debei and Avison (2011), and GSMA Intelligence and CAICT (2016). In the author's opinion, that fibre or other fast fixed networks are required to transport data is not taken into consideration to the required extent. It is true that huge amounts of data can be transferred from devices to masts, or the other way around, with almost no delay using the 5G network. Also, the connection between two or more masts over radio relay is possible. However, in the end data are always transported at least partially using fixed line, usually fibre cables. Therefore, these cables have to be existent in order to be able to handle the huge amounts of data. Overall, it can be deduced that technologies that are already today no longer modern will reduce or diminish, which causes a huge change in the respective industries as they will lose a part or even their entire business and have to focus on other topics if they want to stay in the market or are not diversified enough.

Also the customer support infrastructure, which is often outsourced, is expected to change as digitisation, evaluation, clustering and processing of incoming information can be automated to a certain degree using specialised software in-house (interviewee 5). This is confirmed by KPMG (2018b).

In addition, it is expected that the number of content providers will increase to a magnitude that will not be as controllable as MNOs are (interviewee 6). Interviewee 7 opines that those that do not have their own infrastructure and do not offer sufficient speed and good service will disappear from the market. Interviewees 4, 6 and 7 agree that not much is going to fall away in a future telecommunication ecosystem.

All four interviewees agree that software robotics will play a serious role in a future telecommunication ecosystem and will be used inter alia to make processes faster, reduce costs and provide innovation possibilities. Therefore, it will greatly support cooperation and partnership as well as in coping with demographic change. However, interviewees 5 and 6 state that software robotics will become standard in the whole telecommunication ecosystem and not be in the foreground as strongly as it is now. 'Becoming standard' is interpreted as meaning software robotics is acknowledged as a crucial part in the ecosystem that has to be adopted and not an option. Therefore, it will not be in the foreground as it is now, because it is regarded as a prerequisite.

Intelligent Automation Providers

According to interviewees 9 and 10, a future telecommunication ecosystem will be based on partnerships which will increase in importance and will be decisive in future success. Interviewee 10 further states that the topics of shared and open source economy will be crucial to future telecommunication ecosystems, and the overall amount of data is expected to increase massively, just as the exchange of data and communication in general. Moreover, new services will emerge based on the closed partnerships. Interviewee 9 stresses the importance of platform provision as part of partnerships between MNOs and other companies, e.g. in the medical area. Additionally, cooperation with retailers and logistic companies could be beneficial to all participants. The general importance of partnerships is acknowledged by Ballon (2007), Camponovo and Pigneur (2003), GSMA Intelligence and CAICT (2016) and Osterwalder and Pigneur (2002). It is understood that such a strong focus is placed on partnership, cooperation and platforms because the interviewees work in an area that is already characterised by partnerships and cooperation. Moreover, they have a deep understanding of their industry that enables them to identify trends early. Therefore, highlighting this topic for a future telecommunication ecosystem is reasonable to the author.

New services, e.g. for older people or based on available data, will be a major factor in a future telecommunication ecosystem. The importance of data and data-driven services is confirmed by Deloitte (2017b), and Kallio, Tinnilä and Tseng (2006). The strong focus on data-driven services was expected by the author because the interviewees work in an industry that is already data-driven. Thus, they know the development of data and information, and also know their importance to the industry and its future.

Interviewee 10 expects that chip and SIM card manufacturers could lose importance in the ecosystem or even break away as these chips can be directly installed by device manufacturers. Interviewee 10 expects merger and consolidation in a future telecommunication ecosystem mainly of large companies that buy start-ups, and many new market participants, that partially use MNOs’ infrastructure to provide their services. The effects and benefits of merger and acquisition are thematised by Al-Debei and Avison (2011), and GSMA Intelligence and CAICT (2016). No big change in the structure of the ecosystem is expected. The author regards the loss of importance of SIM card manufacturers as comprehensible as more and more devices get embedded SIM cards that are included in the device hardware, meaning that no physical SIM card has to be changed when a contract changes but only the new contract has to be installed on the embedded SIM card.

Software robotics is considered essential to a future telecommunication ecosystem by all three interviewees and it will become more important over time. It is expected to support e.g. data analysis, contract negotiation, integration and compliance topics. Also, partnerships will be prepared with the help of software robotics. Software robotics will support data-driven innovation and will be included in almost everything from sales to retail and communication.

<u>RPA Providers</u>

All three interviewees agree that partnerships are of utmost importance in a future telecommunication ecosystem. Partnerships are e.g. required as MNOs are not regarded as capable of creating applications and software solutions on their own. The same is true when it comes to offering services, such as cloud solutions or hosting or system operation. MNOs are seen as most innovative if they work together with partners. One big advantage MNOs have is their huge customer base, which can be approached with new services and products that are offered together with their partners. Moreover, MNOs’ customer insights make them even more attractive to other companies' cooperation. In cooperation with the respective institutions, MNOs could provide platforms, e.g. for e-learning, virtual classrooms or medical topics. Moreover, cooperation with other service providers like power suppliers and public utilities could be beneficial as these companies also have to dig trenches to lay their infrastructure. If the infrastructure of these companies is lain together at the same time, costs can be saved. Additionally, partnerships with Asian MNOs could give non-Asian MNOs a head start when it comes to new technologies or trends as these are often applied earlier in eastern countries. Overall, partnerships are regarded as a decisive factor in growth and MNOs are expected to become service providers in close collaboration with partners. The importance of partnerships and their benefits are confirmed by Ballon (2007), Camponovo and Pigneur (2003), GSMA Intelligence and CAICT (2016), and Osterwalder and Pigneur (2002). It is understood by the author that partnerships especially and cooperations are highlighted by the interviewees from RPA providers because the interviewees are employed in an area that is strongly characterised by partnerships and cooperation. Moreover, as many of the interviewees have partnerships with MNOs and due to the deep insights they have into MNOs, their view of a future telecommunication ecosystem is reproducible to the author.

In a future telecommunication ecosystem the fixed line is expected to disappear in private customer business (interviewee 11). While the overall decline of fixed line is supported by Schön, Zimmermann and KVJ (2011), the author understands that mainly the commercial use of fixed lines will decrease but not the overall use as fixed line is also required to transfer mobile data from masts to respective data centres.

In general, fast companies will take over slow ones in a changing environment (interviewee 12). This statement has to be qualified as small companies that are relatively fast will probably not be able to take over big but slow companies. It is understood that interviewee 12 means that fast companies will have an advantage over slower ones and that faster ones could buy slower ones if their capital resources are sufficient and if it fits a respective strategic initiative.

Overall, the number of market participants in a future telecommunication ecosystem is not expected to decrease strongly, even if a consolidation in the market takes place.

Interviewees 11 and 12 agree that software robotics will be essential to a future telecommunication ecosystem and will influence many processes and transactions. It is expected to support the identification of business partners as well as customers that can better be approached through partnership.

5.1.6 Cases' Answers to Research Questions

RQ1

MNOs: The contemporary situation in the telecommunication market of MNOs is complex, as on the one hand there is an increasing demand for MNOs' services, while on the other MNOs have to face severe challenges. Competition from OTT providers and MVNOS, increasing infrastructure investment as well as a high cost pressure are among these challenges. Among important trends are mobile and cloud gaming, autonomous driving and IoT, which all depend on a strong network infrastructure. Big Data are a vital driver that provides big opportunities, e.g. for the creation of new business models. However, it is not yet in the state it should be. BI and Big Data both are crucial to MNOs, e.g. for analysis, customer centricity and cost reduction. Software robotics is inevitable for MNOs e.g. regarding improvement of processes, decision-making and analysis. These technologies together enable new levels of quality, new business cases and an increase in revenue.

Consulting Companies: Consulting companies regard the contemporary situation in the telecommunication market for MNOs as difficult. The situation is characterised by increasing competition, which is a threat to MNOs' current business models, great cost pressure, high investment costs and strict regulation. 5G with the possibilities it provides, e.g. for autonomous driving or IoT, as well as the provision of additional services for customers are regarded as most important trends to MNOs. Big Data are a further important topic and together with BI a decisive factor in MNO's profitability and growth, enabling e.g. the creation of new products or binding customers and increasing profitability. Software robotics is crucial to MNOs' growth, e.g. through its analytics and decision-making capabilities. The advantages of BI, Big Data and software robotics can be further improved by combining these technologies.

Intelligent Automation Providers: Intelligent Automation providers regard the current telecommunication market for MNOs as characterised by strong competition and great opportunities. MNOs face further challenges, such as strict regulation and requirements of network roll-out. On the other hand, trends such as telemedicine, IoT, smart home and mobility concepts, provide big opportunities to them. Big Data are very important for MNOs due to their capabilities but have to be used to a greater extent in order to realise their potential. BI and Big Data are crucial to MNOs' forecast, analysis, decision-making and customer centricity. Software robotics is essential to MNOs as it ensures competitiveness, e.g. by improving customer service, automating repetitive tasks and making processes more efficient. The combination of these technologies is crucial to the realisation of all their benefits to the greatest possible extent.

RPA Providers: RPA providers regard the contemporary situation in the telecommunication market for MNOs as difficult due to fierce competition and fragmented markets. The market is characterised by high cost pressure and a need for good infrastructure. Further challenges are the high investment costs of the roll-out of 5G, binding customers and strict regulation. Therefore, being open to participation in trends, such as autonomous driving, telemedicine and IoT, is crucial to MNOs. Big Data and BI are further important topics due to their possibilities that support MNOs in creating knowledge, improving services and providing new offers. Software robotics has a great influence on MNOs as it assists process automation, decreasing costs and decision-making. BI, Big Data and software robotics are complementing technologies. Hence, their combination enables bigger benefits than using them on their own.

RQ2

MNOs: 5G, software robotics and analytics are the most important technologies for MNOs, on which many innovations will be based. BMI is not regarded as a prerequisite to MNOs' survival. Nevertheless, MNOs search for and invest in potential future business models in order to secure their future to a certain degree. Architectural and routine innovation are identified as most important innovation dimensions to MNOs, while a mix of all innovation dimensions is regarded as reasonable.

Consulting Companies: 5G, analytics and software robotics are the most important technologies for MNOs, given the possibilities they provide. Overall, innovation is crucial to MNOs' creation of trends and investment in new topics. BMI is very important to allowing MNOs to stay relevant in the market. Radical and architectural innovation are perceived as the most crucial innovation dimensions for MNOs.

Intelligent Automation Providers: 5G and software robotics are regarded as the most important technologies for MNOs due to the many possibilities they provide. Overall, innovation is crucial to MNOs' maintaining a good position in the market. BMI is seen as prerequisite to future development and growth. Radical innovation is seen as the most important innovation dimension for MNOs.

RPA Providers: Software robotics and network infrastructure are the most important technologies for MNOs. Innovation is seen as crucial to MNOs' future and vital to their organic growth. BMI is also essential to securing their market position and staying competitive. Architectural innovation is the most important innovation dimension for MNOs, especially in terms of their development and growth.

RQ3

MNOs: It is expected that a future MNO business model will strongly focus on the provision of infrastructure and use cases based on infrastructure. In addition, partnering and cooperation, which can have many facets, will be essential to MNOs' future business models. Therefore, current shortcomings have to be abolished, shops and employees have to be reduced and online business fostered. Customer centricity based on data has to be central to all action and existing silos have to be torn down. MNOs' core services are individualised for private customers, accompanying them during their stages of life, and provide infrastructure and data connectivity as prerequisite to further technology such as autonomous driving or IoT. Building company-based campus networks could be a main service for business customers. BI and Big Data will be central components and are expected to be enablers of future MNO business models. Software robotics will play an essential role, e.g. in making networks more energy efficient and intelligent, be able to build networks faster, learn customers' needs, and provide new business models. Generally, software robotics will be required for MNOs' survival.

<u>Consulting Companies</u>: A future MNO business model is expected to be characterised by its network infrastructure as prerequisite to communication and exchange, as well as further technologies, such as autonomous driving and IoT, on which new business models can be based. Data analytics will be a further integral part of MNOs' future business models, e.g. offering data-driven and position-based services. Partnerships will also play an integral role. Therefore, MNOs have to focus more on innovation, cut old tariffs and tariff structures, and focus more on automation as well as more intelligence. MNOs' main services will revolve around the provision of infrastructure including adjunct and data-driven services. BI and Big Data will be essential, e.g. to evaluation, predictive maintenance and the identification of further new business models. Software robotics will be vital in future and an integral part of MNOs' business models, e.g. regarding automation of tasks, reduction of complexity and creation of new business models.

<u>Intelligent Automation Providers</u>: A future MNO business model is expected to be characterised by partnership and cooperation, which can have many facets, and respective new offers that originate in them. MNOs will be service- and data-driven companies that also have their stake in the area of autonomous driving. Therefore, MNOs have to enter new fields of business with new products and focus more on their customers. MNOs will offer their infrastructure and connectivity, as well as data analytics and data-driven services as core

services. BI and Big Data will play a crucial role in future MNO business models as they support improvement of products and increasing customer proximity, and enable competitive advantage. They also facilitate future profitability and growth, as well as the identification of further new business models. Software robotics will be essential to future MNO business models, e.g. regarding data preparation, analysis and securing of competitive advantage. It is required to stay relevant in the market.

RPA Providers: A future MNO business model is expected to be characterised by the provision of mobile and fixed line infrastructure, the provision of services based on this infrastructure, as well as partnership and cooperation including common services as partnership supports growth and enables a common market development. For a future business model MNOs have to focus more on their customers and apply new technologies, such as software robotics. Moreover, the network infrastructure has to be optimised and a concentration on services has to be facilitated. The main services will be the provision of infrastructure and respective services in cooperation with partners. BI and Big Data are essential to future MNO business models for the creation of insight, which can be the baseline for further services. Software robotics is also expected to be crucial to future business models' generation of knowledge and identification of new business models.

RQ4

MNOs: A future telecommunication ecosystem is expected to be characterised by merger and acquisition but even more by partnership and cooperation. Fixed line telephony is expected to decline, while data sovereignty will become more important. Software robotics is expected to be decisive in a future telecommunication ecosystem, e.g. for fast network roll-out, prediction, intelligent networks, and fast market access in cooperation, but regulation and control have to be considered.

Consulting Companies: A future telecommunication ecosystem will be characterised by partnership and cooperation in order to be able to provide a full service, promote networks and enter markets together. Cable and classic satellite television will become less important due to an ongoing change towards video-on-demand. Moreover, the number of content providers is expected to reduce and slow-changing companies that do not own a network infrastructure will disappear from the market. Software robotics will be essential to a future telecommunication ecosystem and greatly support cooperation and partnership. It will become a standard component in the whole ecosystem.

Intelligent Automation Providers: A future telecommunication ecosystem will be based on partnership and new services that base on this. Chip and SIM card manufacturers are expected to lose importance. At the same time, merger and acquisition as well as new market participants are expected. Software robotics is regarded as essential to a future telecommunication ecosystem and will increase in importance. It will support data analysis, contract negotiation and the preparation of partnerships.

RPA Providers: A future telecommunication ecosystem is expected to be characterised by partnership, e.g. for the creation of applications and software solutions but also for offering services together. Fixed line is assumed to become less important for the private customer business. The number of market participants is not expected greatly to decrease. Software robotics will be essential to a future telecommunication ecosystem and will help in identifying potential business partners and customers.

5.2 Cross-Case Analysis

In this section a cross-case analysis is conducted. For this purpose the main statements of the within-case analyses are compared, referring to the overall RQs. In this way, commonalities and differences between the single cases are identified. The RQs are taken as an organisational structure for the respective subsections. At the end of each subsection a summary is offered answering the single RQs. A RQ is regarded as answered if, in light of the information gained from the interviews, the respective topics could be covered by an absolute majority of the cases.

5.2.1 Cross-Case Analysis for RQ1

Regarding RQ1, all cases agree that the market is characterised by strong competition not only between MNOs but also with MVNOs and OTT providers. New solutions like satellite networks for telecommunication use (case 2) and potential market entries of big global companies provide further challenges (case 1). Moreover, an ongoing consolidation of the market is expected (cases 2 and 4). Strong competition in the market is confirmed by Balon and Liau (2012), Becot et al. (2010), Du Preez and Pistorius (2002), European Commission (2013), and Schön, Zimmermann and KVJ (2011).

All cases agree that the customer has to be at the centre of MNOs' actions. Customer journey and experience are currently not covered as it should be (case 1), while MNOs are not close enough to their customers (case 2). In addition, customer acquisition is hard as e.g. the respective customer support is not seen as good (cases 2 and 3). Hence customer centricity and added value for customers must be focused on to realise the greatest possible value from customers (case 4). The importance of customer centricity is supported by Camponovo and Pigneur (2003), Ghezzi, Cortimiglia and Frank (2015), and Osterwalder and Pigneur (2002).

Regarding cost pressure, all four cases show that it is a major obstacle to fast development and growth for MNOs that is based inter alia on strong competition in the market. Therefore, MNOs have to become more effective and efficient in what they do to reduce costs (cases 2, 3 and 4), while improving services and products for their customers (cases 1, 3 and 4). The high cost pressure is acknowledged by the European Commission (2013).

The focus on the infrastructure and the roll-out of 5G is a further characteristic of the market according to all cases. Moreover, MNOs are tied to the infrastructure and have to use it to make profit for the next innovation cycle (case 2). Also, cooperation in the infrastructure area would be feasible (case 3) to achieve a good overall coverage with high speed and good quality (case 4). The need for infrastructure roll-out is supported by Banović-Ćurguz and Ilišević (2017).

Innovation is a leading topic in the market and important to MNOs in securing their market position, reacting quickly to changing conditions and increasing revenue (cases 1, 2 and 4). However, MNOs have a certain lack of creativity (case 1). The importance of innovation is also highlighted by Drucker (1998), Pisano and Teece (2007), Rouse (2015), and Schumpeter (1934).

All cases show that the market is characterised by strict regulation. Regulations on MNOs and the telecommunication market make processes and decisions in the EU slower than is the case in the USA and prevent strong increases in sales (cases 1 and 2). The challenges of regulation are confirmed by GSMA (2017) and EY (2015). While cases 1 and 2 highlight the downsides of a strict regulation, case 3 stresses that regulations should partially be stricter to increase the quality of MNOs' infrastructure by forcing them to provide a countrywide minimum service. It is understood by the author that a stricter regulation for increased network coverage and quality is brought up as a topic in case 3 as not every household is covered with mobile connectivity, e.g. in Germany, meaning that not all people can use data or telephony services at home. In Germany only 98% of households had to be covered with LTE by end of 2019. However, stricter regulation could be one possibility to enable a countrywide network coverage, while cooperation between MNOs to cover white spots together or the government building its own masts that are free to use or usable for a certain fee for MNOs would be other solutions to this issue.

MNOs have an old IT landscape (case 1), which can be a disadvantage as MNOs business is mainly driven by their IT systems (case 2). Therefore, IT has to be considered in MNOs' actions (case 3).

All four cases regard regulation as a major challenge to MNOs. Cases 1, 2 and 4 demand less strict regulation as well as more freedom and flexibility for MNOs in order to increase their competitiveness and profitability. This challenge is confirmed by GSMA (2017) and EY (2015).

Another major challenge to MNOs is strong competition (cases 1, 2 and 4), acknowledged by Balon and Liau (2012), Becot et al. (2010), Du Preez and Pistorius (2002), the European

Commission (2013), and Schön, Zimmermann and KVJ (2011), not only by small and fast companies that are more agile than big MNOs (case 1) or by hardware or OTT providers (case 2), but also between MNOs for the acquisition of customers (case 4).

A further big challenge for MNOs is infrastructure, which requires huge investment (cases 1, 2, 3 and 4), long pay-off times and has to be implemented really fast (case 1) in order to cover the expected increase in data traffic (case 2). A further challenge with the infrastructure is that others use it for their own business models and do not involve MNOs that have to bear the entire cost (case 2), while MNOs are not allowed to focus only on profitable areas (case 1). The high investments costs of infrastructure are confirmed by Banović-Ćurguz and Ilišević (2017).

Cost pressure is stated as a challenge MNOs have to face (cases 1, 2 and 4). It is confirmed by the European Commission (2013).

Cases 1, 3 and 4 show that MNOs have to focus on trends and adopt them early to realise their advantages which help to retain and win new customers. Hence trends help in securing and increasing revenue. Therefore, even specialist departments can be built up (cases 1 and 4). Especially if MNOs see their competitors applying trends, they have to be fast and participate themselves, what can also be done within the framework of a project (case 3).

A major trend that is identified by all cases is the shift to additional and value-adding services that do not have to be closely connected to MNOs original products and services. The requirement to provide new services is supported by GSMA Intelligence and CAICT (2016), Ballon (2007), and Kallio, Tinnilä and Tseng (2006).

Another trend, covered by cases 1 and 2, is 5G, which enables real-time connectivity in a high quality with high speed and is therefore of great importance to technologies like IoT, autonomous driving or telemedicine. All cases regard IoT as an important trend topic for MNOs as it connects technologies and sensors in a significant and efficient way. Cases 1, 2 and 4 list mobility, which includes autonomous driving, as an additional important trend topic for MNOs as they not only provide the required infrastructure for this but they can also support with further services. Cases 1, 3 and 4 bring up telemedicine, such as remote surgery or consultation, as crucial trend for MNOs. Moreover, mobile and cloud gaming are trends seen in cases 1, 2 and 3 and are worth many billion euros. The importance of 5G to trends like IoT and autonomous driving is confirmed by Deloitte (2017b), EY (2015), GSMA Intelligence and CAICT (2016) and Schön, Zimmermann and KVJ (2011).

Big Data are seen as important driver that is essential to MNOs by all four cases as the amount of data is steadily growing and it provides big changes for them. This importance is acknowledged by Deloitte (2017b). However, the topic is not yet in the state it should be at MNOs. Big Data can e.g. be used for the identification of potential new business models and their value for increasing profitability and growth is even increased in combination with BI. One of the main uses of these two technologies is seen in forecasting and analytics by all four cases as new knowledge and understanding can be generated, predictive models can be built and decisions can be prepared. Moreover, all cases agree on the usefulness of Big Data and BI to bind customers, e.g. through improved customer experience, individualised customer approaches, churn analysis and recommendations systems. Cases 2 and 4 highlight their potential for the creation of new products and services, while cases 1 and 3 add their assistance in cost reduction.

Software robotics' adoption is seen in all four cases to be crucial to MNOs both currently and in future. Generally, it is expected that software robotics' importance will increase as it helps in ensuring competitiveness, while increasing profitability and growth. All four cases agree that software robotics are important to analytics and decision-making, e.g. for preparation of data analyses, proactive network maintenance or pattern recognition. In addition, all cases highlight its importance for process optimisation, time saving and decreasing cost, e.g. through reduction of effort, automation of processes, speed increases of processes, support in peak situations, and shifting of employees to more meaningful tasks. Cases 1, 2 and 4 further add software robotics' influence on the increase in process quality, e.g. in call centres. The importance of software robotics for MNOs is confirmed by Almato (2016), Azoff (2017), Guibao, Yubo and Jialiang (2017), Infosys (2017), Kibria et al. (2017), KPMG (2018b), McKinsey &

Company (2017), strategy& (2015), and Telefónica (2018). However, case 2 also stresses that RPA does not always keep all that was promised before its application and that software robotics are currently mainly used for the optimisation of existing processes and not for more value-adding tasks, like the analysis of user behaviour or the creation of new business models based on analysis. It is understood by the author that the problem that RPA does not always keep what was promised can be tackled by creating contracts between MNOs and RPA providers that guarantee what was promised. In this way, no surprises to MNOs regarding their expectations should occur. Regarding the current use of software robotics, it is understood by the author that MNOs use them currently mainly in areas where they can realise a fast and high benefit, which is assumed to be in the optimisation of existing processes. However, once this is done, the focus is expected to be on more value-adding tasks.

All cases agree that a combination of software robotics with BI and Big Data will be even more beneficial to MNOs than a separated adoption, e.g. because quality can be further increased, improved planning possibilities are enabled, revenue can be further increased, decisions can be improved, trends can be identified earlier and new products created. The possibilities and advantages further increase with the amount of available data as software robotics, BI and Big Data are supplementary technologies. Only in case 2 is the influence of BI in such a combination regarded as limited if reports are in focus that are usually standardised (interviewee 4). Moreover, the short-term beneficial effects of such a combination are currently overrated, according to interviewee 4. The limited influence of BI on standardised reports is regarded as comprehensible by the author. Nevertheless, BI can also be used for other tasks in such a combination. The author also regards the overrating of short-term effects as understandable as much advertising is done with theoretical possibilities of these combinations. However, all cases agree that the importance of the topics will further increase in the future. Therefore, the full potential could be realised then.

Summary of Cross-case analysis for RQ1

Summarising the cross-case analysis for RQ1, it may be stated that the market is characterised by strong competition between MNOs, MVNOs and OTT providers, but also by emerging solutions like satellite networks and potential market entries of big global companies. Customer centricity has to be at the centre of MNOs' actions more than it currently is. Cost pressure is a major obstacle to MNOs. Further market characteristics are the focus on infrastructure and the roll-out of 5G, which require high investment. Additionally, strict regulation is a major challenge to MNOs. Innovation is important in the market to secure MNOs' market position. The early adoption of trends can support MNOs inter alia in retention and generation of new customers. Major identified trends are the shift to additive and value-adding services and 5G, including the use cases based on it, such as IoT, autonomous driving, telemedicine or mobile gaming.

Big Data are a key driver of MNOs, providing opportunities and possibilities such as the identification of new business models. However, it is not yet in the state it should be at MNOs. Big Data's value in increasing profitability and growth is even higher when combined with BI, e.g. for generation of insight, preparation of decisions, and binding customers.

The adoption of software robotics is crucial to MNOs' sustainable development, e.g. to ensure competitiveness, to increase profitability and growth, decision-making and process optimisation. BI, Big Data and software robotics facilitate the greatest benefits if used together. The opportunities and possibilities are expected to increase with the steady growth of available data.

5.2.2 Cross-Case Analysis for RQ2

Regarding RQ2, which focuses on innovation, all four cases agree that 5G is among the technologies of the highest importance to MNOs as it is not only a prerequisite to IoT, mobile gaming and remote surgery but in general to the huge number of devices that are expected to be part of a future network and the respective data traffic. 5G provides the required connectivity and bandwidth. Moreover, 5G is regarded as prerequisite to new business models. The importance of 5G to topics like IoT and autonomous driving is confirmed by Deloitte (2017b), EY (2015), GSMA Intelligence and CAICT (2016), and Schön, Zimmermann and KVJ (2011).

A further high priority technology that is confirmed by all four cases is software robotics as it, for example, ensures competitiveness, improves forecasts, optimises processes and strongly supports analyses. It can be implemented in various areas, such as call centres where it leads, transcribes, translates and analyses conversation. Intelligent search, image recognition, predictive maintenance and the processing of natural language are enabled by software robotics. Its importance to MNOs is confirmed by Azoff (2017), Bruckner, Zeilinger and Dietrich (2012), and Scheer (2017).

Analytics is a high priority technology for MNOs which are often used together with software robotics, e.g. for customer analytics regarding churn, user behaviour, personalised advertising and the creation of added value services. In this way, customer loyalty can be increased. The importance of customer centricity and related topics is highlighted by Camponovo and Pigneur (2003), Ghezzi, Cortimiglia and Frank (2015) and Osterwalder and Pigneur (2002).

In case 1 blockchain is listed as an additional technology important to MNOs, while automation in general is highlighted by cases 1, 2 and 3. IoT is stressed by cases 1 and 2, and autonomous driving only by case 4.

All four cases regard routine innovation as a standard innovation dimension that has to be present at all times as it helps to secure MNOs' core business and to recover costs.

Disruptive innovation is seen as less important as it has not worked for MNOs so far (case 1). This is confirmed by case 2, which also suggests that building new business models is not the core competence of MNOs and that they do not have many opportunities to do this with their portfolio, as is proven by several unsuccessful attempts in the past and present. Case 3 states that disruptive innovation is more important to start-ups than MNOs but is still a topic MNOs have to pursue in order to not be left behind. Therefore, MNOs have to work in this area. It is especially important to development and growth, as confirmed by case 4. Cases 1 and 4 confirm that if MNOs want to be active in the field of disruptive innovation, this should be pursued using a partnering approach. The importance of partnership is noted by Ballon (2007), Camponovo and Pigneur (2003), GSMA Intelligence and CAICT (2016), and Osterwalder and Pigneur (2002). The author sees disruptive innovation as less important to MNOs than the other innovation dimensions because the statements provided by cases 1 and 2 are more persuasive, as they are regarded as better informed than those of cases 3 and 4 as both, MNOs and consulting companies, normally have deeper insight into MNOs' business and the telecommunication market. However, if disruptive innovation is to be pursued, a partnership approach, as suggested by cases 1 and 4, seems reasonable to the author.

Radical innovation is seen as very important in all four cases, while cases 2 and 3 show it to be an intermediary step to architectural innovation. Especially regarding 5G, radical innovation is important as MNOs can use their current business models in monetising new technical components as well as additional services based on these net components (cases 2, 3 and 4). Blockchain and quantum computers are other possibilities for new technical components (case 3). Given the statements from all four cases, the author understands routine innovation to be more important to MNOs than routine and disruptive innovation, because through radical innovation MNOs can make use of new technical components while maintaining their existing business model. When the new technical components are used and MNOs are familiar with them, a shift towards architectural innovation can also be made, which needs a new business model besides new technical components.

Architectural innovation is also shown to be essential by all four cases. Case 2 states that, based on architectural innovation, future development and growth of MNOs can be secured, mainly driven by data for the creation of new business models. Case 1 cites connected factories as application area, while case 4 sees their advantage in revenue increases. Both, cases 1 and 4, show that architectural innovation is best addressed in cooperation with partners. Case 1 indicates that MNOs that are active in this innovation dimension can shape the market. Case 4 further shows that not only is MNOs' main service, based on architectural innovation, of high interest but also additional services, and that MNOs have to be courageous to be active in this innovation dimension. The importance of partnerships is noted by Ballon

(2007), Camponovo and Pigneur (2003), GSMA Intelligence and CAICT (2016) and Osterwalder and Pigneur (2002). The author understands that architectural innovation is more important to MNOs than routine and disruptive innovation and as important as radical innovation. The reason for the same importance as radical innovation is that the author sees radical innovation as an intermediary step towards architectural innovation - just as in cases 2 and 3 -, which is hard for MNOs to achieve on their own. Hence also the inclusion of partners in the area of architectural innovation is understandable to the author.

Innovation is shown to be crucial to MNOs' future development by cases 2, 3 and 4, as it fosters the creation of trends as well as engagement in new topics and their integration after testing and evaluation (case 2). MNOs could become irrelevant if they do not focus on innovation (case 3). Innovation helps MNOs to position themselves in the market and defend themselves against competitors (cases 3 and 4). Moreover, new customers can be won and innovation is seen as the key to organic growth (case 4). The importance of innovation is confirmed by Drucker (1998), Pisano and Teece (2007), Rouse (2015) and Schumpeter (1934).

Cases 1 and 3 state that BMI is not a prerequisite to MNOs' future survival but MNOs are expected to lose importance and become smaller if they do not innovate their business model. Case 2 adds that BMI does not have a huge importance for MNOs in the short run, but in the long run it will become more important. Therefore, BMI and the search for new business models are regarded as important to MNOs' future if they want to stay relevant, want to secure their market position and plan to develop and grow (cases 2, 3 and 4). The need for BMI for future revenue and to cope with a changing environment is confirmed by Fernández and Usero (2009), and GSMA Intelligence and CAICT (2016).

Summary of Cross-case analysis for RQ2

It can be stated that 5G is one of the most important technologies for MNOs as it is prerequisite to further technologies such as IoT or mobile gaming. It is also a precondition of other new business models. Also, software robotics and analytics are seen as most important technologies due to the many possibilities they provide.

In general, innovation is crucial to MNOs' future development as it facilitates the creation of trends and engagement in new topics. Additionally, innovation supports MNOs in improving their market position and in defending against competitors, e.g. by winning new customers. It is seen as prerequisite if MNOs do not want to become irrelevant and is the key to organic growth.

BMI is regarded as crucial to MNOs' remaining relevant in the market and not becoming smaller. Furthermore, it is required for the securing of MNOs' market position, future development and growth. Therefore, BMI and the search for new business models is of outstanding importance to MNOs.

Architectural and radical innovation are the most important innovation dimensions for MNOs, followed by routine and disruptive innovation.

5.2.3 Cross-Case Analysis for RQ3

Regarding RQ3, which covers a future MNO business model, all cases show that it has to revolve around partnership and cooperation. These partnerships can be created in various ways:

(I) cooperation with service providers where MNOs provide the infrastructure and the partner provides the services, while approaching the market together, e.g. with Spotify or Netflix (cases 1 and 4),

(II) cooperation with other MNOs, e.g. in the same county, in network sharing (case 1) or in an Asian country by early participation in new trends (case 4),

(III) cooperation with other infrastructure companies, e.g. energy suppliers or public utilities to achieve leverage (cases 2 and 4),

(IV) cooperation with other data companies in sharing anonymised data to create more valuable data with more information for the generation of deeper insight into customers and for model development (case 3),

(V) cooperation with institutions to provide platforms, e.g. for remote medical consultation or e-learning (cases 3 and 4);

(VI) cooperation with hardware manufacturers, e.g. to provide smart home products out of one hand, including the respective hardware, software and connectivity (case 4), or

(VII) cooperation with specialised service providers that provide their service, e.g. analysis, to MNOs' customers using MNOs' brand and public image while staying in the background (case 4).

Overall, partnerships can be used to share risk and reduce complexity in single companies (case 1) but also in the generation of value-added services (case 2). Generally, MNOs are experienced in being more innovative when they work together with partners (case 4). Moreover, partnership is seen as decisive in future growth (case 4). The importance of partnership is also highlighted by Ballon (2007), Camponovo and Pigneur (2003), GSMA Intelligence and CAICT (2016), and Osterwalder and Pigneur (2002). As can be seen, different kinds of partnership are feasible for MNOs. In the author's opinion, a combination of these diverse possibilities for partnership will be decisive in MNOs' future and not the focus on a single one.

A further essential part of future MNO business models will be the provision of infrastructure, according to cases 2 and 4. According to case 2, the 5G infrastructure enables communication and connectivity between various devices, e.g. at IoT, or for autonomous driving but also between people. The importance of 5G to autonomous driving is highlighted by cases 2, 3 and 4. The main use cases for B2B besides the pure infrastructure provision will be, for example, the provision of software robotics components, cyber security services, setting up connected factories and ensuring automation and information exchange between machines, as well as building campus networks (cases 1 and 2). Overall, data traffic will increase massively over time. Hence MNOs are the key to determining whether this works because without a fitting network no use cases can be realised. Therefore, networks are and will stay at the centre of MNOs' service provision and will be the business in which they earn most of their money. Customers' well-being has accordingly always to be in the focus of MNOs' actions. MNOs could also work as gate keepers managing access to their network and provide security services for their network. According to case 4, not much growth is expected in the network infrastructure and it is expected that in future mainly mobile data will be used by private customers, while business customers will further use commercial fixed lines. However, infrastructure will be at the heart of MNOs' activities and MNOs will work as infrastructure providers for other companies (case 4). Case 1 shows a divergent picture of the infrastructure in future MNO business models. On the one hand, the pure provision of network infrastructure is regarded as a loss scenario as revenues will be driven by use cases and not by the provision of infrastructure. It is expected that the infrastructure is taken for granted in 15 to 20 years and that then revenues are generated by use cases. Nevertheless, the infrastructure provision for business customers is expected to be essential for at least 10 to 15 years as it will be the main business for MNOs. Regarding private customers no additional growth is expected as it will remain as it is for at least 10 to 15 years and bring steady revenue. On the other hand, 5G provides increased transmission speed, low latency and the possibility of network slicing, which in turn builds the origin of further new business models. Moreover, managing the network is highly complex and the margins for infrastructure providers are attractive. Therefore, MNOs are expected to be smart pipe providers in future, a service of increasing importance. Nevertheless, the existing business model is expected to stay to a large extent as it is over the next five to 10 years. The importance of MNOs' infrastructure is confirmed by Banović-Ćurguz and Ilišević (2017), Ghezzi, Cortimiglia and Frank (2015), and Osterwalder and Pigneur (2002) as it delivers value to companies, while Camponovo and Pigneur (2003), Ghezzi, Cortimiglia and Frank (2015), and Osterwalder and Pigneur (2002) acknowledge customer centricity. Regarding the statement that not much growth is expected in network infrastructure, the author believes that growth here does not refer to the roll-out of new technologies, such as 5G, but rather to the covered area. In many countries the entire available area is almost covered, which means that not much additional area can be covered if an expansion to other countries is not taken into account. The author regards the statement that the network infrastructure will be less decisive in future than the respective use cases as understandable. The infrastructure is expected always to be the baseline of any operation of MNOs. Moreover, it has to be considered that a further developed technology will probably follow 5G and that this technology and its infrastructure will again be in the foreground before use cases, which have to be defined for it, will again become more important. This could be seen as a kind of cycle.

According to cases 2, 3 and 4, data analytics and data-driven business will be another integral part of future MNO business models and will contribute up to 20% to MNOs' revenue outside Europe and up to 10% in Europe. In their future MNOs are seen as data-driven companies. The data services can, for example, revolve around customer data evaluation, monitoring of data, or advertising, and can even be detached from MNOs' infrastructure to reach more prospective customers. According to case 2, the provision of free data subscriptions in exchange for customers' data is also feasible. Generally, MNOs have to develop a vision of the products and content they will offer in a future business model and foster added value for customers. Data are a highly important topic for MNOs and will have a huge influence on MNOs' future business models. The importance of data and data-driven services is noted by Deloitte (2017b), and Kallio, Tinnilä and Tseng (2006).

To achieve a future MNO business model certain parts of current business models have to be adapted, shortcomings have to be overcome and applicable parts of the current business models have to be adopted.

Customers and customer support are cited in all four cases as topics that MNOs have to focus on and in which they have to improve their current status. All four cases show that the customer has to be at the centre of MNOs' actions and plans, and therefore the right mindset at MNOs has to be fostered. One possibility to improve customer experience is to make the whole customer topic more data-driven, e.g. through proactively approaching customers, for example, regarding weather warnings in their area or detected malfunctions of their devices including solutions (case 1). Customer services could be more automated in order to be faster, cover more people's interests and more topics in general, while at the same time improving the quality of interaction. Therefore, software robotics could be applied (cases 2, 3 and 4). Overall, greater interaction with customers could be fostered, not only the monthly submission of invoices (case 3). Moreover, an early identification of customers' requirements and trends is necessary to be able early to respond to developing trends (case 1). However, certain customer contacts should not be maintained solely using technology, but directly (case 4). The importance of customer centricity is acknowledged by Camponovo and Pigneur (2003), Ghezzi, Cortimiglia and Frank (2015), and Osterwalder and Pigneur (2002).

Regarding products case 1 states that new products are required for MNOs' development and have to be promoted, and therefore capability has to be built up for marketing in distinct ways, e.g. using network slicing, new B2B solutions, adaptive pricing and bundling. Case 2 approves the importance of product innovation and adds that old tariffs and tariff structures have to be stopped. Case 3 adds that products have to be tailored to the respective user groups. According to case 4, MNOs need to be more courageous to offer completely new services and products, and to access areas they have not been to before. The provision of new services and products is confirmed as crucial to MNOs' development by GSMA Intelligence and CAICT (2016), Ballon (2007), and Kallio, Tinnilä and Tseng (2006).

Regarding infrastructure all four cases agree that MNOs' infrastructure and its expansion are essential to MNOs' business and that investment in it, e.g. for antenna stations, is crucial and has to be kept at a high level to ensure competitiveness. However, a certain willingness to prefer monetisation of services using infrastructure over infrastructure itself has to be shown (case 4). The importance of the infrastructure is acknowledged by Banović-Ćurguz and Ilišević (2017), Ghezzi, Cortimiglia and Frank (2015) and Osterwalder and Pigneur (2002). As already stated above, it is assumed by the author that the monetisation of infrastructure and services will build a cycle, meaning that with the introduction of the next generation infrastructure, e.g.

6G, monetisation of the infrastructure will be in the foreground, before the monetisation of the use cases will take over again.

Partnership needs to be fostered more than today as it will become more important (cases 1, 2 and 3). In future there will be more cocreation and coinnovation as well as more interaction with start-ups because partnerships are required for everything that cannot be done by MNOs alone (cases 1, 2 and 3). A procedure has to be defined to approach prospective partners, as partnerships are vital to MNOs' success (case 1). That partnerships are crucial is supported by Ballon (2007), Camponovo and Pigneur (2003), GSMA Intelligence and CAICT (2016) and Osterwalder and Pigneur (2002).

Automation is a further topic that has to be more in the focus of new MNO business models. In general, more automation, including an automation strategy and more intelligence in processes, is required as otherwise MNOs cannot keep up with their competitors as automation, e.g. software robotics, helps to decrease costs and MNOs to become leaner (cases 1, 2 and 4). Automation is regarded as a cornerstone of digitisation and therefore centres of excellence that focus on this topic have to be created and the respective governance and compliance have to be built up (case 4).

Cases 1, 2 and 4 agree that MNOs have to adopt a stronger role as service providers, e.g. to build campus networks where they also are the connector between customer and hardware provider as full-service providers.

Cases 1 and 4 also state that the right employees that think outside the box, are knowledgeable in several topics, have a good network and a future-orientated mindset are prerequisites to getting to a fitting future MNO business model. Therefore, a company's culture has also to change and bureaucracy has to decrease. However, it has to be considered that in future only a part of the current employee base will be required because much will be automated and the respective tasks for employees will partially not be available any more. The importance of having the right people is confirmed by Amit and Zott (2012).

Television will become less important as consumption of videos changes to mobile and consequently, the respective business models will disappear. Therefore, MNOs should not be too heavily engaged in this topic in future (case 2).

A change from mobile telephony to telephony using mobile data is expected (case 3), as well as the disappearance of SMS and MMS (case 2). The trend of a decline in SMS use is confirmed by Banović-Ćurguz and Ilišević (2017).

Existing silos need to be broken up in order to get more and deeper information and foster cooperation (case 1).

Only interviewee 4 states that no big changes have to be made to MNOs' current business model. As only one interviewee states that no big changes will be made to MNOs' current business model but all other interviewees identified changes that are understandable to the author, the author deduces that changes to MNOs' business model will occur.

If a closer look at the future core service of MNOs is taken, the four cases do not agree on one single core service but rather on several that are important to MNOs:

(I) infrastructure provision, to enable high performance data connectivity between two or more devices in any possible way and because it provides access to MNOs' customers and builds the baseline for other services (cases 1, 2, 3 and 4)

(II) content and product provision, e.g. according to individual life situation with provision of great user experience, or large portfolio of applications with individualised content including use of customer data for the creation of additional offers and added customer value (cases 1, 2, 3 and 4)

(III) service provision, e.g. building campus networks and being connector between customers and hardware providers, operating customer networks, providing cyber consultation, network consulting and data-driven services, as well as managing data streams and controlling them (cases 1, 2, 3 and 4)

(IV) data analytics, e.g. customer movement, customer profiles or user behaviour in anonymised format for companies and public sector (cases 2 and 3).

All four cases agree that the importance of BI and Big Data for future MNO business models will further increase as they enable transparency and quality. These technologies can be used, for example, for analysis of required capabilities and user behaviour, for predictive maintenance, creation of movement profiles, optimisation purposes and the identification of new business models. Moreover, BI and Big Data can be used to drive innovation, improve products, decrease costs, conduct error analysis and to get closer to customers. Therefore, an innovation-encouraging culture has to be present at MNOs. However, it will not be possible to operate certain business functions without applying BI and Big Data. These technologies are usable by all business departments and will be taken for granted in every future business model. Big Data especially are evolving due to new algorithms. Only interviewee 7 is sceptical of BI that is regarded as a basic topic that does not become more relevant as only few developments are made in this area.

All cases state that the role of software robotics in future MNO business models will become more important and essential to MNOs' survival. Software robotics will be used for all internal processes and it will have significant influence on them. While RPA is expected to become a commodity that everyone uses as standard, a fast development of Intelligent Automation is expected, which will be an integral part of future MNO business models, where its focus will mainly be on the services that are supported by it. Its tasks will be, for example, to improve energy efficiency, to bring more intelligence into the network, to help in better taking care of customers, to provide additional value to customers, to decrease processing times, to reduce manual tasks and system breaks, to secure competitive advantage and to monitor systems. Software robotics is seen as a prerequisite to competition and a fast network expenditure. Without the application of software robotics MNOs will not be able to survive as it is required to control costs, increase efficiency and as it provides the baseline to continue the capital-intensive business of MNOs. The capabilities and importance of software robotics are confirmed by Almato (2016), Azoff (2017), Guibao, Yubo and Jialiang (2017), Infosys (2017), Kibria et al. (2017), KPMG (2018b), McKinsey & Company (2017), strategy& (2015) and Telefónica (2018).

Summary of Cross-case analysis for RQ3

Summarising the cross-case analysis for RQ3, it can be stated that a future MNO business model is expected to revolve around partnership and cooperation. Partnerships can have many facets and e.g. be between MNOs, with other infrastructure companies, service providers or hardware manufacturers. A combination of these kinds of partnership will be crucial to MNOs' success. A further essential part of MNOs' future business model will be the provision of infrastructure as enabler of communication and connectivity between various devices and people. In everything MNOs do customers' well-being has to be in their focus. Data analytics and data-driven business are expected to be an integral part of future MNO business models that will make a major contribution to MNOs' revenue.

As future core services the provision of infrastructure for enablement of high-performance connectivity as well as the provision of content and products, e.g. according to individuals' life stage, are identified. Additionally, the provision of services, e.g. building and operating campus networks or offering data-driven services, as well as the provision of data analytics, e.g. customer movement, are regarded as core services

To achieve a future business model, several things need to be changed or adapted. The focus on customers and customer support has to improve, e.g. by making it more personal, data-driven and automated. New tailormade products have to be developed and promoted using the possibilities 5G and further technologies provide, while old tariffs and tariff structures have to be stopped. The infrastructure expansion has to be fast and the respective investments have to be high. More engagement and attention have to be given to partnerships as they will become more important. Automation including a respective strategy needs to be adopted where feasible and significant. MNOs must regard themselves as service providers that attract and keep the right employees with the required skills, knowledge and attitude. Television is expected to become less important due to changing customer behaviour. SMS and MMS are expected to disappear and mobile telephony will be replaced by telephony using mobile data.

Existing silos at MNOs have to be broken up for more and deeper connections and knowledge generation.

BI and Big Data are very important for future MNO business models and this importance will increase. They will, inter alia, be used for analysis, predictive maintenance, identification of new business models, to drive innovation and improve products. Therefore, an innovation-encouraging culture is required. BI and Big Data will be mandatory for operating certain business areas, will be usable by all business departments, and will be a fixed part of every future business model.

Software robotics will have an essential role in future MNO business models. RPA is expected to become a commodity, while Intelligent Automation will, inter alia, be used for improvement in efficiency and effectiveness, and to bring intelligence into the network. It is a precondition of competition and a fast network roll-out. Without it MNOs are not expected to survive.

5.2.4 Cross-Case Analysis for RQ4

Regarding RQ4, a future telecommunication ecosystem will, on the evidence of all four cases, mainly be characterised by partnerships and these will become increasingly intensive. Partnerships will be used to offer additional technologies, services, e.g. weather forecast, payment services, data analytics, IoT and content, as well as value to customers, and there is no way past them. In this way, partnerships will be a factor in diversification in a telecommunication ecosystem (cases 1, 2, 3 and 4). MNOs will be in the heart of a future telecommunication ecosystem, because they not only have a huge customer base that is decisive in placing new services and offers, but they also possess deep understanding of customer that make them even more attractive (case 4). It is not expected that the ecosystem will be purely technical or purely based on applications, but a mix of both with customers at its centre (case 4). In a future telecommunication ecosystem the infrastructure will be provided by MNOs, while services will mainly come from third parties, so every partner can focus more on its core functions but together they can provide a complete service. Hence it is especially for those companies beneficial that can create additional value for each other (cases 1 and 2). The market approach will be made jointly using complementary products (cases 1 and 2). It is expected that the industry boundaries will blur and different industries will grow together, e.g. education, medicine, production, insurance and automotive (case 4). In this way, new business areas can be developed, innovation will be fostered and risk can be shared, but for this development also high investment is required (cases 1, 2 and 4). Nevertheless, profitability can be increased and thus future investment can be planned (case 2). Hence partnership is a decisive factor in growth of the ecosystem (case 4). Overall, a future telecommunication ecosystem will be characterised by shared and open source economy, with more data exchange and communication (case 3). It is not expected that the ecosystem will be purely technical or based on applications, but will be a mix of both with customers in focus (case 4). The importance of partnerships is confirmed by Ballon (2007), Camponovo and Pigneur (2003), GSMA Intelligence and CAICT (2016) and Osterwalder and Pigneur (2002), while the requirement to provide new services is acknowledged by Ballon (2007), GSMA Intelligence and CAICT (2016), and Kallio, Tinnilä and Tseng (2006).

A future telecommunication ecosystem is also expected to be characterised by merger and acquisition, where hardware manufacturers, e.g. those of network components, could buy a MNO (case 1). Overall, it is expected that hardware manufactures will become more influential in a future telecommunication ecosystem, although there will be fewer than today (case 2). Case 1 confirms that hardware manufacturers could attain more influence in future, because it might be that certain companies are not allowed to sell their products in certain countries for political and security reasons. The effects and benefits of merger and acquisition are acknowledged by Al-Debei and Avison (2011), and GSMA Intelligence and CAICT (2016).

It is not expected that a future telecommunication ecosystem will look like the current, due to expected adaptions and adoptions.

Fixed line telephony is expected to disappear or become far less important in a future telecommunication ecosystem, as it can be performed, for example, using IP-telephony (cases

1 and 2). The fixed line for data transmission will also disappear or become less important, at least in the private area. It may be replaced with other technologies, e.g. radio relay or laser (cases 2 and 4). However, interviewee 6 sees fixed line providers as a further part of a future telecommunication ecosystem. The overall decline of fixed line is noted by Schön, Zimmermann and KVJ (2011). As mentioned above, the author understands that the fixed line for data transfer will still play an important role in the transmission of data to data centres.

Satellite and cable television will become less as more data can be transferred using wireless networks and the trend is towards video-on-demand and streaming, where consumers are not bound to a certain place (case 2).

Manufacturers of SIM and chip cards could break away, because of eSIM cards and the possibility directly to install chip cards in the mobile devices (case 3). The retreat of SMS is confirmed by Banović-Ćurguz and Ilišević (2017).

Overall, it is expected that companies that are able to adapt fast to changing situations will be superior to companies that only adapt slowly or do not adapt at all (case 4).

OTT providers, such as Google or Facebook, could play a bigger role in a future telecommunication ecosystem if they decide to install their own telecommunication network (case 1). The threat to MNOs caused by OTT business models is acknowledged by Becot et al. (2010), Du Preez and Pistorius (2002) and Schön, Zimmermann and KVJ (2011).

According to case 2, the number of content providers will steadily increase in a future telecommunication ecosystem and they will not be as controllable as are MNOs. By contrast, case 4 states that the number of participants in the ecosystem will not change to any great extent. Interviewee 3 states that individual participants in the ecosystem could fall away. The author regards the statement of case 2 as understandable as theoretically everyone who is able to programme applications for mobile devices can provide them using existing marketplaces. Hence the number of content providers could greatly increase. If case 4 regards only companies such as infrastructure component or device manufacturers, MNOs and end-customers, as part of the ecosystem, the claim that the number of participants in the ecosystem will not change to any great extent may be regarded as understandable. In this situation it is seen by the author that cases 2 and 4 have a differing understanding of the telecommunication ecosystem and both statements on their own can be retraced.

The role of software robotics in a future ecosystem will be an essential to the market participants (cases 1, 2, 3 and 4). Nevertheless, adopters have to stick to the regulations (case 1). Software robotics will be the decisive factor in fast network roll-outs taking all participating companies into account, and also in accessing the market quickly in cooperation. Moreover, software robotics will be used to create intelligent networks in cooperation with partners. Regarding autonomous driving, connectivity, processor technology, image post-processing and object recognition, software robotics will also have an important role in the telecommunication ecosystem (case 1). In addition, software robotics will promote innovation and support cooperation and partnership as well as in their preparation (cases 2, 3 and 4). Its support in data analysis, contract negotiation, compliance topics will be essential (case 3). Software robotics will enable connections between applications of different companies and improve communication between them (case 4).

<u>Summary of Cross-case analysis for RQ4</u>

Summarising the cross-case analysis for RQ4, it can be stated that a future telecommunication ecosystem will be characterised by partnership. These are expected to become more intensive and will be used inter alia to offer additional services and technologies in order to bring value to the customer. MNOs will be at the heart of such a future telecommunication ecosystem as they have a huge customer base as prerequisite to placing new services and offers. At the same time, they have deep customer insights that can be used. The market is expected to be approached jointly with partners and industry boundaries will blur, while different industries grow together. Partnership approaches will mainly be seen in areas where they are beneficial to both parties. Overall, data exchange and communication will increase. Merger and acquisition are expected in a future telecommunication ecosystem.

Fixed line telephony will become less relevant or even disappear. The same is expected to be true for satellite and cable television providers. SIM and chip cards could break away. Fast adapting companies are expected to be superior to other companies.

Software robotics will play an essential role in a future telecommunication ecosystem and will be the decisive factor in a fast network roll-out if all participating companies are taken into account. It will be used to create intelligent networks in cooperation with partners and be a prerequisite to autonomous driving and connectivity. Software robotics will support cooperation and partnership as well as in their preparation.

5.3 Modified conceptual Framework

In this section the modified conceptual framework including all influencing factors is illustrated, before the single factors are discussed.

Figure 25 shows the modified conceptual framework populated for the telecommunication industry based on literature, insights from conducted interviews and inside knowledge of the researcher.

Figure 25: Modified conceptual Framework for the Telecommunication Industry

Technology

5G as technology and enabler of many use cases for MNOs and the telecommunication ecosystem is currently one of the most important technologies for MNOs as it not only provides advantages in speed, latency and bandwidth for traditional telecommunication services but also for many services that base on this technology, such as campus networks, autonomous driving or telemedicine. Therefore, this technology is regarded as very important for the mid- and long-term future of MNOs until a next generation technology is introduced (all interviews). The high importance of 5G for MNOs and businesses that want to build services on it is confirmed by the author who experienced the demand and hope for it during his time as consultant and even more while working at Telefónica. Although cloud business is mainly thematised in literature and less by interviewees, it is expected to be an influential technology for MNOs as they can use cloud-based infrastructure for their data centres and networks, which enables network virtualisation and software-defined networks, leading to the enablement of more flexible communication services (interviewees 1, 2, 3 9, 11 and 12). The importance of change from on-premise to more cloud-based infrastructure at MNOs is confirmed by the author as the software robotics projects he participated in were in the beginning based on on-premise solutions while later being introduced as cloud solution. Cyber security is an important topic according to literature and interviewees as on the one hand it supports in protecting customer and company data as well as MNOs' network. On the other hand, it enables the provision of security services to SMBs that are attacked on a regular basis and can profit from the profound knowledge of telecommunication companies that constantly have to defend their networks (interviewees 5, 6 and 7). During the projects the author participated in the requirements for cyber security among others in terms of data protection became increasingly important and they are expected to become even more crucial in future. Therefore, the author confirms the high importance of this technology for MNOs. Data insights is a further important technological factor influencing MNOs. While literature already provides deep insights in terms of data analytics enabled by BI and Big Data, interviewees add to these insights by stressing the importance of forecasting, predictive models and pattern recognition. Additionally, data insights help in binding customers and reduce costs, while also enabling new products based on identified patterns and enabled insights. Furthermore, data insights become an even more important technology if combined with software robotics (all interviews). As the author’s software robotics projects but also other projects covered among others the topics ‘Big Data’ and ‘BI’, he experienced the relative importance that data insights have for MNOs. ESport is a very important factor for MNOs as it is one of the main growth factors in future as not only the number of people participating in eSport is constantly increasing but also the money they spend on it and the data required for it. In eSport especially mobile gaming is growing which suits MNOs as it directly affects their customers. But also cloud gaming and online gaming may not be neglected and can be influenced and used by MNOs providing not only the required infrastructure to provide a seamless experience to customers but also additional services (interviewees 1, 2, 3 and 10). The broad field of new and innovative services is a further important factor for MNOs’ future. As stated in literature and by interviewees new and innovative data services, self-care apps, mobile financial services, IP messaging, sale of network speed, health care and personalised services are part of it. But it can have many more facets, such as provision of software robotics components, adaptive pricing and specialist departments to realise identified trends as stated by interviewees. Besides this, the number of innovative services is permanently increasing with every new opportunity that is identified and every new idea that is created. The importance of innovative services was experienced by the author when working for MNOs and seeing that some have not only specialist departments but subsidiaries that solely focus on identifying, evaluating and introducing innovative services to the market. IoT including M2M is a very important technology for MNOs listed equally in literature and interviews that can strongly expand the services based on it. As connection of multiple devices is a prerequisite for IoT to work, MNOs already have a share of the market. However, based on this market participation MNOs are able to further expand the services they provide in the IoT area to private and business customers. Through the customer data they have MNOs can identify which services would be most value adding to customers (all interviews). Although smart home, buildings and city are only listed in literature as important technologies and not by the interviewees, they are regarded as further integral technology for MNOs. This is due to the many possibilities they provide to make lives easier and help to reach a low-carbon future. Such a low-carbon future can among others be realised by optimised traffic management based on positioning and movement data, automated urban lightning leading to less energy consumption, parking optimisation through guiding systems that help the search for a parking lot and thus reducing air pollution, and also precision agriculture where big machines are steered automatically or remotely but also crop is analysed remotely to determine the best time for harvesting (interviewees 2, 7 and 9). Already several years ago, the author participated in a project of a MNO to introduce smart metering at customers to automatically inform customers' electricity supplier about consumption. Hence, the author can confirm that this topic was not only relevant in the past but will also be crucial in future. Software robotics are key to MNOs future success as stated in literature and even more stressed by interviewees. RPA, AI, ML and DL will not only be used for process automation which is mainly relevant in the beginning to get familiar with these technologies but for more complex and value adding tasks, such as customer interaction in call centres through speech recognition. Interviewees add that software robotics further help MNOs in making their networks more intelligent and in providing profound analyses and respective decision proposals. Moreover, costs and time are a further important aspect software robotics address besides increases in process quality by eliminating mistakes through manual handling. Again, the biggest benefits can be realised by combining software robotics with data insights (all interviews). Through participation in several projects to introduce software robotics at MNOs, the author confirms the high importance these technologies have for MNOs as well as the benefits they provide for MNOs' operations.

"As far as profitability is concerned, they (software robotics) will be the factor that will have the most cost-cutting effect because they can predict: What do I have to do where, assuming that I have the highest profit or the lowest costs or have the highest efficiency." – Interviewee 2

"(…) everyone knows that this (software robotics) is the competitive factor par excellence." - Interviewee 2

“This (software robotics, BI, Big Data) will also be an integral part, it will be a no-brainer. Just like we use Excel or other products today. Normally it will simply be a component that we will no longer discuss, but it will no longer be so strongly in the foreground. The focus will be more on the services it supports.” – Interviewee 6

A key technological aspect listed by interviewees is MNOs’ infrastructure, which is seen as heart of MNOs’ actions. Only through their infrastructure MNOs can provide communication services and data connection. Therefore, infrastructure is one of the most important technologies for MNOs. It is MNOs’ decision how to proceed with it, meaning to provide dumb or smart pipes. Also, the new infrastructure based on 5G enables network slicing which in turn provides more monetisation possibilities to MNOs by providing certain frequencies for special services that exactly require the benefits that a certain frequency band provides. Besides the current infrastructure, new and further data transmission technologies such as radio relay, laser and the next telecommunication standards after 5G are also part of infrastructure technologies that are highly important to MNOs (interviewees 1, 2, 3, 4, 5, 6, 7, 9,10, 11, 12 and 13).

<u>Opportunities</u>

Both, literature and interviewees, agree that fostering customer centricity is a huge opportunity MNOs should use. While literature mainly focuses on customer experience and engagement, interviewees take it a step further by also stating that MNOs’ customers must be at the centre of their actions. Besides this an individual customer approach is required, which can be improved based on data insights and software robotics, as well as a focus on customers’ well-being (all interviews). An opportunity only mentioned in literature and just to a minor degree is globalisation. According to the author’s opinion, interviewees did not directly cover globalisation as they included it in their statements about the telecommunication ecosystem. Nevertheless, globalisation is a major chance for MNOs as it enables, for example, cooperations with foreign MNOs to create new services together and learn from each other.

Based on the experience of the author, a further advantage enabled by globalisation that many MNOs realise is that single companies of an enterprise copy services and products that a related company already introduced successfully. In this way, no knowledge of these services and products is communicated to competitors that could copy them. Moreover, the author saw that commonly approaching the market to buy network equipment and mobile devices enables much lower prices, which is a further advantage enabled by globalisation for enterprises if they do not want to approach the market together with competitors. M&A is a chance for MNOs covered in literature and by interviewees to a similar degree pointing at the advantages a consolidation of the market can provide. Nevertheless, it is no main issue for literature and interviewees compared to other opportunities (interviewees 8 and 13). That M&A provides many opportunities but also pitfalls can be confirmed by the author through participating in a big M&A project of two MNOs. However, as big M&A in the telecommunication market are no daily business, its importance is relatively low compared with other opportunities. Mobile workforces and fostering a low-carbon future through remote working is solely stated in literature. The interviewees did not cover and identify mobile workforces as a major chance for MNOs. According to the author, the benefit of mobile working could be of minor effect to MNOs as most people working from home today or in future already have the required communication infrastructure for it. Therefore, it is not seen as a big opportunity. In contrast, both agree on operational efficiency being a great opportunity for MNOs that can be achieved among others by outsourcing, process optimisation, automation and by increasing process quality. Besides this, interviewees agree that operational efficiency is further increased by combining software robotics with BI and Big Data (all interviews). The software robotics projects in which the author participated were mainly about operational efficiency. Therefore, the author experienced the big benefits his customers realised and confirms the high importance that this opportunity provides. While literature marginally covers partnering as an opportunity for MNOs by focusing on partnerships with service providers and sales channels, interviewees identify partnering as a main opportunity for MNOs with many facets. Partnering is not only seen with service providers but also with infrastructure providers, other MNOs, data companies, institutions, specialised service providers and start-ups. A big and resilient partner network helps MNOs in their future and realising new and beneficial services for their customers and to stay profitable (all interviews). As stated above, the author had contact with MNOs' subsidiaries that focus on new and innovative services and products for their customers by mainly fostering partnerships with diverse parties. Based on this, he confirms the high importance that partnering has for MNOs.

Challenges & Constraints

A big challenge literature and interviewees identify is the business environment in which MNOs act. This environment is currently characterised by poor ecosystem relationships that can be overcome by using the big opportunities partnerships provide. Economic uncertainty in an overall complex environment with changing market conditions and monopolies are additional constraints affecting MNOs (all interviews). A further challenge for MNOs is changing customer needs. While literature lists customers' low willingness to pay for advanced technologies, like 5G, and a lack of availability of relevant content as constraints MNOs have to deal with, interviewees expand this. Interviewees state also customer acquisition, sub-optimal customer support and missing customer loyalty as constraints. Also customer contact and support as well as the change to telephony using mobile data are challenges imminent to MNOs (all interviews). According to the experience of the author, the challenge that changing customer needs present to MNOs cannot be neglected. MNOs try to adapt quickly to changes in the market or of customer needs but as these seem to change relatively rapidly MNOs can have trouble to keep up with them. Competition is equally stated in literature and by interviewees to be a very severe constraint for MNOs. Both put forward the fierce competition between MNOs, MVNOs and OTT providers acting on the same market leading to cost pressure and higher churn rates, declining arpu, lower revenues, lower margins and lower profitability. But also competition with hardware manufacturers and more agile companies is a challenge to be faced. Besides this, traditional telecommunication services are substituted, e.g. by OTT applications and big global companies that are on the edge of participating in a telecommunication market with overall lower entry barriers, for example, by providing satellite networks covering MNOs' white spots. Overall, their challenge is to reduce costs to stay profitable and shift from monetisation of infrastructure, meaning traditional telecommunication services, to monetisation of new, more value-adding services. Therefore, the author confirms the severeness of this challenge. This competition also puts MNOs' business models under pressure (interviewees 1, 2,3, 4, 5, 6, 9, 10, 11, 12 and 13). Through participation in a M&A project of two MNOs the author realised how fierce competition in the telecommunication market is, which was ultimately one of the main reasons for this M&A project.

"This is a very low-margin business. There is a lot of competition and the mere provision of standard services such as mobile telephony, for example, is no longer a viable option." – Interviewee 7

MNOs' corporate culture is a further constraint MNOs' have to deal with in their strife for success. They have to work on their organisational agility to deal with new situations and requirements faster and more open minded to realise benefits. Therefore, an overall future-orientated mindset is required and a low resistance of employees in terms of change. With given company cultures MNOs are currently not moving fast enough. Besides this, bureaucracy is currently too high and there are too many existing silos preventing MNOs from being more flexible and faster. This is confirmed by the author. In his software robotics projects at MNOs that were not only about introducing new technology and solutions but also about change management, he experienced the partially low willingness of employees to change but also the lack of organisational agility to adapt to new situations. Especially people working in areas that did not experience much change over the last years were very resistant to change and showed less open mindedness than other employees. Also bureaucracy provided an obstacle in these projects as, for example, providing user rights for software that software robotics should interact with were only granted after much discussions and delay, although they were stated as prerequisite for software robotics' success right from the beginning (interviewees 1, 4 and 8). Only literature lists data and shortening innovation cycles as challenges for MNOs. While literature states data issues and huge amounts of fragmented, unused and unstructured data as big challenge for MNOs, interviewees regard them as big opportunity for MNOs.

"Every telco has a great deal of data based on all the customer data, which is currently not used logically or meaningfully." – Interviewee 8

In terms of shortening innovations cycles, literature focuses on the one hand on overall shortening technology cycles, meaning that one technology is soon replaced by succeeding technology and thus MNOs do not have enough time to fully engage in new technologies. On the other hand, MNOs' poor rates of innovation are listed as a big constraint. According to the experience of the author, data are not amongst the biggest challenges MNOs face. Most MNOs know about the data they have and their key challenge is to use them in a meaningful way. Both, literature and interviewees, regard investment as a big challenge for MNOs as it is capital-intense to build a telecommunication network and infrastructure investments have long pay-off times. Besides infrastructure, renewing old IT landscapes and introducing new systems but also digitisation require high investments. Moreover, integrations of new applications and systems with existing technology need investments and so does introduction of software robotics (interviewees 1, 2, 6, 7, 11 and 12). This is confirmed by the author having experienced that monetary resources are less available for investments outside infrastructure right after a new generation of telecommunication technology is about to be introduced as this introduction is given highest priority. Nevertheless, also the high investment costs for infrastructure were experienced as big challenge. Literature and interviewees equally identify market saturation in the telecommunication market as a constraint that causes a stagnation in network growth and slower subscriber growth. Strict regulations are an additional challenge for MNOs that may not only focus their network expansion on profitable areas but also have to cover areas with few potential customers. Moreover, regulation forces MNOs in certain countries to pay huge amounts for access to sufficient radio spectrum with the right frequencies that is auctioned by the government. During the last years, data protection became a further more regulated area forcing MNOs to change their operations and handling of available data (interviewees 1, 2, 3, 4, 6, 7, 9, 11 and 13). The challenge of strict regulation, e.g. auctioning of frequencies, is confirmed by the author having analysed the last frequency auctions in Germany which cost multiple billions of euros for frequency-winning MNOs. While literature sees lack of available resources and the race for talent as a not too big challenge for MNOs, interviewees regard the resources topic as severe. They further identify lack of creativity and problems to find and employ the right employees as constraints MNOs have to deal with. Furthermore, thinking outside the box is a currently missing skill of many resources. Also missing good and resilient employee networks and sub-optimal resource effectiveness and efficiency are big challenges for MNOs. The problem of lack of knowledgeable resources thinking outside the box was experienced by the author when introducing software robotics at MNOs (interviewees 5, 7, 11 and 12). During meetings and gathering information mostly the same few people were able to answer questions and participate in discussions. Moreover, a silo-thinking was identified because when discussing the benefits of an automation based on software robotics only the benefits for the customer's own department were relevant and not the advantages such an automation could have for other departments. The reason for this is that the departments worked as silo-like constructs not having more contact with other departments than required. Training is perceived as big challenge in literature and by interviewees. The challenge is identified as constraint in renewing competences but also in adapting, integrating and reconfiguring organisational skills. Moreover, missing skills in the workforce and training employees to become more knowledgeable are challenges to be faced (interviewees 1 and 13). Interviewees list security as an additional challenge in terms of defending MNOs' networks from outside attacks be it physical or non-physical. Power shortage is a further security concern for MNOs as it can severely affect their networks and operations leading to potential data lost (interviewee 4).

<u>Innovation</u>

Innovation is only stated by interviewees in such depth with a MNO-specific scope. A crucial opportunity for MNOs is technological innovation in terms of cocreation and coinnovation with partners, which enables combining ideas and skills from various partners to get promising ideas, tools, services or products for both companies' customers (all interviews). As stated above, the cocreation and coinnovation approach was experienced by the author when being in contact with MNOs' subsidiaries that are specialised on creating new services for their customers in partnerships with other companies. As this enables benefits and competitive advantages it is perceived as being very important in terms of innovation at MNOs. BMI is also very relevant to MNOs. Through BMI they are able to reinvent their business and to adapt to or even lead in new market opportunities that can secure their business and provide a head start compared with their competitors. BMI enables MNOs to be more secure in their future and safeguard their business, e.g. from too much competition. It is regarded as a key instrument for MNOs' future that has to be executed on a regular basis to not only realise one-time effects. A prerequisite for it is staff that is willing to change and adapt to new situations and tasks (interviewees 1, 2, 5, 6, 7, 8, 9, 10, 11, 12 and 13).

"But I just believe that all the business models of the whole industry will be based on AI and machine learning capabilities in the next 10 to 20 years." – Interviewee 9

"So I would say that business model innovation is extremely important for the development and growth of MNOs." – Interviewee 10

Selection of the right innovation dimensions to be mainly active in is crucial to MNOs to be future-proof, too. While routine innovation has to be given at all times as it summarises the basic operations of MNOs such as usage and marketing of existing infrastructure and telecommunication services, MNOs should focus on radical and architectural innovation if it comes to future success and sustainable development and growth. Thereby, it needs to be considered that MNOs can realise radical innovation more easily than architectural innovation. This is the case as with radical innovation MNOs do not need to change their business model but they only have to integrate new technologies and new technical competences in their existing business model. This does not require as much change as architectural innovation would require, which is easier for MNOs to achieve if done in a partnership approach. Furthermore, architectural innovation is harder to achieve due to MNOs' challenges regarding employees' willingness to change, adaptability to new situations, low organisational agility, lack of creativity and missing skills in the workforce. Disruptive innovation can be beneficial to MNOs but is perceived as being the least relevant innovation dimension for them as it is hard to achieve and sustain. Also in the case of disruptive innovation a partnering approach would be the best way for MNOs.

"But let me say that understanding data and using it to create innovation and added value is the focus of MNOs and there's a lot more to it." – Interviewee 9

The topic of innovative strength is decisive. (…) it's crucial whether I come up with innovations today or whether I just follow the trends." – Interviewee 13

<u>Ecosystem</u>

The telecommunication ecosystem is a further factor strongly influencing MNOs and their actions in terms of the ILM and is solely stated by interviewees in the given depth and specifically for MNOs. A future telecommunication ecosystem is expected to be influenced and guided by much more B2B transactions. It will be more about content and connection as well as partnership and cooperation than it is nowadays and many commonly created products and services will be available (interviewees 2, 3, 4, 5, 6, 7, 9 and 11). Already now MNOs can prepare for such a future telecommunication ecosystem by focusing on cocreation, coinnovation and strengthening and creating partnerships, which was experienced by the author while working for MNOs.

"(…) cooperation will become much more intensive and downstream it will become more intensive in the sense that other services will be made available to the customers." – Interviewee 2

"In the end, (…) cooperation with other companies will certainly become more, in every direction, so that you can focus more on your core functionalities." – Interviewee 5

Parts of the current telecommunication ecosystem that are not expected to be relevant in future are SIM card manufacturers as these can be directly integrated in devices. But also selected hardware manufacturers are expected to disappear besides landline and fixed network for private customers. SMS and MMS will be less relevant and so will traditional mobile communication be which can be substituted through communication using data (interviewees 4, 5, 7, 10 and 12). The author confirms that several parts of the current telecommunication ecosystem are not expected to be part of the future one, as working at MNOs he came, for example, in contact with the topic ‘eSIM’ several times as eSIM makes it easier and faster to sell and integrate customer contracts in devices. Also the decline of fixed network for private customers was seen as well as the substitution of SMS, MMS and partially traditional voice services by data services. Identified relevant parts of current telecommunication ecosystem are smart devices supporting personal assistants, such as Alexa and Siri, but also the respective apps and platforms. Data connection will be more relevant in a future telecommunication ecosystem for diverse services based on it and substitute traditional telecommunication services. Sovereignty of data will be a central point in future especially in terms of customer data. The offered product and service portfolios will be much larger and diverse compared with the ones of today. In terms of data sovereignty and data protection the author agrees that this will be crucial for a future telecommunication ecosystem. As data protection becomes increasingly important to customers, they do not want to share their data with everyone without knowing what their data is used for. In fact, most customers only want to share their data if it is beneficial for them and only as long as it is required. This gives MNOs a further opportunity for their future by positioning themselves as strong and reliable data protectors for their customers (interviewees 4, 5, 6 and 10). Overall, the telecommunication landscape is expected to change. Countless content providers will participate in the telecommunication ecosystem and the participants are expected to grow closer together but loosen their ties when new and more promising opportunities occur. Hardware manufacturers will still be relevant but less influential as they will be enabler for using software and platforms and not the big innovators themselves. Telecommunication infrastructure will be central to the ecosystem as it forms the backbone on which all services are provided. Software robotics and data insights are expected to be central components bringing participants in the telecommunication ecosystem closer together and enabling faster, better and more customer-centric services (all interviews).

“So the ecosystem is of course highly complex. I believe the fast eat the slow, not the big eat the small. And the slow ones - they're not going to survive.” – Interviewee 12

5.4 Conclusions

RQ1 was answered by describing the contemporary situation in the telecommunication market for MNOs as well as the way BI, Big Data and software robotics have an impact on MNOs. Regarding RQ2, the impact that innovation has on MNOs’ future development was illustrated as well as the implication of Pisano’s (Pisano, 2015) ILM on MNOs. RQ3 was addressed by depicting the look of a possible future MNO business model and the impact of BI, Big Data and software robotics on it. Finally, RQ4 was covered by providing a possible future telecommunication ecosystem including the impact of software robotics. In light of the provided answers to RQ1, RQ2, RQ3 and RQ4, the research aim, which is to provide a framework within which MNOs are guided to innovate their business model for organisational sustainability by exploring key aspects based on the contextualised 'Innovation Landscape Map' of Pisano and by developing an industry-specific, new transition model grounded on the same, can be answered as follows. Innovation and especially BMI have to be at the heart of MNOs’ actions if future development and growth are considered. Radical and architectural innovation are the most important innovation dimensions in which MNOs should engage, while routine and disruptive innovation are less important but may not be neglected. A future MNO business model is expected to revolve around partnerships which can have diverse shapes, infrastructure, customers and data. Hence these topics have to be in the focus of MNOs contemporary and future actions and considered in the decisions they take. Moreover, MNOs future core services will be data analytics besides the provision of infrastructure, content and products. BI, Big Data and software robotics are regarded as central components of future MNO business models but have to be used to a much greater extent than today if their whole potential is to be realised. Customers and customer support, as well as new, innovative, tailored products are relevant parameters of future MNOs business models. Moreover, MNOs' infrastructure including the respective investment, partnerships, co-creation, co-innovation and more interaction with start-ups, as well as automation as cornerstone for digitisation are identified as further crucial parameters. Also, adopting the role as service provider and employing the right employees are critical factors in success. By contrast, linear television is expected to become almost irrelevant in the future, while mobile telephony is expected to become less relevant due to a change to telephony using mobile data. Likewise, SMS and MMS are seen as being less relevant in the future.

In section 6.2 key aspects of a future MNO business model are conceptualised. These aspects of a potential business model can be used by MNOs in the proposed or in a modified state for the reinvention of their current business model.

In general, the cases used for this research will be the baseline for first insights on which new research can be based.

6 Contribution

In this chapter the findings and results of the analysis of the conducted research are translated to contributions. First of all, the contribution to knowledge is illustrated, based on the insights gained from the in-case and cross-case analyses to answer the RQ. Additionally, a possible extension of Pisano's (2015) ILM is suggested as a contribution to knowledge as well as a modified conceptual framework populated for the telecommunication industry. The contribution to practice is explained, which suggests (I) key aspects of an industry-specific business model for MNOs. This contribution to practice directly relates to the research aim to provide a framework within which MNOs are guided to innovate their business model for organisational sustainability by exploring key aspects based on the contextualised 'Innovation Landscape Map' of Pisano and by developing an industry-specific, new transition model grounded on the same. Moreover, the contribution to practice provides (II) a roadmap with recommendations for practitioners based on the modified conceptual framework and identified influencing factors. Finally, the contribution is assessed before the limitations and further research possibilities are suggested.

6.1 Contribution to Knowledge

The contribution to knowledge of this research may be divided into three parts: (I) the provision of a framework within which MNOs are guided to innovate their business model in order to reach organisational sustainability, (II) a confirmation as well as the development of an industry-specific, new transition model based on Pisano's (2015) ILM for MNOs, and (III) the provision of a modified conceptual framework populated for the telecommunication industry.

The analysis of the telecommunication market including trends and challenges in combination with the findings from the in-depth interviews shows that a severe change is happening in the telecommunication market, which strongly affects MNOs. This change is inter alia driven by increasing competition, high cost pressure, high demands of network infrastructure including investment in new technology, and strict regulation. It is explained that MNOs will lose significance if they do not adapt to new customer demands, new technology and emerging trends. It is suggested that MNOs have to rethink their market appearance and offers as well as their currently used business models which are not expected to be competitive and meet customer demands to the full extent in the future. As a result of this analysis it can be stated that MNOs are expected to become less important and lose market share if they do not tackle challenges and expected future customer needs by innovating their business model.

In the literature review theory of innovation in general as well as BMI are identified as highly influential factors in companies' sustainable development and growth. Here special focus is directed to disruptive innovation. The concepts and possibilities of software robotics and Big Data and BI are discussed in the literature review. In light of the literature and the data analysis of the expert interviews a connection of software robotics with Big Data and BI is suggested as this enables new possibilities for MNOs that can be incorporated in new business models. In fact, it was found and confirmed by all interviewees that future MNO business models will probably not work without the application of software robotics, Big Data and BI, which have to be connected in order to enable their full potential. Through these technologies insights into the market, customers, development, trends, challenges and many more topics can be generated, which support MNOs in creating and introducing new tactics, strategies and also business models that ultimately assist them in securing their market standing, further expansion, development and growth, as well as organisational sustainability. Therefore, it is strongly suggested that these technologies are not only used in a comprehensive and reasonable way by MNOs but also that they be interconnected, if they are not already, to enable the highest possible benefits to MNOs. Additionally, essential aspects of an infrastructure and data-driven services business model for MNOs were developed to provide a framework within which MNOs can adapt their current business model (compare section 6.2).

It has been found that MNOs have to adapt their current business models in order to be able to meet their customers' future demands and be prepared to react on forthcoming trends. This is not expected to work without a comprehensive adoption of software robotics, Big Data and BI. Hence, as an outcome of this research it can be stated that these technologies have to be incorporated much more strongly at MNOs than they currently are. Through a stronger incorporation the most beneficial effects of these technologies can be realised and the organisational sustainability of MNOs can be fostered and reached. A further finding of the research is that strong partnerships will be a major factor in MNOs' future success, even with other MNOs, as partnerships help further to improve MNOs' market standing, technical capabilities and service provision.

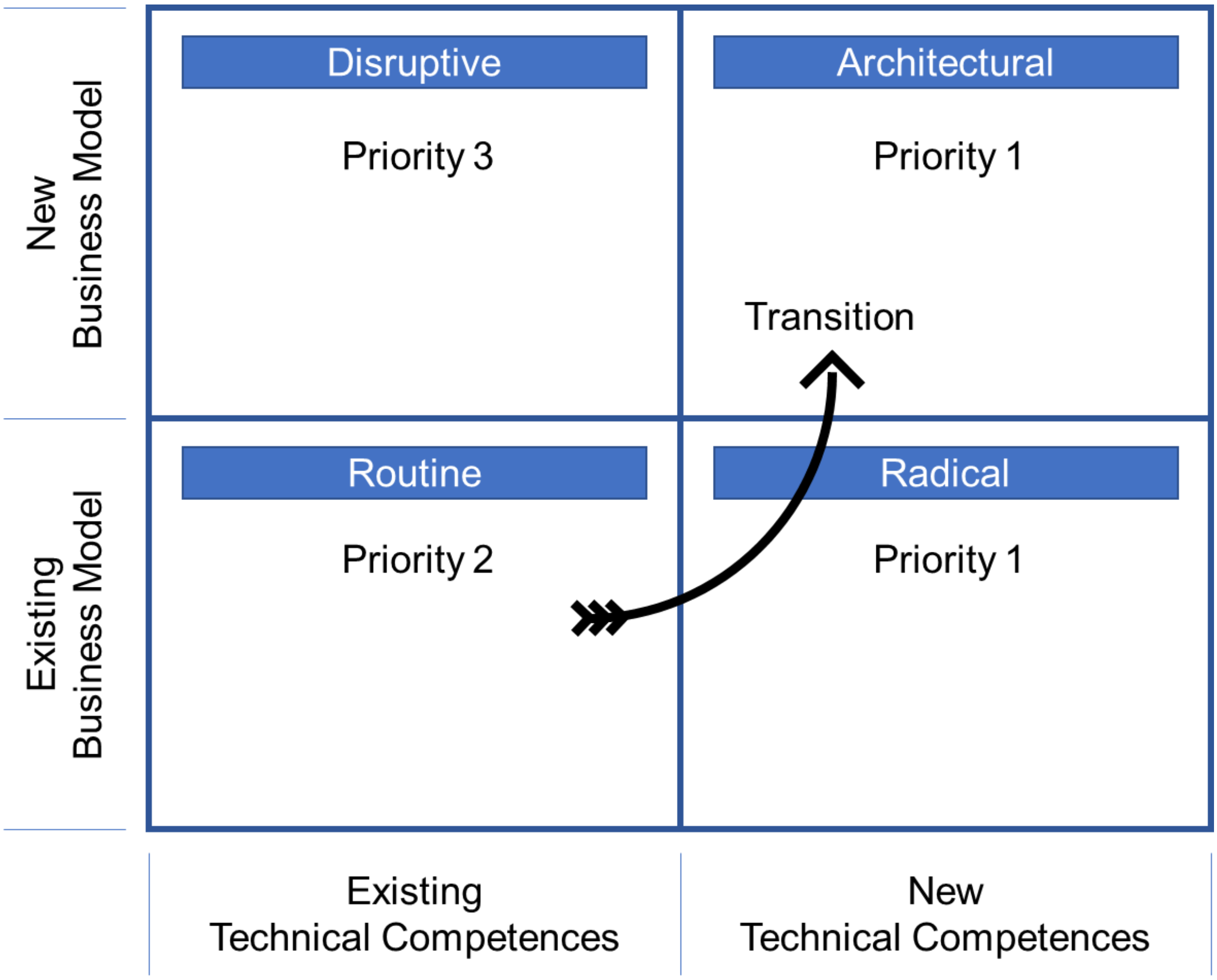
Given this, a first contribution to knowledge is made by providing guidance to MNOs on how to innovate their business model in order to reach organisational sustainability.

Another contribution to knowledge is the development of an industry-specific, new transition model based on Pisano's (2015) ILM for MNOs. On this newly developed transition model architectural innovation, among other things, is given the same importance and priority as radical innovation.

According to Pisano (2015, p. 12), "Businesses in markets where the core technology is evolving rapidly (like pharmaceuticals, media, and communication) will have to be much more keenly oriented toward radical technological innovation (…)". The communication market is thematised in this quote and MNOs are an essential part of it. Therefore, the quote directly refers to MNOs. Concluding, Pisano's (2015) statement is confirmed by the results of this research project that state that radical innovation is the most important innovation dimension for MNOs. However, according to the results of the research not only radical innovation, but also architectural innovation is of highest interest to MNOs, meaning that they are weighted equally. Therefore this research suggests expansion of Pisano's (2015) statement to give architectural the same importance and priority as radical innovation at MNOs.

Pisano's (2015) statement that balance and mix are decisive when strategically thinking about the four innovation dimensions is confirmed by this research which finds that all innovation dimensions are important to MNOs but to differing degree. Routine innovation is regarded as a standard requirement that has to be practised at any time as it supports in securing MNOs' core business. Disruptive innovation is seen as the innovation dimension least important to MNOs but if pursued, a partnership approach should be followed. Radical and architectural innovation are suggested to be equally important. Radical innovation is seen as an intermediate step towards architectural innovation as once MNOs are familiar with new technical components that are used with their existing business model, a change to the use of the new technical components in a new business model can be made. For the step to radical or to architectural innovation with radical innovation as intermediate step, not only are new technical components required but also the respective technical competences. This means that a company must not only be able to see the emergence of a new technology in time, but has also to be able to evaluate the chances and risks associated with a new technology. Based on this evaluation a company has to respond quickly to the technological challenge. This further means that a company has to be able to redesign its business model and change its technical competences. Hence the right employees with technical competence are needed for radical as well as architectural innovation. Through their technical competence new technologies and changes can be observed in time, chances and risks can be evaluated, and responses prepared, such as an adaption of the business model. The move from routine to architectural innovation with radical innovation as intermediate step can be seen as a new transition model. However, as the step from radical to architectural innovation is hard for MNOs to achieve on their own, cooperation and partnership may be necessary to achieve this innovation dimension. Concluding, radical and architectural innovation are the dimensions most important to MNOs' growth, development and sustainability. These are followed by routine innovation, a prerequisite to securing MNOs' core business and to recovering costs. Disruptive innovation is the least important and should be tackled in partnership. The proposed MNO-specific transition model is illustrated in figure 26.

Figure 26: Proposed MNO-specific Transition Model of the Innovation Landscape Map



Structure in accordance with Pisano (2015)

Based on this, a second contribution to knowledge is reached by confirming that radical innovation is the most important innovation dimension to MNOs and a mix of the four innovation types is required. In light of this, Pisano's (2015) statement can be confirmed and architectural innovation is suggested as equally important to radical innovation for MNOs. Therefore an extension of Pisano's (2015) proposed model for MNO's is suggested. Moreover, besides the MNO-specific implications a new transition model is developed in which radical innovation is regarded as intermediate step between routine and architectural innovation for MNOs.

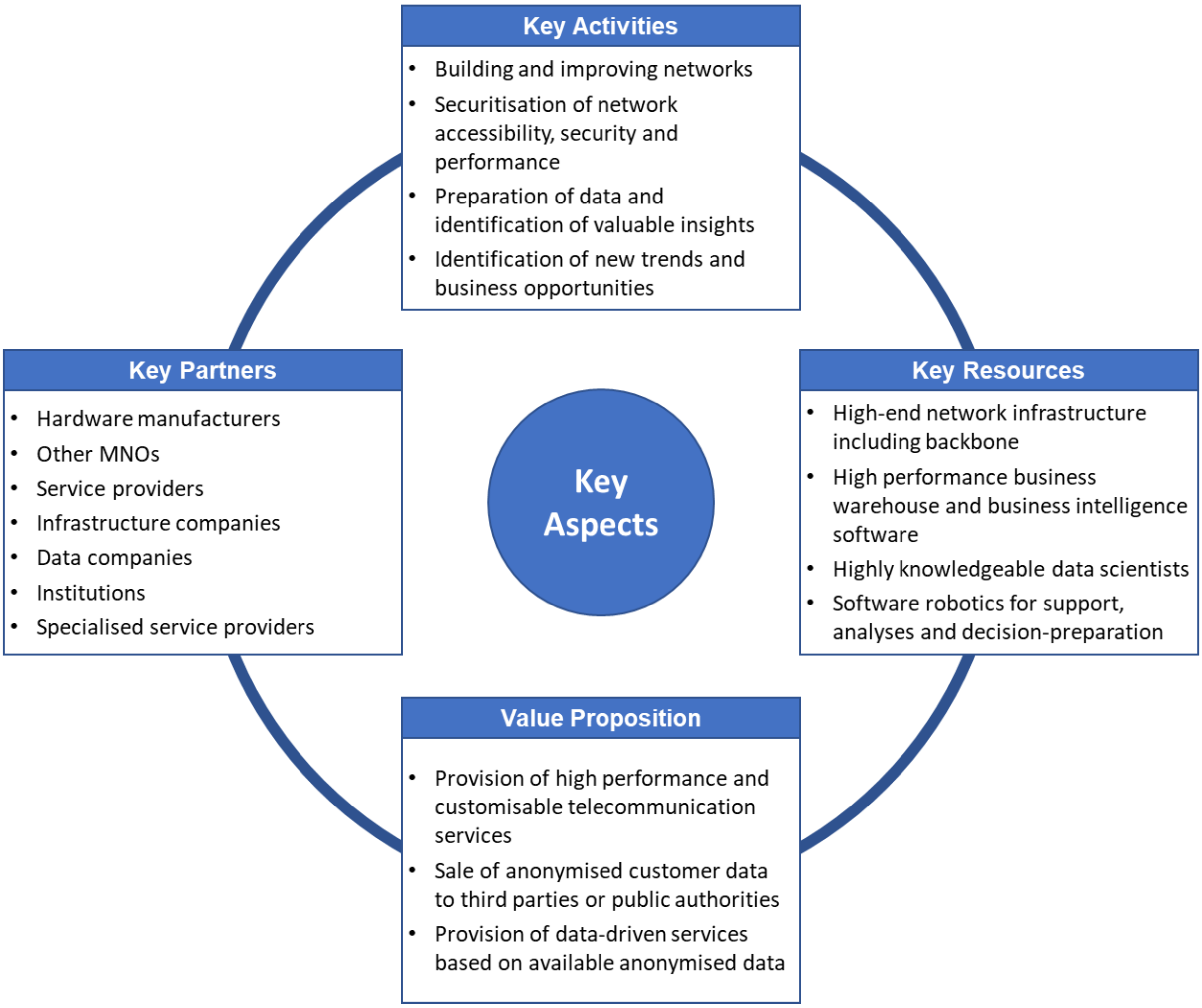
A third contribution to knowledge is the modified conceptual framework as stated in section 5.3. While the originally developed conceptual framework (compare figure 20) is populated using literature, the modified one is amended by insights from expert interviews as well as inside knowledge of the researcher. In this way, a more holistic framework is provided that would not have been achievable solely based on literature. This modified framework differs from the original framework in the addition of further factors, mainly for the themes ‘innovation’ and ‘ecosystem’, that influence MNOs’ future business model and their positioning in terms of innovation. Thus, Pisano’s (2015) ILM is extended by external influencing factors relevant for the telecommunication market. As this is a new and original approach, it is a further contribution to practice.

6.2 Contribution to Practice

The contribution to practice of this research may be divided into two parts: (I) The findings of this research suggest a change in current MNO business models towards more data-driven services, while maintaining the infrastructure business at the same time. The results can be regarded as a solid base for the definition of a strategy for MNOs. (II) Based on the modified conceptual framework and identified influencing factors, a roadmap for practitioners with recommendations is provided.

As a first contribution to practice, the generated key aspects of the possible industry-specific infrastructure and data-driven services business model for MNOs can be used in the proposed or in a modified state for the reinvention of MNOs’ current business model. Figure 27 shows the key aspects of this industry-specific business model for MNOs, which builds on the results of this research.

Figure 27: Key Aspects of suggested Infrastructure and data-driven Services Business Model for MNOs



The key aspects focus on key activities, key partners, key resources and value proposition.[1]

Key activities for such a business model revolve around various aspects important to MNOs. One the one hand, building new and improving existing networks will be and stay at the heart of MNOs' actions, so that MNOs are able to provide their traditional services to customers and also offer new services. On the other hand, not only is the physical construction and maintenance of such networks relevant but also securing their accessibility, security and

[1] The key aspects of the suggested infrastructure and data-driven services business model for MNOs are based on the following information.
Key partners: result of subsection 5.2.3
Key activities: result of subsections 5.2.1, 5.2.2, 5.2.3
Key resources: result of subsections 5.2.1, 5.2.2, 5.2.3, 5.2.4
Value propositions: result of subsection 5.2.3

performance, in order to keep both the data of their customers and internal data safe, and to provide high-quality products fast and without interruption. Besides this, the preparation of available data in an anonymised way and the identification of valuable insights, which fosters competitive advantage and helps in increasing MNOs' revenue when sold or used, are further key activities on which MNOs should focus. Moreover, the identification of new trends and business opportunities is vital to MNOs' gaining or improving their competitive advantage and increasing their future sustainability and revenue.

Key partners are a further essential aspect of such a future business model. These partnerships should be with hardware manufacturers, like smartphone or CPE or smart home providers, so that MNOs are able to provide hardware, software and connectivity out of one hand. In this way, MNOs are the single point of contact with customers, which grants them improved visibility and recognition. Partnerships with other MNOs are also recommended, e.g. to share networks in areas that are only covered sufficiently by one MNO. In this way, MNOs save a lot of money by not having to build a network in an area that is not attractive to them, if there is already a partner network existing. Furthermore, partnerships with MNOs in other countries help in identifying trends at an early stage so that first mover advantages can be exploited. Through partnership with service providers, services from third parties are directly marketed by MNOs. In this way, competitive advantages are secured through exclusivity. Cooperation with infrastructure companies, such as energy suppliers of public utilities, support in achieving leverage, e.g. through putting cables of an energy supplier and MNOs in the same trench instead of digging two of them. Cooperation with other data companies fosters sharing of anonymised data. Data are combined and more valuable data with more information is generated to allow deeper insight and develop models. This leads MNOs to an improved position in the market and creates competitive advantage. But cooperation with public institutions is also a key aspect of partnership. Together with them, platforms can be developed, e.g. for remote doctor consultation or e-learning. Furthermore, cooperation with specialised service providers is recommended that provide their services to MNOs' customers and to do so use MNOs' brands and public image. The specialised service providers stay in the background fulfilling their tasks, e.g. analysis, while the MNOs' public image is used and recognised by customers.

As key resources to make such a business model work a high-end network infrastructure, e.g. 5G, with the corresponding backbone, such as fibre optic cables and servers, is required to be able to provide telecommunication services, such as data and voice transmission, in high quality with low delay and high capacity. For data-driven services business warehouses to handle Big Data as well as BI software are required along with other relevant software, such as software for software robotics for support purposes, e.g. analysis, streamlining and automation of processes, and decision-preparation. Moreover, highly knowledgeable data scientists are a prerequisite to generation of the required insights and assist the implementation and definition of assisting technologies, such as software robotics, BI and Big Data.

The value proposition of such a business model is divided into three parts. The first is the provision of high performance and customisable telecommunication services through MNOs. For example, through the new 5G networks MNOs are able to approach the mass market with a new technology that enables faster and more reliable data transfer, which is a prerequisite to Industry 4.0, edge computing and autonomous driving. But completely new business models for MNOs' customers are also enabled solely on the provision of such high performance technology and services. The second value proposition is the sale of anonymised customer data. These data can be movement or usage data sold to third parties, which combine these data with their own to generate deeper insights into customers and processes, or to public authorities that can use these data for traffic management and making cities smarter. The third value proposition concerns the provision of data-driven services based on available anonymised data. These services can offer new and value-added services to private customers, business customers and public authorities.

These four aspects can also be used as a MNO-specific part of Osterwalder's and Pigneur's (2010) Business Model Canvas. To complete such a MNO-specific Business Model Canvas customer relationships, customer segments, channels, cost structure and revenue streams would further be required.

In order to get to such a suggested infrastructure and data-driven services business model, MNOs have to change and optimise several things in their current operations. These have to be tackled as soon as possible in accordance with further findings of this research. The following actions are suggested and could be focused on by MNOs at short notice in order to not lose too much time in the adaption of their business model.

(1) Putting customers at the centre of MNOs' actions and improving customer support and interaction through more automation, higher quality and number of interactions, higher adoption rate of data-driven services, faster identification of requirements and trends
(2) Introduction of new services, enabled e.g. by new technologies and available data, as well as adaptive pricing and abolition of old tariffs and tariff structures
(3) Further and fast network expansion with high investment
(4) Fostering existing and closing new partnerships
(5) Greater automation to get leaner, faster, reduced bureaucracy and cut internal costs
(6) Hiring the right employees for future tasks
(7) Changing the corporate culture to be more open to change and innovation

Based on the developed key aspects of the suggested infrastructure and data-driven services business model for MNOs, the aim of this research project to provide a framework within which MNOs are guided to innovate their business model for organisational sustainability by exploring key aspects based on the contextualised 'Innovation Landscape Map' of Pisano and by developing an industry-specific, new transition model grounded on the same is regarded as accomplished by the author.

As a second contribution to practice and based on the modified conceptual framework and identified influencing factors (compare section 5.3), the following recommendations for practitioners emerge from the research.

The usage of new and future-orientated technologies should be a central factor of MNOs' actions. 5G as enabler of many use cases needs to be fostered for early realisation of the benefits it provides. It should be included in new telecommunication contracts to promote its benefits and get customers used to its advantages. This also means that a fast network expansion, which is connected to high investment, is required to not only promise a service but to be able to deliver it. Cloud infrastructure needs to be strengthened and new services and products should be based on it. Cyber security must be a crucial part of MNOs' future actions not only to defend their own network and infrastructure but also to provide respective services to private and business customers. Through a thorough focus on eSports MNOs can reach customers not in their scope so far at the same time strongly promote the advantages that 5G provides. IoT and M2M are promising areas to generate revenue. Therefore, MNOs should, beside the provision of infrastructure for this technology, access the devices and software market for IoT more strongly and preferably in partnership with a company that is already active in the market. Also regarding smart home, buildings and city markets MNOs should increase their footprint by not only providing the infrastructure for it but accessing the more beneficial areas, e.g. provision of data, analyses and derived services. In terms of software robotics MNOs already started their actions but need to increase their efforts. In this way, they could not only realise more advantages enabled by software robotics but also realise them faster which would give them a competitive advantage over competitors. It could support MNOs in getting leaner and faster, reducing bureaucracy and cutting internal costs.

Among the opportunities they should engage in, putting customers at the centre of their actions and improving customer support and interaction through more automation, higher quality and number of interactions, higher adoption rate of data-driven services, faster identification of requirements and trends is a crucial part. Also getting rid of old tariffs and tariff structures, while at the same time introducing new services enabled by new technologies and data is an opportunity MNOs should take. The advantages that globalisation provides should be realised, for example, by a constant exchange with partners or related companies on ideas on how to approach the market with new products and by searching together for suppliers to combine demands for better prices. In terms of M&A the focus should not only be on big companies that have many customers and a good infrastructure that can be combined with the own one to realise scale effects. The focus should also be on identifying small companies that offer promising products that complement MNOs' own product offers and increase the overall value when offered together. Furthermore, these small companies can support in reaching niche markets and winning new customers. Operational efficiency needs to be advocated as it helps MNOs with their financials through decreasing costs and making processes leaner, faster and less prone to error. One of the biggest opportunities that should be realised are partnerships. These should be fostered whenever they are beneficial for both partners independent of the kind of partner and the chosen approach. At the same time existing partnerships should be maintained if they proved successful in the past. Strong partnerships do not only help MNOs in the current market situation but also make their future business more resilient.

Regarding challenges and constraints, MNOs have to be able to react more agile and flexible to changes in customer needs and the telecommunication market. Therefore, a corporate culture that is open minded, future-orientated and open to change and innovation is required. Such a corporate culture cannot be implemented over night but has to be established over several years. The desired corporate culture can be supported by employing people that already have the required mindset and by a management and promoters that lead as examples. Through permanently communicating success stories that base on an open-minded corporate culture more people are convinced to become part of it. In this way, a shift from the given corporate culture to the desired one can be started. A future-orientated corporate culture also helps MNOs with shortening innovation cycles as the company is better prepared for change. High investment costs are a challenge that is expected to further exist in future. MNOs can share their networks with each other in areas that are not profitable so that not all MNOs have to build a network in these places. In this way, a certain part of investment costs is saved. Moreover, in several countries a change from frequency auctions, which cost MNOs multiple billions of euros that cannot be used for network roll-out, to more future-orientated and cheaper distribution of frequencies should be demanded through discussion with politicians and also by using lobbyists to influence regulation. Through partnership approaches investments can be split between partners. The challenge of an increasing market saturation could be tackled by provision of smart devices requiring SIM or eSIM cards that in turn require additional telecommunication contracts or adaption of the available ones to cover more SIM cards. In this way, the number of potential customers would not increase but the number of potential contracts. Besides this, also hiring the right employees is a challenge to be overcome. When hiring employees, it should not only be searched for people fulfilling the tasks currently required but also for people that are skilled to fulfil tasks that are anticipated to be relevant in future. Moreover, willingness to lifelong learning and open-mindedness as well as future-orientation are characteristics to be looked for. The lack of knowledge in certain areas should be focused by providing trainings to educate employees in terms of new requirements in their job. Furthermore, trainings for employees to be prepared for another job in the same company, if they want to experience something new, are required. In this way, employees can be bound to the company and at the same time they get a better overview of the company, acquire more skills and the company can benefit from connected thinking enabled by employees that worked in more than one department of a company. The challenge of data security should be taken very seriously by providing contracts that specifically protect customer data more than average contracts. This could be done using additional data protection services that can be booked as part of contracts. In this way, customer trust could be increased and a unique selling proposition is built, which is mainly relevant for data-sensitive customers.

Coinnovation and cocreation with partners needs to be fostered to enable further benefits for customers and profit for MNOs. BMI should be in MNOs' focus all the time as it is a requirement for their future survivability and success. Thereby, MNOs should closely stick to the innovation dimensions of the ILM. This means that they have to be active in routine innovation, which forms the baseline of their actions, but also engage in radical innovation, which is easier for MNOs to achieve than architectural innovation. Architectural innovation should be one of MNOs' goals in a partnership approach as it is harder to achieve for MNOs on their own.

MNOs should always have in mind that their infrastructure builds the heart of a future telecommunication ecosystem. This knowledge provides a good position when negotiating with customers or partners. MNOs should focus on and foster the parts that are identified to be central parts of a future telecommunication ecosystem, while getting rid of the parts that are not expected to be relevant. In this way, they can already prepare for their future now.

6.3 Assessment of Contribution

The contribution's strength and validity, its originality, creativity and innovation can be tested following Baptista et al. (2015). Originality is inherent to creativity and innovation.

According to Guetzkow, Lamont and Mallard (2004, p. 190), originality is defined by "using a new approach, theory, method, or data; studying a new topic, doing research in an understudied area; or producing new findings". To achieve originality in this research project, new data are gathered from semi-structured, in-depth interviews with knowledgeable persons using a case study design. The research was conducted on a new topic and in an area that is understudied. Also, a gap in knowledge could be identified, which is at the same time the justification for the relevance of this research. Moreover, new data were generated in the interviews that were analysed and reflected on by the researcher and which were finally used as foundation for the suggestion of key aspects of an infrastructure and data-driven services business model for MNOs. Hence, according to the definition of Guetzkow, Lamont and Mallard (2004), originality of the contributions is ensured. Originality can also be reached by building on existing knowledge (Baptista et al., 2015). This is achieved by using the knowledge summarised in the literature review (compare chapter 2) as foundation of the study. Baptista et al. (2015) state that originality needs to be accompanied by significance. The significance of a contribution is not only reached by focusing on a problem that concerns nearly all MNOs, but also by providing the elements that form a framework within which MNOs are guided to innovate their business model as a starting point. In light of this, originality is perceived as being tested positively.

According to Bennich-Björkmann (1997) and Baptista et al. (2015), for creativity novelty and relevance are required. As stated above, MNOs are in a fast-changing and highly competitive market, which presents certain threats to them. They have problems in determining a strategy to ensure growth and development and find a suitable business model that secures future sustainability. Therefore, the relevance of this research project to MNOs is given as it supports them in innovating their business model for future sustainability. Regarding novelty, key aspects of an infrastructure and data-driven services business model for MNOs are suggested, which can be regarded as cornerstone of MNOs innovating their business models. Novelty is reached as this research project is the first to focus on the specified problem imminent to MNOs using scientific procedures and standards. Therefore, also creativity is regarded as tested positively.

Regarding the topic of innovation, the contribution of this research is assessed as having economic relevance because it can directly be applied at MNOs and help them to solve the addressed problems, in accordance with Baptista et al. (2015). In this way, also innovation can be assessed positively.

Concluding, the contribution's strength and validity are regarded as confirmed as the contribution is novel, significant, relevant and applicable.

6.4 Limitations and further Research

In this subsection limitations of the work are considered and further research possibilities based on this work suggested.

<u>Limitations</u>

A first limitation is that only one researcher conducted this research, due to the framework of the work. This can influence the research in several ways. The conduct of the interviews and their analyses can be influenced by the author's constitution of the day, which is prone to change. Interpretation of interview data is conducted from only one point of view, meaning that other interpretations could be possible if other researchers had participated in the interviews, analyses and interpretations. This limitation could be overcome by conducting the research with more than one researcher. In this way, bias could also be reduced.

Further limitations are time and flexibility. This originates in the structure of the doctorate programme, which is designed for managers who want to study part-time. Therefore, not the whole available time of the researcher can be focused on the studies but a split of the available time between studies and work is inevitable. Therefore, time and flexibility are limited. With more time and flexibility for the study, more iterations, reflection and creativity could be possible. However, if a result of the research is deemed to be practical for a business, it can directly be applied using the adopted approach. As the author was aware of these limitations before the research was started, he tried to reduce them as much as possible.

As this research is qualitative and not quantitative, no generalisation of the its findings and conclusions is possible, nor can its findings and conclusions be regarded as statistically representative. This is due to the fact that only a limited number of experts were available and not a high number of opinions were required to get the required insights but deep insights of highly knowledgeable persons. No additional knowledge relevant to this research would be gained if many interviews had been conducted. Concluding, the study relies on few experts who are knowledgeable enough to answer the interview questions.

The interviews were conducted in German, which reduces misunderstandings due to language barriers, and translated into English afterwards. The limitation is that the translation could have caused the loss of fine linguistic characteristics, even if the author tried to mitigate this limitation as much as possible by e.g. using the German as well as English interview transcripts for the analysis and interpretation.

Further research

It was understood by the author and confirmed by interviewees that big innovations, which can lead to the innovation of MNOs' business models, do not mostly originate in MNOs but rather in other companies. In a further study this could be tested and verified quantitatively.

One of the findings of this research is that partnership and cooperation will probably be a critical success factor in MNOs' future. As this was mainly considered from MNOs' point of view, further qualitative research could focus on the partnerships from the perspective of potential partners of MNOs with a special focus on most relevant cooperation areas and conditions under which prospective partners should approach MNOs.

Further qualitative research could focus on the identification of companies that are of greatest interest to MNOs regarding merger and acquisition. In this way, companies that might support the generation of new MNO business models could be found earlier, which in turn could lead to a head start for the respective acquiring company.

As mentioned in the interviews, big companies, such as Google or Facebook, are a potential threat to MNOs as they have a huge amount of available capital and could enter the MNO market fairly fast by building their own networks and thus start competition with established MNOs. A qualitative study could examine how big this threat is and how such a market entry of a big company that is not yet involved in the telecommunication market might appear.

In the interviews it was also mentioned that the right people have to work at MNOs in order to face current and future challenges. However, it was not specified what the right people look like, meaning which skills and knowledge they should have. In a qualitative study the profiles of employees, which may be regarded as essential to MNOs in the future, could be identified.

Further qualitative research could also focus on the influence of specific new technologies, such as blockchain, on MNOs.

Regulation is regarded both as partially too strict and not strict enough. Qualitative research could be conducted on the influence of regulation on MNOs and further involved parties in the telecommunication market.

Additional qualitative research could focus on the relationship of the outcomes of software robotics promised by the sellers and the actual outcomes. This could not only be done regarding duration from start to implementation but also regarding enabled efficiency, costs and reallocation of employees.

With the aforementioned limitations in mind, further research using different methods could contribute to knowledge by adding further insight or strengthening the findings of this work.

The point of view of this work is that of MNOs. In quantitative research the point of view of MNOs' customers could be adopted to gain further understanding of their expectations and requirements, which could also lead to a change in MNOs' business models.

It is assumed by the author that in several years there will be persons more knowledgeable in the combination of the topics 'MNOs' and 'software robotics'. Moreover, the adoption of software robotics at MNOs will be at a completely different level. Hence future qualitative research could focus on even newer business models for MNOs. In the same research the results of this work could be tested and validated.

The vital aspects of an infrastructure and data-driven service business model for MNOs, which consist of key activities, key partners, key resources and value proposition, are comparable in their structure with Osterwalder's and Pigneur's (2010) Business Model Canvas. Further research could concentrate on the remaining aspects that are required for the Business Model Canvas (customer relationships, channels, customer segments, cost structure and revenue streams) and connect them to this thesis' findings. In this way, a complete Business Model Canvas for MNOs could be elaborated.

7 Conclusion and Outlook

The overall research aim of this work is to provide a framework within which MNOs are guided to innovate their business model for organisational sustainability by exploring key aspects based on the contextualised 'Innovation Landscape Map' of Pisano and by developing an industry-specific, new transition model grounded on the same. Accordingly, the overall RQ ‘What does it take to position MNOs in a changing telecommunication market?’ was formulated.

In order to answer and test the RQs the literature review provides a first and broad overview of knowledge as a base for understanding. Firstly, the telecommunication market in general was discussed to determine its current situation. Therefore, several trends, such as the increase in M2M connections and in worldwide internet accesses as well as in mobile service subscriptions, changes in mobile phone adoption and the use of data and the increasing importance of cloud infrastructure and network virtualisation were depicted. Besides these positive trends negative ones have to be considered, like slowing down growth rates, substitution of MNOs’ services, declining ARPU and MNOs’ declining share of revenue in the telecommunication ecosystem. Challenges have also to be taken into account to draw a comprehensive picture of the telecommunication market. These challenges include increasing competition, problematic monetisation of MNOs’ services, globalisation, uncertain regulatory environment as well as changing customer needs. As a result the future of MNOs can be described as competitive and uncertain. This led to the question whether MNOs’ business models are suitable for their future development and sustainability.

The second section of the literature review covers the topic innovation. In the beginning, the focus lies on the theory of innovation in general, before a closer look at the ILM, disruptive innovation and further innovation types is taken. This is followed by zooming in on BMI including the meaning of business models and theory of BMI. The theoretical insights gained from this are afterwards compared with the currently used MNO business models as well as BMI at MNOs by analysing them in detail. Strategic management views such as IBV, RBV and

DC are considered as they can be used as baseline for BMI with regard to strategic management. It is seen that insufficient research has been conducted into MNO business models and BMI for MNOs in the past years. Therefore, the question arose what role innovation plays in MNOs' future development and what innovation types are relevant to MNOs. It was noted that the topics of how future MNO business models and a future telecommunication ecosystem could look are not sufficiently covered in the literature and these needed to be addressed in this research.

The following section covers the concept of software robotics, consisting of RPA and Intelligent Automation technologies, as well as their application at MNOs, e.g. in the areas of automation, streamlining and decision preparation. The last section of the literature review focuses on the topics Big Data and BI, explaining their concepts as well as their use at MNOs, e.g. in profiling, customer targeting, network optimisation, cost reduction and fraud and churn analysis. As a result of the sections on software robotics and Big Data and BI it can be stated that the respective technologies are expected to be crucial to MNOs and therefore have to be considered in the RQs concerning MNOs contemporary situation, possible future MNO business models and possible future telecommunication ecosystem.

Overall, the most important findings of the literature review were that MNOs' current business models are not future-proof against the emerging trends and challenges MNOs have to face and that there is insufficient up-to-date research on how MNOs can oppose these challenges and participate in the trends. Software robotics, BI and Big Data were identified as important technologies that are most effective if used together. However, their future use at MNOs is not yet identified sufficiently.

For the creation of a framework of BMI for MNOs which covers the identified gaps and takes the aforementioned technologies into account, a setup that follows academic and ethical standards was chosen. The research followed a subjectivist epistemological stance, that of an interpretivist. From an ontological stance a subjectivist approach was also chosen. As a deep understanding of the situation and possible solutions was required as well as insight from highly knowledgeable persons, a qualitative approach was identified as most promising. Therefore, a case study in a mono method setting was chosen. Following this, four cases, MNOs, consulting companies, RPA providers and IA providers were identified as most relevant to this research. To get the required data, semi-structured in-depth interviews with experts were conducted to get deep insights into their points of view of MNOs' future, possible business models and a possible future telecommunication ecosystem.

In July 2019 a pilot study was conducted and the data collection process started with a total of 13 interviews over seven months. The interviews were recorded, transcribed and translated in order to have a sound data base. In a next step they were uploaded to NVivo for further classification and coding. Therefore, a coding structure was defined for categorising findings and enabling pattern matching. In within-case analyses the results of the single interviews were compared to get an in-depth understanding of each case, before the results were compared in the cross-case analysis. The results gained were approved for validity and reliability. The findings are used to populate a modified conceptual framework for the telecommunication industry. Research ethics were considered at any time.

As a result and contribution of this work key aspects of an infrastructure and data-driven services business model for MNOs were suggested, which can be used in the current or in a modified version for the innovation of MNOs' business models. The framework suggests that MNOs continue to focus on the network infrastructure by keeping it up-to-date with the latest technology and by covering as many areas as possible with high speed, fast access and sufficient capacity. In this way, they keep their current customer base and can even increase it. Access to customers is seen as a crucial asset that MNOs must never lose. With the focus on infrastructure MNOs are also able to generate revenue which covers their basic operations. The second part of the key aspects of the suggested MNO business model is the provision of data-driven services, which is mainly about two directions. On the one hand, MNOs are able to offer specialised and individualised services and products to their customers in light of information, such as customers' usage or location data. In this way, MNOs can create lock-in effects for their customers and, based on the provided services, even increase the ARPU due to a possible monetisation of the provided services. On the other hand, MNOs can use the data generated by their customers, for example, to create profiles and sell them anonymised to third parties, such as companies or public authorities, which can, for example, create further services based on these data or improve public transport. For the infrastructure part as well as for the data-driven services part software robotics, BI and Big Data are identified as inevitable, as these technologies support, inter alia, an efficient and optimised operation of the infrastructure as well as the preparation of data, automation of processes and preparation of decisions. A future MNO business model is expected to be characterised by partnership in many ways, e.g. with other MNOs, hardware manufacturers or other infrastructure companies.

As to the limitations of this research and further possible research, partnership and cooperation as success factors critical to MNOs' future could be analysed from partners' point of view in qualitative research in order to provide a fuller picture and further specify the suggested business model for MNOs. Also, the identification of companies or sectors that are most promising for merger with or acquisition by MNOs could be a next step in research as it further shows the way for MNOs' future growth and development. An analysis of the threat from big players not yet active in the area of MNOs could lead to further understanding of how to make the future of MNOs safer.

Future research is thus required to continue critically to monitor the development of MNOs as well as the telecommunication and adjunct markets, and to develop valuable understanding for practice, research and society as a whole within this framework as MNOs either change significantly, disrupt and innovate, or become a commodity.

8 Reference list

Acemoglu, D. and Restrepo, P. (2017) *Robots and Jobs: Evidence from US Labor Markets*.

Al-Debei, M.M.; Avison, D. (2011) 'Business Model Requirements and Challenges in the Mobile Telecommunication Sector', *Journal of Organisational Transformation & Social Change*, 8, pp. 215–235.

Al-Debei, M.M., El-Haddadeh, R. and Avison, D. (2008) *Defining the Business Model in the New World of Digital Business. Proceedings of the 14th Americas Conference on Information Systems*. Toronto, Canada, 14-17 August.

Allmark, P.; Boote, Jonathan, Chambers, Eleni; Clarke, A.; McDonnel, A.; Thompson, A.; Tod, A.M. (2009) 'Ethical issues in the use of in-depth interviews: literature review and discussion', *Research Ethics Review*, 5(2), pp. 48–54.

Almato (2016) *Neuer Großkunde: Deutsche Telekom realisiert Automatisierungsprojekt mit ALMATO*. Available at: https://almato.de/news/blog/trend-details/neuer-grosskunde-deutsche-telekom-realisiert-automatisierungsprojekt-mit-almato/ (Accessed: 20 July 2018).

Aluwihare-Samaranayake, D. (2012) 'Ethics in qualitative research: A view of the participants' and reserachers' world from a critical standpoint', *International Journal of Qualitative Methods*, 11(2), pp. 64–81.

Aly, A.; Griffiths, S.; Stramandinoli, F. (2017) 'Towards intelligent social robots: Current advances in cognitive robotics', *Cognitive Systems Research*, 43, pp. 153–156.

Amaze (2015) *Delivering value through data: Transforming information into knowledge and action*.

Amit, R.; Zott, C. (2001) 'Value creation in e-business', *Strategic Management Journal*, 22, pp. 493–520.

Amit, R.; Zott, C. (2012) 'Creating Value Through Business Model Innovation', *MIT Sloan Management Review*, pp. 41–49.

Analysys Mason (2020a) *73 MNOs worldwide have launched 5G services, bringing benefits to consumers and communities*.

Analysys Mason (2020b) *Connected consumer survey 2019: Mobile customer satisfaction in Europe and the USA*.

Analysys Mason (2020c) *COVID-19 scenarios for telecoms operator service revenue: Worldwide forecasts 2019-2024*.

Analysys Mason (2020d) *Promoting new services alongside FMC in Europe: Case studies and analysis*.

Analysys Mason (2020e) *SMBs lack the necessary resources to craft and sustain strong protection against cyber threats*.

Analysys Mason (2020f) *The cloud-gaming opportunity for operators*.

Arthur D. Little (2018a) *Telecoms data monetization: Reality, not a mirage: Big Data can deliver the promise of converting data into competitive advantage*.

Arthur D. Little (2018b) *Why machine learning is crucial to effective utilization of big data: Managing and gaining the most value from big data*.

Atluri, V.; Dietz, M.; Henke, N. (2017) *Competing in a world of sectors without borders*. Available at: https://www.mckinsey.com/business-functions/mckinsey-analytics/our-insights/competing-in-a-world-of-sectors-without-borders (Accessed: 16 June 2020).

Atoyebi, D. (2018) *Big Data combined with Machine Learning helps businesses make much smarter decisions*. Available at: https://www.entrepreneur.com/article/303470 (Accessed: 16 June 2020).

Azoff, M. (2017) *2017 Trends to Watch: Artificial Intelligence*.

Bain & Company (2019) *Simple and digital is calling - Will telcos answer? By eliminating complexity and embracing digital, telcos can improve customer experiences, cut costs and boost revenue*.

Ballon, P. (2005) *Best Practices in Business Modelling for ICT Services*. Delft.

Ballon, P. (2007) 'Business modelling revisited: the configuration of control and value', *info*, 9(5), pp. 6–19.

Balon, M. and Liau, B. (2012) 'Mobile virtual network operator', in Matera, F. (ed.) *XVth International Telecommunications Network Strategy and Planning Symposium (Networks), 2012: 15 - 18 Oct. 2012, Rome, Italy.* Piscataway: IEEE, pp. 1–6.

Banović-Ćurguz, N. and Ilišević, D. (2017) *Development Trends of Telecommunications Metrics. 2017 40th International Convention on Information and Communication Technology, Electronics and Microelectronics (MIPRO)*. Opatija, Croatia, 22-26 May.

Baptista, A.; Frick, L.; Holley, K.; Remmik, M.; Tesch, J.; Âkerlind, G. (2015) 'The doctorate as an original contribution to knowledge: Considering relationships between originality, creativity, and innovation', *Frontline Learning Research*, 3(3), pp. 55–67.

Barnett, G. (2015) *Robotic Process Automation: Adding to the Process Transformation Toolkit*.

Barney, J. (1991) 'Firm Resources and Sustained Competitive Advantage', *Journal of Management*, 17(1), pp. 99–120.

Barreto, I. (2010) 'Dynamic Capabilities: A Review of Past Research and an Agenda for the Future', *Journal of Management*, 36(1), pp. 256–280.

Barth, P.; Bean, R. (2012) *Who's really using big data*. Available at: https://hbr.org/2012/09/whos-really-using-big-data (Accessed: 16 June 2020).

Bataller, C. and Harris, J. (2016) *Turning Artificial Intelligence into Business Value. Today*.

Becot, S., Bedini, I., Belaunde, M., Marin, S.P., Rugnon, O.L.D. and Molina, B. (2010) *Empowering Telco operator convergence through a common marketplace. 2010 14th International Conference on Intelligence in Next Generation Networks*. Berlin, Germany, 11-14 October.

Benhima, M.; Reilly, J.P.; Naamane, Z.; Kharbat, M.; Kabbaj, M.I.; Esqalli, O. (2013) 'Design and implementation of the Customer Experience Data Mart in the Telecommunication Industry: Application Order-To-Payment end to end process', *IJCSI Journal*, 10(3).

Bennich-Björkmann, L. (1997) *Organising innovative research: The inner life of university departments*. Oxford: IAU Press.

Berruti, F.; Nixon, G.; Taglioni, G.; Whiteman, R. (2017) *Intelligent process automation: The engine at the core of the next-generation operating model*. Available at: https://www.mckinsey.com/business-functions/digital-mckinsey/our-insights/intelligent-process-automation-the-engine-at-the-core-of-the-next-generation-operating-model (Accessed: 16 June 2020).

Bidin, M.A.F.; Yunus, A.M. (2017) 'Business Intelligence using data mining for organizational sustainability: A case study of Digi Telecommunication Sdn Bhd', *International Journal of Academic Research in Business and Social Sciences*, 7(12), pp. 471–485.

Bohlin, E. (2007) 'Business models and financial impacts of future mobile broadband networks', *Telematics and Informatics*, 24(3), pp. 217–237.

Bouwman, H., Faber, E. and Haaker, T. (2004) 'Balancing strategic interests for network value of mobile services', in *Proceedings of the Tenth Americas Conference on Information Systems: August 2004, New York, New York*, pp. 2521–2529.

Bouwman, H., Haaker, T. and Faber, E. (2005) 'Developing Mobile Services: Balancing Customer and Network Value', in *Second IEEE International Workshop on Mobile Commerce and Services: 19 July 2005, Munich, Germany.* Los Alamitos: IEEE Computer Society, pp. 21–31.

Boyce, C. and Neale, P. (2006) *Conducting in-depth interviews: A guide for designing and conducting in-depth interviews for evaluation input*: Pathfinder International.

Bronkhorst, J.; Schaveling, J.; Janssen, M. (2019) ‘Commoditization and IT Product Innovation Strategies from an IT Firm Perspective’, *Information Systems Management*, 36(2), pp. 126–140.

Bruckner, D.; Zeilinger, H.; Dietrich, D. (2012) ‘Cognitive Automation: Survey of Novel Artificial General Intelligence Methods for the Automation of Human Technical Environments’, *IEEE Transactions on Industrial Informatics*, 8(2), pp. 206–215.

Bryman, A. (2012) *Social research methods*. 4th edn. Oxford: Oxford University Press.

Brynjolfsson, E. and McAfee, A. (2011) *Race Against The Machine: How the Digital Revolution is Accelerating Innovation, Driving Productivity, and Irreversibly Transforming Employment and the Economy*. Lexington: Digital Frontier Press.

Brynjolfsson, E. and McAfee, A. (2014) *The second machine age: Work, progress and prosperity in a time of brilliant technologies*. New York: W. W. Norton & Company.

Brynjolfsson, E., Hitt, L.M. and Heekyung, H.K. (2011) *Strength in Numbers: How Does Data-Driven Decisionmaking Affect Firm Performance?*.

Bughin, J.; Chui, M.; Manyika, J. (2014) ‘Ten IT-enabled business trends for the decade ahead’, *McKinsey on Business Technology* (33), pp. 58–69.

Business Objects (2005) *Business Intelligence Solutions: Discover the rights fit for your needs and industry*. Available at: http://web.archive.org/web/20051214103908/http://www.businessobjects.com/solutions/default.asp (Accessed: 16 June 2020).

Calza, F.; Parmentola, A.; Tutore, I. (2017) ‘Types of Green Innovations: Ways of Implementation in a Non-Green Industry’, *Sustainability*, 9(8).

Camponovo, G. and Pigneur, Y. (2003) ‘Business model analysis applied to mobile business’, in *5th International Conference on Enterprise Information Systems: 23 - 26 April 2003, Angers, France*.

CFO (2017) *Finance Technology: How Finance Can Transform the Business by Harnessing Robotic Power*.

Chang, Z. and Tang, S. (2010) ‘A business model research on telecommunication operator transformation’, in Yang, F. (ed.) *3rd IEEE International Conference on Broadband Network and Multimedia Technology (IC-BNMT), 2010: 26 - 28 Oct. 2010, Beijing, China ; proceedings.* Piscataway: IEEE, pp. 888–892.

Changwei, L. (2012) ‘Telco development trends and operator strategies’, *WinWin*, pp. 19–22.

Chesbrough, H. (2006) *Open Business Models: How to Thrive in the New Innovation Landscape*. Boston: Harvard Business School press.

Chesbrough, H. (2010) ‘Business Model Innovation: Opportunities and Barriers’, *Long Range Planning*, 43, pp. 354–363.

Chesbrough, H.; Rosenbloom, R.S. (2002) ‘The role of the business model in capturing value from innovation: evidence from Xerox Corporation's technology spin-off companies’, *Industrial and Corporate Change*, 11(3), pp. 529–555.

Christensen, C.M. (2002) ‘The rules of innovation’, *MIT Technology Review*, 105(5), pp. 32–38.

Christensen, C.M.; Bower, J.L. (1996) ‘Customer power, strategic investment and the failure of leading firms’, *Strategic Management Journal*, 17, pp. 197–218.

Christensen, C.M.; Raynor, M.; McDonald, R. (2015) ‘What Is Disruptive Innovation?’ *Harvard Business Review*, pp. 44–53.

Chui, M., Manyika, J., Bughin, J., Brown, B., Roberts, R., Danielson, J. and Gupta, S. (2013) *Ten IT-enabled business trends for the decade ahead: Updated research*.

Cisco (2016) *Cisco Visual Networking Index: Global Mobile Data Traffic Forecast Update, 2015–2020*.

Cloudera (2015) *Big Data Use Cases for Telcos: How Telcos are utilizing Hadoop & Big Data to derive business value*.

Cohen, L., Manion, L. and Morrison, K. (2007) *Research Methods in Education*. 6th edn. New York: Routledge.

Comarch (2019) *Artificial intelligence and machine learning as the foundations of 5G network monitoring*.

Creswell, J.W. (2014) *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*. 4th edn. Thousand Oaks: Sage Publications.

Datameer (2018) *The role big data will play in AI's future*. Available at: https://www.datameer.com/blog/role-big-data-artificial-intelligence-future/ (Accessed: 16 June 2020).

Deloitte (2015) *Opportunities in Telecom Sector: Arising from Big Data*.

Deloitte (2017a) *Technology, Media and Telecommunications Predictions*.

Deloitte (2017b) *To be or not to be: The future of the telco business model*.

Demil, B.; Lecocq, X. (2014) 'The rise and fall of an open business model', *Revue d'économie industrielle* (146), pp. 85–113.

DISYS (2015) *Robotic Process Automation: Optimizing today's banking workforce*.

Drucker, P.F. (1985) *Innovation and Entrepreneurship*. New York: Harper & Row.

Drucker, P.F. (1998) 'The Discipline of Innovation', *Harvard Business Review*, pp. 1–8.

Du Preez, G.T.; Pistorius, C.W.I. (2002) 'Analyzing technological threats and opportunities in wireless data services', *Technological Forecasting and Social Change*, 70(1), pp. 1–20.

Easterby-Smith, M., Thorpe, R. and Jackson, P.R. (2008) *Management Research*. 3rd edn. London: Sage Publications.

Easterby-Smith, M., Thorpe, R. and Jackson, P.R. (2015) *Management & Business Research*. London: Sage Publications.

Edmondson, A.C.; McManus, S.E. (2007) 'Methodological fit in management field research', *Academy of Management Review*, 32(4), pp. 1155–1179.

Eisenhardt, K.M. (1989) 'Building Theories from Case Study Research', *The Academy of Management Review*, 14(4), pp. 532–550.

Eisenhardt, K.M. (1991) 'Better stories and better constructs: The case of rigor and comparative logic', *Academy of Management Review*, 16(3), pp. 620–627.

Eisenhardt, K.M.; Graebner, M.E. (2007) 'Theory Building from Cases: Opportunities and Challenges', *Academy of Management Journal*, 50(1), pp. 25–32.

Eisenhardt, K.M.; Martin, J.A. (2000) 'Dynamic Capabilities: What are they?' *Strategic Management Journal*, 21, pp. 1105–1121.

Elena, C. (2011) 'Business intelligence', *Journal of Knowledge Management, Economics and Information Technology*, 1(2), pp. 101–113.

Elliott, L. (2015) *Robots threaten 15m UK jobs, says Bank of England's chief economist*. Available at: https://www.theguardian.com/business/2015/nov/12/robots-threaten-low-paid-jobs-says-bank-of-england-chief-economist (Accessed: 17 June 2020).

European Commission (2013) *State of the Telecoms Services Sector in Europe*.

European Commission (2016) *Study on future trends and business models in communication services*.

EY (2015) *Global telecommunications study: navigating the road to 2020*.

Faber, E., Ballon, P., Bouwman, H., Haaker, T., Rietkerk, O. and Steen, M. (2003) 'Designing business models for mobile ICT services', in *16th Bled Electronic Commerce Conference eTransformation: 9 - 11 June 2003, Bled, Slovenia*.

Faber, E., Haaker, T. and Bouwman, H. (2004) 'Balancing Requirements For Customer Value Of Mobile Services', in *17th Bled eCommerce Conference eGlobal: 21 - 23 June 2004, Bled, Slovenia*, pp. 1–16.

Fernández, Z.; Usero, B. (2009) 'Competitive behavior in the European mobile telecommunications industry: Pioneers vs. followers', *Telecommunications Policy*, 33(7), pp. 339–347.

Financier Worldwide (2014) *Consolidation likely in the European telecoms sector*. Available at: http://www.financierworldwide.com/consolidation-likely-in-the-european-telecoms-sector/VMY-6-_wuUk (Accessed: 16 June 2020).

Ford, M. (2016) *The Rise of the Robots: Technology and the Threat of Mass Unemployment*. New York: Basic Books.

Forrester (2017a) *The New Frontier Of Automation: Enterprise RPA*.

Forrester (2017b) *The Total Economic Impact Of Blue Prism Robotic Process Automation (RPA) Platform*.

Frankenberger, K.; Weiblen, T.; Gassmann, O. (2013) 'Network configuration, customer centricity, and performance of open business models: A solution provider perspective', *Industrial Marketing Management*, 42, pp. 671–682.

Frey, C.B. and Osborne, M.A. (2013) *The Future of Employment: How susceptible are Jobs to Computerisation?*.

Frisanco, T. (2010) *Benchmark-based assessment of outtasking, outsourcing, and managed services for mobile network operators. 2010 IEEE Network Operations and Management Symposium - NOMS 2010*. Osaka, Japan, 19-23 April.

Gambardella, A.; McGahan, A.M. (2010) 'Business-Model Innovation: General Purpose Technologies and their Implications for Industry Structure', *Long Range Planning*, 43, pp. 262–271.

Gassmann, O.; Enkel, E.; Chesbrough, H. (2010) 'The future of open innovation', *R&D Management*, 40(3), pp. 213–221.

Ghezzi, A.; Cortimiglia, M.N.; Frank, A.G. (2015) 'Strategy and business model design in dynamic telecommunications industries: A study on Italian mobile network operators', *Technological Forecasting and Social Change*, 90, pp. 346–354.

Gilad, B. and Gilad, T. (1988) *The business intelligence system: A new tool for competitive advantage*. New York: Amacom.

Gill, J. and Johnson, P. (2002) *Research Methods for Managers*. 3rd edn. London: Sage Publications.

Girotra, K.; Netessine, S. (2014) *Four Paths to Business Model Innovation*. Available at: https://hbr.org/2014/07/four-paths-to-business-model-innovation (Accessed: 16 June 2020).

Given, L.M. (2008) *The SAGE encyclopedia of qualitative research methods*. Thousand Oaks: Sage Publications.

Glaser, D., Ludolph, J., Schaubroeck, R. and Vendrig, T. (2019) *A new path for telco customer engagement*. New York.

GlobalData (2020a) *Esports*.

GlobalData (2020b) *Telefonica Managed Security*.

Godelnik, R. (2020) 'The sharing economy dilemma: the response of incumbent firms to the rise of the sharing economy', *International Journal of Innovation*, 8(2), pp. 176–203.

Granot, E.; Brashear, T.G.; Motta, P.C. (2012) 'A structural guide to in-depth interviewing in business and industrial marketing research', *Journal of Business & Industrial Marketing*, 27(7), pp. 547–553.

GSMA (2017) *The Mobile Economy 2017*.

GSMA (2020) *The mobile economy 2020*.

GSMA Intelligence (2020a) *IoT in business 2020: The enterprise voice on IoT adoption*.

GSMA Intelligence (2020b) *Operator revenue in the enterprise market: Tracking the journey, measuring growth*.

GSMA Intelligence and CAICT (2016) *Mobile operators: the digital transformation opportunity*.

Guba, E.G. (1990) *The Paradigm Dialog*. London: Sage Publications.

Guba, E.G. and Lincoln, Y.S. (1994) 'Competing Paradigms in Qualitative Research', in Denzin, N.K. and Lincoln, Y.S. (eds.) *Handbook of qualitative research.* Thousand Oaks: Sage, pp. 105–117.

Guetzkow, J.; Lamont, M.; Mallard, G. (2004) 'What is originality in the humanities and the social sciences?' *American Sociological Review*, 69(2), pp. 190–212.

Guibao, X.; Yubo, M.; Jialiang, L. (2017) 'Inclusion of Artificial Intelligence in Communication Networks and Services', *ITU Journal* (1), pp. 1–6.

Haaker, T., Bouwman, H. and Faber, E. (2004) 'Customer and Network Value of Mobile Services: Balancing Requirements and Strategic Interests', in *Twenty-Fifth International Conference on Information Systems*, pp. 1–14.

Henderson, R.; Clark, K. (1990) 'Architectural Innovation: The Reconfiguration of Existing Product Technologies and the Failure of Established Firms', *Administrative Science Quarterly*, 35(1), pp. 9–30.

Hoepfl, M.C. (1997) 'Choosing qualitative research: A primer for technology education researchers', *Journal of Technology Education*, 9(1), pp. 47–63.

IBM (2012) *Big data analytics for communications service providers*.

IBM (2013) *Analytics: Real-world use of big data in telecommunications*.

IDC (2020) *5G goes commercial: Early experiences and future prospects*.

Infosys (2017) *Intelligence is in the Airwaves for Telecoms Firms*.

Insani, R. and Soemitro, H.L. (2016) *Data mining for marketing in telecommunication industry. 2016 IEEE Region 10 Symposium (TENSYMP)*. Bali, Indonesia, 9-11 May.

International Engineering Consortium (2000) *Business Intelligence for the Telecommunication Industry*.

Ireland, R.D.; Hitt, M.A.; Camp, S.M.; Sexton, D.L. (2001) 'Integrating entrepreneurship and strategic management actions to create firm wealth', *Academy of Management Executive*, 15(1), pp. 49–63.

IRPA (2016) *Benefits of RPA*. Available at: http://www.irpanetwork.com/benefits-of-rpa/ (Accessed: 28 November 2016).

Jennings, A., Kurematsu, A., Irgon, A., Vessonder, G. and Wright, J.R. (1991) *AI in Telecommunications. International Conference on Artificial Intelligence,* 24-30 August.

Jick, T.D. (1979) 'Mixing Qualitative and Quantitative Methods: Triangulation in Action', *Administrative Science Quarterly*, 24(4), pp. 602–611.

Johnson, M.W.; Christensen, C.M.; Kagermann, H. (2008) 'Reinventing Your Business Model', *Harvard Business Review*, 86(12), pp. 50–59.

Jou, S. and Ng, R.T. (2013) 'Introduction and the Changing Landscape of Business Intelligence', in Morgan & Claypool Publishers (ed.) *Perspectives on business intelligence.* (Synthesis Lectures on Data Management), pp. 1–5.

Justice, C. (2016) *Robotic Process Automation: Will you be a leader or a laggard?* Available at: http://www.cio.com/article/3019311/leadership-management/robotic-process-automation-will-you-be-a-leader-or-a-laggard.html (Accessed: 16 June 2020).

Kaleelazhicathu, R.K., Gjerde, I.G., Smura, T., Hämmäinen, H. and Tesch, T. (2014) *Techno-economics of integrated communication systems and services*.

Kallio, J.; Tinnilä, M.; Tseng, A. (2006) 'An international comparison of operator-driven business models', *Business Process Management Journal*, 12(3), pp. 281–298.

Khumalo, M.; van der Lingen, E. (2017) 'The open business model in a dynamic business environment: A literature review', *South African Journal of Industrial Engineering*, 28(3), pp. 147–160.

Kibria, M.G., Nguyen, K., Villardi, G.P., Ishizu, K. and Kojima, F. (2017) *Big Data Analytics and Artificial Intelligence in Next-Generation Wireless Networks*.

KPMG (2018a) *Operating in a disrupted world: 2018 telecom CEO outlook*.

KPMG (2018b) *Transformation der Telekommunikationsunternehmen 2025*.

KPMG International (2016) *Rise of the humans: The integration of digital and human labor*.

Krämer, J.; Wohlfarth, M. (2017) ‘Market power, regulatory convergence, and the role of data in digital markets’, *Telecommunications Policy*, pp. 1–18.

Lacity, M. and Willcocks, L.P. (2016) *Robotic process automation: The next transformation lever for shared services*: The London School of Economics and Political Science.

Lacity, M.; Willcocks, L.P. (2015) *What knowledge workers stand to gain from automation*. Available at: https://hbr.org/2015/06/what-knowledge-workers-stand-to-gain-from-automation (Accessed: 16 June 2020).

Lacity, M., Willcocks, L.P. and Craig, A. (2015a) *Robotic process automation at Telefónica O2*: The London School of Economics and Political Science.

Lacity, M., Willcocks, L.P. and Craig, A. (2015b) *Robotic process automation: Mature capabilities in the energy sector*: The London School of Economics and Political Science.

Le Clair, C. (2018) *The Forrester Wave: Robotic Process Automation, Q2 2018*.

Leung, R.A., Nastar, C., Vanborre, F., Favart, C., Hackenbroich, G., Taylor, P. and Trastour, D. (2013) ‘BI Game Changers: an Industry Viewpoint’, in Morgan & Claypool Publishers (ed.) *Perspectives on business intelligence.* (Synthesis Lectures on Data Management), pp. 7–18.

Levesque, H. and Lakemeyer, G. (2008) ‘Cognitive Robotics’, in van Harmelen, F. (ed.) *Handbook of knowledge representation.* (Foundations of Artificial Intelligence). Amsterdam: Elsevier, pp. 869–886.

Lewis-Beck, M.S., Bryman, A. and Liao, T.F. (2004) *The SAGE encyclopedia of social science research methods*. Thousand Oaks: Sage Publications.

Lia, M. (2015) ‘Customer Data Analysis Model using Business Intelligence Tools in Telecommunication Companies’, *Database Systems Journal*, 6(2), pp. 39–47.

Lindgardt, Z., Reeves, M., Stalk, G. and Deimler, M.S. (2009) *Business Model Innovation: When the Game Gets Tough, Change the Game*.

Lorenzo, J., Peters, A. and Robskovsky, D. (2002) *Information systems: show me the money*. London: Kurt Emblem Publishers.

Lowes, P., Cannata, F.R.S., Chitre, S. and Barkham, J. (2016) *Automate this: The business leader's guide to robotic and intelligent automation*.

Magoulas, R. and Lorica, B. (2009) *Big Data: Technologies and Techniques for Large-Scale Data*. Sebastopos: O'Reilly Media, Inc.

Magretta, J. (2002) 'Why business models matter', *Harvard Business Review*, 80(5), pp. 86–92.

Manyika, J., Chui, M., Brown, B., Bughin, J., Dobbs, R., Roxburgh, C. and Byers, A.H. (2011) *Big Data: The Next Frontier for Innovation, Competition & Productivity*. New York.

Mason, J. (2002) *Qualitative researching*. Thousand Oaks: Sage Publications.

Mathison, S. (2005) *Encyclopaedia of Evaluation*. Thousand Oaks: Sage Publications.

McKinsey & Company, I. (2016) *Telecommunications industry at cliff's edge: Time for bold decisions*.

McKinsey & Company, I. (2017) *A future for mobile operators: The keys to successful reinvention*.

McLeod, R. and Schell, G.P. (2004) *Management Information systems*. 9th edn. Upper Saddle River: Pearson Prentice Hall.

Mejía-Trejo, J. (2017) 'The determinant factors of open business model', *Nova Scientia*, 9(18), pp. 394–436.

Merriam, S.B. (1998) *Qualitative research and case study application in education: Revised and expanded from case study research in education*. 2nd edn. (The Jossey-Bass Higher Education Series). San Francisco: Jossey-BAss.

Mihailovic, J. (2019) 'The future of mobile operators: New business models', *Journal of Sustainable Business and Management Solutions in Emerging Economies*, 24(2), pp. 73–84.

Miles, M.B. and Huberman, A.M. (1994) *Qualitative data analysis: An expanded sourcebook*. Thousand Oaks: Sage Publications.

Miller, G.A. (1994) 'The Magical Number Seven, Plus or Minus Two Some Limits on Our Capacity for Processing Information', *Psychological Review*, 101(2), pp. 343–352.

O'Brien, J.; Kok, J.A. (2006) 'Business intelligence and the telecommunications industry: Can business intelligence lead to higher profits?' *South African Journal of Information Management*, 8(3).

OECD (2005) *Oslo Manual: Proposed guidelines for collecting and interpreting technological innovation data*.

Olaru, C. (2014) 'Business Intelligence in Telecommunications Industry', *International Journal of Economic Practices and Theories*, 4(1), pp. 89–100.

Omdia (2020a) *Android TV: Pay-TV operator outlook update: Android TV matures with more operator-led customization*.

Omdia (2020b) *London tech week and TechXLR8: Industry insights report 2020: Essential tech trends for enterprises that will form the distinction between success and failure*.

Omdia (2020c) *Smart home case study: Google: Google continues to make progress in the race for the smart home*.

Omdia (2020d) *Smart home services forecast report: 2020-25: Smart home services will generate $197bn in new revenues over the next five years*.

Orb, A.; Eisenhauer, L.; Wynaden, D. (2001) 'Ethics in qualitative research', *Journal of Nursing Schoolarship*, 33(1), pp. 93–96.

Osterwalder, A. (2004) *The business model ontology: A proposition in a design science approach*. Dissertation. University of Lausanne.

Osterwalder, A. and Pigneur, Y. (2002) *An e-Business Model Ontology for Modeling e-Business. 15th Bled electronic commerce conference*. Bled, Slovenia, 17-19 June.

Osterwalder, A. and Pigneur, Y. (2010) *Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers*. New York: Wiley.

Osterwalder, A., Lagha, S.B. and Pigneur, Y. (2002) *An Ontology for Developing e-Business Models*.

Palthe, J. (2014) 'Regulative, Normative, and Cognitive Elements of Organizations: Implications for Managing Change', *Management and Organizational Studies*, 1(2), pp. 59–66.

Pareek, D. (2007) *Business intelligence for telecommunications*. (Informa telecoms & media, 2). Boca Raton: Auerbach Publications.

Patton, M.Q. (1990) *Qualitative evaluation and research methods*. Beverly Hills: Sage.

Patton, M.Q. (2002) *Qualitative research & evaluation methods*. 3rd edn. Thousand Oaks: Sage Publications.

Peng, M.W.; Sun, S.L.; Pinkham, B.; Chen, H. (2009) 'The Institution-Based View as a Third Leg for a Strategy Tripod', *Academy of Management Perspectives*, pp. 63–81.

Pettigrew, A.M. (1990) 'Longitudinal Field Research on Change: Theory and Practice', *Organization Science*, 1(3), pp. 267–292.

Pisano, G.P. (2015) 'You need an innovation strategy', *Harvard Business Review*, 93(6), pp. 44–54.

Pisano, G.P.; Teece, D.J. (2007) 'How to Capture Value from Innovation: Shaping intellectual Property and Industry Architecture', *California Management Review*, 50(1), pp. 278–296.

Porter, M.E. (1980) *Competitive Strategy: Techniques for Analyzing Industries and Competitors*. New York: The Free Press.

Prabhu, S.; Arora, R.S.; Mishra, S. (2018) 'Need for new business models in telecom and emerging trends', *Telecom Business Review: SITM Journal*, 11(1), pp. 30–36.

PwC (2017) *Artificial Intelligence and Robotics – 2017: Leveraging artificial intelligence and robotics for sustainable growth*.

Rammer, C.; Peters, B. (2015) 'Innovation als Erfolgsfaktor der deutschen Industrie? Der Beitrag von Produkt- und Prozessinnovationen zu Beschäftigung und Exporten', *Vierteljahreshefte zur Wirtschaftsforschung*, 84, pp. 13–35.

Reuver, M. de; Bouwman, H.; MacInnes, I. (2009) 'Business model dynamics: a case survey', *Journal of Theoretical and Applied Electronic Commerce Research*, 4(1), pp. 1–11.

Robson, C. (2002) *Real world research*. 2nd edn. Oxford: Blackwell.

Roland Berger (2015) *Telekommunikation*. Available at: http://www.rolandberger.de/expertise/branchenexpertise/telecommunications/ (Accessed: 27 January 2015).

Rosenbloom, R.S. and Spencer, W.J. (1996) *Engines of Innovation: U.S. Industrial Research at the End of an Era*. Boston: Harvard Business Review Press.

Rouse, M. (2015) *Business model innovation*. Available at: http://searchcio.techtarget.com/definition/business-model-innovation (Accessed: 17 June 2020).

Ruttan, V.W. (2001) *Technology, Growth, and Development: an Induced Innovation Perspective*. New York: Oxford University Press.

Samulowitz, H., Reddy, C. and Sabharwal, A. (2014) *Cognitive Automation of Data Science*.

Sandulli, F.; Chesbrough, H. (2009) 'The two faces of open business model', *SSRN working paper series*, pp. 1–25.

Saunders, M., Lewis, P. and Thornhill, A. (2007) *Research Methods for Business Students*. 4th edn. Harlow: Pearson Education Limited.

Scalera, F. (2012) 'Development Strategies of Telecommunication Companies after the Markets' Liberalisation: A Case Study: Telecom Italia'. 8 th International Strategic Management Conference, *Procedia - Social and Behavioral Sciences* (58), pp. 149–158.

Scheer, A.-W. (2017) *Performancesteigerung durch Automatisierung von Geschäftsprozessen*. Saarbrücken.

Schön, O., Zimmermann, P. and KVJ, S. (2011) *Innovating the Telco Business Model: Drivers and Emerging Trends*.

Schumpeter, J.A. (1934) *The Theory of Economic Development: An Inquiry into Profits, Capital, Credit, Interest, and the Business Cycle*. Cambridge: Harvard University Press.

Schumpeter, J.A. (1942) *Capitalism, Socialism, and Democracy*. New York: Harper.

Scott, W.R. (1995) *Institutions and Organizations: Ideas, Interests and Identities*. Thousand Oaks: Sage Publications.

Seidman, I. (2006) *Interviewing as qualitative research: A guide for researchers in education and the social sciences*. 3rd edn. New York: Teachers College Press.

Shaw, K.E. (1978) 'Understanding the curriculum: The approach through case studies', *Journal of Curriculum Studies*, 10(1), pp. 1–17.

Shih, F.-J. (1998) 'Triangulation in nursing research: issues of conceptual clarity and purpose', *Journal of Advanced Nursing*, 28(3), pp. 631–641.

Snijders, C.; Matzat, U.; Reips, U.-D. (2012) 'Big Data: Big Gaps of Knowledge in the Field of Internet Science', *International Journal of Internet Science* (7), pp. 1–5.

Statista (2016) *Veränderung der Preise für Telekommunikationsdienstleistungen in Deutschland von 1996 bis 2015 (gegenüber dem Vorjahr)*. Available at: https://de.statista.com/statistik/daten/studie/215848/umfrage/entwicklung-der-preise-fuer-telekommunikation-in-deutschland/ (Accessed: 17 June 2020).

Storbacka, K.; Frow, P.; Nenonen, S.; Payne, A. (2012) ‘Designing business models for value co-creation’. Special issue – toward a better understanding of the role of value in markets and marketing, *Review of Marketing Research*, 9, pp. 51–78.

strategy& (2013) *Benefiting from big data: A new approach for the telecom industry*.

strategy& (2015) *Value-based network management for telecoms: Building big-data capabilities to optimize capital and operating expenses*.

Sun Microsystems (2005) *Business Intelligence and Data Warehousing: Transform raw data into business results*.

Taga, K., Opitz, M., Portal, J., Kuruvilla, T. and Boehmer, C. (2010) *Cost Reduction in the Telecom Industry: Why operators need to act now to escape from the low-profit spiral*.

Tashakkori, A. and Teddlie, C. (2010) *Handbook of Mixed Methods in Social & Behavioural Research*. 2nd edn. Thousand Oaks: Sage Publications.

Teece, D.J. (1986) ‘Profiting from technological innovation: Implications for integration, collaboration, licensing and public policy’, *Research Policy*, 15, pp. 285–305.

Teece, D.J. (2006) ‘Reflections on “Profiting from Innovation”’, *Research Policy*, 35(8), pp. 1131–1146.

Teece, D.J. (2010) ‘Business Models, Business Strategy and Innovation’, *Long Range Planning*, 43, pp. 172–194.

Teece, D.J.; Pisano, G.P.; Shuen, A. (1997) ‘Dynamic Capabilities and Strategic Management’, *Strategic Management Journal*, 18(7), pp. 509–533.

Telefónica (2018) *Algorithmen und Datenanalysen: Telefónica Deutschland nutzt Künstliche Intelligenz im Mobilfunknetz*. Available at: https://blog.telefonica.de/2018/02/algorithmen-und-datenanalysen-telefonica-deutschland-nutzt-kuenstliche-intelligenz-im-mobilfunknetz/ (Accessed: 17 June 2020).

Tornbohm, C. (2016) *Robotic Process Automation: Eight Guidelines for Effective Results*. Available at: https://www.gartner.com/doc/reprints?id=1-3U26FK2&ct=170222&st=sb (Accessed: 5 January 2020).

UiPath (2017) *RPA and Big Data: The perfect match?* Available at: https://www.uipath.com/blog/rpa-and-big-data (Accessed: 17 June 2020).

Von Hippel, E. (2005) *Democratizing Innovation*. Cambridge: The MIT Press.

Wallstreet-online (2020a) *Development of MNO Share Prices from 2015 - 2020*. Available at: https://www.wallstreet-online.de/aktien/china-mobile-aktie/chart#t:5y||s:lines||a:abs||v:week||b:15175,850775%20%7C%20Telefonica%20(Aktie);3596,555750%20%7C%20Deutsche%20Telekom%20(Aktie);112190645,A1XA83%20%7C%20Vodafone%20Group%20(Aktie);14341,A0HL9Z%20%7C%20AT&T%20(Aktie)||ads:null (Accessed: 23 June 2020).

Wallstreet-online (2020b) *Development of Share Prices of typical MNO vs User of MNO Network*. Available at: https://www.wallstreet-online.de/aktien/china-mobile-aktie/chart#t:5y||s:lines||a:abs||v:week||b:112190645,A1XA83%20%7C%20Vodafone%20Group%20(Aktie);623,906866%20%7C%20Amazon.com%20(Aktie)||ads:null (Accessed: 2 August 2020).

Weber, A.; Haas, M.; Scuka, D. (2011) ‘Mobile service innovation: A European failure’, *Telecommunications Policy*, 35(5), pp. 469–480.

Whitehead, M., Phillips, T., Page, M. and Molina, M. (2011) *European Mobile Industry Observatory 2011*.

Willcocks, L.P., Lacity, M. and Craig, A. (2015) *The IT function and robotic process automation*: The London School of Economics and Political Science.

Wireless Week (2018) *Turning telco networks into customer insight channels across all industries*. Radnor.

Wong, P.W. (2014) ‘A snap shot on qualitative research method’, *Educational Research and Reviews*, 9(5), pp. 130–140.

Wulf, J., Zernekow, R. and Duser, M. (2010) ‘Analysis of future telecommunication business models using a business model ontology’, in *2010 9th Conference on Telecommunications Internet and Media Techno Economics (CTTE): 7 - 9 June 2010, Ghent.* Piscataway: IEEE, pp. 1–7.

Xu, Q.; Chen, J.; Xie, Z.; Liu, J.; Zheng, G.; Wang, Y. (2007) ‘Total Innovation Management: a novel paradigm of innovation management in the 21st century’, *Journal of Technology Transfer*, 32(1), pp. 9–25.

Yin, R.K. (2009) *Case Study Research: Design and Methods*. 4th edn. (Applied Social Research Methods Series, 5). Thousand Oaks: Sage.

Zott, C.; Amit, R. (2007) ‘Business Model Design and the Performance of Entrepreneurial Firms’, *Organization Science*, 18(2), pp. 181–199.

9 Appendices

Word Frequency Lists

Literature review word frequency list (excerpt from NVivo)

Word	Length	Count	Weighted Percentage (%)	Similar Words
data	4	338	2,11	data
business	8	317	1,98	business, businesses, businesses'
model	5	288	1,80	model, model', modelling, models
mno	3	220	1,37	mno
companies	9	193	1,21	companies, companies', company
services	8	183	1,14	service, services, servicing
customer	8	181	1,13	customer, customers, customers'
innovative	10	175	1,09	innovate, innovated, innovating, innovation, innovations, innovative, innovator, innovators
network	7	133	0,83	network, networks
value	5	133	0,83	value, valued, values
research	8	132	0,82	research, researched, researcher, researchers, researches
software	8	124	0,77	software
market	6	116	0,72	market, marketing, markets
telecommunication	17	115	0,72	telecommunication, telecommunications
robots	6	113	0,71	robot, robotic, robotics, robotics', robots
technology	10	103	0,64	technological, technologies, technology
processes	9	101	0,63	process, processable, processes, processing
competitive	11	91	0,57	competition, competitive, competitiveness
development	11	87	0,54	develop, developed, developing, development, developments, develops
changing	8	82	0,51	chang, change, changed, changes, changing

Cross-case word frequency list (excerpt from NVivo)

Word	Length	Count	Weighted Percentage (%)	Similar Words
business	8	485	1,54	business, busy
data	4	466	1,48	data
model	5	347	1,10	model, models
customer	8	339	1,08	customer, customers, customers', customized
innovators	10	333	1,06	innovate, innovation, innovations, innovative, innovator, innovators
services	8	294	0,94	service, services
future	6	291	0,93	future
technology	10	269	0,86	technological, technologically, technologies, technology
mnos	4	240	0,76	mnos, mnos'
companies	9	234	0,75	companies, company
network	7	191	0,61	network, networked, networking, networks
providers	9	190	0,60	provide, provided, provider, providers, providers', provides, providing
markets	7	162	0,52	market, marketing, markets
telecommunications	18	135	0,43	telecommunication, telecommunications
time	4	128	0,41	time, timely, times
components	10	124	0,39	component, components
rpa	3	122	0,39	rpa
processes	9	121	0,39	process, processed, processes, processing
things	6	118	0,38	thing, things
development	11	116	0,37	develop, developed, developer, developing, development, developments, develops