Platform Business Modelling for Enhancing the Efficiency of Freight Logistics in the Maritime Supply Chain

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Declaration

I hereby declare that the materials contained in this thesis have not been previously submitted for a degree or professional qualification in this or any other university. I further declare that this thesis is solely based on my own research, my own independent work.

I declare that all information in this research has been obtained and presented in accordance with academic rules and ethical conduct.

Oliver Weisshuhn
Date: 02 October 2019

Abstract

The emerging platform economy is transforming industries, and thus also the freight logistics industry. In particular, industry platforms based on blockchain technology that process business-to-business (B2B) transactions offer enormous potential for enhancing efficiency in the maritime supply chain network. This results in completely new requirements for service and software-oriented technology companies with regard to the development and the operation of these industry platforms. But to what extent are the existing business model frameworks suitable to support platform providers in their business model transformation and what are the essential success factors?

This thesis is concerned with developing a framework based on the principles of platform business modelling for enhancing the efficiency of freight logistics in the maritime supply chain. Following a research design based on the criteria of a case study, 15 interviews were conducted with experts from a global information technology company and the maritime industry – four of them in a validation phase. In a multi-layered approach, generative causal factors underpinning the platform business model transformation were identified and presented with their interdependencies in an explanatory model. Although several mechanisms were active, the findings of the data analysis emphasise explicitly the causal capacity of the cross-sector partnership mechanism and the governance mechanism. As a result, a new platform business model framework - the "4/9 Platform Business Model Canvas" (4/9 PBM-C) - has been developed, which represents an evolution of the established business model frameworks for the emerging industry platform business. The usefulness and applicability were tested by deriving an action plan that could enable executives to develop a platform business model - with the aim of increasing efficiency in maritime freight logistics.

The results of this study have broader practical implications, as the “4/9 Platform Business Model Canvas” and the recommendations for action can also be adapted to the industry-specific platform requirements of other industries.

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My heartfelt thanks also go to my wife and my family, without whom it would not have been possible to achieve this undertaking.
I dedicate this research to my two daughters - Julia and Lena - who are still at the beginning of their own educational path. I hope that there will be a time in their lives when they will make the same far-reaching decision and remember the time when they accompanied me in writing this thesis during their childhood. You will have my full support!

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Abbreviations

4/9 PBM-C ……..	4/9 Platform Business Model Canvas
AFM ……..	Action Formation Mechanism
API ……..	Application Programming Interface
B2B ……..	Business-to-Business
BC ……..	Blockchain
BDE ……..	Business Development Executive
BM ……..	Business Model
BMC ……..	Business Model Canvas
CAQDAS……..	Computer-Assisted Software for Qualitative Data Analysis
DBA ……..	Doctor of Business Administration
E2E ……..	End-to-End
IATA……..	International Air Transport Association
IP ……	Intellectual Property
MLO ……..	Maritime Logistics Organisation
P&L ……..	Profit & Loss
P2P ……..	Peer-to-Peer
P-BMC……..	Platform Business Model Canvas
R&D ……..	Research & Development
SM ……..	Situational Mechanism
SME ……..	Subject Matter Expert
SCC……..	Supply Chain Collaboration
SSOT ……..	Single Source of Truth
TM ……..	Transformational Mechanism

Chapter 1 Introduction

1.1 Introduction

The purpose of this chapter is to provide the reader with the research context underlying this study (Section 1.2). Here, the practical relevance of this study and its scope are described and the motivation of the author to carry out this study is explained. Then, based on the problem statement, the current scientific situation on this topic is discussed before the chosen research design for answering the research questions is introduced. Section 1.3 presents the industry context of maritime freight logistics before the research aim and objectives derived from the research context are presented in section 1.4. This chapter ends with an overview of the chapter structure of this study in Section 1.5.

1.2 Research context

The ubiquitous business models of e-commerce platforms, such as Amazon Marketplace, or collaboration platforms such as Facebook in the business-to-consumer sector are increasingly being applied to the business-to-business sector (Gallay, Korpela, Tapio, & Nurminen, 2017). In the context of the emerging platform economy, this study was motivated by the fact that in recent years the researcher has observed an increasing shift to blockchain-based industry platforms in maritime freight logistics as part of his business development activities in the transportation sector. These business-to-business industry platforms are a “revolutionary paradigm shift” (Kamble, Gunasekaran, & Arha, 2018, p. 1) as they offer companies of the maritime freight logistics industry the possibility to organise themselves into business networks and to execute data transactions in the maritime supply chain transparently and more efficiently (Harrison, Lowry, Widdifield, & Hamilton, 2018). New business relationships emerge (Andreassen *et al.*, 2018) and business processes are changing in terms of transport planning and control

and the provision of information from production to consumption (Lee & Song, 2010).

The decisive factor here is the use of a new technology, the blockchain technology, which “ensures transparency, traceability, and security” of data transactions between the companies involved (Saberi, Kouhizadeh, Sarkis, & Shen, 2018, p. 1). At the time of this research, the emerging blockchain technology is in a technological hype (Dhillon, Metcalf, & Hooper, 2017; Drescher, 2017; Hackius & Petersen, 2017) which increases the relevance of this study. This is obvious, even though the blockchain-driven transformation of supply chains (Saberi *et al.*, 2018) is still at an early stage and it is, therefore, not yet foreseeable whether this technology will prevail in the coming years (Casino, Dasaklis, & Patsakis, 2019; Chang & Iakovou, 2019; Drescher, 2017).

In this market environment, global software- and service-oriented technology companies are increasingly using their technological capabilities and changing their business models to develop and operate industry platforms for various target industries (Hackius & Petersen, 2017). It is therefore questionable whether the critical success factors taken for granted so far, such as customer relationship, price, delivery capability and product quality (Meyer & Lunnay, 2013), still appear suitable for the platform business. So, what are the critical success factors for a global information technology company to successfully transform its existing software- and service-oriented business model into a blockchain-based platform business model to respond to the new dynamics in the emerging platform economy in maritime freight logistics? And do the existing business model frameworks support such a platform business model transformation?

It is precisely established companies that often fail because managers do not pursue new market opportunities with disruptive innovations. This is because they incrementally improve their existing solutions to secure revenue and customer satisfaction and, thus, allegedly make correct - rational - business decisions (Christensen, 2013). This continues until startup companies successfully attack their business models with disruptive innovations. A phenomenon that Christensen (2013, p. 236) describes as "The Innovator's

Dilemma". As a consequence of corporate practice, established global information technology companies face considerable challenges in transforming their existing software- and service-oriented business model into a platform business model. The existence of a platform strategy at the strategic level and a resulting business model at the tactical level does not necessarily ensure that the defined activities are also executed at the operational level, since an organisation is a complex and dynamic system with employees at different hierarchical levels and with IT systems and technologies (Mingers & Standing, 2017). In such an open system, social structures are the basis of various mechanisms - which have certain characteristics and causal forces that can have a positive or negative effect on the operationalisation of the platform business model (Mingers & Standing, 2017).

Therefore, this study aims to develop a framework which is rooted in the principles of platform business modelling to enhance the efficiency of freight logistics in the maritime supply chain. Although the existing management literature on industry platforms and platform business model innovations is developing rapidly (Zhao, Fan, & Yan, 2016), a substantial part of the existing academic literature focuses mainly on a theoretical discourse on network effects or pricing in multi-sided markets (Evans, 2003; Filistrucchi & Geradin, 2012; Rochet & Triole, 2004; Song, Xue, Rai, & Zhang, 2018) and business model frameworks (Gassmann, Frankenberger, & Csik, 2015; Osterwalder, 2011; Walter, 2016). However, to the researcher's knowledge, there is no well-founded research that provides deep insights into the business model transformation of platform owners for business-to-business industry platforms and, thus, the phase prior to the platform launch (Tura, Kutvonen, & Ritala, 2018). Research has only recently begun to address the phenomenon of blockchain-based industry platforms and is therefore still at an early stage to explain the complex interrelationships between the platform owner and the business network. The reason for this is that industry platforms have only gained in importance through blockchain technology, as this creates the necessary trust in secure data transactions in multi-stakeholder environments (Wang, Han, & Beynon-Davies, 2019; Zhao *et al.*, 2016). With respect to

blockchain technology as the underlying technology for industry platforms, some management literature even claims that blockchain technology will revolutionise the industries (Dhillon *et al.*, 2017; Swan, 2015; Woodside, Augustine, & Giberson, 2017; Zhao *et al.*, 2016). Other authors point out that it is just a new technological hype driven by IT companies and that there are hardly any convincing use cases where blockchain technology has advantages over existing technology (Casino *et al.*, 2019; Hackius & Petersen, 2017).

This study is rooted in the research philosophy of critical realism, the value of which is to provide insights into structures and mechanisms in open systems and to explore causal explanations (Dwivedi, 2009; Kaidesoja, 2013; Williams & Karahanna, 2013). Since the "explanation of social phenomena by revealing the causal mechanisms which produce them is the fundamental task of research" (Danermark, Ekstrom, & Jakobsen, 2005, p. 1), this research is driven by the key research question:

> *What are the key causal mechanisms underpinning the platform business model transformation of a global information technology company for maritime freight logistics?*

Following a qualitative research approach, the research questions are investigated with an explanatory research design based on the criteria of a case study. The data from primary research were collected through semi-structured interviews from experts of a global information technology company. The global information technology company (TechCorp) in which this empirical research was conducted is a leading provider of hardware, software and IT services and one of the largest consulting firms in the world. With more than 300,000 employees worldwide, the company is one of the market leaders in the emerging high-value segments of the IT market, including analytics, blockchain technology, artificial intelligence and cloud and security services. Also in response to these new market dynamics, the global information technology company created a new business unit for industry platforms to build a range of strategic technology and business capabilities, particularly in the area of the emerging blockchain technology. This new business unit aims to actively build business networks with its customers in order to transform, for

instance, supply chains or cross-border trade finance. It is therefore intended to fulfill the company-wide mission of establishing blockchain technology in the market and thus follow the corporate strategy that gives blockchain technology a similar transformative significance for business-to-business transactions as the Internet does for information (Woodside *et al.*, 2017). In recent years, the global information technology company was named in various press releases as a platform provider in blockchain projects in maritime freight logistics. The main objective of these projects was the formation of cross-industry business networks and the evaluation of the blockchain technology used in the defined business processes. Through empirical observations and discussions with industry participants and experts from the global information technology company, the researcher found that the goals formulated during project initiation were not immediately achieved. This was due to different perspectives of the potential network members on the business model and platform governance, which had a negative impact on project success and the rapid emergence of business networks.

In this context, the key causal factors underlying the platform business model transformation of the global information technology company are identified and described in a multi-layered approach before a framework, rooted in the principles of platform business modelling, is presented as contribution to practice. Therefore, this study links the different research fields in a unique way, so that the findings about blockchain-based industry platforms in maritime freight logistics provide added value for business practice and contribute to academic knowledge.

1.3 Industry Context of maritime freight logistics

The industry context of this study encompasses the maritime freight logistics industry, which accounts for approximately 90% of world trade (Hasan, AlHadhrami, AlDhaheri, Salah, & Jayaraman, 2019). In this multi-stakeholder environment the entities involved are part of the maritime end-to-end (E2E) value chain (Hotze, 2016) and provide container transportation, logistics or

other supply chain related services such as warehousing and handling services (Hall, Brien, & Woudsma, 2012; Lee & Meng, 2015; Lee & Song, 2010). This industry is characterised by strong “competitive pressure and demand volatility” (Palmieri, Parola, Song, & Baglieri, 2019, p. 64).

Global sourcing of production resources in the course of globalisation, has redefined maritime freight logistics (Seo, Dinwoodie, & Roe, 2015), with the consequence that maritime logistics service providers have adjusted their transportation services to the extent that manufacturers shift their production to countries with cheaper resources (Lam & Song, 2013). Reliable global maritime supply chains are, therefore, also globalised and crucial for the global economy, as manufacturers and consumers are increasingly closely interlinked in the value chain (Lam & Song, 2013). While, however, international freight forwarders orchestrate the supply chain for the shippers and play a significant role in logistics value creation (Lee & Meng, 2015; Lloyd´s Maritime Academy, 2018c), carriers such as liner shipping companies or inland transport companies are only reduced to the low-margin transport of goods (Lloyd´s Maritime Academy, 2018d).

In such a multi-stakeholder environment, different customer/supplier relationships need to be considered (Lee & Song, 2010):

Shippers engage *international freight forwarders* to plan and coordinate their worldwide transports. These international freight forwarders are non-asset-based entities that act as intermediaries for the multimodal cross-border transport of international import and export shipments through asset-based carriers (Lee & Meng, 2015). Shippers contract with international freight forwarders because they have extensive and long-standing relationships with liner shipping companies and inland transport companies, which results in a fast and reliable provision of transport capacity (Arya, 2015).

International freight forwarders contract *liner shipping companies* and *inland transport companies* to provide maritime E2E transport services. Liner shipping companies offer a frequent schedule and reliable transport services (Notteboom, 2006). Therefore, large liner shipping companies have built up a global network with large transport capacities along the major world trade

routes (Lloyd´s Maritime Academy, 2018a), made possible by mergers and acquisitions and the emergence of mega-carriers. Instead, small and medium-sized liner shipping companies concentrate on certain minor routes (Lee & Meng, 2015).

The *port* provides infrastructure and logistics services for liner shipping companies. In world trade, ports at the interface between sea and land have a central function in handling various types of sea freight classified as containerised cargo or liquid cargo (Lloyd´s Maritime Academy, 2018a). Here, improving the efficiency of port operations is crucial for the maritime supply chain (Lee & Song, 2017). The port authorities - private or public – therefore, have the task of planning and managing physical infrastructures such as railways, waterways, roads and bridges, and of coordinating and managing the activities of the logistics service providers located in the port in accordance with national law or regulations (Verhoeven, 2010). For loading and unloading of container vessels, terminal operators provide the technical equipment and infrastructure in protected areas of the port, along the container ship berths (Ha, Yang, & Lam, 2019).

These market conditions in maritime freight logistics are favourable for blockchain-based industry platforms for a number of reasons in order to increase efficiency in the maritime supply chain:

First, maritime freight logistics faces enormous challenges as shippers demand a reliable and cost-efficient E2E supply chain with permanent visibility into the localisation and condition of their shipments (Seo, Dinwoodie, & Roe, 2014; Wu *et al.*, 2017). Its value depends on the extent to which it maximises customer satisfaction and minimises costs for the logistics providers involved in the maritime supply chain (Lee & Song, 2010).

Second, maritime freight logistics is a complex multi-stakeholder environment with authorities from the public sector and companies from the private logistics and information technology sector.

Third, maritime freight logistics continues to be characterised by the involvement of various intermediaries, including freight forwarders, brokers

and agents, and a high level of data exchange through peer-to-peer (P2P) communication (Wu *et al.*, 2017), a process which is still highly paper-based. The World Economic Forum (2013) estimates that reduction of supply chain barriers in border control and more efficient transport and communication processes could increase global trade by nearly 15%.

1.4 Research aim and objectives

The aim of this study is to develop a framework rooted in the principles of platform business modelling to enhance the efficiency of freight logistics in the maritime supply chain.

In order to achieve this aim, the research objectives are set as follows:

Research Objective 1: To conduct a critical review of existing streams of literature on industry platforms for maritime freight logistics and platform business model innovation in order to identify key theoretical issues leading to a conceptual framework that will guide primary research

Research Objective 2: To draw on a range of qualitative data collection methods and analytical techniques to investigate the key causal factors underlying the current business model of a global information technology company in relation to maritime freight logistics

Research Objective 3: To consider, on the basis of stakeholder perceptions and opinions, the conditions for the effective application of the principles of platform business modelling within the context of maritime freight logistics.

Research Objective 4: To derive, on the basis of the research findings, a framework rooted in the principles of platform business modelling geared towards the optimisation of maritime freight logistics.

The research questions derived from the literature review in Chapter 2 are then presented in connection with a conceptual framework in Section 2.7.

1.5 Thesis structure

This thesis consists of six chapters:

Chapter 1 introduces the research context and provides the rationale for carrying out this study. Against this background, the research aim and objectives are presented.

Chapter 2 identifies and discusses, based on a thematic structure, the available literature on industry platforms for maritime freight logistics and platform business model innovation. This results in a conceptual framework that brings together the relevant findings from the literature and the empirical knowledge of the researcher and serves as an orientation map for data collection in primary research.

Chapter 3 presents – based on the research position of critical realism (CR) underlying this study - the applied research methodology and critically justifies its applicability. After the description of the data collection and the analysis method, the limitations of the applied research methodology, as well as the ethical aspects resulting from the research, are discussed.

Chapter 4 is concerned with the data analysis and the resulting findings, and presents an explanatory model for the platform business model transformation.

Chapter 5 presents a new platform business model framework for industry platforms in maritime freight logistics - the “4/9 Platform Business Model Canvas”. Furthermore, a concrete action plan is derived which can support executives in successfully implementing a platform business model in their respective companies.

Chapter 6 is the final chapter and it highlights the key findings of this study; it explains how the aim and objectives are achieved and how the research questions are answered. After presenting the study's contribution to knowledge and practice, the limitations of this study and the implications for further research are considered.

Chapter 2 Literature Review

2.1 Introduction

This chapter examines, in a thematically structured way (Section 2.2), the existing literature on market conditions for platform innovations in maritime freight logistics and on industry platforms and platform business model innovation in order to derive the research questions from the identified research gaps. Section 2.3 discusses the market conditions for platform innovations in maritime freight logistics due to their importance for a potential market entry decision. Section 2.4 addresses the specific characteristics of industry platforms in the context of platform innovations before the relevance of a platform business model for a global information technology company is discussed in Section 2.5. In this way, a company´s activity system is examined to the extent that it will be changed by the transformation from a software- and service-oriented business model, to a platform-oriented business model. Section 2.6 then discusses the different concepts of business model frameworks and their applicability for the operationalisation of platform business models. Finally, in Section 2.7, the findings of the literature review are synthesised in a conceptual framework which serves as justification for the derived research questions and is an orientation map for data collection in primary research.

2.2 Structure and thematic focus

Against the background of the **Market Conditions for platform innovations** in maritime freight logistics, this literature review focuses on the investigation of the main research areas of literature illustrated in Figure 2.1. While the result of platform business modelling is a platform business model, which forms the basis for the development and operation of an industry platform and thus influences market conditions for platform innovations in maritime freight logistics, there are also feedback loops between these elements.

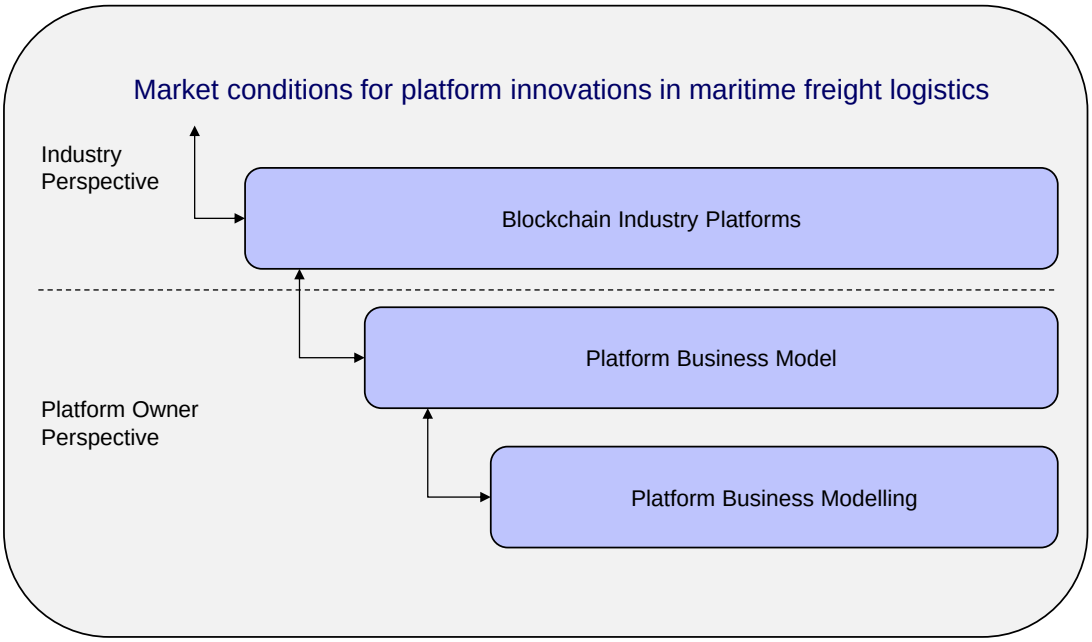

Figure 2.1 Main research areas of literature

- **Blockchain Industry Platforms** offer enormous potential for enhancing efficiency of freight logistics in the maritime supply chain through new forms of data transactions.
- A **Platform Business Model** is essential for global information technology companies to successfully enter the emerging platform economy and to respond to the increasing competition from start-up companies.
- **Platform Business Modelling** is based on a platform business model framework with the aim to operationalise the business model for the target market.

2.3 Market conditions for platform innovations in maritime freight logistics

Academic research in general management, organisation and innovation management shows increasing interest in platform innovations (Moser & Gassmann, 2016), as platform innovations are also of strategic importance in management practice in order to exploit new business potential in the maritime

freight logistics industry. However, the success of platform innovations depends crucially on the market conditions under which they are introduced.

2.3.1 Platform Innovations

The term *platform* is used very differently in the academic discourse. Gawer and Cusumano (2014) trace the term platform back to the beginnings of product development in the industrial age, where core components of products were reused. Gawer (2014) distinguishes technological platforms according to three types (internal platforms, supply chain platforms and industry platforms), while Gawer and Cusumano (2014, p. 417) identify “internal or company-specific platforms and external or industry-wide platforms” as the two predominant types of platforms.

Internal or product platforms (Gawer, 2014) consist of components that are developed within a company and made available directly to the business units for use in derivatives with customer-specific features, thereby enabling synergies and cost savings in development and production (Gawer & Cusumano, 2014; Meyer, 1997; Sanderson & Uzumeri, 1995). According to Wheelwright and Clark (1992), the use of internal or product platforms in different products enables cost savings through reduced development and maintenance costs and quality and performance improvements through sustainable optimisation of common platform components. Even though the managerial decision to develop the platform remains in the company, innovations can only be implemented incrementally, as developments are limited to available resources and knowledge within the company (Gawer & Cusumano, 2014).

Supplier platforms are based on internally developed components which are complemented by external innovations from a limited number of selected suppliers that have access to interface specifications (Brusoni, 2005; Zirpoli & Caputo, 2002). In this cooperation, the company has direct bilateral contracts with its suppliers.

However, current academic research is increasingly focusing on ***external or industry platforms*** (Cusumano, 2010a, 2010b; Gausdal, Czachorowski, & Solesvik, 2018; Gawer & Cusumano, 2008, 2014). External platforms facilitate interaction between companies by sharing the interface specification with an ecosystem of complementors so that they can develop and integrate innovations for the platform (Chesbrough & Van Alstyne, 2015; Eisenmann, Parker, & Van Alstyne, 2011). Gawer and Cusumano (2014) define *external* platforms as technologies developed by one firm upon which other firms can build valuable complementary services. However, Gawer and Cusumano (2008) argue that not every technology can become a platform because an industry platform has to address a specific business problem relevant to many companies in the industry on the one hand, and fulfil a critical function necessary for the entire technological system on the other. A key differentiator between external platforms and internal platforms is that the powerful network effects arise on external platforms (Gawer & Cusumano, 2014; Parker, Van Alstyne, & Choudary, 2016). The success of an industry platform depends on how open such a technology for complementors is and how easily they can co-create platform services for the core application (Ceccagnoli, Forman, Huang, & Wu, 2012). In a case such as this, the platform owner manages the governance for the platform technically through platform rules or commercially through licenses or transactional usage fees (Gawer & Cusumano, 2014).

2.3.2 Data-driven efficiency in maritime freight logistics

The literature essentially agrees that shippers increasingly require more effective and responsive E2E transport services from the maritime freight logistics industry (Palmieri *et al.*, 2019; Seo *et al.*, 2014; Seo, Dinwoodie, & Roe, 2016; Soosay & Hyland, 2015) which is a complex multi-stakeholder environment. Also to overcome some of the major challenges in maritime freight logistics such as “order delay, damage to goods, errors, and multiple data entry” (Tijan, Aksentijević, Ivanić, & Jardas, 2019, p. 1). Therefore, industry platforms specified in the previous section might significantly enhance

the E2E process efficiency in this multi-stakeholder environment with authorities from the public sector (local port authorities and customs authorities), companies from the private logistics sector such as liner shipping companies, terminal operators, freight forwarders and other logistics service providers (Lee & Meng, 2015), and companies from the IT sector (global information technology companies, local IT providers).

No seamless information transparency

The enormous global container movements require efficient shipment tracking to manage global logistics activities (Hasan *et al.*, 2019). But nowadays there is still a lack of seamless information transparency across the entire E2E supply chain (Hasan *et al.*, 2019). Even the largest logistics companies do not have the power and ability to achieve transparency and real-time access to information of their complex supply chain in the multi-stakeholder environment of maritime freight logistics (Korpela, Hallikas, & Dahlberg, 2017). This concerns, for example, reliable information on arrival and departure times (Andersson & Leander, 2019), information about the availability of port and hinterland facilities and the current status of the container and its future movements at any time (Seo *et al.*, 2014). Current transport management systems cannot provide validated, real-time information (Wu *et al.*, 2017) and for transactions with proprietary and confidential information between supply chain partners, it is critical that data quality is maintained across the different transport stages (Marinagi, Trivellas, & Reklitis, 2015). Furthermore, in this competitive environment, logistics service providers retain their customer and transport data in their corporate systems (data ownership) and make them only available, in peer-to-peer communication, to those companies within the supply chain that require them due to the existing business relationship (data control) (Wu *et al.*, 2017).

No digitised freight documents

But, to enhance efficiency in the maritime supply chain it is necessary that all mostly paper-based freight documents are available any time (Seo *et al.*,

2014). This concerns documents such as bills of lading, as evidence of contract of carriage (Vasilakis & Rawindaran, 2016), “packing lists, letters of credit, insurance policies, orders, invoices, sanitary certificates, certificates of origin” (Chang & Iakovou, 2019, p. 7). Therefore, there are enormous opportunities for supply chain management, which arise from digitalisation in general (Büyüközkan & Göçer, 2018; Palmieri *et al.*, 2019), but also from the emerging blockchain technology, in particular (Chang & Iakovou, 2019). Especially the bill of lading process as one of the main processes in the shipping industry could be significantly improved by the use of blockchain technology to ensure auditability, transparency and immutability (Czachorowski, Solesvik, & Kondratenko, 2019; Goudz & Steiner, 2019).

Low level of automation

The maritime freight logistics industry is characterized by a low level of automation (Czachorowski *et al.*, 2019). Due to the high degree of standardisation in data exchange between logistics service providers in the horizontal and vertical value chain, it is rather conservative in the application of innovations in its logistics processes (Lee & Song, 2017). Therefore, maritime freight logistics is a promising field for blockchain-driven platform innovations (Bichou & Gray, 2004) due to the dependencies between the logistics companies involved in the supply chain and the public sector (De Martino, Errichiello, Marasco, & Morvillo, 2013; Konovalenko & Ludwig, 2019). However, the degree of automation in the network depends decisively on the degree of digitisation; with different effects: On the one hand, the speed with which information is transmitted between the logistics participants can be significantly increased and errors in transmission and during transport can be avoided (Goudz & Steiner, 2019). Platform innovations also offer the possibility of transferring data from one's own transport management systems to a standardised industry application, thereby achieving significant cost savings through automated processes (Goudz & Steiner, 2019).

2.3.3 Supply chain collaboration

More recently, companies have realised that competition no longer takes place only between companies but, in particular, between their supply chains (Botes, Niemann, & Kotzé, 2017) which is why the selection of the logistics partners and their management is becoming a critical success factor (Kum Fai & Vinh, 2016; Palmieri *et al.*, 2019). An optimally functioning supply chain thus improves the company's performance significantly (Cao & Zhang, 2011; Hove-Sibanda & Pooe, 2018). Even though vertical and horizontal integration (Lee & Song, 2017) between the companies involved in the maritime supply chain has already increased in recent years, supply chain collaboration with other logistics service providers involved in the supply chain is unavoidable (Korpela et al., 2017) in order to ensure a more efficient flow of goods through lower transaction costs (Kum Fai & Vinh, 2016; Seo *et al.*, 2014).

Competition

In maritime freight logistics there is a “coexistence of competition and cooperation at the same time” (Donato, Carfì, & Blandina, 2018, p. 4). Given the complexity of the maritime supply chain, the logistics service providers involved collaborate to a certain extent, despite power asymmetries, which result from the size of the companies involved or, in certain constellations, from their customer-supplier relationship (Kum Fai & Vinh, 2016; Reimann & Ketchen, 2017). The competitive liner shipping market, in particular, has traditionally been characterised by a high degree of cooperation due to its unique cost structure with relatively high fixed costs, compared to variable costs for the provision of liner services (Lloyd´s Maritime Academy, 2018a). Competing liner shipping companies, therefore, apply cooperation strategies through alliances and consortia with their competitors (Álvarez-Sanjaime, Cantos-Sánchez, Moner-Colonques, & Sempere-Monerris, 2013; Lloyd´s Maritime Academy, 2018b). This “coopetition” makes it possible to obtain more value from their activities (Donato *et al.*, 2018).

Collaboration

As global supply chains span geographies, modes of transport and industries (Wu *et al.*, 2017), the literature agrees that companies of the maritime supply chain are forced to be well networked to ensure a smooth and efficient flow of goods (Palmieri *et al.*, 2019; Permala *et al.*, 2015). Regarding the E2E supply chain, there are different forms of supply chain collaboration (Barratt, 2004). The vertical supply chain collaboration with shippers and other logistics service providers of the E2E supply chain as well as the horizontal supply chain collaboration with competitors. While existing literature deals comprehensively with supply chain collaboration from the perspective of a (production) company that improves its supply chain with suppliers and customers (Cao & Zhang, 2011), current research increasingly focuses on horizontal supply chain collaboration (Soosay & Hyland, 2015). However, both forms of supply chain collaboration – vertical and horizontal - are of particular importance here, as the entire ecosystem involved in the E2E supply chain processes data transactions via an industry platform. In this context, industry platforms open up a new perspective as a result of increasing digitisation, as supply chain collaboration is increasingly being driven by the logistics service providers involved. Since in this form of collaboration - in contrast to asset sharing - only little-prepared data is exchanged between the process partners, it is a supply chain collaboration with low collaboration breadth and depth.

Trust

In order to improve supply chain management and to achieve innovative processes in supply chain collaboration in business networks (Seo *et al.*, 2016) freight forwarders, liner shipping companies, inland transport companies, ports and customs authorities need an information-sharing culture that also allows the sharing of "more sensitive, strategic information" (Fawcett, Wallin, Allred, Fawcett, & Magnan, 2011, p. 54). Shipping companies that provide a substantial part of the transport services within the global maritime supply chain, especially, play a central role for industry platforms. This collaboration

may, however, be constrained by the "lack of trust and commitment" (Kum Fai & Vinh, 2016, p. 562), so that a collaborative culture must be created based on the different elements “trust, mutuality, information exchange, and openness and communication” (Barratt, 2004). However, it remains questionable how far information sharing goes, "given the trust levels, power dynamics and governance structures evident in supply chains" (Soosay & Hyland, 2015, p. 622).

Here, blockchain technology which ensures tamper-proof and trustworthy transactions, can overcome distrust and enable a new form of collaboration to find effective and sustainable solutions for cross-organisational business processes (Chang & Iakovou, 2019; Czachorowski *et al.*, 2019). The overall goal for the benefit of all actors involved in maritime freight logistics is that such data-driven platform innovations ensure an E2E supply chain visibility and timely provision of freight and customs information, and thus support a smooth flow of goods in the supply chain (Seo *et al.*, 2014).

Integration

The effort and risk involved in using an industry platform designed as a collaboration platform is high, as it involves a comprehensive business process reengineering in the company in order to map the new processes between the logistics partners involved in the maritime supply chain (Arduino *et al.*, 2012). Although internal and external integration is needed (Stank, Keller, & Daugherty, 2001), the willingness of employees to support interorganisational collaboration beyond the existing level of cooperation is limited due to the “resistance to change” (Kum Fai & Vinh, 2016, p. 563). However, Fawcett *et al.* (2011) emphasise the connecting role of IT, which is a crucial prerequisite for the connectivity of the company. In this context, information and communication technology costs for collaboration applications should not be so high that smaller companies are prevented from participating (Hove-Sibanda & Pooe, 2018), as this can force the competition authorities to intervene. In order to create the necessary business networks for this, global

information technology companies that act as neutral platform providers play a decisive role.

2.3.4 Disintermediation in maritime supply chain networks

Producers and consumers have a far-reaching functional and strategic relationship with each other in which transport intermediaries (middleman) are involved (Hall & Jacobs, 2010). Intermediaries are used in sustainable supply chain management in maritime freight logistics when the knowledge of the contracting companies about the processes is low and intermediaries can, therefore, provide added value. (Cole & Aitken, 2019). At the same time, intermediaries are criticised for resisting innovations that could limit or eliminate their function (Hall & Jacobs, 2010).

Impact of digitalisation on intermediaries

The progressive digitalisation of processes, in conjunction with disruptive platform innovations, will significantly change the traditional industry structure (Linton, 2018). As industry platforms are shifting the boundaries between the entities involved in the maritime sector (Emmrich, 2015) and disruptively changing established business processes (Notheisen, Cholewa, & Shanmugam, 2017), intermediaries are exposed to the risk of disintermediation (Linton, 2018; Polim, Hu, & Kumara, 2017). This describes the removal of a level of intermediaries from the supply chain (Michelman, 2017; Morschett, 2012), as intermediaries usually do not have their own assets, such as liner shipping companies and inland transport companies. As a result, global-scale transactions in the maritime supply chain previously handled by intermediaries or trusted third parties (Hasan *et al.*, 2019) are processed directly within the business network of platform users (Dhillon *et al.*, 2017; Saberi *et al.*, 2018; Swan, 2015) and thus reduce operational costs (Czachorowski *et al.*, 2019). International freight forwarders who coordinate multimodal transports as intermediaries could be affected by disintermediation as blockchain-based industry platforms will, for example, change the clearing

and settlement process (Matopoulos & Papadopoulou, 2010). In this context, IT service providers have a very strong market position due to their access to extensive computing power, software, development capabilities and qualified IT specialists (Kim, 2016). New disruptive blockchain-based business models from third parties, which are likely to enter the market, can have a significant impact on the maritime supply chain (Wang *et al.*, 2019) and threaten the business models of intermediaries such as international freight forwarders.

Expansion of value creation

In addition, the business models of international freight forwarders are threatened by a further risk (Wang *et al.*, 2019). Liner shipping companies could expand their service portfolio through "vertical integration forward and/or backward" by offering additional value-added services in the area of customs clearance or document processing (Schramm, 2012, p. 183). This would enable them to offer their customers end-to-end services, with the opportunity to “bypass other transport intermediaries and make them obsolete” (Schramm, 2012, p. 184). On the other hand, however, there are also opinions in the literature that the approach of utilising a middleman continues to exist in order to facilitate different interests in a multi-stakeholder environment (Arya, 2015; Belavina, 2012). Arya (2015, p. 393) argues that intermediaries, including freight forwarders, brokers and agents, are generally a relevant part of the supply chain and have a “transactional role by reducing search and matching costs, providing inventory and capacity, or aggregating supply/demand to achieve economies of scale”. Belavina (2012) also mentions that these intermediaries have extensive and long-standing relationships with numerous national and international carriers, and can ensure that shippers receive the same advantages that they would only receive from long-term sourcing partners with long-term framework agreements. A meaningful explanation is provided by Wang *et al.* (2019), who argue that disintermediation occurs when the costs for intermediaries in the supply chain exceed their value.

2.4 Blockchain industry platforms in maritime freight logistics

As described in detail in the previous sections, the process complexity of maritime freight logistics and the lack of information transparency require reliable industry platform solutions (Hasan *et al.*, 2019). The emerging blockchain technology has a decisive importance here. Even though research on blockchain technology is developing rapidly nowadays there is a lack of comprehensive academic literature (Czachorowski *et al.*, 2019), as its practical application is still limited. However, there is an extensive debate about the impact of blockchain technology on the supply chain (Wang *et al.*, 2019) - driven by the usage of crypto currencies (Tijan *et al.*, 2019), but especially about the advantages or disadvantages with regard to existing technologies (Casino *et al.*, 2019; Wu *et al.*, 2017).

2.4.1 Characteristics of industry platforms

Multi-sided markets

Scholars agree that platforms are related to the economic term of two-sided or multi-sided markets in which distinct user groups interact with one another (Evans, 2003; Filistrucchi & Geradin, 2012; Kim, 2018; Rochet & Triole, 2004). In these markets, multi-sided platforms function as intermediaries which enable transactions between the distinct user groups of the different sides of the platform (Armstrong, 2006; Casadesus-Masanell & Zhu, 2013; Eisenmann *et al.*, 2011; Evans, 2003). Consequently, Gawer (2014) expands this perspective by emphasising that platforms act as intermediaries for network members who would otherwise not be able to do business directly with each other.

While the mainstream of recent literature considers multi-sided markets as markets that exist in the virtual (online) world, where companies such as Amazon or eBay provide online services to different groups of online users (Moser & Gassmann, 2016), other scholars also refer to multi-sided markets

in the real world (Armstrong, 2006; Van Alstyne, Parker, & Choudary, 2016). Former matchmakers who acted as intermediaries, or today's dating agencies or nightclubs that bring men and women together (Armstrong, 2006; Evans, 2003). Filistrucchi and Geradin (2012) emphasise that multi-sided markets are a specific type of market in which a platform provider offers distinct products to two or more distinct customer groups.

With regard to the new emerging multi-sided markets, the academic literature reflects the evolution of the term “platform”. Starting with engineer-driven publications on platforms at the beginning, business-oriented platforms are now the focus of academic research (Moser & Gassmann, 2016). One criticism, however, is that the scientific literature on multi-sided markets investigates characteristics of existing platforms (Hagiu, 2007), rather than the conditions under which platforms emerge (Tan, Pan, Lu, & Huang, 2015; Tura *et al.*, 2018). Thus, Rochet and Triole (2002) have considered different existing platforms - such as credit card systems (Visa and MasterCard) for merchants and consumers in the payment industry or platforms for video games. In line with their work are numerous other papers such as Armstrong (2006), which analyses existing platforms from different perspectives. While current research focuses mainly on theoretical investigations on network effects or pricing (Tan *et al.*, 2015), this study examines the emergence of blockchain-based industry platforms in an industry context. Nevertheless, the current state of scientific research is important, since the available knowledge influences the design of the business model for industry platforms (Tura *et al.*, 2018).

Network effects

In demand-side economies direct and indirect network effects or network externalities exist between the two sides of the market (Armstrong, 2006; Rochet & Triole, 2002). *Direct network effects* occur when the benefit for a user joining the platform depends on the number of users on the same side of the platform. Network effects originally occurred in communication networks (Rochet & Triole, 2004). The benefits - and thus the value - of one's own telephone are greater for the individual user the more people use a telephone

in the network (Rochet & Triole, 2004). Armstrong (2006) emphasises that in multi-sided markets *direct network effects* depend on the number of users in the group into which one enters, while *horizontal indirect network effects* (Kim, 2018) depend on the size of the group on the other side of the platform (Filistrucchi & Geradin, 2012). While in a buyer/seller market, the presence of other buyers has no immediate advantage, as a higher demand leads to higher prices, buyers indirectly benefit from a larger number of potential buyers (Amit & Zott, 2001). An e-commerce platform, such as eBay, becomes more attractive for merchants the more potential buyers use the platform. It is, therefore, important for a buyer that more potential buyers join the buyer group, as this leads to other merchants joining the platform, thereby improving the range and quantity of goods offered (Amit & Zott, 2001).

In the platform business, *vertical indirect network* effects arise when the benefit for the user is not directly attributable to the core functionality, but on the value and number of applications applied to the platform (Cennamo, 2018). A vertical network consists of various complementary components or services in which the benefit arises from the whole system, not from the individual components of the network. For a computer, the hardware and the operating system are essential components, but they are useless until software applications enable a fully functional network (Evans, 2003; Gawer & Cusumano, 2014).

Dobbs (2014) recognises that Porter (2008) was already pointing to network effects in his five forces model, but considered the extent of these network effects (high/low) as an indicator of the attractiveness of an industry, rather than describing it as a business driver in a networked economy.

Platform ecosystem

Increasing customer demands and industry-specific developments - caused by rapid technological change - also dramatically change the demands and expectations of companies on their suppliers or IT service providers, who must, therefore, fundamentally adapt their business and operating models (Christensen, McDonald, Altman, & Palmer, 2018). In the context of business-to-business platforms within a progressively evolving industry, this

transformation requires a new business structure - a platform ecosystem (Gawer & Cusumano, 2014). According to Moser and Gassmann (2016), each platform ecosystem has a platform owner, platform users and external complementors. Van Alstyne *et al.* (2016) extend this structure by adding the role of the platform operator, which acts as an interface to the users and complementors of the platform, while the owner of the platform owns the intellectual property (IP) and controls the ecosystem. Eisenmann, Parker, and Van Alstyne (2008) also share this view by distinguishing between the platform owner (sponsor) as designer and holder of intellectual property rights and the platform operator responsible for rules and architecture. The benefit for the platform owner, who has to change his own business model, is that he technically implements new processes in the platform ecosystem of the participating companies (Parker & Van Alstyne, 2005; Rochet & Triole, 2002) and, thereby, establishes new customer relationships in the value chain (Lee, Kim, Noh, & Lee, 2010).

In the following pages, the focus is on the platform owner, as this function is of particular importance for the strategic management of the platform ecosystem.

Platform owner

Companies pursuing a platform strategy must ask themselves whether they need to change their business model and whether the necessary resources and skills are already available or still needed (Walter, 2018). This includes the creation of an independent business unit for the new industry platform business (Kim & Min, 2015), measurement systems with key figures for executives to manage an industry platform business successfully (Parker *et al.*, 2016), and a network of complementors who are entering into new niche markets with industry platform innovations (Markides, 2006).

In general, the platform owner acts as a provider of services while network members consume these services. Thus, owners of an e-commerce platform sell space for online advertising to advertising agencies and a service to consumers who pay a transaction fee for using the e-commerce platform (Evans, 2011). From the perspective of merchants and consumers, products

and services offered on the e-commerce platform are exchanged bilaterally between these parties (Moser & Gassmann, 2016) at an agreed price on the basis of the platform conditions. These platforms create entirely new markets because they are modular with a central technological core and peripheral components that can be developed or modified by complementors, such as external IT developers (Cusumano, 2010b; Gawer, 2014). The value of these innovations increases with the number of users using the platform and its complementary services (Gawer & Cusumano, 2008).

Therefore, platform owners, such as salesforce.com offer development tools and services to motivate external developers to develop new functionality for the platform (Cusumano, 2010a). This allows platform owners to benefit from innovations, from third party providers, that they would not have considered themselves (Chesbrough & Van Alstyne, 2015). Therefore, the platform owner plays an essential role in building and managing the platform's ecosystem (Tiwana, 2014). Since traditional governance models for internal or supplier platforms can no longer be used (Gawer, 2014), ecosystem governance is essential for the competitiveness and performance of the industry platform for three reasons. First, the platform owner provides the technological core and platform interfaces, as well as the platform's business model (Choi & Phan, 2012). According to Moser and Gassmann (2016), both this technological innovation and the business model must be well developed in order to be beneficial for all ecosystem entities. Nambisan and Baron (2013) also point to the volatile platform business environment, which is subject to constant technological change. Therefore, the strategy and platform business model have to be continually adapted. Second, the platform owner ensures operational excellence and coordinates all internal and external organisational activities (Gawer, 2014) and third, the platform owner sponsors the complementors, so that they join the ecosystem of the platform (Choi & Phan, 2012). Gawer and Cusumano (2008) argue that, unlike industrial manufacturing, where a manufacturer still has control over his product, this control in the platform economy is increasingly shifting from the platform owner to the ecosystem.

In such a multi-stakeholder environment (Ha *et al.*, 2019), platform innovations can have a decisive value by making existing business processes more efficient and reorganising or even dissolving established organisational structures and power relationships. However, as Mitchell, Agle, and Wood (1997) emphasise, the diverse parties involved have different power, legitimacy and urgency to act. Conflicts of interest between these parties with regard to the development strategies to be pursued, must also be continuously moderated and negotiated (Ha *et al.*, 2019; Hall *et al.*, 2012), as positions and interests can change dynamically (Windsor, 2010). Therefore, a stakeholder analysis is important for platform providers who intend to enter such a multi-stakeholder environment with an industry platform (Bunn, Savage, & Holloway, 2002) since a stakeholder analysis provides relevant insights into market participants and their relationship to each other (Freeman, 2010). Companies from the private logistics and IT sector, as well as the public sector (customs, port authorities), have different and sometimes conflicting interests with regard to platform ownership (Arduino *et al.*, 2012; De Martino *et al.*, 2013). While private companies aim to generate profits and reduce costs through platform innovations, the public sector is motivated to increase socio-economic well-being (Arduino *et al.*, 2012; Chen, Xu, Zhang, & Zhang, 2018). Such a constellation results in complex coordination and decision-making processes with regard to the implementation of platform innovations. A critical success factor here is the willingness to adopt a new form of supply chain collaboration in cross border trade - even across sector boundaries (Chang & Iakovou, 2019).

2.4.2 Blockchain technology as basis for industry platforms in maritime freight logistics

According to Hasan *et al.* (2019), the application of blockchain technology in the supply chain has enormous advantages in terms of supply chain visibility and process automation". Literally translated, the blockchain is a chain of transaction blocks (Brühl, 2017b; Wang *et al.*, 2019) that allows companies

within a business network to make transactions without any intermediaries (Christidis & Devetsikiotis, 2016; Yli-Huumo, Ko, Choi, Park, & Smolander, 2016). As with the digital currency Bitcoin, which can do without banks as intermediaries (Letourneau & Whelan, 2017; Scott, Loonam, & Kumar, 2017), blockchain technology has the potential to change existing business models in maritime freight logistics as well (Gausdal *et al.*, 2018; Swan, 2015; Takahashi, 2016).

Disruptive potential for the maritime supply chain

It is expected that blockchain technology will lead to a "revolutionary paradigm shift" in the way transactions are processed in the maritime supply chain (Kamble *et al.*, 2018, p. 1), although Saberi *et al.* (2018) argue that there are various barriers in applying and implementing this technology in supply chain networks. However, the disruption potential is not only due to the characteristics of the new technology, but also to the use of the data obtained to create new logistics services and new business models that are changing the industry (Club of Logistics, 2014; Tijan *et al.*, 2019). These data, alongside resources, labour and capital, has become another relevant production factor and "an essential element of competitive differentiation" (Jeseke, Grüner, & Weiß, 2013, p. 29). The application of blockchain technology can realise the vision of an automated value chain affecting all logistic and payment processes (Tijan *et al.*, 2019, p. 1). When a single asset flows along the supply chain from production to consumption, each transport step can be tracked as a transaction in the event history (Hasan *et al.*, 2019). "Digital assets (such as warranties, certifications, copyrights, licenses, serial numbers, barcodes)" can be processed uniquely and in parallel to physical assets and official documents such as tracking orders, receipts, invoices, payments can be stored tamper-proof (Tijan *et al.*, 2019, p. 6). Therefore, blockchain technology enables supply chain transparency by highlighting "the nature (what it is), the quality (how it is), the quantity (how much of it there is), the location (where it is) and the ownership (who owns it at any moment)" of a product (Saberi *et al.*, 2018, p. 5). Thus, the Emirate of Dubai intends to replace all freight and customs

documents in the import and export of goods by Smart Contracts based on blockchain technology (ICT Monitor Worldwide, 2017). The aim is to simplify movements of goods and to increase supply chain transparency through real-time information on the delivery status (Kshetri, 2018). The financial transactions between the service partners in the supply chain can also be automated and securely managed globally and independently of the used software solution. This is in contrast to today's practice, in which business transactions and the exchange of freight and customs documents are largely handled centrally by an intermediary (Chang & Iakovou, 2019).

Secure transactions on industry platforms

For innovative platform services, blockchain technology is of immense importance (Subramanian, 2017) as it allows *secure* business transactions, such as financial transactions and the processing of operational supply chain data and information (Tijan *et al.*, 2019). Blockchain technology was originally developed as a “decentralised transaction and data management technology” (Yli-Huumo *et al.*, 2016, p. 1) for the open source cryptocurrency Bitcoin (Nakamoto, 2008). Any information is stored in encrypted and compressed data units, the so-called blocks (Christidis & Devetsikiotis, 2016; Tapscott & Tapscott, 2017). The data is not stored on a central server, but - after verification in the peer-to-peer network (Christidis & Devetsikiotis, 2016; Tapscott & Tapscott, 2017) - on all decentralised participating computers of the network (Böhme, Christin, Edelman, & Moore, 2015). The principle of this technology is that new digital transactions containing information are aggregated into blocks that are linked to previous blocks and thus form a chain of records - the blockchain (Andoni *et al.*, 2019; Saberi *et al.*, 2018; Yli-Huumo *et al.*, 2016). Each transaction receives a time stamp and is secured by cryptological methods, using the private and public keys of the sender and receiver (Brühl, 2017b). A subsequent transaction only matches the preceding transaction if it is verified by a hash link (Nofer, Gomber, Hinz, & Schiereck, 2017). In this way, each node in the network stores the blockchain and a consensus function preserves the immutability of the blockchain (Bashir, 2017;

Wang *et al.*, 2019). Due to these security features blockchain technology provides a secure and manipulation-protected form of data exchange.

New architecture of trust

Blockchain technology has its origin in the cryptocurrency bitcoin, which is strongly criticised as speculative asset (Böhme *et al.*, 2015; Nofer *et al.*, 2017; Swan, 2015), due to security and privacy concerns regarding sensitive data (Kshetri, 2018; Woodside *et al.*, 2017; Wu *et al.*, 2017) and due to the high power consumption when creating (mining) the cryptocurrency (Apte & Petrovsky, 2016; Böhme *et al.*, 2015; Swan, 2015). However, several scholars agree that the blockchain, due to its characteristics, technically creates trust in supply chain management, which is so far offered by intermediaries as a service (Chang & Iakovou, 2019; Economist, 2015; Wang *et al.*, 2019). In this way, companies can do business with each other without risk and without great effort, and thereby close the trust gap that arises when business relationships take place digitally. Since blockchain transactions represent values (Saberi *et al.*, 2018), the Internet of things could become an Internet of values (Meinert, 2016; Tapscott & Tapscott, 2017).

2.5 Platform business model

For decades, Michael Porter´s “Five Forces Model” (Porter, 1980), has been applied to production and services companies operating in the conventional pipeline business with producer-consumer relationships (Parker *et al.*, 2016; Van Alstyne *et al.*, 2016). Literature agrees that the Five Forces Model is based on the classical value chain with sequential activities and input/output relationships, which are typical for the transport of goods and the flow of information through the value chain from supplier to consumer (Van Alstyne *et al.*, 2016; Walter, 2018). Porter (2008) defines the five forces as the threats through competitive rivalry, bargaining power of suppliers and buyers, potential new entrants and substitutes, which a company faces in the competitive environment of its industry (Dobbs, 2014). However, Van Alstyne *et al.* (2016)

argue that Porter´s Five Forces Model has weaknesses in its applicability to multi-sided markets. In multi-sided markets the previously clearly defined boundaries between customers, suppliers and competitors (Van Alstyne *et al.*, 2016) are increasingly blurring with the emergence of virtual markets and electronic intermediaries (Armstrong, 2006; Karagiannopoulos, Georgopoulos, & Nikolopoulos, 2005). Van Alstyne *et al.* (2016) argue that external forces in supply-oriented economies threaten the company's value creation, while external platform ecosystems in demand-oriented economies are especially necessary to be successful.

2.5.1 Classification of innovations

Companies face enormous challenges caused by rapid technological change, globalisation, demand volatility (Palmieri *et al.*, 2019) and the permanent availability of knowledge, which leads to intense time and knowledge competition (Casadesus-Masanell & Ricart, 2010). Therefore, companies continuously have to develop new innovative products and improve their processes in order to increase revenue and profit margins (Amit & Zott, 2010). Croitoru (2012) even sees innovation as another production factor.

The concept of innovation can be traced back to Schumpeter (1939, p. 80), who classifies innovations in “technological change in production of commodities” (product innovation), “taylorisation of work”, or “setting up of new business organisations” (process innovation) and “opening up of new markets” (business model innovation). Schumpeter (1939) distinguishes an innovation from an invention that is economically irrelevant until it becomes an innovation in practice. Tidd (2001), however, classifies an innovation according to the extent of change and the competitive advantage that companies with different types of innovation can achieve. In this regard, Tidd (2001) distinguishes between incremental, radical and disruptive innovations and points to the important aspect of technological and economic contingencies that influence or restrict innovations through uncertainty or complexity. Pisano (2015) takes the same view, but still makes a connection between the value added

generated by an innovation and the use of resources. By understanding the economic value that companies can generate through different types of innovation, companies can use their resources more effectively.

Pisano (2015, p. 8) introduces his "Innovation Landscape Map" that classifies innovations according to the degree to which they are based on technical competencies and a change in their business model. This helps companies decide whether a potential innovation fits their existing business model and capabilities. In the four quadrant matrix of the Innovation Landscape Map, Pisano (2015) distinguishes between "*routine innovations*", which are only incremental technological improvements developed in the company on the basis of existing thought patterns and "*radical innovations*" that are based on a technological breakthrough. As far as the business model is concerned, he distinguishes between "d*isruptive innovations*" that require an adaptation of the business model and "*architectural innovations*" that are additionally based on a technological breakthrough. Chapman, Soosay, and Kandampully (2002, p. 359) add that an innovation changing the "functioning of society" can also be described as transformational.

This study classifies blockchain-based industry platforms in their development stage between the 1st quadrant (disruptive innovation) and the 2nd quadrant (architectural innovation). Industry platforms have a disruptive effect due to their high value creation potential, since the underlying new service-oriented business models can change the traditional business models of entire industries. Therefore, with regard to the blockchain technology used, structural changes in an entire industry are possible through a new form of collaboration. In this context, the emerging blockchain technology also requires new technical competencies from the companies involved in the implementation of blockchain-based industry platforms (Ozalp, Cennamo, & Gawer, 2018). This is comparable to the transformational effects of platforms such as Uber on the taxi industry or Airbnb on the hotel industry in the business-to-consumer segment (Täuscher & Laudien, 2018; Tura *et al.*, 2018). At this point, the "overuse of disruptive innovation/disruption as a synonym for any new threat and underuse of disruptive innovation as a theoretical concept" in the

academic literature should be noted (Christensen *et al.*, 2018, p. 1044). The theoretical foundations of disruption theory (Christensen, 2006; Christensen *et al.*, 2018) will be discussed in detail later in Section 2.5.6, as they constitute the necessity of the business model transformation of an established global information technology company.

Figure 2.2 illustrates Pisano´s innovation classification (Pisano, 2015) in the perspectives of a required change of the business model (y-axis) and the required technical competencies (x-axis).

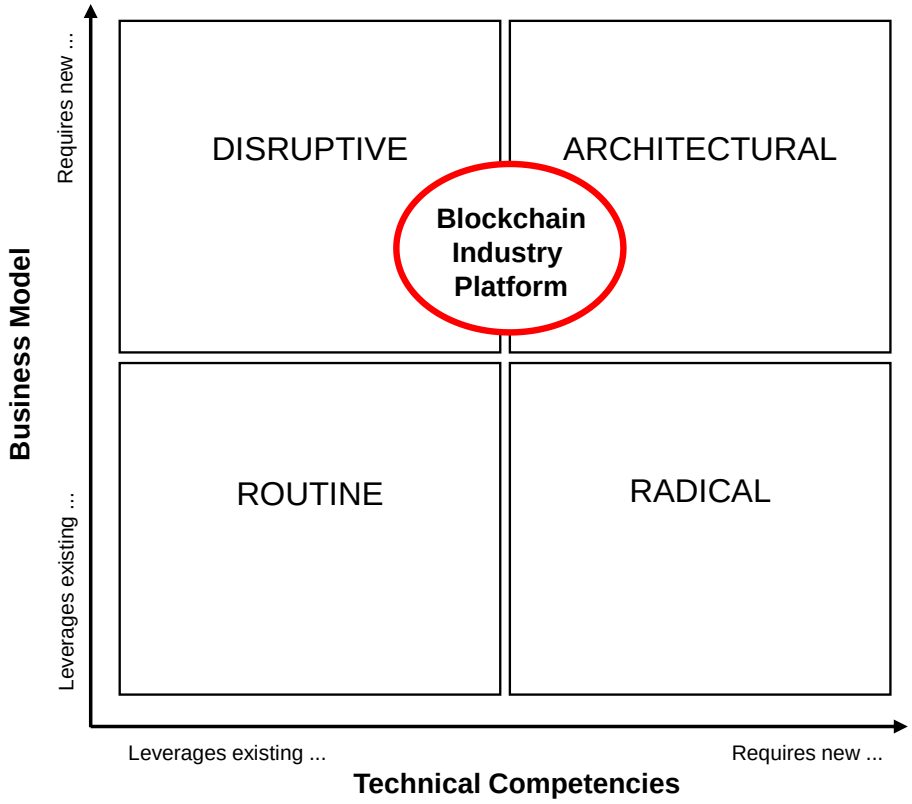

Figure 2.2 Innovation Landscape Map
Source: Pisano (2015) [Adapted]

This classification of industry platforms, which is relevant for global information technology companies, shows that a new platform business model is required, while, at the same time, partly new technical competencies are required.

2.5.2 Platform business model innovation

Existing research has focused on product innovation and process innovation (Casadesus-Masanell & Zhu, 2013). Nevertheless, in recent years scholars have been progressively engaged in another type of innovation - namely business model innovation - which has become increasingly important in management practice and scientific literature (Amit & Zott, 2012; Casadesus-Masanell & Zhu, 2013; Chesbrough, 2007; Gassmann, Frankenberger, & Csik, 2013b; Gassmann *et al.*, 2015). According to Osterwalder (2011, p. 14) the business model represents "the rationale for how a company creates, delivers and acquires value", while Amit and Zott (2010) describe business model innovation as the process of modifying an existing or creating a new activity system. Business model innovation is therefore beneficial for companies as existing resources, skills and competencies can continue to be leveraged, and no major investments in production facilities, production equipment or research and development (R&D) are required (Amit & Zott, 2010). However, Foss and Saebi (2017) differentiate yet further by arguing that the focused modification of the business model retains the value proposition and is limited to a modular change, while the complex business model innovation is associated with a change in the entire business model. In the context of this study, the transformation of a software- and service-oriented business model of a global information technology company into a platform business model, is such a complex business model innovation.

This poses major challenges for established global information technology companies for various reasons. Fjeldstad and Snow (2018) argue that the commitment to a platform strategy at the strategic level and the development of a business model at the tactical level does not automatically mean that the defined activities are also implemented at the operational level. While a change in the organisational structure can be implemented observably at company level, or a new business model can be communicated through corporate communication, these activities trigger mechanisms within the organisation which, in turn, have a positive or negative influence on the

outcome (Fleetwood, Brannan, & Vincent, 2017). The company is a complex and dynamic open system with employees at various hierarchical levels and with IT systems and technologies (Mingers & Standing, 2017). These social structures lead to different mechanisms that affect the desired platform business due to their characteristics and interdependencies (Mingers & Standing, 2017). It is, therefore, the task of management research to explain which mechanisms interact with each other in which way, and thereby cause the observable or unobservable phenomena (Mingers & Standing, 2017).

2.5.3 Business models in the networked economy

According to Foss and Saebi (2017), the predominant theme of business model innovation is anchored in the literature on corporate and strategic management. New opportunities of value creation - through cross-company and even cross-industry transactions in virtual markets (boundary-spanning aspects) (Zott & Amit, 2010) - differ from the firm-centered product and process innovations (firm centric perspective) (Morris, Schindehutte, & Allen, 2005). However, with the beginning of the Internet age and fast-growing Internet companies, many scholars have asked whether the traditional analytical units of strategy development - industries, companies or business units - are still the right ones (Kim & Mauborgne, 2004). Therefore, academic research is proposing the *business model* as the unit of analysis for new Internet-based companies (McGrath, 2010; Täuscher & Laudien, 2018) as the dotcom boom has increased the importance of the business model in practice (Demil & Lecocq, 2010; Wirtz, Pistoia, Ullrich, & Göttel, 2016).

The further development of business models is indispensable for companies, as it enables them to operationalise their strategy by adapting organisational structures, processes and systems (Osterwalder, 2011). Business models describe the logic for profitable growth and define how value is created for customers and business partners (Najmaei, 2016). The analysis of business models, therefore, makes it possible to identify existing risks and exploit new opportunities for business. In this context, Amit and Zott (2001) argue that

Internet businesses outperform traditional businesses as their digital business models have a higher potential for value creation through software-based technologies. Such companies are increasingly changing industries and seemingly secure business areas by introducing new rules with digital business models. Therefore, Amit and Zott (2001) propose an integrative approach to analyse business model innovations in strategic management and entrepreneurship literature in order to create value for the company and its customers, suppliers and partners through the successful identification of business opportunities.

2.5.4 Social mechanisms

“Modern social theory has a tendency to describe social phenomena rather than to explain” (Hedström & Swedberg, 1998, p. 1). However, knowing the causes and mechanisms that trigger the observed social phenomena (Edling & Rydgren, 2016) is essential for entrepreneurial practice. It is here where management research can make an important contribution by identifying and explaining the effects of social mechanisms (Edling & Rydgren, 2016) that are active in the platform business model transformation “to close the gap between theory and analysis, and to theorise in a more creative way” (Edling & Rydgren, 2016, p. 1136).

A social mechanism is a sequence of events through which a cause X - under certain conditions - can cause an effect Y in the area of social relations. In "complex, open-system organisational environments" (Wynn Jr & Williams, 2012, p. 798) these events can be causally reducible to actions and interactions of individuals (Edling & Rydgren, 2016) and can be observable or unobservable (Mingers & Standing, 2017). Although causality in philosophy is a controversial subject, Bygstad and Munkvold (2011b, p. 1) point out that "causality is expressed in the term mechanism", simply defined as a causal structure that explains a phenomenon. In contrast to sociological positivism, however, the aim here is not to identify universal laws by causality or methods

for determining causal effects, but to bring light into the "black box" through explanations (Hedström & Wennberg, 2017, p. 92).

However, while the existing literature postulates that the effect of mechanisms and their interaction with each other is dependent on social conditions (Fletcher, 2016), Hedström and Wennberg (2017) refer to the existence of general mechanisms. These mechanisms work - independent of the social settings - according to the same "logical principles" and explain "the particular by the general" (Hedström & Swedberg, 1998, p. 2).

2.5.5 Platform mechanisms

Global information technology companies have advantages over start-up companies when entering the platform business, as they already have a loyal customer base and have an existing value network of third-party providers (McIntyre & Srinivasan, 2017; Parker *et al.*, 2016; Song *et al.*, 2018). Yet, in a world of "democratised network access and pull marketing", these advantages are becoming increasingly less relevant (Parker *et al.*, 2016, p. 86). Many established global information technology companies respond to emerging industry platforms by integrating the platform business model into their existing software- and service-oriented business models (Kim & Min, 2015). However, this raises the question of how platform related mechanisms, such as pricing and subsidy mechanisms (Gawer & Cusumano, 2008), collaboration mechanisms or revenue sharing (Osterwalder, Pigneur, & Tucci, 2005) - which are relevant from a holistic view of the business model - work at the micro-level under new market conditions. With regard to platform innovations, these social mechanisms, which are rooted in the company's institutional regulatory systems, have a decisive influence on the success of the industry platform implementation (Modell, 2009). The mechanisms-based approach is now an analytical approach to systematically grasp these mechanisms (Mingers & Standing, 2017). Figure 2.3 shows the relationships between the observed phenomena at the macro level of organisations or networks and the mechanisms operating at the micro level (Hurrell, 2014).

Hedström and Wennberg (2017) categorise the mechanisms according to situational mechanisms (SM) that arise from the **C**onditions (C) of the macro-environment and that influence the **G**oals of the actors (G) on the micro-level, as well as action formation mechanisms (AFM) that shape the **B**ehaviour of the actors (B) and transformational mechanisms (TM) that trigger the intended or unintended macro-level **O**utcome by common actions (O).

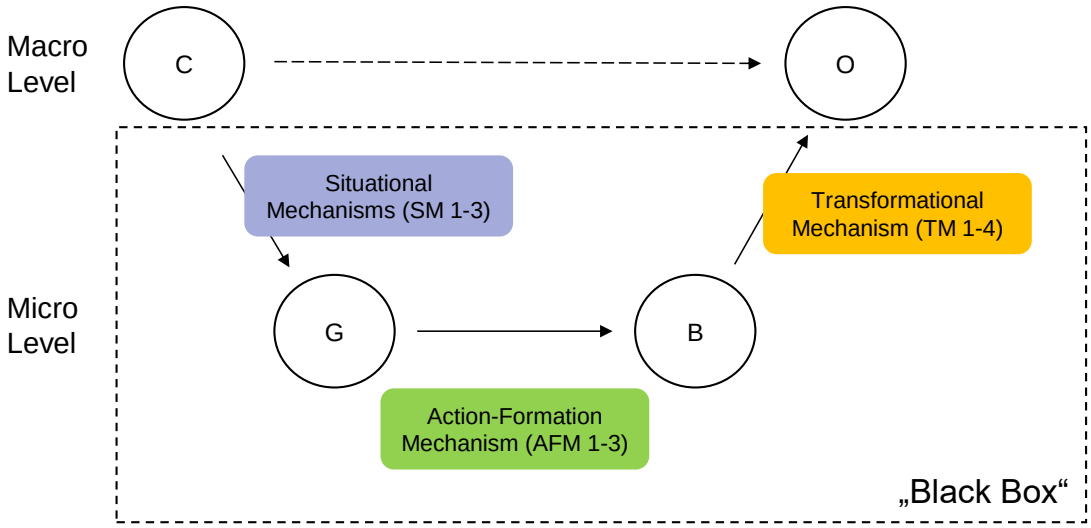

Figure 2.3 Types of mechanisms
Source: (Hedström & Wennberg, 2017)

Table 2.1 presents an overview of possible mechanisms that are considered in the literature and that could be relevant to the transformation of the platform business model.

Acronym	Potential Mechanisms	Description	Authors
Situational Mechanisms *(arise from the conditions of the macro-environment)*			
SM 1	Corporate Entrepreneurship Mechanism	Determines the growth and sustainability of the company, as the entrepreneurial spirit of executives is necessary to successfully develop new business models and innovations	Bygstad *et al.* (2016)
SM 2	Cross-Sector Partnership Mechanism	Facilitates the development of new business models with parties from different sectors that contribute complementary capabilities	Dahan *et al.* (2010)
SM 3	Scoping Mechanism	Defines the activities that are performed internally or transferred to other companies	Gawer and Cusumano (2008)
Action Formation Mechanisms *(shape the behaviour of the actors)*			
AFM 1	Pricing and Subsidy Mechanism	Controls as part of the market mechanism the use of the platform by platform actors	Gawer (2014); (Gawer & Cusumano, 2008)
AFM2	Sales Management Mechanism	Enables the achievement of operational sales targets derived from the strategic objectives of the company	Chesbrough (2010)
AFM 3	Governance Mechanism	Monitors and coordinates the inter-organisational behaviour in relation to the platform usage	Lee and Meng (2015)
Transformational Mechanisms *(trigger the macro-level outcome)*			
TM 1	Self-Reinforcing Innovation Mechanism	Leads to new services and generates new usage potential through the implementation of a structured innovation process in the organisation	Bygstad *et al.* (2016)
TM 2	Self-Reinforcing Adoption Mechanism	Describes that a growing platform attracts more third-party providers, which increases network effects	Bygstad and Munkvold (2011b), *Parker et al. (2016)*
TM 3	Standards Reinforcement Mechanism	Describes that more complementary products drive standardisation and increase the value of the platform, which attracts more users	*Bygstad (2010), Grindley (1995)*

Table 2.1 Overview of potential mechanisms affecting the business model

2.5.6 Situational mechanisms

Corporate Entrepreneurship Mechanism

Given the dynamic environment and complex business relationships, corporate entrepreneurship plays a critical role in the business model transformation (Hu, Huang, Zeng, & Zhang, 2016). Literature agrees that the company's growth and sustainability depend crucially on the entrepreneurial ability of its managers to successfully shape new business models and innovations (Berglund & Sandström, 2017; Bygstad *et al.*, 2016; Geradts & Bocken, 2019; Nayager & Van Vuuren, 2015). However, managers of established global information technology companies are in an innovator's dilemma when confronted with disruptive technologies (Christensen, 2013; Christensen, 2006) and related organisational changes (Power & Singh, 2007). Christensen (2013) argues that managers make supposedly correct - rational - entrepreneurial decisions in order to meet classic success factors such as customer needs, profit and growth targets, but do not sufficiently pursue innovations that do not meet these success factors in the short term. This innovator's dilemma, therefore, suggests that these companies often fail as a result in the long term (Berglund & Sandström, 2017), which is explained by the two central elements of the theory:

S-curve: As shown in Figure 2.4, the benefit or value to the customer of an innovation is based on an S-curve (Christensen, 1992). Starting from the initial idea for a new innovation, time-consuming iterative optimisations are necessary in the initial phase, which only bring a relatively low value to the customer (Adner & Kapoor, 2016). However, once the basic technology or solution has been developed, the value increases exponentially with each improvement. After the most intrinsic value adjustments have been made, the value curve takes a degressive course, as each further optimisation has only a relatively small value contribution (Adner & Kapoor, 2016).

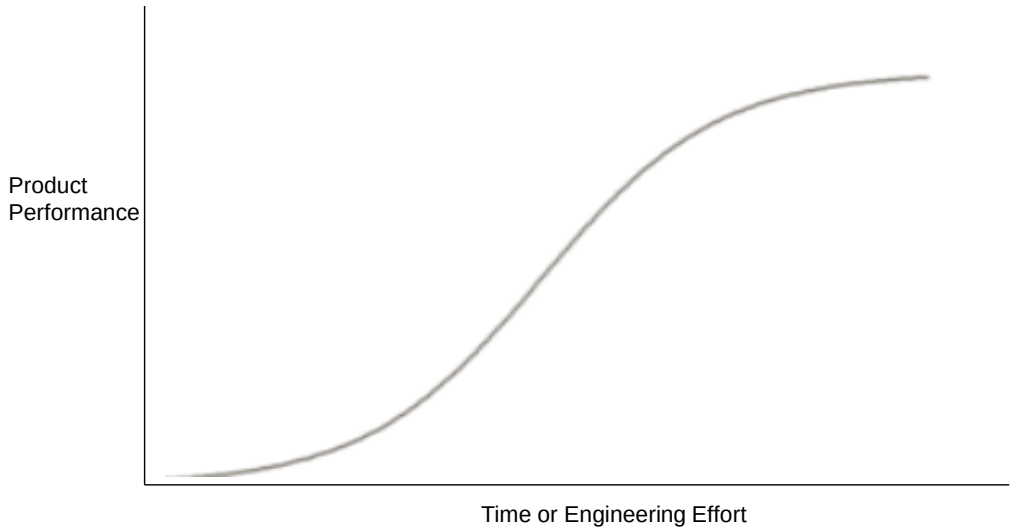

Figure 2.4 The Innovation S-Curve (Christensen, 1992)

Customer expectations: Established global information technology companies have a large customer base, which, in turn, is associated with high sales expectations (Michelman, 2017). In order to secure these revenues, customer requirements are met with regard to the continuous improvement of their products, which, in turn, means that customers are not interested in disruptive innovations. However, while incumbents with incremental product enhancements are already at the end of the S-curve (Chasteen, 2003), start-up companies have the opportunity to move deeply into the S-curve with disruptive innovations without competition in promising niche markets (Berglund & Sandström, 2017; Christensen, 1992; Markides, 2006). It is too late for established companies to react when customers start to take an interest in these innovations (Chasteen, 2003). The innovation unfolds its greatest added value for customers, as it is already in the exponential range of the S-curve, and thus begins to replace the established solutions. However, the market conditions under which Christensen (1997) developed his theory differ significantly from those in an emerging networked economy with industry platforms. The literature agrees that one mechanism of dealing with disruptive technologies is to foster an entrepreneurial attitude in the company (Berglund & Sandström, 2017; Chasteen, 2003), which is also defined as intrapreneurship (Parker, 2011). Yet ecosystem entrepreneurs face particular

challenges with regard to the emerging business networks of industry platforms, as goals and priorities within the ecosystem must be jointly defined and enforced (Nambisan & Baron, 2013).

Cross-Sector Partnership Mechanism

The business model is the central logic for strategic decisions to create both social and economic values within a business network (Dahan *et al.*, 2010). This business model can be designed across companies (Amit & Zott, 2010) (Amit & Zott, 2010) by including strategic industry partnerships with key industry partners important to the success of an industry platform (Tan, Tan, & Pan, 2016). Global information technology companies face a number of challenges as they enter the platform business, including the need to adapt their business model to the economic, institutional and geographic conditions (Dahan *et al.*, 2010) of the maritime freight logistics sector. If global information technology companies do not have the financial resources or industry knowledge, they can consider a cross-sector industry partnership in which the parties bring complementary skills along the value chain (Mingers & Standing, 2017). This allows the platform to be adapted to the requirements of the industry and investments, costs and risks can be minimised for the parties involved (Dahan *et al.*, 2010). From the point of view of potential platform users, such an approach also leads to higher user acceptance if companies of their own industry align the industry platform with the industry requirements via the platform industry partnership (Bygstad & Munkvold, 2011b).

Figure 2.5 shows the options of building business networks for blockchain-based industry platforms (Blessing-Hartley, 2018). In distributed consortium-based networks, the platform owners, who can also be organised as a joint legal entity (e.g. Joint Venture), are equally entitled partners (Andoni *et al.*, 2019). In contrast, in owner-directed networks the platform owner, as the “single trusted authority”, is in a position to determine the direction of the industry platform (Andoni *et al.*, 2019, p. 146). Finally, community-based networks are driven by industry standards organisations or existing non-blockchain network owners.

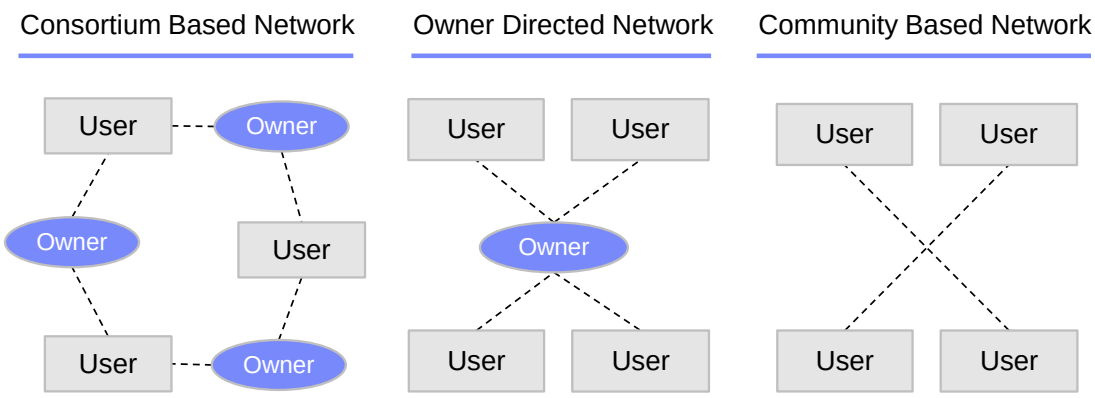

Figure 2.5 Different types of blockchain networks
Source: Blessing-Hartley (2018) [Adapted]

Scoping Mechanism

The financial configuration can be based on joint investments (Ghezzi, 2012) in the platform according to a partnership model. From this partnership model, decisions on the functional scope and technological design of the platform, as well as the Intellectual Property (IP) and price model, will be derived (Gawer & Cusumano, 2008). Revenue-sharing agreements between the platform owner and the complementors have the effect of increasing the value of the platform for platform users by providing additional services (Gassmann *et al.*, 2015).

2.5.7 Action-Formation Mechanisms

Pricing and Subsidy Mechanism

Platform-based ecosystems (Tura *et al.*, 2018), which use industry platforms for data transactions, function like markets (Tan *et al.*, 2016), in which the provision of data meets the demand for it. The price mechanism is the essential control factor for the transactional data exchange and thus the interaction between the users (Gawer, 2014; Kim, 2016). Osterwalder (2004) classifies the various pricing categories according to fixed pricing, differential pricing and market pricing, whereby billing for the use of a transactional industry platform is based on a transaction fee or subscription fee (Evans, 2011; Filistrucchi,

Geradin, van Damme, & Affeldt, 2014). However, the volume of transactions processed via the platform depends not only on the absolute price level, but also on the price structure as the relative price ratio between the different user groups (Rochet & Triole, 2002). The user-specific transaction fee is proportional to the benefit that users receive from the ecosystem connected to the platform (Parker *et al.*, 2016). Compared to inland transport companies, ports and terminal operators, the monetary benefit of maritime supply chain data is greater for liner shipping companies and freight forwarders, as they already have a contractual relationship with shippers and can monetise new commercial value-added services (Lee & Meng, 2015; Lloyd´s Maritime Academy, 2018d). This can also mean that certain user groups, such as land transport companies, can use the service free of charge and will, therefore, be subsidised by the platform owner, as their supply chain data is crucial for the growth and success of the platform (Gawer & Cusumano, 2008; Parker *et al.*, 2016).

Sales Management Mechanism

Sales Management enables the achievement of the operative sales targets, which are derived from the strategic goals of the company (Chesbrough, 2010). The sales management mechanism describes how sales activities on the execute level will be controlled by sales management on the control level (Chesbrough, 2010). In terms of platform business, the sales organisation of a global information technology company faces completely new challenges. The sales cycle is significantly extended, as the launch of an industry platform requires the formation of a business network of companies from different industries before network effects occur (Tura *et al.*, 2018). Pre-sales activities, which support the sale of products and services to a single company in the typical software and services business, are now focused on building business networks (Walravens & Ballon, 2013). Also, considerable coordination costs resulting from the negotiation of Smart Contracts must be taken into account in pre-sales activities (Beck, Müller-Bloch, & King, 2018). Parker *et al.* (2016) emphasise that sales management, which previously controlled sales on a

quarterly basis according to key figures such as revenue, signings and product margin, has no experience with the success factors of platforms such as positive network effects or performance of complementary services.

Governance Mechanism

The governance mechanism determines which user groups are authorised to use the industry platform (Kim, 2016) and defines the terms and conditions under which the industry platform can be used by the different entities (Tan *et al.*, 2016). Quality control monitors the behaviour of users on the platform (Belleflamme & Peitz, 2019). The aim is that companies in the ecosystem, which are also in competition with each other, collaboratively exchange information in order to improve the transparency of the supply chain, instead of just pursuing their own interests (Lee & Meng, 2015). An important ability of the platform owner is to build trust between the different network members of the platform and to create a common platform identity (Gawer & Phillips, 2013; Täuscher & Laudien, 2018). In this context, blockchain technology, which enables secure data transactions, plays a critical role in creating this trust in supply chain transactions between network members (Chang & Iakovou, 2019; Saberi *et al.*, 2018). Supply chain networks require a privately permissioned blockchain with authorised network members certified by certifiers to participate in the supply chain (Saberi *et al.*, 2018). This is in contrast to the blockchain-based cryptocurrency Bitcoin, which is publicly tradable (Andoni *et al.*, 2019; Saberi *et al.*, 2018). Yet, Smart Contracts as transaction protocols that execute the terms of a contract within the business network (Wang *et al.*, 2019; Yli-Huumo *et al.*, 2016; Zhang & Wen, 2017) may involve risks for the platform users due to "autonomous enforcement mechanisms" (Beck *et al.*, 2018, p. 1030). Therefore, platform governance, for which the platform operator is responsible, has a central function (Tiwana, Konsynski, & Bush, 2010) and justifies its legitimacy in the platform ecosystem (Gawer & Henderson, 2007). Platform governance refers to the stakeholders and platform network members on the one hand and the complementors on the other (Tura *et al.*, 2018). While platform owners in the closed governance

format have full control over the functionalities and intellectual property of the platform, the open governance format offers complementors the possibility of adding innovative services to the platform (Chesbrough & Van Alstyne, 2015; Gawer & Cusumano, 2008). For this, the platform governance must ensure an open architecture and interfaces (Adner & Kapoor, 2010). However, this also entails the risk that the platform will lose its relevance if the complementary services are of greater benefit to the platform users than the actual platform itself (Zhu & Furr, 2016).

2.5.8 Transformational mechanisms

Self-Reinforcing Innovation Mechanism

Global information technology companies have software and IT services capabilities that are essential for the development and operation of industry platforms. Nonetheless, it is the integration of complementors at an early stage of the market that can increase the value of the platform for users (Cennamo, 2018). Open architectures offer the possibility for complementors to design new services (Gawer & Cusumano, 2007), which are developed into complementary innovations - also with external partners (Bygstad, 2010; McIntyre & Srinivasan, 2017). If these innovations are integrated into the existing technology and infrastructure base, new ideas arise through the generative innovation mechanism (Bygstad *et al.*, 2016) - stimulated by "human creativity and the desire to improve current conditions" (Jennings, 2015, p. 365).

Self-Reinforcing Adoption Mechanism

While the innovation mechanism enables the platform owner to offer new services, the mechanism that leads to an increasing number of network members using the platform is relevant (Parker *et al.*, 2016). The self-reinforcing adoption mechanism explains that more (complementary) services make the platform more valuable to the users, whereby more users participate

in the platform through indirect network effects (Cennamo, 2018; McIntyre & Srinivasan, 2017; Parker *et al.*, 2016). More important than registering new customers, however, is that the platform is of such value to customers that they actively and permanently use it (Parker *et al.*, 2016). The innovation affinity of network members to use blockchain technology as early adopters also plays a key role here (Woodside *et al.*, 2017), and trust is the "predominant factor driving their adoption" (Wang *et al.*, 2019, p. 10).

Marketing for an industry platform differs significantly from conventional product marketing. While in traditional product sales the marketing function is separated from the product and product information is pushed via certain communication channels (push strategy), in platform businesses marketing must be embedded in the platform (Parker *et al.*, 2016). Accordingly, "user commitment and active usage" are the true mechanisms of customer adoption (pull strategy) leading to new customers and further growth (Parker *et al.*, 2016, p. 85). However, for transactional industry platforms in the business-to-business context of maritime freight logistics, participation in a platform continues to be influenced by the power relations between the companies involved (Reimann & Ketchen, 2017). Companies such as liner shipping companies or global freight forwarders, which are in a customer relationship with other logistics service providers, can force these providers to participate in the industry platform due to economic dependency (Kshetri, 2018). This effect can contribute to the commercial success of the platform, especially in the case of industry platforms based on an industry partnership with one or more logistics companies as investors. However, Michelman (2017) points out that modern technology trends - such as the blockchain technology - which are overestimated in the hype take time to be adopted by an entire network. These implications are to be taken into account by the global information technology company as a platform owner when designing the business model.

Standards Reinforcement Mechanism

The structure of the self-reinforcing adoption mechanism is comparable to that of the standards reinforcement mechanism, which indicates that through

further complementary innovations the confidence of the user increases, that the platform becomes an industry standard (Grindley, 1995). This increases the benefits for platform users, in the sense that other users participate in the platform (Bygstad, 2010). A prerequisite for this working mechanism is that the platform is technically designed as an open architecture so that external third-party providers can easily develop or integrate services (Bygstad & Munkvold, 2011b). But the future success will depend on blockchain standardisation and interoperability of the blockchain platforms (Chang & Iakovou, 2019), currently constrained by the variety of rapidly emerging blockchain-based applications (Casino *et al.*, 2019). This leads to a complexity in the development of the platform, since the interactions and dependencies with the ecosystem are much more comprehensive than what is usual in IT development within company boundaries (Boudreau & Hagiu, 2008). In this context, standards organisations can help define standards schemes to reduce complexity (Saberi *et al.*, 2018).

2.5.9 Mechanisms relevant in platform business model transformation

In summary, the following figure provides an overview of the mechanisms examined in the previous sections that are relevant in the platform business model transformation. They are assigned to the categories of situational, action-formation and transformational mechanisms and coloured accordingly.

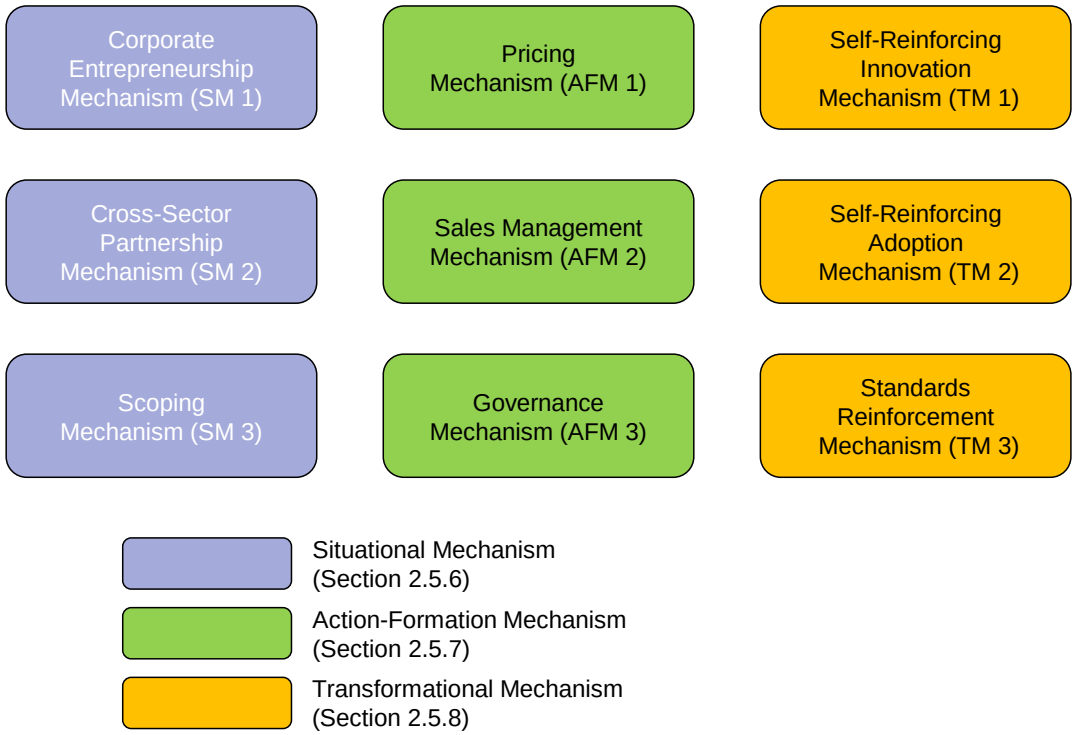

Figure 2.6 Mechanisms relevant to platform business model transformation

The first research question is derived from the preliminary analysis of the potential mechanisms affecting the platform business model transformation of a global information technology company. This first research question, presented as part of the conceptual framework in Section 2.7, aims to investigate the key causal mechanisms underpinning the platform business model transformation of a global information technology company for maritime freight logistics.

2.6 Platform business modelling

In management research, business model frameworks for the development of new business models or the modification of existing business models (business model innovation) are intensively examined (Foss & Saebi, 2017; Schneider & Spieth, 2013). However, the industry platform business places completely new requirements on a business model that must be oriented towards transaction markets, ecosystem management and new pricing models (Fehrer, Woratschek, & Brodie, 2018). Research on business model frameworks provides insights into the structuring, visualisation, communication and implementation of business models, which can be understood as a necessary starting point for business model innovations (Boons & Lüdeke-Freund, 2013). Since a substantial part of the existing literature on business models deals with business model frameworks, the relevant authors and their work on this topic are presented in the following section.

2.6.1 Determination of target industry for platform business

In the classic pipeline business with bilateral producer-consumer relationships, for which the existing business model frameworks are designed, the market focus is on the individual consumer (Parker *et al.*, 2016; Van Alstyne *et al.*, 2016). In the platform economy instead, the ecosystem of network members represents the target market (Palo & Tähtinen, 2013; Tura *et al.*, 2018). As shown in Table 2.2, the business model literature provides a heterogeneous view of how the target market of a service or product is determined and which corporate function is responsible for making such a decision. While some business model frameworks specify that the strategic decision for the target customers or target segments is made within the general core or product strategy (Zott & Amit, 2008), others propose a specific business model component for this purpose. With regard to the emerging platform economy, Tan *et al.* (2015) instead refer to an external influence in the form of an

opportunity or threat within a multi-stakeholder environment that triggers platform development.

Author	BM Component/ Corporate Function	Statement on Market Focus
Hamel (2002)	Core Strategy	*"Your company´s [..] market scope"*
Shafer, Smith, and Linder (2005)	Strategic Choices	*"Customer (Target Market, Scope)"*
Chesbrough (2007)	Target Market	*"Identify a market segment, that is, the users to whom the offering is useful and for what purpose"*
Zott and Amit (2008)	Product Market Strategy	*"What customers to serve?", "Which geographic markets to address?"*
Gawer and Cusumano (2008)	Platform Leadership	Coring and tipping as strategic options "*[..] to* tackle adequately both the technology and business aspects of platform leadership"
Johnson, Christensen, and Kagermann (2008)	Customer Value Proposition	*"Target customer"*
Osterwalder (2011)	Customer Segment	*"A business model may define [..] customer segments"*
Tan *et al.* (2015)	Strategy	*"…platform development is typically initiated by an environmental trigger"*
Gassmann *et al.* (2015)	Target Customer	*"Who is your target customer (segment)"*
Wirtz *et al.* (2016)	Customer Model	*"Target groups"*
Walter (2016)	Interaction Elements	No target market/customer related components

Table 2.2 Relevance of target market in the business model literature

2.6.2 Business model components

In the literature, scholars have been discussing business model components for many years. From Hamel's (2002) point of view, the components customer interface, core strategy, strategic resources and value network are the four main components of a business model, which are linked to each other via the three bridge components customer benefit, configuration and company

boundaries. Three years later, Morris *et al.* (2005) published a comprehensive study on 18 academic publications on business model frameworks, each of which consisted of four to eight components. A total of 24 different business model components were identified, 15 of which were used more than once. The following components were most frequently mentioned: Value Offering (11), Economic Model (10), Customer Interface/ Relationship (8), Partner Network/ Roles (7), Internal Infrastructure/ Connected Activities (6), Target Markets (5) (Morris *et al.*, 2005). Based on their analysis Morris *et al.* (2005) proposed an integrative six-component framework to characterise a business model, regardless of the type of company. They presented the components type of offering, target customers, internal capabilities, competitive strategy, revenue model and growth strategy and apply them on three different levels (foundation level, proprietary level, rules). In further developments, Amit and Zott (2010) focus on a company's activity system by introducing a holistic, multi-dimensional, business model innovation framework. Rusnjak (2016) in turn looks at the business model from different management and planning levels. The success of the business model therefore depends on the planning of all business model components (Wirtz *et al.*, 2016), which are managed at the strategic and tactical level and are operationalised at the operational level. Wirtz *et al.* (2016) have also analysed the existing literature on business models and presented the most comprehensive business model framework, which has a strategic, customer- and market-oriented as well as value creation component. Each of these components consists of three sub models. They analysed how these nine components (strategy, resources, network, customers, market offering (value proposition), revenues, service proposition, procurement, finances) were used in 16 of the most relevant business model frameworks in terms of intensity of use and component spectrum.

2.6.3 Business model frameworks

The business model frameworks discussed in this section are a conceptual compilation of various components and associated activities that can

constitute a platform business. However, these are only theoretical best practice assumptions derived from existing business models.

Business Model Canvas

The popular "Business Model Canvas" (Figure 2.7) - developed by Osterwalder (2011) - is widely adopted in business practice and considers nine interrelated business model components (de Oliveira & Cortimiglia, 2017; Joyce & Paquin, 2015): Customer segments, value propositions, key partnerships, key activities, key resources, cost structure, channels, customer relationships, revenue streams (Joyce & Paquin, 2015).

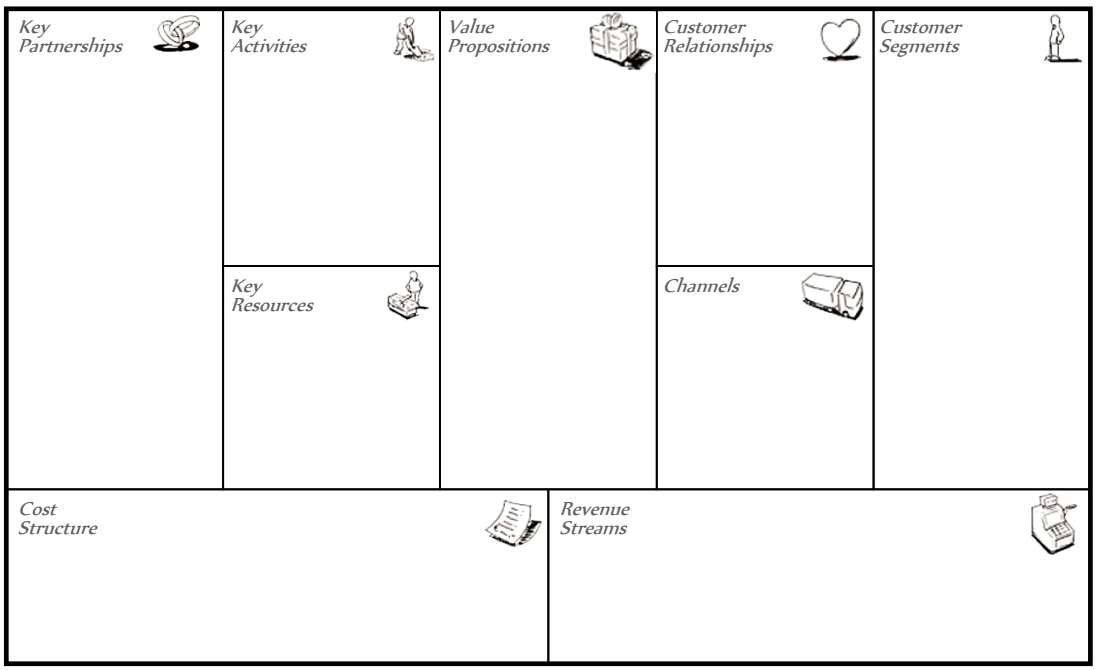

Figure 2.7 Business Model Canvas by Osterwalder (2011)

These components cover the four main areas of a business: customers, offering, infrastructure, and financial viability. In view of the global financial crisis, environmental incidents and global social imbalances, Joyce and Paquin (2015) have added two more layers (environmental and social layer) to the original business model canvas. The three layers of their Triple Layered Business Model Canvas illustrate more clearly how a company generates

economic, ecological and social value. Stähler (2015) postulates a business model framework that is similar to the approach of Osterwalder (2011) but still integrates the culture/values component. In this context, reference is also made to the relationship with the partner network, which has a decisive influence on corporate identity. Johnson *et al.* (2008) name value proposition, profit formula, key processes and key resources as the main components of a business model. Compared to Osterwalder (2011), however, partner networks are not considered separately, but as part of the key resources component.

In academic literature, the Business Model Canvas originally developed by Osterwalder (2011) is described as well suited to developing business models for companies in which a manufacturer serves the needs of consumers (Walter, 2016). This refers to the traditional value chain in which suppliers supply raw materials, semi-finished products or components to a manufacturer who sells the end products after further production steps (Parker *et al.*, 2016).

Business Model Navigator

According to Gassmann *et al.* (2015), companies must be aware of the strategic importance of business model innovations, but must also apply the methods that are suitable and appropriate for their development. In this context, they have analysed business models that have led to a disruption in their industry over the past decades and have found that more than 90% of these business model innovations are merely recombinations of well-known ideas, concepts and elements of business models from other industries (Gassmann, Frankenberger, & Csik, 2013a). Kim and Min (2015) also argue in the same direction that business model innovations are achieved either through their own technological innovations (original) or in response to new, disruptive business models of other players in the market (imitation).

Gassmann *et al.* (2015) have identified 55 samples of successful business model innovations that can serve as a template for a change in the company's own business model. For these 55 patterns, they have developed the St. Gallen Business Model Navigator, which is a more abstract representation compared to the Business Model Canvas by Osterwalder (2011). Their

business model framework is limited to four dimensions, which are represented in the "magic triangle" (Gassmann *et al.*, 2015, p. 2). This answers the four central questions of value proposition (What?), the value chain for the customer (How?), the target customer segment (Who?) and the revenue model (Value?) (Gassmann *et al.*, 2015). Pattern 52 (Diners Club (1950), Amazon Store (1995), eBay (1995)) is the starting point for business model innovations in multi-sided markets.

Platform Business Model Canvas

Van Alstyne *et al.* (2016) distinguish linear business models (pipelines) from networked business models (platforms). While linear business models enable a linear flow of goods and information from the producer to the consumer, networked business models allow users to create and consume value (Palo & Tähtinen, 2013). In this context, Walter (2016) argues that the application of the well-known Business Model Canvas (BMC) is limited in the dynamic environment of the emerging platform economy, as there are no longer linear A-B relationships (supplier-producer, producer-customer). Instead the basic principle of platform business models is to orchestrate a business network. The main point of criticism is the restriction to the nine predefined components, which, for example, do not include any platform services of complementors (Mauer & Faschingbauer, 2013; Weiner, Renner, & Kett, 2010).

With the Platform Business Model Canvas (P-BMC) Walter (2016) has developed an alternative approach to illustrate the structure of a platform business model framework (Figure 2.8). The goal of the platform owner is to enable an exchange of values between the three external parties - producers, consumers and partners (Walter, 2016).

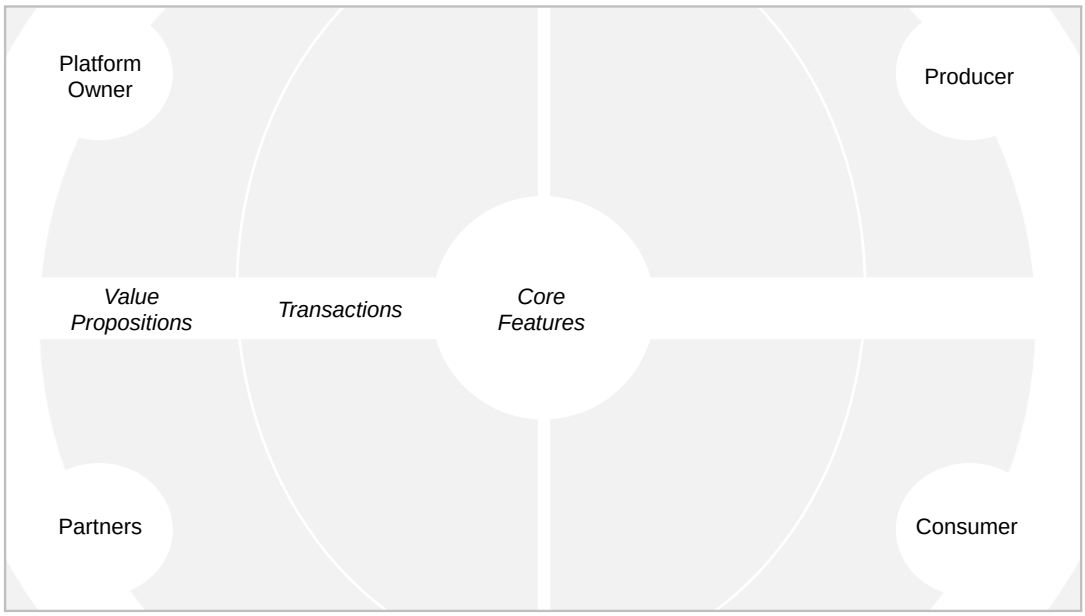

Figure 2.8 Platform Business Model Canvas
Source: (Walter, 2016) [Adapted]

In contrast to the BMC, the P-BMC has a circular structure and is divided into 4 quadrants that are assigned to the relevant stakeholder groups – platform owner, partners (complementors), producer and consumer. The P-BMCs focuses on the platform's key functionalities (core features), which are tailored to the needs of platform users and their interaction with the ecosystem. These core features, such as sophisticated algorithms for matching processes or search functions, interfaces for partners to place advertisements or to offer value-added services, determine the success of the platform. This results in platform transactions between the users of the platform, which then provide a benefit (value proposition) for the different user groups. However, this model has limitations because it only considers the interaction elements and technical functionalities of the platform. Relevant factors of the business model, such as a differentiated pricing model and the resources and activities required to operate a platform, are not the main focus.

The emerging platform economy (Kenney & Zysman, 2016) increasingly places new demands on service and software-oriented information technology companies. From the previous analysis of the business model frameworks, the question arises to what extent the existing business model frameworks are

suitable for implementing a platform business model (Kim, 2018). While the first research question poses the diagnostic question about the key causal factors active in the platform business model transformation, the second - solution-oriented - research question investigates the conditions for an effective application of the principles of platform business modelling. In connection with the main research areas of literature examined, the research questions are presented in the conceptual framework in the following section.

2.7 Research questions and conceptual framework for analysis

The aim of this section is to present a conceptual framework that illustrates the main research areas systematically examined in the literature review as well as the market conditions for platform innovations in their relationship to each other. Here, the empirical knowledge of the researcher on the research topic is also taken into account (Regoniel, 2015). Within the context of this qualitative research, the conceptual framework is a suitable instrument for visualising these main research areas of literature and their interrelations in a simplified form (Green, 2014) “with the purpose of understanding a problem" (Fain, 2017, p. 103). Figure 2.9 illustrates – starting from the perspective of a global information technology company (platform owner perspective) - the impact of blockchain-based industry platforms on the market conditions for freight logistics in the maritime supply chain (industry perspective) (Miles, Huberman, & Saldaña, 2014; Regoniel, 2015):

- *Supply chain collaboration* will be fostered by progressive digitisation based on blockchain technology, enabling a new form of collaboration in business networks and trust in secure transactions. The goal is to increase process efficiency through industry platforms in maritime freight logistics (Marinagi *et al.*, 2015).
- *Blockchain industry platforms* offer enormous potential for enhancing *efficiency in maritime freight logistics* through new forms of data transactions, including customs clearance and document processing.

- *Disintermediation* occurs when the value of industry platforms as disruptive innovations exceeds the value of international freight forwarders, brokers and agents and thus challenges their business models (Christensen & Overdorf, 2000; Pisano, 2015). As a result, the boundaries between the entities involved in the maritime supply chain are shifted (Emmrich, 2015).

The conceptual framework derived from the literature review serves the author as an orientation map for data collection in primary research by linking the research focus of the literature with the research questions (Green, 2014).

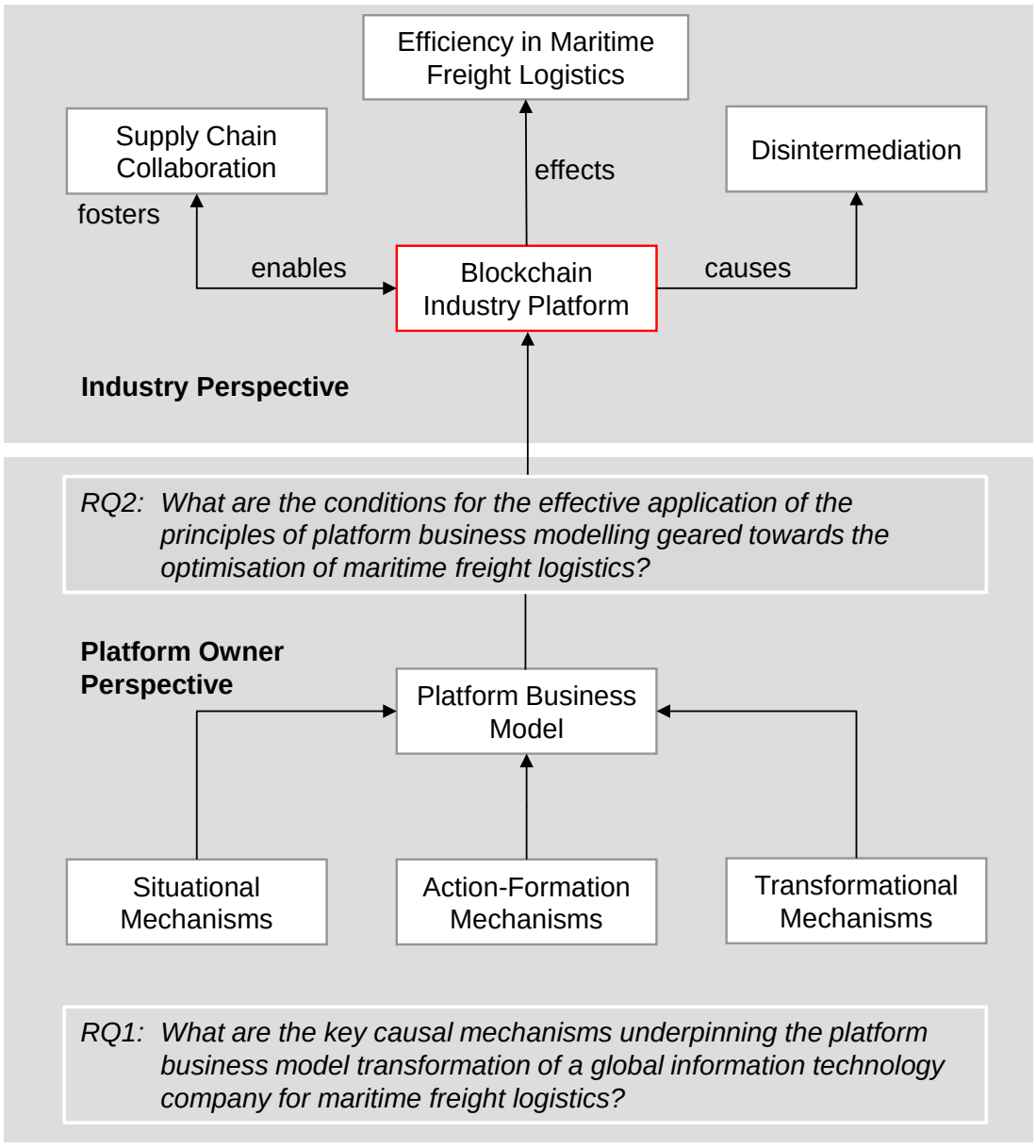

Figure 2.9 Conceptual framework for analysis

As illustrated in Figure 2.9, the operationalisation of the platform business model is influenced by various mechanisms – the *situational mechanisms, action-formation mechanisms and transformational mechanisms* - that have a positive or negative impact.
Therefore, the first - diagnostic - research question aims to examine the potential causal mechanisms identified in the literature with regard to their impact on the platform business model:

Research Question 1 *(diagnostic):*

> *What are the key causal mechanisms underpinning the platform business model transformation of a global information technology company for maritime freight logistics?*

The appropriate platform business model enables the development and operation of an industry platform for maritime freight logistics. The question arises as to whether the existing business model frameworks identified in the literature review are suitable to support a global information technology company in its strategic transformation from a software- and service-oriented business model into a platform business model. Therefore, the second - solution-oriented - research question is formulated:

Research Question 2 *(solution-oriented):*

> *What are the conditions for the effective application of the principles of platform business modelling geared towards the optimisation of maritime freight logistics?*

2.8 Chapter conclusion

In this chapter the market conditions for platform innovations in maritime freight logistics were discussed before the literature on industry platforms, business models, and the business model frameworks required to create them was critically analysed.

Market conditions for platform innovations in maritime freight logistics are of central importance for the strategic decisions of a global information technology company when establishing a platform business in this industry segment. The industry segment of maritime freight logistics is a multi-stakeholder environment with companies from the logistics and IT sector, but also with public authorities from the public sector which have different and sometimes contradictory interests. IT innovations such as blockchain-based industry platforms make it possible to make processes more transparent and efficient through increasing digitalisation on the one hand and to bring about a change in the industry structure through the disintermediation of intermediaries integrated into the maritime value chain on the other. This development will accelerate to the extent that the willingness to collaborate in the maritime supply chain increases. This willingness is precisely the foundation for new forms of data exchange - via blockchain-based industry platforms.

Since blockchain-based industry platforms - as the literature shows - are still in an early stage of evolution (Saberi *et al.*, 2018), there are considerable knowledge gaps - in practice and research. In the industry context of this study, blockchain-based industry platforms are of great relevance because they have disruptive effects on established industry structures and processes in the multi-stakeholder environment of maritime freight logistics. There is a wide-ranging debate in the literature and in practice about the benefits of blockchain technology and the compromise between data protection and transparency that is essential for the widespread adoption of this technology (Wu *et al.*, 2017). However, the formation of a required business-to-business ecosystem is challenging due to the complex relationships between the platform owner, its industry partners and the users of the industry platform.

Since the focus of this study is on the business model transformation of a global information technology company acting as a platform owner, the literature review has identified a need for further research in the area of business model innovation.

The research gaps can be summarised as follows:

- Lack of empirical research on the activity system of a platform operator and the causal mechanisms underlying it, which are important for the transformation from a software- and service-oriented business model into a platform business model
- Lack of understanding of platform business model frameworks and their components from which a platform business model for practice can be derived. This is, however, necessary to the extent that digitalisation and new technologies such as the blockchain technology are shifting established pipeline business models (Parker *et al.*, 2016; Van Alstyne *et al.*, 2016) into business models of a networked economy (Palo & Tähtinen, 2013).

The empirical investigation of the research questions in primary research should help to close these research gaps. In this context, Osterwalder´s Business Model Canvas (Osterwalder, 2011) with its nine business model components provides structural orientation in data collection and data analysis. In order to achieve this goal, the methodology underlying this study is therefore presented in the following chapter.

Chapter 3 Methodology

3.1 Introduction

This chapter presents the methodology underlying this study as described in Table 3.1. The starting point is the commitment of the researcher to the research position of critical realism, the ontological, epistemological and axiological dimensions of which underpin this study (Section 3.2). Section 3.3 explains why an inductive research approach was selected as a suitable research approach for this study. From this, an explanatory research design based on the criteria of a case study was derived in Section 3.4. The research design is presented as a framework for data collection and data analysis and the rationale for its applicability to answer the research questions is explained. Section 3.5 - data collection - is concerned with the use of available information sources and describes in detail the chosen qualitative method of data collection through semi-structured expert interviews and justifies their applicability. Here, the sampling strategy of purposive sampling followed by snowball sampling aims to identify appropriate interview participants in order to ensure the best possible quality of data collection (Section 3.6). Based on this, Section 3.7 – data analysis - describes the RRRE model (Resolution, Redescription, Retrodiction, Elimination) developed by Bhaskar (2013a, p. xvii) as the explanatory framework for analysis and evaluation of the collected data. Section 3.8 describes how the research results were validated by experts through unstructured interviews. Finally, the limitations (Section 3.9) and ethical considerations (Section 3.10) associated with the study are presented.

Theme	Characteristics	Application in this study
Focus	Studying complex social phenomena	Investigation of the platform business model transformation of a global information technology company for enhancing efficiency in maritime freight logistics
Research Position	Critical Realism	Credible explanation of causal structures which is precisely the strength of critical realism
Research Approach	Inductive	Inductive research approach that aims to generate new insights instead of testing it
Research Design	Single case study	Explanatory research design based on the criteria of a case study - focused on structures and institutional mechanisms
Data Collection	Qualitative	Semi-structured interviews with interview participants from different business units in order to obtain meaningful and rich data
Sampling Procedure	Non-probabilistic	Purposive sampling followed by snowball sampling
Data Analysis	Explanatory	RRRE model (Resolution, Redescription, Retrodiction, Elimination) developed by Bhaskar (2013a, p. xvii) as explanatory framework to explain the platform business model transformation

Table 3.1 Overview of the methodology underlying this study

3.2 Research position

This chapter discusses the research position of critical realism (CR) underlying this study along the dimensions of ontology, epistemology and axiology before presenting the methodology derived from it. For critical realists “the objective

of social science is not to predict but to explain” an outcome (Fleetwood *et al.*, 2017, p. 6). Therefore, the value of applying critical realism is to generate causal explanations and insights into structures and mechanisms underlying observable phenomena in open systems (Kaidesoja, 2013; Williams & Karahanna, 2013). Powerful credible explanations on causal structures and institutional mechanisms is precisely the strength of critical realism research (Hoddy, 2019; Wynn Jr & Williams, 2012). The aim is, therefore, to identify the key causal mechanisms underlying the platform business model transformation of an information technology company through which this observable business model transformation can be explained. In the following sections it is shown how the research questions derived from the literature are answered from a CR perspective.

3.2.1 Ontology

Ontology is concerned with the question of whether the social and physical world exists independently of humans (objective) or whether it exists only through the actions of humans or is constructed from their perceptions (subjective) (Bell, Bryman, & Harley, 2018; Orlikowski & Baroudi, 1991). In contrast to other research philosophies that have ”flat ontologies” (Sayer, 2000, p. 12) critical realists are committed to a “stratified or depth ontology” (O’Mahoney & Vincent, 2014, p. 9) that distinguishes between the three levels or domains of reality (Bhaskar, 2013b).

In this layered ontology of critical realism the *empirical level* is the domain of observations and experiences, whereby these phenomena are always “mediated through the filter of human experience and interpretation" (Fletcher, 2016, p. 183). The *actual level* focuses on the mechanisms that cause these empirical observations and experiences, regardless of whether they are perceived or interpreted (Nastar, Boda, & Olsson, 2018). These phenomena, in turn, are the result of causal structures and causal mechanisms that exist on the *real level* (Bhaskar, 2014b). Figure 3.1 illustrates this layered ontology of CR.

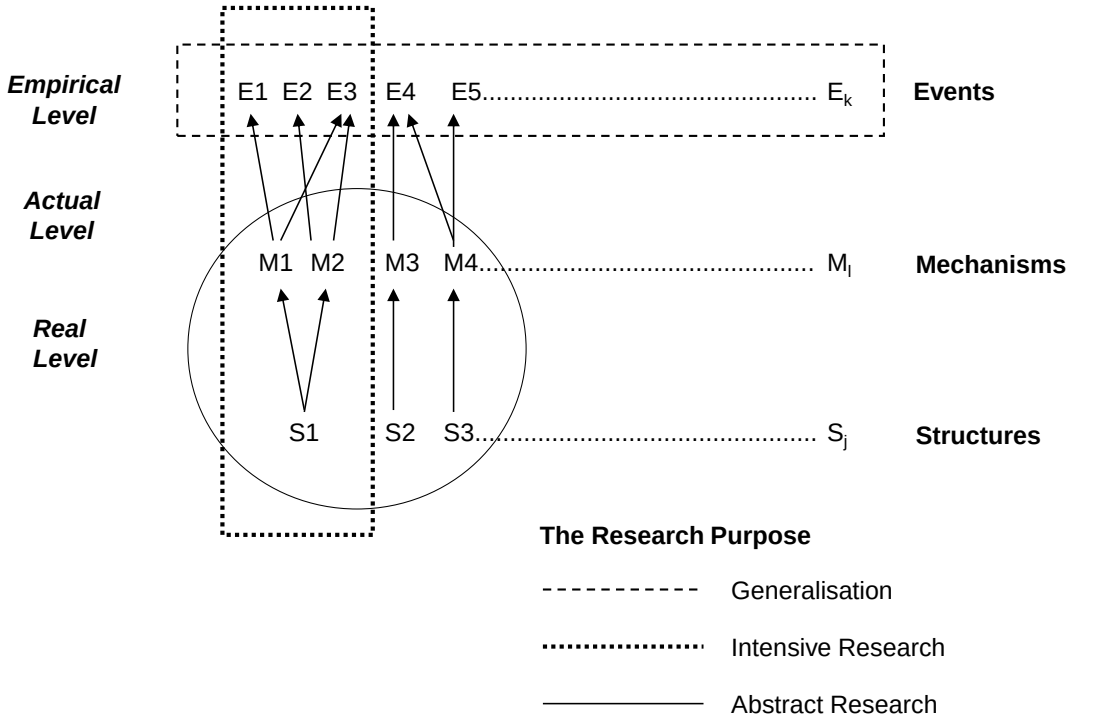

Figure 3.1 Layered ontology of CR
(Bygstad & Munkvold, 2011b; Sayer, 2010)

While the aim of positivist research is to determine regularities from observable phenomena and to derive explanations and predictions from them (Easton, 2010; Mingers & Standing, 2017), CR research, instead, aims to investigate mechanisms and structures which are not observable but which trigger observable phenomena (Bygstad, 2010). Critical realism is therefore grounded in abstract research, not "to uncover general laws, but to understand and explain the underlying mechanisms" (Bygstad & Munkvold, 2011b, p. 3). Accordingly, a typical intensive research design (Danermark *et al.*, 2005) covers all three levels of the layered ontology of CR and is concerned with “what makes things happen in specific circumstances” (Sayer, 2000, p. 20).

Hedström and Swedberg (1998, p. 2) have the “vision of an explanatory sociology that contains of an ensemble of such fundamental mechanisms that can be used for explanatory purposes in a wide range of social situations”. In contrast, Roberts (2014) argues that the result of a mechanism depends on the context, i.e. the interaction with other mechanisms. Although it is possible to gain an understanding of the functioning of a specific mechanism, it is not

possible to predict its outcome in a different context, as it can interact with or be influenced by a number of other mechanisms (Fleetwood *et al.*, 2017; Smith, 2010). Due to this contingent causality, CR research therefore cannot claim to be able to make predictions about an outcome (Smith, 2010). However, the observed phenomena are triggered by the "generative mechanism or causal structure at work" that can be studied in the domain of the real but remain inaccessible in the domain of the actual and the domain of the empirical (Bhaskar, 2013a, p. xvii). This is comparable to a buyer and a seller who agree on a price in a price negotiation situation. While the actual negotiation process can be observed at the empirical level, the underlying market mechanism of supply and demand remains hidden (Bygstad & Munkvold, 2011b).

From the researcher's point of view, one of the objectives of this study is to become aware of the stratified realities that are important by designing and implementing a platform business model in a global information technology company. This understanding is necessary to identify the causal generative mechanisms in the domain of the real and thus deeper levels.

3.2.2 Epistemology

Epistemology is the branch of philosophy concerned with the nature of knowledge, the rationality, and justification of belief (Wynn Jr & Williams, 2012). The researcher shares the constructionist´s view that knowledge is constructed by human beings and that knowledge is fallible (not perfect). Thereby, the development of knowledge is driven by the creation of causal explanations. In social sciences often only the traditional ontological dichotomy between the objectivist approach with quantitative methods (positivism) and the subjectivist approach with qualitative methods (interpretivism) is described (Hurrell, 2014; O'Mahoney & Vincent, 2014). But both schools of thought have difficulties representing the sole claim to truth convincingly throughout the evolution of philosophy. In consequence, this contradiction between the positivist and interpretivist research philosophy is addressed by the philosophy

of critical realism that seeks to *understand* mechanisms and structures that cause observable phenomena (Easton, 2010; Jesper & Árni, 2008).

However, since an approach is meaningless without the contextual understanding, Bhaskar (2014a) has introduced *context* to the social sciences through his principle of the *context mechanism outcome triple* (CMO). This means that the researcher is not seeking for a correlation to explain the observed phenomena (O), but rather explores the causality (M) and how the investigated phenomena are linked in an existing context (C) (O'Mahoney & Vincent, 2014). In this way, it is impossible for the researcher to be independent of his research subject (Ackroyd & Karlsson, 2014).

3.2.3 Axiology

Axiology is concerned with the value commitments of the researcher underpinning this study. While the positivist´s belief is that research is value-free and independent of the researcher (Gammelgaard, 2004; Sachan & Datta, 2005), the researcher shares the interpretivist´s belief of a value-laden nature of (social) research and that the researcher is part of the object being studied. (Hirschman, 1986). Following Bhaskar (2013a), research is driven and impregnated by values - which contradicts the positivist stance of value-free research. The term "critical" within CR refers to the commitment to change unsatisfactory realities, which is made possible by the "role of knowledge in human self-emancipation" (Benton & Craib, 2010, p. 120). In this study, the common interests of the relevant stakeholder groups are pursued as opposed to the individual interests of dominant individuals. However, sustainable changes can only be realised in the global information technology company if the motives of the social actors from the various stakeholder groups and the corresponding institutional structures and mechanisms are understood. By accepting reality and at the same time recognising the importance of social interaction with the object of study, more reliable results can be achieved (Mingers, 2004). From the researcher's point of view, research makes a positive contribution to business practice, since the findings of research can

help to change an unsatisfactory situation. In the context of this study, the existing software- and service-oriented business model of a global information technology company can be transformed into a platform business model - with the goal of developing and operating industry platforms. These industry platforms in turn enable new automated transactions and communication processes between the parties involved in maritime freight logistics, which significantly enhances efficiency in the maritime supply chain.

3.3 Research approach

The research approach is derived from the researcher´s research position and is the procedure "that spans the steps from broad assumptions to detailed methods of data collection, analysis and interpretation" (Creswell & Creswell, 2017, p. 3). In general, social science distinguishes between deductive and inductive research approaches (Bell *et al.*, 2018). However, in contrast to other research philosophies that only accept deductive or inductive approaches, CR research is not restricted to a specific approach, but selects the appropriate approach based on the research questions to be answered (Ackroyd & Karlsson, 2014; Denzin & Lincoln, 2011; Fletcher, 2016). This double recognition is a modern approach in social science research (O'Mahoney & Vincent, 2014). Consistent with the ontological and epistemological assumptions of CR (Hoddy, 2019), this study uses an inductive research approach whose "inductive strategy of linking data and theory" aims to generate new insights instead of testing it (Bell *et al.*, 2018, p. 23). Such inductive approaches "predominate within CR research" (Hurrell, 2014, p. 243) because they provide deep analytical insights (Vincent & Wapshott, 2014) into the interaction of mechanisms. These mechanisms are triggered by stakeholder behaviour and conflicting interests at the "micro-level" (Mangan, Lalwani, & Gardner, 2004, p. 568). Furthermore, critical realism does not only rely on inductive approaches, but usually combines induction and deduction (abductive approach) (Jennings, 2015). Starting from the theory and the derived conceptual framework, new topics or ideas should also be able to

emerge inductively in primary research (Fletcher, 2016; Parr, 2013). In the following, the research design selected for this study will be derived from this inductive research approach.

3.4 Research design

This section explains why the chosen research design as framework for data collection and data analysis is well suited for answering the research questions (Bell *et al.*, 2018). In line with the philosophy of critical realism, this study follows an explanatory research design (Yin, 2017) based on the *criteria of a case study research design* (Wynn Jr & Williams, 2012). The intention is to explain the observable "social phenomena" (Parr, 2013, p. 197) through causal institutional mechanisms. Such an approach is also suitable because the associated empirical research was carried out in a global information technology company (TechCorp), which represents *the case* for this study (Nayager & Van Vuuren, 2015). TechCorp is a leading global provider of hardware, software and IT services and one of the world's largest consulting firms. Innovation capabilities and permanent product and process innovations - supported by research and development (R&D) - are a decisive factor of the corporate strategy and are intended to ensure competitiveness. However, business model innovations are becoming increasingly important in order to transform the software- and service-oriented business model into a platform business model.

A case study research design is best suited to gain new insights in the research field of platform business model innovation, where little research has been done so far. The case study is the predominant research approach in business-to-business research (Easton, 2010) and is considered to be the most appropriate in “early phases of new management theory, when key variables and their relationships are being explored” (Gibbert, Ruigrok, & Wicki, 2008, p. 1465). The platform business model as an unit of analysis (Täuscher & Laudien, 2018) with its dynamic dependencies (Eisenhardt, 1989) is viewed in the industry context of maritime freight logistics and is thus not isolated from

its "rich, real-world context” as compared to a laboratory experiment (Eisenhardt & Graebner, 2007, p. 25).

Due to the diversity of information and the detailed analysis of the analysis unit, it is possible that new knowledge will be generated through this research approach (Eisenhardt, 1989). Thus, the goal of this study is to build new knowledge and not to test hypotheses.

3.5 Data collection

This section describes in detail the chosen data collection method and critically justifies its applicability and the use of available information on the case under investigation. In line with the research philosophy of critical realism, the starting point of data collection is an idea about possible structures and mechanisms that trigger the perceived events at the empirical level (O’Mahoney & Vincent, 2014). Due to the unstructured, open approach, qualitative methods in primary research are well suited to verify such assumptions or to develop new explanations (Bell *et al.*, 2018). Therefore, data collection through interviews as “the predominant method of data collection in qualitative research” (St. Pierre & Jackson, 2014, p. 715) has been chosen for this study because the research questions require an explorative approach. In advance, different methods were examined for their applicability, which, however, were not considered for this study for the following reasons:

Method	Justification for rejecting the method for this study
Participant Observation	The views of experts on a platform business model are based on industry knowledge and analytical reflections on existing processes. Participant observation is rejected because mechanisms that influence these views cannot be identified and revealed through this method. Participant observation is in particular being used to observe actors and their behaviour in their environment (Di Domenico & Phillips, 2012) with the aim of understanding the reasons for human behaviour in a particular context (Guest, Namey, & Mitchell, 2013).
Focus Group	Focus groups are not suitable for discussing a strategic and business-critical research topic (Clifford, Cope, Gillespie, & French, 2016) - like an emerging platform business model - in an early market phase, since the "group context may not be appropriate to discuss sensitive issues" (Harrell & Bradley, 2009, p. 11). The function or hierarchical position of the participants can also prevent individual participants from expressing their personal opinions comprehensively and in depth (Bell *et al.*, 2018). In addition, there are restrictions on bringing together the necessary, globally distributed experts in a focus group for reasons of time and budget.
Self-Completion Questionnaire	This method has not been chosen because self-completion questionnaires for new strategic topics can simply be rejected by the participants and do not reveal the context of an answer as with in-depth interviews (Patten, 2016). While the researcher intends to consider new aspects when investigating the dynamic platform business model transformation, the use of static self-completion questionnaires in primary research does not allow new aspects to be flexibly included (Patten, 2016).

Table 3.2 Overview of considered methods and reasons for their rejection

Instead, data collection through semi-structured interviews has been chosen as the prevailing method, "to obtain both retrospective and real-time accounts

by those people experiencing the phenomenon of theoretical interest" (Gioia, Corley, & Hamilton, 2013, p. 19). The semi-structured interview is well-suited for this explanatory empirical study in a research field where existing literature and research is limited (Bell *et al.*, 2018). It offers the researcher the flexibility to deepen the context with the interview participants or to develop new ideas that have not been considered so far (Clifford *et al.*, 2016; Harrell & Bradley, 2009). Since the semi-structured interview allows improvisation and examination of the research topic, it can be conducted in such a way that the interview questions will be planned, but do not necessarily have to be conducted in a certain order (Runeson & Höst, 2009). In order to gain a comprehensive understanding and differentiated view of the research topic, the semi-structured interviews were conducted with consultants from Business Consulting, logistics subject matter experts (SMEs) from Industry Solutions/Platforms and experts from Research & Development (R&D). Although Creswell (2015) proposed a minimum sample size of 3-5 participants along with other data for case study research, the number of interviews was not initially set. Instead, data were collected over a period of fifteen months from April 2017 to July 2018 (Table 3.3) until theoretical saturation (Bell *et al.*, 2018). Theoretical saturation is the point at which “incremental learning is minimal” (Eisenhardt, 1989, p. 545) because the data collected begin to repeat the cycle (Glaser & Strauss, 2017). This was achieved after a total of 11 semi-structured interviews were conducted. The interview participants were all randomly male. However, this is in accordance with the chosen sampling procedure of purposive sampling, which does not dictate the gender of the interview participants, but instead focuses on the richness of the information (Ritchie, Lewis, Nicholls, & Ormston, 2013; Tongco, 2007).

Year/ Month	Acronym	Function Interview Participant	Functional Group	Region
2017/04	S-1	Subject Matter Expert – Freight Logistics	Industry Solutions	Americas
2017/04	S-2	Subject Matter Expert – Freight Logistics	Industry Solutions	Americas
2017/07	C-1	Business Analyst	Business Consulting	Europe
2017/07	S-3	Subject Matter Expert – Maritime Freight Logistics	Industry Solutions	Asia-Pacific
2017/07	C-2	Solution Manager	Business Consulting	Asia-Pacific
2017/07	R-1	Research	R&D	Europe
2017/07	C-3	Consulting Manager	Business Consulting	Europe
2017/08	C-4	Consultant	Business Consulting	Europe
2017/09	S-4	Solution Manager	Industry Platforms	Americas
2018/02	R-2	Research	R&D	Asia-Pacific
2018/07	IND-1	Subject Matter Expert – Supply Chain Management	Industry Platforms	Europe

Table 3.3 Interview participants of the study for data collection

For the interviews, which lasted between 60-90 minutes, a predefined interview guide divided into four sections was used (Appendix 3: Interview guide). After the opening questions in Section 1, the questions in Sections 2 and 3 served to gain a deep understanding of the research topic and to obtain interview data for answering the research questions before the interview ended with the closing questions in Section 4. Due to the interviews with experts from different geographical regions (Americas, Asia-Pacific and Europe), the interviews were conducted in bilateral conference calls with audio conference function, which also ensured clarity of audition and accurate recording of the data.

Furthermore, in order to improve the results of this study, four further interviews with selected experts were conducted in a conversation and discussion format after data analysis and answering the research questions. This will be discussed in detail in Section 3.8.

3.6 Sampling procedure

In line with the philosophy of critical realism, the researcher has chosen a *purposive sampling* strategy followed by *snowball sampling*. In the non-probabilistic form of purposive sampling (Onwuegbuzie & Collins, 2007; Ritchie *et al.*, 2013), the research questions provide an indication of which interview participants should be involved (Bell *et al.*, 2018). On this basis, the researcher then selected interview participants according to his assessment (Black, 2011) of who was able to provide information based on their knowledge or experience (Ritchie *et al.*, 2013; Tongco, 2007). In order to ensure the best possible quality of the research results, specific criteria were defined according to which the potential interview participants were selected for the semi-structured interviews (Bell *et al.*, 2018):

a. No restriction on age, gender or origin
b. At least 5 years of employment to ensure an understanding of internal business processes
c. Industry knowledge about the transportation sector and maritime freight logistics
d. Understanding of the sales process and implementation of industry solutions/platforms
e. Knowledge of the significance of business models and their operationalisation for implementing a platform strategy

The interview participants were selected from the following business units of the global information technology company, as people who are involved in the design and operationalisation of a platform business model (Figure 3.2):

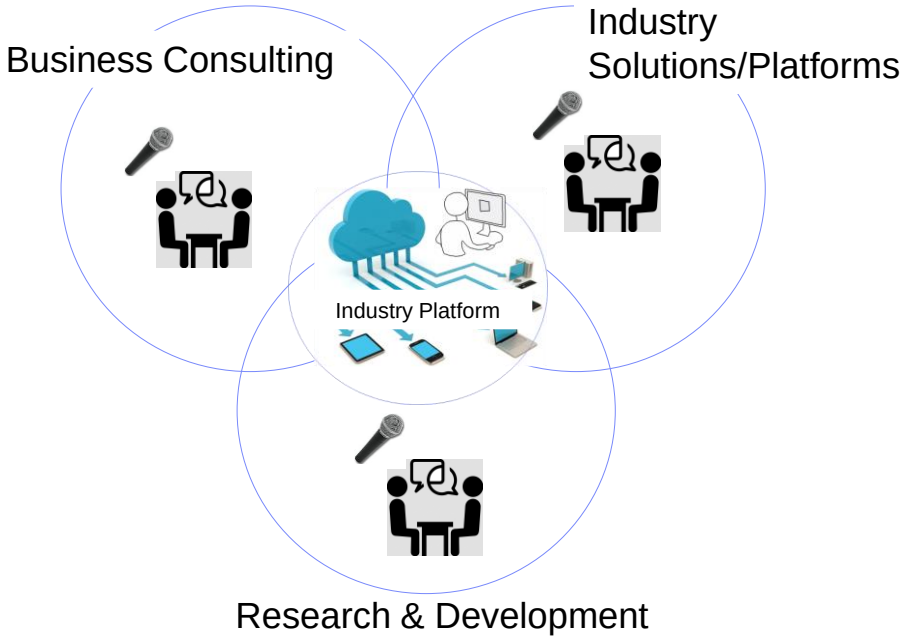

Figure 3.2 Business units from which interview participants are selected

Business Consulting: Business consultants develop industry platforms and integrate them into the business processes and IT applications of clients.

Industry Sales: Industry experts sell industry solutions to clients as they have a deep understanding of the processes in the maritime supply chain and the complex industry structure with different types of logistics service providers.

Research & Development: Research & Development executives are responsible for designing the product and market entry strategy.

The interview participants identified new potential interview candidates whose participation in the study was considered useful from their point of view *(Bernard, 2017).* This snowball sampling as a form of non-probability sampling is a useful way to “pursue the goals of purposive sampling” by using the first informants to nominate other potential interview candidates (Given, 2008, p. 815). Due to this “referral mechanisms”, this sampling strategy results in an ever-increasing number of potentially knowledgeable respondents for the researcher (Chiappa, 2013, p. 58).

3.7 Data analysis

This section describes how interview data is transformed for systematic use and explains the analytical framework for the subsequent data analysis.

3.7.1 Transformation of data

The data collected in the empirical study were transformed in such a way that they can be used for analysis in the various phases of the RRRE model. As shown in Table 3.4, this process can be divided into five steps.

No.	Analysis Step	Analytical Focus
1	Transcription	Literal transcription of the interviews and - in the case of interviews in German - translation into English
2	Definition of Initial Coding Categories	a. Definition of initial coding categories for business model components b. Definition of initial coding categories for key causal mechanisms
3	Coding	a. Analysis of the interview data with regard to their relevance for answering research questions b. Assignment of the codes to the initial coding categories
4	Refinement of Coding Categories	Creation of sub-categories
5	Creation of Coding Scheme	Creation of a coding scheme with coding categories on different hierarchy levels
	Iterative Sequence of Steps 3 and 4	

Table 3.4 Iterative coding process

After conducting the interviews, the recordings were literally transcribed to ensure that all information can be used (step 1). Interviews conducted in German were translated into English. The literature review has indicated that the Business Model Canvas of Osterwalder (2011) with the components of customer segments, value propositions, key partnerships, key activities, key resources, cost structure, channels, customer relationships and revenue streams is a suitable unit of analysis and that the codes can be captured according to this structure (Battistella, De Toni, De Zan, & Pessot, 2017). In step 2, a first coding scheme was created, structured according to the business model components of the Business Model Canvas and the causal mechanisms identified in the literature. In the third step, coding was carried out immediately after the transcription process as an important analytical step to break down the interview data into small sequences (Bell *et al.*, 2018) and to assign them to the initial coding categories (Simons, Lathlean, & Squire, 2008). In this context, NVivo was used as computer-assisted software for qualitative data analysis (CAQDAS) to support the coding and data analysis process. In step 4, the codes were then grouped into subcategories and the coding scheme refined. Steps 3 and 4 were performed iteratively until all interviews were analysed and a complete coding scheme was created that transparently structures the interview data for content analysis. On this basis, the coding scheme with coding categories on up to 3 hierarchy levels was created in step 5.

Figure 3.3 illustrates the coding scheme (level 1) developed for data analysis.

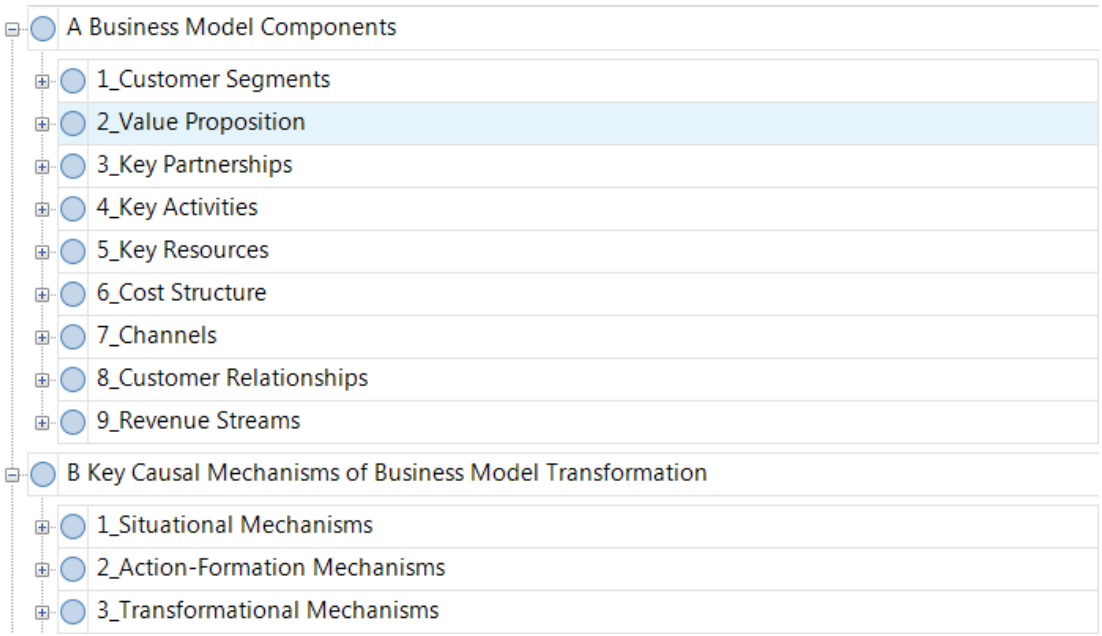

Figure 3.3 NVivo coding scheme for structured capturing of interview data

3.7.2 The RRRE model

The starting point for this study was the transformation of a software- and service-oriented business model into a platform business model, which the researcher observed (Bygstad *et al.*, 2016; Yin, 2017). This phenomenon was affected by processes in the complex and dynamic system of the global information technology company under consideration. Therefore, management research can make an important contribution by explaining the mechanisms that trigger the platform business model transformation (Mingers & Standing, 2017).

For data analysis, the **RRRE** model developed by Bhaskar (2013a, p. xvii) is the explanatory framework to explain the phenomenon by “resolution of a complex event into its components, theoretical redescription of these components, retrodiction to possible antecedents of the components and elimination of alternative causes”. When using the RRRE model, it is important to emphasise that phase two (redescription) and phase three (retrodiction) are

not possible without reference to the existing research and available literature examined in Chapter 2 (Fleetwood *et al.*, 2017).

The first phase of the RRRE Model is about **R**esolution of a complex phenomenon into the relevant causal entities (Bhaskar, 2014b), which may have a causal effect on the phenomenon observed (Wynn Jr & Williams, 2012). In this study, the components of the business model represent the causal entities which control the operational activity system in the global information technology company in order to implement the platform strategy. This activity system is created and designed by business units, individuals and systems and their interaction (Bygstad *et al.*, 2016; Sayer, 2000).
In the second phase of theoretical **R**edescription (abduction), the causal entities are redescribed or recontextualised (Mingers & Standing, 2017) in the context of existing theories (Fletcher, 2016). In this way, the components will be abstracted by applying "hypothetical conceptual frameworks and theories about structures and relations" to interpret and explain the phenomena in a new context (Danermark *et al.*, 2005, p. 110). This gives social scientists the opportunity "to understand previously taken-for-granted phenomena in a novel way" (Meyer & Lunnay, 2013, p. 9). With regard to the business model innovation considered in this study, this may mean that the theory of the Innovator's Dilemma can no longer be fully applied to the emerging industry platform business and the observable phenomena are therefore not sufficiently explainable.

In the third phase "**R**etrodiction to possible causes" (Bhaskar, 2013a, p. xvii), the observed phenomena are explained with hypotheses about mechanisms in the domain of the real (Bygstad *et al.*, 2016; Easton, 2010) "which are capable of producing them" (Sayer, 2010, p. 72). With a mechanism-based approach, potential mechanisms that influence the transformation of the company's business model into a platform business model can be identified and categorised.

In the fourth phase of **E**limination, a plausible justification is provided for the generative (Bhaskar, 2013a, p. xvii) or key mechanisms from the multitude of

mechanisms identified in the third phase that “have better explanatory power than alternatives” (Bygstad *et al.*, 2016, p. 4). Independent evidence and empirical analysis are used to eliminate alternative mechanisms until the generative mechanisms that triggered the observed phenomenon are identified (Wynn Jr & Williams, 2012). This approach is crucial for a successful design and implementation of the company´s platform business model focusing on maritime freight logistics.

Table 3.5 summarises the individual phases of the RRRE model Resolution (R), Redescription (R), Retrodiction (R) and Elimination (E) with their analytical focus and explains how these phases are applied in this study.

Phases	**RRRE Model**	**Analytical Focus**	**Application in this study**
Description of phenomenon			
Phase 1	***Resolution***	…of a complex phenomenon into its causal entities (causal analysis)	Causal entities affecting the platform business model are systematically categorised (as observed in the domain of the empirical)
Phase 2	***Redescription*** *(Abduction)*	…of component causes	Redescription of the causal entities in light of existing theory and the knowledge about business model innovations discussed in the literature review
Phase 3	***Retrodiction***	…to possible mechanisms which are capable of producing the phenomena observed	Identification of possible causal mechanisms operating in the open system with different social stakeholders - affecting the design and implementation of a platform business model
Phase 4	***Elimination***	…of possible alternatives	Independent evidence and empirical analysis to identify the generative mechanism that triggered the observed phenomena

Table 3.5 The RRRE model from Bhaskar (2014b)

3.8 Validation of research results

After analysing the collected data and answering the research questions, the results of this study were validated with four interview participants selected according to the purposive sampling method (Table 3.6). In line with the research philosophy of critical realism, the aim was to obtain feedback on the results of this research study. The validation interviews were carried out as unstructured interviews in a conversation and discussion format in the period from February to March 2019.

Year/ Month	Acronym	Function Interview Participant	Functional Group	Region
2019/02	V-1	Industry Leader – Travel & Transportation	Industry Platforms	Europe
2019/02	V-2	Blockchain Business Development Executive	Industry Platforms	Europe
2019/02	V-3	Consulting Manager	Business Consulting	Europe
2019/03	V-4	Director Blockchain Solutions	Industry Platforms	Europe

Table 3.6 Interview participants for validation of research results

For the interviews, which each lasted about 60 minutes, a guideline was used, containing - visualised – the approach and the main research results of this study (Appendix 4: Presentation for validation of research results). The guideline was structured in such a way that the interview participants were able to understand the research approach and the research results. Starting from the research aim, the industry context of maritime freight logistics was introduced. Subsequently, the main areas of literature were outlined before the applied methodology was explained. The discussion focused on the explanatory model and the “4/9 Platform Business Model Canvas” as the main research results of this study. The interview was conducted in such a way that each slide of the guideline was interactively discussed with the interview participants. Critical - positive or negative - feedback from the interview

participants was explicitly requested by the researcher. The feedback of the interview participants was used to substantiate certain statements of the analysis and to refine the research results. The relevant aspects resulting from the validation process will be discussed and highlighted in the following chapters.

3.9 Limitations

This methodology is not without limitations. However, these limitations are consistent with the research philosophy of critical realism underlying this research.

The researcher acknowledges that the findings of a single case study are not representative or generalisable in the traditional positivist sense (Eisenhardt & Graebner, 2007; Flyvbjerg, 2006). Nevertheless, the persuasiveness and quality of the theoretical conclusions allow the results of the case study to be applied not only to this case under investigation but also to other situations in a similar (industry) context (Bell *et al.*, 2018). Consistent with critical realist philosophy the strength of this research approach resides in the extension of knowledge and generalisation through a deeper understanding of causal mechanisms under certain conditions (Easton, 2010). The purpose of case study research is precisely the inductive building of theory and not its deductive verification (Eisenhardt & Graebner, 2007). Generalisations can then also take the form of concepts or rich insights (Walsham, 2006), which is made possible by "generalising empirical description to theory" (Lee & Baskerville, 2003, p. 237). Yin (2009, p. 15) concludes that “case studies, like experiments, are generalisable to theoretical propositions and not to populations or universes. In this sense, the case study, like the experiment, does not represent a ‘sample’, and the researcher's goal is to expand and generalise theories (analytical generalisation) and not to enumerate frequencies (statistical generalisation)”.

The business relevance of this study is that the research results serve as a catalyst for action (action stimulus) in order to initiate positive action to improve

current practice. Although there are numerous mechanisms in every open system, the aim is not to find as many mechanisms as possible in the research context, but to identify key mechanisms (Bygstad & Munkvold, 2011b). These key mechanisms are those with the strongest explanatory power with regard to the empirical evidence, i.e. the causal structure that best explains the observed events (Bhaskar, 2013a, p. xvii). Therefore, data collection and analysis is repeated until the explanatory power of these key mechanisms becomes apparent.

Since the interview participants from the business units Business Consulting, Industry Solutions/Platforms and Research & Development have been purposefully selected, the sampling procedure is, therefore, not random but targeted (Bell *et al.*, 2018). Here, it is the declared aim to gain rich insights into the research topic from key informants, in the awareness that the results cannot be generalised for the entire stakeholder group (Bell *et al.*, 2018). A decisive approach to excluding the biases of a professional stakeholder group is to consider the research topic with experts from different business units, hierarchical levels and geographies (Eisenhardt & Graebner, 2007). Although the biases in data collection and analysis are mitigated, the findings of the interviews are influenced by the subjective perception and interpretation of the researcher, which, however, is in line with the philosophy of critical realism.

3.10 Ethics

This section addresses the ethical aspects underlying this study. The basic principle of ethical behaviour is not to harm the individuals interviewed or the organisation as the case under investigation (Israel & Hay, 2007; Simons, 2009). Before conducting the interviews, the participants were informed in detail about the aim and procedure of the study by providing them with a participant information sheet with possible questions and answers (Appendix 1: Participant information). The interview participants then gave their informed consent to participate in the interview by signing a research

consent form, which guarantees anonymity, confidentiality of the data and the right to withdraw from the interview at any time (Appendix 2: Research consent form). All information collected in the course of this study will be kept strictly confidential (Runeson & Höst, 2009). The data has been made anonymous and participants cannot be identified in any report or publication. Only the researcher has access to the data stored securely on a password-protected notebook with an encrypted hard disk. After completion of the research work and submission of the thesis, the data of this study will be stored securely on an encrypted hard disk for potential publication for a maximum of five years and then deleted. The guiding principles for data storage and deletion are the Edinburgh Napier University's Data Protection Code of Practice (Edinburgh Napier University, 2017) in conjunction with the German Federal Data Protection Act (Bundesdatenschutzgesetz), in particular Section 40, processing and use of personal data by research institutes (Bundesministerium der Justiz und für Verbraucherschutz, 2015).

3.11 Chapter conclusion

This chapter has presented the researcher´s philosophical stance in relation to critical realism and the research methodology underlying this study. It has been argued that CR provides the means to achieve the aim of this study and to overcome the limits of the opposing approaches of positivism and interpretivism in the context of logistics and information technology research. CR following a layered ontology is a suitable perspective to generate - in light of the research questions - causal explanations and insights into structures and mechanisms of the open system under investigation. In line with the philosophy of critical realism, this study follows a qualitative research approach from which an explanatory research design, based on the criteria of a case study, has been derived. Although the researcher acknowledges that the results of a case study are not representative or generalisable in the traditional positivist sense, the purpose of this case study research is - consistent with the research philosophy of critical realism - the extension of knowledge and

generalisation through a deeper understanding of causal mechanisms in context (analytical generalisation). The data from primary research will be collected - in consideration of ethical principles - from experts of a global information technology company. This is done through semi-structured interviews, as this qualitative method is well suited for this explanatory empirical study in a research field where existing literature and research are limited. The RRRE model developed by Bhaskar (2013a, p. xvii) is an appropriate explanatory framework for the analysis of the obtained data in order to answer the research question by satisfactorily explaining the causal mechanisms underlying the platform business model transformation. The research results were then finally validated by expert interviews.

Chapter 4 Findings and Analysis

4.1 Introduction

This chapter presents the key causal mechanisms underpinning the platform business model transformation of a global information technology company that have been identified through data analysis. It begins in Section 4.2 with a reiteration of the key features of Bhaskar's RRRE model (Bhaskar, 2013a, p. xvii) used as the explanatory framework to structure the data analysis. As the first level of analysis the observed business model transformation into a platform business model is presented in Section 4.3. The following sections are then structured according to the phases of the RRRE model. In Section 4.4 the causal entities are identified which have a causal effect on the platform business model transformation before these are redescribed against the background of the market conditions in maritime freight logistics (Section 4.5). Section 4.6 then aims to identify the potential causal mechanisms underlying the relevant causal entities. The key mechanisms that significantly cause the platform business model transformation are then identified in Section 4.7. After completing the analytical RRRE cycle, this chapter concludes by presenting an explanatory model of the causal entities with their underlying mechanisms and their relations to each other in Section 4.8.

4.2 Explanatory framework

The RRRE model is used as the explanatory framework for data analysis to explain the phenomenon by "**R**esolution of a complex event into its components, theoretical **R**edescription of these components, **R**etrodiction to possible antecedents of the components and **E**limination of alternative causes" (Bhaskar, 2013a, p. xvii). In the resolution stage, the primary data collected is analysed and the causal entities that might have a significant causal effect on the observed phenomenon are identified. In this phase, the data analysis was

carried out along the components (customer segments, value propositions, key partnerships, key activities, key resources, cost structure, channels, customer relationships and revenue streams) of Osterwalder´s Business Model Framework (Osterwalder, 2011), which was discussed in detail in the literature review. After this, the main purpose of the redescription stage is to validate these causal entities identified against existing theory on industry platforms and business model innovations. This leads to the retrodiction stage, which focuses on a comprehensive break down of these causal entities to identify the generative mechanisms underlying them. Finally, the - elimination stage – aims to eliminate the least probable causes and to identify the *key causal mechanisms* that impact the platform business model transformation under the given conditions in maritime freight logistics.

4.3 Observable events in the platform business

The first level of analysis is concerned with the transformation of the platform business model observed by the researcher and his informants (Bygstad *et al.*, 2016) with regard to the emerging industry platforms for maritime freight logistics:

> *Driven by blockchain technology, the software- and service-oriented business model of a global information technology company has been transformed into a platform business model with the goal of providing industry platforms in the multi-stakeholder environment of maritime freight logistics.*

This phenomenon is based on empirical observations that "the researcher tries to explain" (Wynn Jr & Williams, 2012, p. 804) by identifying the key causal mechanisms and structures within the complex and dynamic system of the global information technology company that cause the platform business model transformation (Volkoff, Strong, & Elmes, 2007). Based on these findings, concrete recommendations for action for executives are derived, the implementation of which can have a possible positive effect on a future platform business.

4.4 Resolution: Identification of causal entities

The first phase of the **R**RRE Model is about **R**esolution of the complex business model into its relevant causal entities (Bhaskar, 2014b) which may have a causal effect on the transformation of the existing software- and service-oriented business model into a platform business model for maritime freight logistics. For the initial analysis, the following business model components, which influence the operational activity system in the global information technology company in the implementation of the platform strategy, are regarded as causal entities. This follows the logic of value creation as stated below:

1. **Customers** in maritime freight logistics have specific needs
2. Global IT companies respond to these needs with a **Value Proposition** through blockchain-based industry platforms.
3. **Key Partnerships** are required to successfully respond to this offer
4. Global IT companies must perform **Key Activities** in the platform business
5. Global IT companies need **Key Resources** to perform these key activities
6. **Costs** must be planned, and investments are necessary
7. Sales **Channels** must be established and used
8. **Customer Relationships** must be developed
9. **Revenue Streams** result from sales activities

Information obtained from the interviews was systematically structured and evaluated in NVivo. In the following, these are used in the phase of resolution to describe the business model components, whereby each business model component is described with a summary of the essential characteristics before these are substantiated by key statements of the informants. These key statements are highlighted by indenting. The goal here is to work out the essential characteristics of the business component against the background of the domain knowledge of the researcher.

4.4.1 Customer Segments

Customers are network members who interact with the industry platform in order to use and provide data. These network members belong to the customer segments *provider of data* and *user of data*. Table 4.1 lists the network members that respondents identified as relevant for a platform business model.

Specification of Component
1_Customer Segments
11_Shippers (user of data)
12_Freight Forwarders (user of data)
13_Liner Shipping Companies (provider of data)
14_Ports/Port Authorities (provider of data)
15_Terminal Operators (provider of data)
16_Inland Transport Companies (provider of data)
17_Authorities/ Customs Authorities (provider of data)

Table 4.1 Specification of component Customer Segments

4.4.2 Value Propositions

Table 4.2 lists the elements that respondents identified as relevant to a platform business model in relation to the business model component "Value Propositions".

Specification of Component	Informants	References
2_Value Propositions	**9**	**116**
20_Achieve E2E Visibility	7	19
21_Apply Blockchain Technology	9	31
22_Enable trusted Transactions	2	5
23_Enhance Automation	4	12
24_Promote Digitisation	2	5
25_Enhance Service Level	2	11
26_Be a trusted Platform Provider	5	19
27_Create Business Networks	5	14

Table 4.2 Specification of component Value Propositions

Summary of the essential characteristics describing the component

From the informants' perspective, the value proposition of a global information technology company operating an industry platform is that it achieves E2E visibility and transparency in the maritime supply chain. By applying blockchain technology, which ensures tamper-proof and trustworthy transactions for exchanging information, the degree of digitalisation and automation can be increased significantly. This can only be achieved if the participating network members have confidence in the performance of the platform provider and their ability to create relevant business networks in maritime freight logistics.

Main evidence in the domain of ‘E2E Visibility’

Most informants mentioned E2E visibility as the most important characteristic of the value proposition of an industry platform for maritime freight logistics.

This is because the existing solutions "…*don't provide the end to end spectrum right now and they certainly don't solve, in many cases, the visibility problem nor do they solve the paper problem..."* (S-2). R-1 emphasises the importance of an industry platform where:

> *"…different providers can connect and exchange data and access data to increase the visibility throughout the end-to-end supply chain…*".

The same view is shared by S-1, who specifies that "…*the estimated arrival time, the duration, the estimated departure time and all information around the containers being loaded and unloaded are on a single platform...".*

Main evidence in the domain of 'Blockchain Technology'

To achieve this, all the informants interviewed believe that blockchain technology is of particular importance for the transformation of the maritime supply chain or as S-2 puts it:

> *"…Yes, blockchain in this industry, I think is going to revolutionise things quite a bit".*

C-3 also sees blockchain as a catalyst for changes, which *"…really enables the transformation at a technical level to address a lot of the key impediments that many would have otherwise put up".* S-4 concretises this statement by explaining that this technology provides:

> "…*a single source of truth that can be trusted across multiple parties involved in any kind of trade transaction. And, therefore, it allows to quickly resolve issues because of the ability to trust the data...".*

Main evidence in the domain of 'Automation'

For the first time, industry platforms with blockchain technology offer new possibilities to automate processes and increase efficiency - in an industry that is characterised according to S-1 through *"…one-to-one peer communications between all of these stakeholders in different systems, different formats, and different reliability and different timetable".* He describes processes in maritime

freight logistics, which are characterised by *"…e-mails, faxes, messages and pieces of paper that can virtually all be eliminated by two things: The creation of a standard platform and the digitisation of documents".* From the point of view of S-4, this leads to operational efficiency as it *"…reduces time with respect to resolution, creates the ability to identify problems and enables exception handling as issues occur in the logistics due to disruptions".*

Main evidence in the domain of 'Trusted Platform Provider'

Frequently raised aspects in respect of the value proposition of a global information technology company providing an industry platform refer to the capabilities of the platform provider. This relates to

> *"…the features of reliability, security and the fact that the operator of the industry platform has scalability, global scalability, cross border scalability…"*

and the ability to ensure *"…compliance with multiple jurisdictions"* (R-2).

Main evidence in the domain of 'Business Network'

According to the majority of informants, an important prerequisite for quickly scaling an industry platform is the *"…advantage of having a broad customer base"* (C-1). In order for these customers to use an industry platform, however, it is important that the platform owner has neutrality and ensures sustainability for the operation of the platform, or as C-1 puts it: *"An IT provider can actually act as an honest broker being more neutral and not having a real stake in the business itself".* On this basis, the platform owner can build up the business network, whereby global information technology companies have a decisive advantage, since they

> *"…already have these large business networks that operate today"* and the ability to lead "…*regulatory discussions, legal discussions and getting the network together"* (R-2).

4.4.3 Key Partnerships

Table 4.3 lists the elements that respondents identified as relevant to a platform business model in relation to the business model component “Key Partnerships".

Specification of Component	Informants	References
3_Key Partnerships	**9**	**61**
31_Industry Partners	9	43
32_Third-Party Service Vendors	5	11
33_Government Initiatives	1	1
34_Associations	3	6

Table 4.3 Specification of component Key Partnerships

Summary of the essential characteristics describing the component

The informants have reported that the industry partnership with companies from the logistics industry is a key success factor in the development and provision of an industry platform. However, a particular challenge is to align the interests and goals of an industry partner with those of the IT provider and to define a commercial model. Collaboration with third-party vendors is also important, as their services can be linked to the industry platform, making it more attractive to users. Finally, it makes sense for the platform owner to participate in government initiatives and industry associations in order to develop industry expertise and establish contacts with potential users of the industry platform in the ecosystem.

Main evidence in the domain of ‘Industry Partners’

All informants have highlighted the importance of industry partners participating in the development and introduction of an industry platform since “…*a technology company is not seen as the right partner for discussing*

industry specific requirements..." (R-1). S-4 confirms this opinion by adding that global information technology companies:

> "…*need industry credibility. And partnering with these organisations that are industry experts and industry leaders allows … to come out with a solution to the market"*.

This approach is "…*the new way of doing business… . And if we don't do these kind of partnerships then we are not in a space for the future and that's the very simple reason why we need to do it..."* (S-4). But C-2 also addresses the area of conflict when customers with whom a long-standing customer-supplier relationship exists have to become equal partners: "…*I think the importance of key partners cannot be overstated in this context while at the same time they are your customers. It indicates their relative importance, since you have the same entities on both sides of the equation…"*. In addition to their role as a key user of the platform, however, it is important to collaborate with:

> "…*partners who are shaping, driving and funding the solution itself..."* (C-3).

R-2 also believes that the success of a joint industry platform is more likely to be achieved "…*through the formation of a separate independent joint venture entity which is likely to have more adoption than if it were just a solution..."* by one of these parties.

In this context, the partnership model becomes relevant. S1 indicates:

> "…*that the future model for platforms are likely to require a consortium approach. I think that these platforms will have to be owned probably by two or three different players who can create a degree of independence and not to be seen to be a monopoly...".*

This is the advantage of a global information technology company since it can *"…bring a consortium together where each of the consortium members … would be willing to reach out to each other...."* (C-2). To what extent a consortium is necessary, however, is somewhat controversial. While C-3 shares the view that *"…a consortium of companies …would be the ideal model..."* S-4 believes that "…*we only need one of these partners to be the*

anchor to replicate the solution. And once the anchor of the solution is identified, then it's just replicating the same model with other providers, other partners...". However, R-2 still refers to the shareholding model of the joint venture, since investments are initially only contributed by the founding members. From his point of view, it is important in order *"…to drive adoption, that the joint venture has to dilute their own stake and give stake..."* to new shareholders over time.

A major challenge in designing the partner model, however, is to take into account the different goals of the participating shareholders. While the goal of the global information technology company as a platform provider "…*is to build a solution and make money from it"* (S-2) the goal of the industry partner *"…is to delight and satisfy all their customers and deliver on all their promises and those two goals don't always line up..."* (S-2). From the perspective of C-4, it is therefore essential to find partners,*"…that we can trust and work forward with...".* A further problem in the cooperation is also that the industry partners who participate in an industry platform compete with each other in the market or how S-3 concretises it: …*whilst they do work well together in some areas of some of the alliances, they also compete very rigorously within the alliances and across the alliances..."*. In addition, the liner container shipping industry has *"…no real industry body like you have IATA in the airline industry…"* (S-3), which, as a neutral institution, is able to moderate different interests. S-3 even believes that, *"…until such time as that industry body is in place and has the strength and has the support of the main carriers, then it's going to be very difficult for the industry to drive platforms".* Therefore:

> "…*the trickiest part is obviously the commercial model and the business model..."* (R-2).

This view is also shared by C-4 who sees the greatest challenge in the design of the business model: "…*What does the business partnership look like? And how is that going to ensure that the input from across the various ecosystem participants is incorporated into the platform…".*

Main evidence in the domain of 'Third-Party Service Vendors'

In order to increase the attractiveness of the industry platform and thus the user adoption, partnerships with third-party vendors "…*who have capabilities that are needed … or that are complementary"* (S-2) are also very important. Other informants share this view that, "…*there is a potential for other value-added services which could be provided by others, not the joint venture…".* (R-2). Accordingly. it is necessary that:

> "…*we are continuously enhancing the platform and are looking at the various as-is and to-be applications that can be brought onto the platform…" (C-4).*

Another relevant approach is to partner or collaborate with existing platform providers or system providers with the aim to *"…leverage data from each other…"* (R-2) or as S-3 puts it: "…*Ideally, let's take the strengths from what each of those have, bring those energies together and then have a much stronger industry platform…".* R-2 also points out that:

> *"…standardisation and interoperability with other business networks is something which comes up a lot in all our conversations around blockchain and business networks and trade and logistics…".*

S-3 also highlights the benefits of customer acceptance, since partnering with other third-party platform providers *"…gives immediate penetration into the market … for those customers…"* using the complementary platforms.

4.4.4 Key Activities

Table 4.4 lists the elements that respondents identified as relevant to a platform business model in relation to the BM "Key Activities".

Specification of Component	Informants	References
4_Key Activities	**5**	**175**
41_Gain Market Insight	2	9
42_Transform Business Processes (Business Process Reengineering)	5	22
43_Manage Ecosystem (Ecosystem Management)	3	23
44_Develop Platform (Platform Development)	5	38
45_Promote Platform (Platform Promotion)	4	21
46_Manage Platform (Platform Management)	4	14
48_Establish Platform Sales Model	5	44
49_Establish new Management System	1	4

Table 4.4 Specification of component Key Activities

Summary of the essential characteristics describing the component

A key activity in the industry platform business is to obtain market insight, in order to transform the business processes in maritime freight logistics through industry platforms on this basis. A central aspect is the cross-industry implementation of standards in data exchange for freight and customs documents as well as status events. The platform development is aimed at this goal by using blockchain technology to create an immutable, security rich and transparent shared network that provides each participant E2E visibility based on their level of permission. Other key activities are to promote the industry platform via various sales channels in order to acquire new users from the ecosystem and to manage the industry platform with suitable governance. In order to increase the value of the industry platform for the users, the ecosystem consisting of industry partners, third-party vendors, authorities and users should be continuously developed. When transforming a software- and

service-oriented business model into a platform business model, one of the key tasks is to establish a new management system and sales model in the global information technology company.

Main evidence in the domain of 'Gain Market Insight'

S-1 sees the advantage of a global information technology company in establishing an industry platform as being that *"…we do get an insight into all interfaces, their information exchanges right across the logistics supply chain…".* From the point of view of S-2, it is even a key task:

> *"…to continually try to understand the businesses that they serve and to create innovative solutions that solve real business problems for those companies…"*

and *"…the internal and the external factors that our clients in this market have to deal with on a regular basis*….". But such an *"…approach needs to be very structured in order to go to the market, to talk to the market, to see what the market needs and how the market can collaborate…"* (S-3).

Main evidence in the domain of 'Business Process Reengineering'

All informants agree that it is necessary to transform business processes in the maritime freight logistics industry through:

> *"…common standards for exchanging information…"* (C-1).

Since *"… the big players didn't come together like in the airline industry and formed something like an IATA to agree on common standards…"* standardisation is "…*a key enabling factor of getting these companies to improve their operations and increase the data sharing possibilities between them"* (C-2). Therefore:

> *"…issues like standardisation, regulatory acceptance, legal acceptance are much more key in the discussions around an industry platform, because that impacts an entire industry…"* (R-2).

Main evidence in the domain of 'Manage Ecosystem'

C-3 shares this view by pointing out that *"…an industry platform … does more than just define standards but actually connects the ecosystem together in a comprehensive way…"* (C-3).

One of the key activities of a global information technology company is to build and manage such a business network of partners and users:

> *"…with the goal to join the various stakeholders together and also to allow third-party vendors or developers to build additional added services…in order to create network effects"* (C-1).

S-2 shares this view as he points out that *"…we are building the solution, but in order for the solution to work, you have to have the ecosystem of players participate…".*

Main evidence in the domain of 'Develop Platform'

The central task of the IT operator, however, is to build the platform through the use of IT capabilities, since the global information technology company has:

> "…*all the tools and methodologies and approaches to be very successful in implementing IT, whereas, in most public companies their IT is not the main function"* (S-2).

Here, *"…we are not looking to create a single kind of end to end solution for all the different players. We are more looking and creating assets that enable us to create a large environment for specific industries"* (R-1) while "…*we try to take care of reused extendibility"* (C-1). According to C-4, one of its main tasks is to determine the right phases for platform development because *"…we are not going to go ahead and build a platform at one go. The platform could have been built in multiple components…".* In this context, R-2 specifies the development priorities:

> *"Since we are currently looking into industry specific requirements to build such a platform, the key activities we are currently driving are around blockchain…".*

One reason for this is that:

> *"…privacy and security can be encapsulated into a solution with blockchain technology"* (S-2).

Data security practices are, hence, so important, because *"…we are handling commercially sensitive data … even if you suggest that through a blockchain solution the IT vendor would not actually have access to the commercially sensitive information"* (C-2).

Main evidence in the domain of 'Promote Platform'

Another key activity is the promotion of the industry platform and the onboarding of customers on the platform - accompanied by the right marketing for an independent industry platform, because *"…marketing is more important than the actual solution"* (C-2). A central point here is:

> *"…without a doubt the articulation of the business value proposition that we lay out in front of the customers. Because it is not like a service sell or a 'software as a service' sell for joining the industry platform. Very often I have seen that we struggle in articulating the business value of an industry platform"* (R-2).

However, if the value proposition of the industry platform is clear, a major task lies in onboarding the ecosystem: "…*that initial onboarding work, especially early on in the process, early on in the maturity of the platform, is a lot of work that needs to be done. And that's very much a consultative effort"* (C-3).

Main evidence in the domain of 'Establish Platform Sales Model'

However, the sales success of a global information technology company depends decisively on whether a suitable platform sales model is implemented

in the company that also supports *"…commercial innovation"* (S-1). The starting point is the:

> *"huge shift … away from hardware and software business to solution oriented and business-oriented business. Because that requires a different skill and a different go to market model. Sales are still … focusing on one single product or single kind of solution. Now, this is not helping if you try to establish an industry platform because this will involve a lot of different products and solution parts. So, you need someone who is agnostic to any kind of hardware or software product. And you also need to better understand the business side. … It is more a kind of a relationship throughout the whole sales cycle than just selling something"* (R-1).

Main evidence in the domain of 'Management System'

Nevertheless, this requires a complete realignment of the management system and the sales model or as R-1 puts it:

> "*We need a lot of changes. So, it's not just about the skills, it's about the culture and the management system that is above such kind of organisations. And you need some kind of measurements; you need to have some kind of structures within your enterprise to be able to handle the overall business. But on the other side, this is hindering us of course in the drive to be able to be as flexible and risk taking as a start-up".*

Although a "…model has not yet been worked out on how to sell platform solutions" (S-1) some informants already formulate thoughts on designing the solution or managing the requirements. *"You need subject matter experts who can speak the language of the industry to help organisations make that decision"* (C-4) and *"… people with a very wide helicopter view because a requirement from one participant might have very unwanted consequences three steps down the line - in a completely different industry"* (C-2). From the point of view of C-2, this, therefore, also requires a model in which sales

representatives are "…*interacting with each other who have never interacted with each other because they were working for different industries"* (C-2).

However, S-1 refers to the fact that:

> "*… one of the new challenges for legacy IT companies is to know how to treat revenue recognition, which goes from a capital investment … to a revenue-based over time based on unknown volumes".*

*W*hile S-2 sees a greater importance in a global sales team, which is sector and industry independent S-1 recognises a decisive problem in the existing assignment of globally operating individual customers to local sellers and indicates that this model *"…is completely unable to sell platforms which are multi-industry".* C-4 complements this statement by emphasising that *"…obviously the incentive for local teams is always to sell local since they don't receive a credit for global solutions. …It will not even be possible to split revenue because P&L's are always held at the local levels. So, for the P&L to be transferred from one local geo to another local geo is often tricky and sometimes probably not possible as well".*

4.4.5 Key Resources

Table 4.5 lists the elements that respondents identified as relevant to a platform business model in relation to the business model component "Key Resources".

Specification of Component	Informants	References
5_Key Resources	**4**	**53**
51_Industry Platform Offering	2	10
52_Organisational Structure	3	14
53_Industry Expertise	3	8
54_Technological Capabilities	4	21

Table 4.5 Specification of component Key Resources

Summary of the essential characteristics describing the component

The central technical resource is the industry platform as an IT application, which is offered to networked members of the maritime supply chain involved in data transactions. In order to develop, sell and operate the industry platform, it is necessary to establish a new organisational structure in the global information technology company, which represents the functions of the relevant human resources. Key resources here are industry expertise and technological skills, the combination of which is crucial for the development of global, cross-industry platforms.

Main evidence in the domain of 'Platform Offering'

An industry platform in maritime freight logistics has to be:

> *"…an industry-leading platform. You can't have multiple platforms doing the same things because that would then be very disruptive for the participants, most importantly the shipper and the consignee… It is a strong case for very strong industry platforms"*

[since otherwise] "*you need to have, in your internal systems, those APIs or interfaces … to be able to support those different formats* (S-3). S-3 can imagine such few industry platforms *"…specific to individual trade lanes that operate on the Transatlantic Northwest Continent to South America trade route, ... Transpacific and … Asia-Europe. So, I think to target one single platform would be ideal".*

Main evidence in the domain of 'Organisational Structure'

Such a platform business requires new organisational structures within the company, which are represented by the new "… *business unit called 'Industry Platforms' … that has been set up specifically to set up, build, run and earn income from providing industry platforms"* (S-1) [and which operates] *"…definitely globally"* (S-2). According to R-2 a strategic importance is given to the:

> *"…corporate business development team who is the primary entity looking at these business models, and the main investment decisions".*

They decide whether the global information technology company "…*should continue to be a usual technology player or an outsourcing infrastructure player versus …should invest in forming an industry platform"* (R-2). When creating an industry platform:

> "…*subject matter experts"* (C-4) are needed from an industry point of view, while *"…research and development ensure that we keep on top of the latest technologies"* (C-1).

As far as the development of an industry platform in the maritime ecosystem is concerned, C-1 refers to the two important key roles of *"…a programme manager who deals with the customer relations and manages the project from a governance perspective"* and a business analyst *"…who translates what the clients want into what the delivery team can actually build and implement".* In this way, *"…the delivery is not going to be local but driven from a global centre"* (C-4).

Main evidence in the domain of 'Industry Expertise'

Another key resource:

> *"…that´s vital also for a technology company to succeed in this industry … is to have freight and industry and supply chain specialist knowledge and expertise. …Industry knowledge and industry content is relevant, and clients expect their technology providers to understand their business."*

C-1 shares this view. "Leveraging our broad knowledge of the shipping industry in general and our relationships … is something that I think we can bring to bear to make our proposition even more interesting".

Main evidence in the domain of 'Technological Capabilities'

In addition to in-depth industry expertise, comprehensive technological skills are required. "…*you need to have strong technological capabilities, you need to be able to design, build and successfully deliver projects"* (S-1). S-4 recognises an advantage when a global information technology company has "…*experiences with strategic outsourcing and global process services ... for a long time. So, we know how to do process outsourcing. ... So, it's just bringing that expertise into offering this kind of a platform".* For this purpose,

> *"…technology companies are from a technical perspective much better positioned to run these platforms, since we do have the servers and the knowledge to keep systems up and running"* (C-1).

As supply chain visibility *"…should happen in real time, then you probably need to have a global presence and you need to have different sites around the world that will take responsibility for specific regions"* (R-1). In addition, from C-1's point of view, users expect from the "…*platform owner not only to have that platform available but also services to integrate the various systems".*

4.4.6 Cost Structure

Table 4.6 lists the elements that respondents identified as relevant to a platform business model in relation to the business model component "Cost Structure".

Specification of Component	Informants	References
6_Cost Structure	**4**	**26**
60_Platform Development	2	2
61_Marketing Expenditures	1	1
62_Customer Acquisition Costs	1	1
64_Capital Investments	4	22

Table 4.6 Specification of component Cost Structure

Summary of the essential characteristics describing the component

The platform development, marketing and service provision of an industry platform entails costs for the platform provider. While on the one hand it is necessary to find a partner for the co-investment, on the other hand it is equally necessary to acquire internal funding.

Main evidence in the domain of 'Platform Development'

In addition to the running costs for operating the industry platform, development costs are a major element of one-time-costs *"…so, it's our resources on the ground and in the delivery centre plus … licenses of the software products that we are using* (C-1). However, in contrast to traditional services and software business:

> "…*sales costs are definitely higher because we are spending so much time in forming a business network, getting people to agree to be part of an ecosystem"* (R-1).

Main evidence in the domain of 'Capital Investments'

But network effects can only be created if *"…a business unit owns this product and has a budget to market it…".* A decisive factor for the market success of a platform innovation is to finance the actual initial platform development through investments and to cover possible running costs in the initial phase. S-3 considers this aspect critically, since:

> "…*we haven't seen a lot of investment. So, it's going to take a technology company that's… going to play in this market … and willing to invest".*

C-4 sees investment decisions dependent on whether a client can be won for a joint investment in the platform business: *"So we are not going to invest in a platform without a standing client to proceed with, so, therefore, all the investment is co-shared…"* or as C-2 puts it: "*I think the trickiest part of the platform business is the upfront cost and the investment required, unless you have a launching customer. But even then, the upfront investment is higher*

because you need to make sure that your solution is scalable, flexible, and generic enough to be able to accommodate the industry requirements instead of just the requirements of a single client. So, there are definitely additional costs involved in the initial investment". Platform innovations based on industry partnerships also change the revenue model through:

> *"…transaction-based pricing or new business model pricing, to take the risk upfront by the partnership and benefit more in the later part of the relationship with the customer"* (S-4).

Nevertheless, the informants agree that, it has to be part of the strategy that the global information technology company:

> "*… is pre-investing in creating such platforms because we are aware that we cannot wait until we have a large signing…"* (R-2).

Therefore, it is important that a budget has "…*been allocated and that budget is what's fuelling, not only the business development but also the actual application development"* (S-2). However, "…*whether or not it's a joint venture you need a really strong business case … to invest.* But such initiatives in the platform business have to be:

> *"… transformational. They have to leverage some of the key things we're trying to do in the market, Blockchain, IOT, Cognitive".*

Although there is a *"…corporate strategy that acts as a kind of internal venture capitalist, … the funds were rather limited.* Therefore, C-1 suggests including external "…*venture capitalists and see… whether you can actually not get $150,000 but $50 million to really get something out with good apps, with good interfaces, with the buy in of some bigger clients…"*

4.4.7 Channels

Table 4.7 lists the elements that respondents identified as relevant to a platform business model in relation to the business model component "Channels".

Specification of Component	Informants	References
7_ Channels	**2**	**13**
71_Direct Sales	1	1
72_Digital Sales Channel	2	5
73_Partner Sales Channel	2	5
74_Business Partners	1	2

Table 4.7 Specification of component Channels

Main evidence in the domain of 'Direct Sales'

The existing or to be established sales channels must ensure that customers are acquired successfully for the industry platform. "*The more quickly you can plug and play it, the better it gets. So that warrants a relook at our sales channels. And today our sales channels are … developed through a relationship with the IT"* (S-4). R-1 also addresses this issue by mentioning that:

> *"… [an] industry platform is more business oriented…. because it solves the problems that you have in the line of business…. So, what we see is the shift over the last couple of years in many industries. We see a shift from IT budget and IT responsibilities from the traditional IT department to the line of business departments. And these are the people who don't care about a single software package or a single service. They are looking for an overall solution that is fixing their business problems".*

Main evidence in the domain of 'Digital Sales Channel'

In addition to customer coverage through local client representatives for:

> "… *small trucking companies to a large shipping organisation and the ports and the government and maybe even the insurance companies -, … another way to go to market is through digital sales channels. Large organisations may warrant face-to-face interaction, but smaller organisations can deal with online and digital onboarding certainly the*

more you are adding value. It is through the Internet, through social media, through people … who are coming directly to the website and signing up for the solution" (S-4).

But from the perspective of R-2 *"…digital sales channels are not unique to industry platforms. We are adopting digital sales channels … for our existing product and services portfolio.*

Main evidence in the domain of 'Partner Sales Channel'

Another option is to use partner sales channels. Industry partners such as liner shipping companies *"…have different entry points into ports and terminals, and … the big shippers"* (C-2). However, C-3 has a critical view of this by describing that *"… their relationships are really at a much lower level in the organisation. It is very operationally focused. They are selling to people that are responsible for executing these transactions …. But what is more important is the C-level".*

Main evidence in the domain of 'Business Partners'

Another important sales channel for the global information technology company is that it does not necessarily cooperate with *"… the shipping lines themselves but with a vendor of solutions that have already a big base of clients. … and want to have a platform that can use the data that their solution generates. So, we have contacts with big terminal operators and vendors of gate operations systems"* (C-1).

4.4.8 Customer Relationships

Table 4.8 lists the elements that respondents identified as relevant to a platform business model in relation to the business model component "Customer Relationships".

Specification of Component	Informants	References
8_Customer Relationships	**7**	**10**
81_A_Maintain Customer Relationship	7	10

Table 4.8 Specification of component Customer Relationships

Main evidence in the domain of 'Maintain Customer Relationship'

The Customer Relationship to Platform Clients is different in platform business compared to hardware and software sales.

> *"There is a huge difference in the kind of relationships you build with the client, and also in the sustainability of these relationships"* (R-1).

While hardware or software clients after some years are easily *"…able to choose another partner to run their environment … they are much more hooked into a specific industry platform… If you have a good relationship with your client, they are more open to you and talk about their pain points, about required improvements of such a platform … Because requirements are changing and therefore it is necessary to be involved … not just to provide the technology, but to provide the overall solution that is sustainable for the industry"* (R-1). From the point of view of R-2, however, maintaining the customer relationship requires a:

> *"…complementary skill. Like the way you will sell or onboard customers onto an industry platform, you need the same amount of conversations around ROI, incentives or the value of an ecosystem to keep the customer relationship alive, intact, and flourishing".*

C-4 adds that, "…*there are some big important players that are critical to making the entire ecosystem work – freight forwarders and the major shipping lines … and large major shippers around the world - the automotive companies, P&G's and people like that".* In contrast to a broad customer base with smaller companies, with which communication is mainly via electronic channels, the large industry and platform-relevant users *"…require more hand holding and personal touch"* (C-3). However, C-4 sees this direct relationship management represented by local sales teams with strong customer loyalty: *"The global team does not go ahead and maintains a steady customer relationship. … Our time is already split across so many accounts unless there is a huge pressing need, we cannot cold call or we cannot go ahead and just do regular relationship building in an account".*

One problem, however, is that industry clients in maritime freight logistics have a lack of trust and concern about monopolies:

> "*So, if IT companies start building these platforms, there would be a lot of questions about whether people would use platforms that were owned by such a powerful industry* (S-1).

S-1 concluded, therefore, that these IT companies have to consider:

> "…*a partnership, a consortium".*

4.4.9 Revenue Streams

Table 4.9 lists the elements that respondents identified as relevant to a platform business model in relation to the business model component "Revenue Streams".

Specification of Component	Informants	References
9_Revenue Streams	**8**	**39**
91_Revenue Sharing with Partners	3	6
92_Platform Revenue (as Platform Operator)	8	20
93_Services Revenue (as Service Provider)	3	13

Table 4.9 Specification of component Revenue Streams

Main evidence in the domain of 'Revenue Sharing with Partners'

All informants have highlighted the importance of a revenue sharing agreement to be agreed with their industry partners**:**

> *"… At the outset, when you bring your consortium together, you need to work out your revenue model and the revenue sharing agreements… - like in the online world where the founding members get a revenue share of each new client that signs up for the platform"* (C-2).

C-4 indicates that, in contrast to "*partners from a commercial standpoint … integration partners are easier to solve because you are either contracting with them or you are sub-contracting with them and then move forward.* In relation to the global information technology company S-1 points out:

> *"…that there is no business model for the future collaboration platforms that will have to be transaction, subscription-based multi-stakeholder solutions".*

Main evidence in the domain of 'Platform Revenue'

Therefore R-1 also raises the question, "… *how can we make revenue out of the core business of the client? If a container is transported over the ocean, we could just make money out of the platform we are providing in terms of cloud services or software. But more important is to think about how we can participate in the transport of this container and what are the charges for such a trail of a container throughout the world?".* However, charges for the use of the industry platform will only be enforceable if there is a positive cost-benefit ratio for those involved in the E2E supply chain. A central point of the business model is the fee model, which has to consider the different roles of the participants in the maritime supply chain. The informants agree that the charging model should be *"…transactional based as opposed to a one fee revenue model"* (C-4).

> *"Generally, that fee would be paid by the shipper because they are the ones receiving the primary benefit"* (C-3).

But there might also be *"a kind of a volume-based subscription fee that freight forwarders and shipping lines pay as well"* (C-3). R-2 shares the view and states that shippers *"will be the end users … Whether they pay their existing freight forwarder $100 or whether they pay … $80, it will come down to a commercial decision for them.* C-3 specifies the fee as fee per container that is charged *"as the container goes through the end to end process … as shipments are approved or as they are cleared through customs and government agencies, on the import and export side".*

However, the decisive factor for smooth physical container transport is that the associated freight and customs documents are made available and documents and information can be used:

> *"So, whether you're publishing events or documents, you publish for free. And when you subscribe and receive information, you pay for that. You pay to receive an event message, or you pay to receive a document"* (S-2).

A particular challenge for the platform provider is to obtain status information from logistics service providers such as inland transport companies since *"…they are not going to pay to use the system because it doesn't give them any advantage. All they are is information providers, so we would make it free to them to publish, or maybe even incentivise them to publish information because they are critical, especially at the beginning and the ending of a journey of a container, to telling us where the container is"* (S-2).

4.5 Redescription: Theoretical redescription of causal entities

In the second phase of the R**R**RE model - **R**edescription - the focus is on redescribing the causal entities analysed in the previous section in the industry context of maritime freight logistics (Fletcher, 2016). This provides the opportunity "to understand previously taken-for-granted phenomena in a novel way" (Meyer & Lunnay, 2013, p. 9). The platform business model transformation was investigated by analysing the business model components (causal entities) based on the informants' statements in order to generalise and abstract them. In the following, the findings from the literature review are now taken into account in the redescription of the causal entities and their interrelationships. The results of the interviews show that a new activity system is emerging in global information technology companies that must meet the requirements of an increasingly networked ecosystem in which industry platforms are the basis for new digital transactions.

Table 4.10 shows how the causal entities identified in the previous section are newly described by redescription into user adoption, platform ownership, industry platform, standardisation of processes and data and governance. To highlight the perspective of the respondents, column three (Key Evidence) lists the codes from the analysed interviews in NVivo with the highest number of associated references. This serves as key evidence for the determination of the presented causal entities.

Causal Entities	Redescription of Causal Entities	Key Evidence	Informants	References
Customer Segments, Channels, Customer Relationships	Facilitates ***User Adoption***	48_Establish Platform Sales Model	5	44
Key Partnerships, Revenue Streams	Forms ***Platform Ownership***	31_Engage with Industry Partners	9	43
Value Propositions, Key Activities, Key Resources, Cost Structure	Enables ***Standardisation of Processes and Data***	44_Develop Platform 21_Apply Blockchain Technology	5 9	38 31
Customer Segments, Key Partnerships	Creates ***Platform Governance***	43_Manage Ecosystem	3	23

Table 4.10 Redescription of causal entities

It was found that the informants did not question the overall business strategy of the global information technology company, but the practical implementation of the business model derived from it. This has led the researcher to a re-conceptualisation of the entire case. Instead of focusing on the overall platform business strategy, the focus was on its operationalisation and thus on the causal factors influencing the platform business model. Figure 4.1 illustrates the influence of the causal entities identified in Table 4.10 on the transformation of the business model into a platform business model.

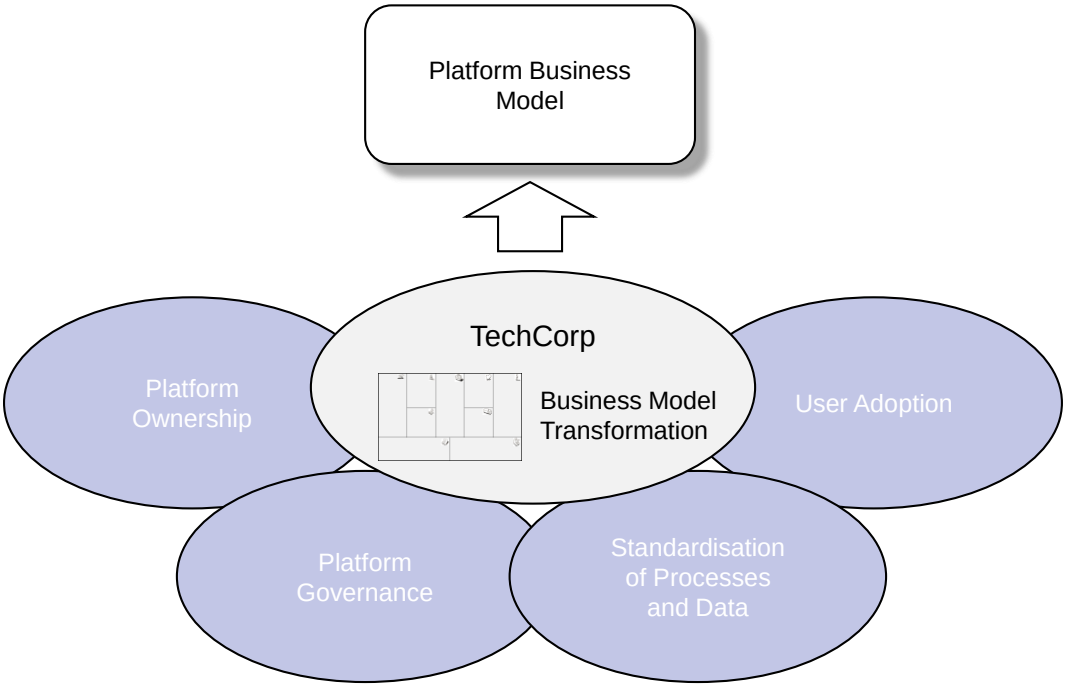

Figure 4.1 Causal entities affecting the platform business model transformation

In the following, the redescribed causal entities are considered in more detail as a basis for the further phases of the RRRE model.

4.5.1 Platform ownership

Previous research has addressed the question of how the strategy of the industry platform needs to be shaped in order to create a successful platform. (Cusumano, 2010b; Gawer & Cusumano, 2007; Lee *et al.*, 2010). As described above, global information technology companies are increasingly responding with an industry platform strategy to the further digitisation options offered by blockchain technology. But while blockchain technology is only an enabler, industry partnerships are from the informants' point of view a critical success factor in the design and market launch of industry platforms in maritime freight logistics. On the one hand, industry partners can use their comprehensive expertise to design the industry platform sector-specifically and promote it through their operative business relationships in their industry networks. On

the other hand, an industry partnership between a technology company and a company from the maritime freight logistics industry also presents challenges in terms of the commercial model underlying the industry platform and the convergence of interests pursued.

4.5.2 Platform governance

The focus of the business model innovation is the provision of the industry platform with its properties oriented to the requirements of the maritime freight logistics industry. The resulting key features of the industry platform are essential for the transactions between the platform users related to E2E transport and customs clearance. In reference to the literature review, industry platforms in maritime freight logistics are collaboration platforms with properties of multi-sided markets, on which data is exchanged between *providers of data* and *users of data* (Hagiu & Wright, 2015). Without these autonomous users and the ecosystem governance provided by the platform owner, an "industry platform is just a technological architecture" (Gawer, 2014, p. 1245). While according to Moser and Gassmann (2016), each platform ecosystem has a platform owner, platform users and external complementors; external complementors are of secondary importance for the industry platform considered in this thesis. The global information technology company has the role of *platform operator*, but also designs the business model as *platform owner* (Van Alstyne *et al.*, 2016). This function is an interface to the network users and potential complementors of the platform. All in all, the right *value proposition* that communicates the benefits for all participants is decisive for the success of the industry platform.

4.5.3 Standardisation of processes and data

The value proposition of an industry platform in maritime freight logistics is geared towards a standardisation of processes and data. Today, the maritime supply chain is characterised by peer-to-peer communication between the

various stakeholders in the maritime supply chain, which implies that transaction data is only exchanged bi-directionally between two companies. This means that companies still face the challenge of bringing multi-structured information from various sources together in one place - the single source of truth (SSOT) (Tapscott & Tapscott, 2016). In this redescription it becomes obvious that the standardisation of processes and data is now being driven by the emerging blockchain technology underlying industry platforms. Standards organisations are of great importance here, as they define the necessary standardisation schemes that provide the framework for blockchain policies and technological requirements (Saberi *et al.*, 2018). Through the use of blockchain technology, the next level of digitisation in the maritime supply chain can now be achieved by managing freight and customs transactions in a tamper-proof and trustworthy manner via decentralised shared ledgers (Brühl, 2017a). The companies involved in the maritime supply chain can thus carry out transactions efficiently and with a high degree of standardisation and automation within the business network, thus ensuring smooth transport within an international transport network. On the one hand, the blockchain technology creates the possibility of a new form of collaboration in business networks along the maritime supply chain in order to take advantage of the standardisation of processes and data (market perspective). On the other hand, this can only be achieved if technology companies offer industry platforms on this technological basis as neutral providers in order to establish these industry standards (provider perspective).

4.5.4 User adoption

The redescription of the causal entities “customer segments, channels and customer relationships” leads to the characteristic of user adoption. While an open platform architecture enables the platform owner and third-party service provider to offer a suite of digital products and integration services (Bygstad & Munkvold, 2011b), it is equally important to focus on the mechanisms that lead to an increasing number of platform users (Parker *et al.*, 2016). Self-reinforcing

user adoption occurs when more services make the platform more attractive to platform users, which leads to more users participating in the platform through network effects (Parker et al., 2016). More important than the registration of new users, however, is that the platform is so attractive for the platform users that they actively and permanently use it (Parker et al., 2016). Accordingly, "user commitment and active use" are the true mechanisms of customer adoption (Parker et al., 2016, p. 85). The global and local sales activities that are defined via the platform sales model should, therefore, be geared to the integration of companies, which also pursue partially different interests, into the business network.

4.6 Retrodiction: Generative mechanisms underlying the platform business model transformation

In the third phase of the RR**R**E model - **R**etrodiction, the aim is to enter the domain of the real in order to identify the potential causal mechanisms underlying the relevant causal entities identified in the phase of resolution and redescribed in the phase of theoretical redescription. With this technique of abstract research, it is possible to hypothesise and identify those mechanisms that might bring about the platform business model transformation (Bygstad, 2010; Meyer & Lunnay, 2013). First, in the industry context of this thesis, the mechanisms identified in the literature review are analysed on the basis of their structures before it is shown which entities are involved in the execution of these mechanisms. The process ends by pointing out the relationships and dependencies between these causal mechanisms in order to create the basis for identifying the key causal mechanisms that significantly cause the platform business model transformation.

For a better understanding of the following explanations, Figure 4.2 shows an assignment of the mechanisms discussed in the literature review to the causal entities identified in the previous section. Their structures will be further examined in the following sections, supported by available empirical evidence from the informants' statements, to ensure that the proposed mechanisms

adequately reflect reality (Wynn Jr & Williams, 2012). The causal structure of the mechanisms is described by a condition or requirement, an action, and an outcome. The mechanisms also interact with each other.

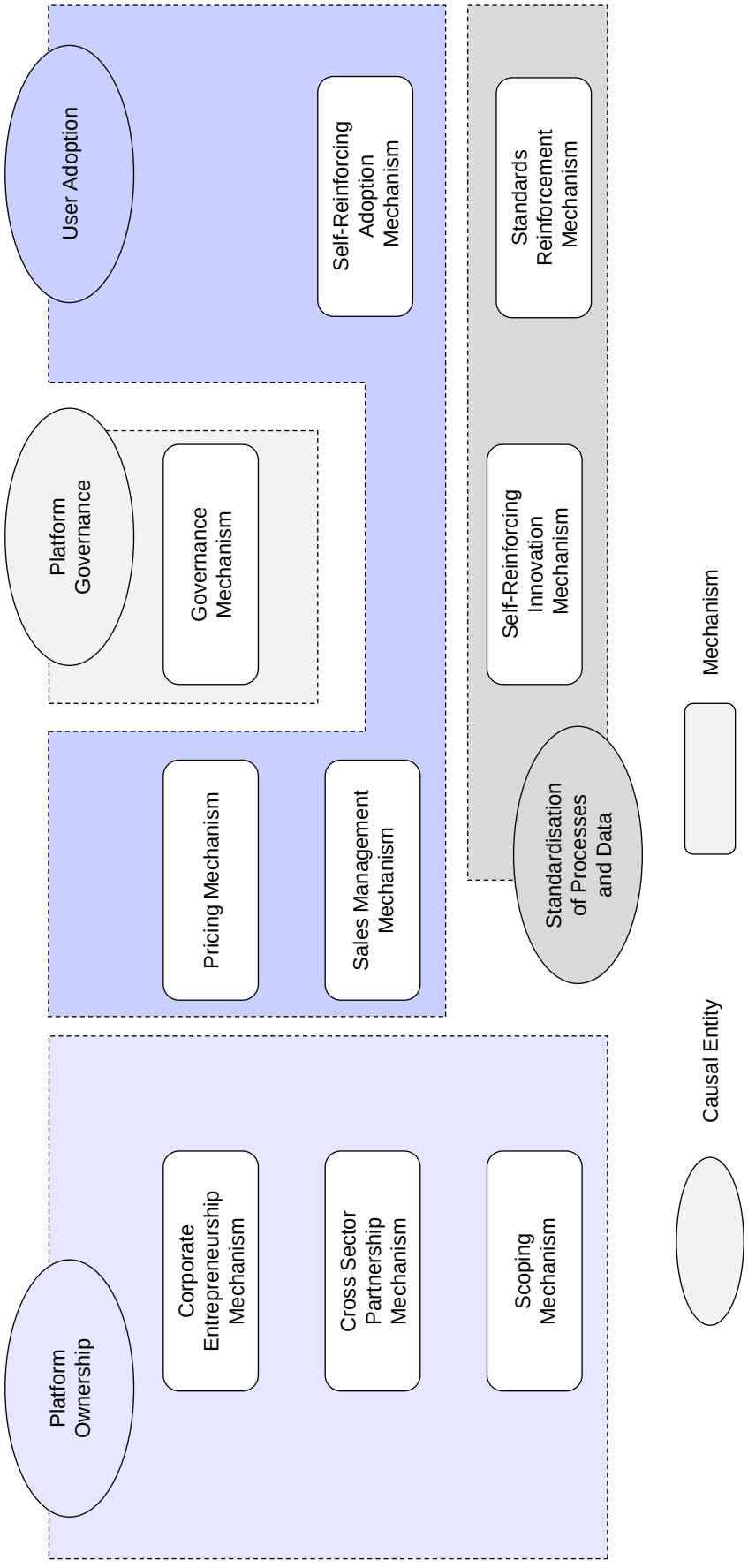

Figure 4.2 Causal entities and causal mechanisms underlying them

4.6.1 Platform ownership

Corporate Entrepreneurship Mechanism (SM 1)

The emerging platform economy is forcing software- and service-oriented technology companies to implement new business models and innovations. From the perspective of the informants, however, this requires a start-up culture and new entrepreneurial thinking of the responsible executives in order to make upfront investments, to create organisational conditions for the development and operation of industry platforms and to implement cross-sector partnership models (Figure 4.3).

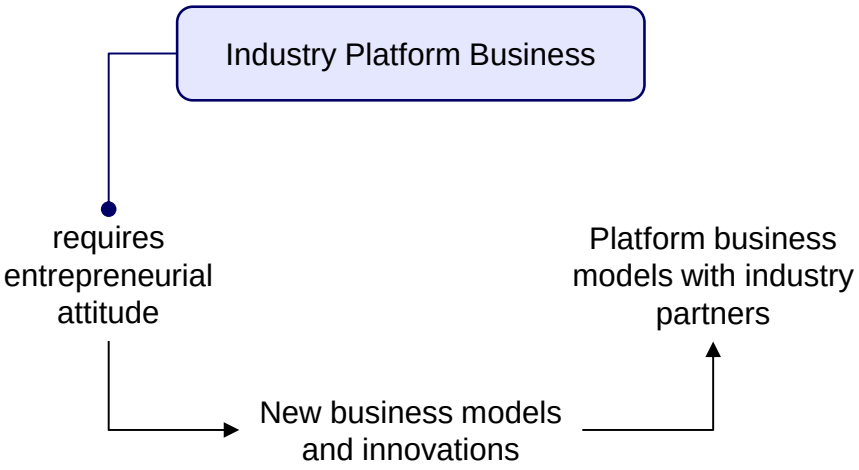

Figure 4.3 Corporate Entrepreneurship Mechanism

Cross-Sector Partnership Mechanism (SM 2)

All the informants emphasised the importance of industry competence in the development of an industry platform in maritime freight logistics. From their perspective, it is therefore necessary to involve industry partners who have the necessary industry expertise along the maritime supply chain and have access to the ecosystem and industry associations when implementing industry platforms. A particular challenge of such a partnership is to align the interests and goals of the industry partner with those of the IT platform owner and to define the commercial model and go-to-market approach. As a result, such a

partnership leads to a higher level of acceptance of the industry platform among network members, since the implemented processes and functionalities are oriented towards the industry requirements defined by the industry partner. However, it is crucial that the industry partner has relatively strong market power so that other potential network members are forced to follow such a strategic transformation. Once an industry platform has been established via network effects, the Cross-Sector Partnership Mechanism (Figure 4.4) can lead to the incorporation of additional industry partners or third-party vendors, whose expertise increase the performance of the industry platform.

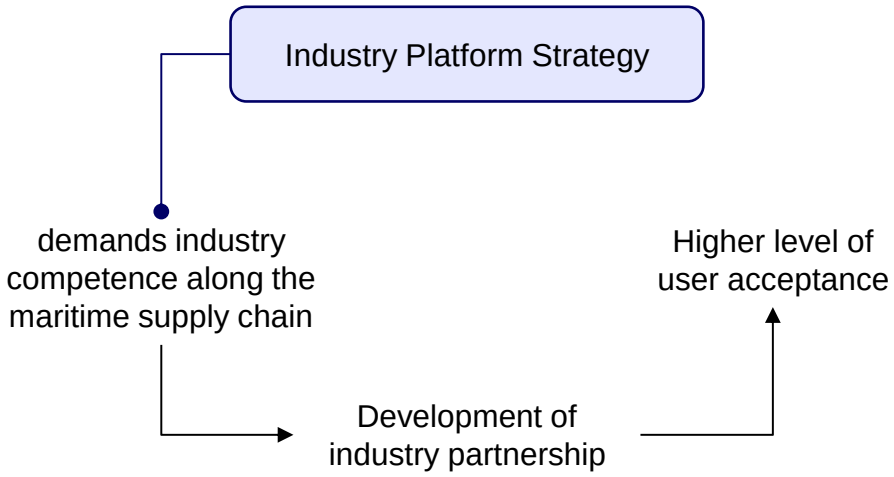

Figure 4.4 Cross-Sector Partnership Mechanism

Scoping Mechanism (SM 3)

A crucial aspect in the development of the cross-sector partnership model described above is the definition of the responsibilities assumed by the partners involved (Figure 4.5). These responsibilities are essentially based on the individual strengths of the partners. While the industry partner contributes with its industry and process expertise, the IT provider as platform operator focuses on the development and operation of the industry platform. Third-party vendors, in turn, supplement the industry platform with external services to increase their performance and thus their attractiveness for users. As a result,

such an allocation of the functional scope to the partners involved leads to the best possible design of the industry platform in terms of services and functionalities.

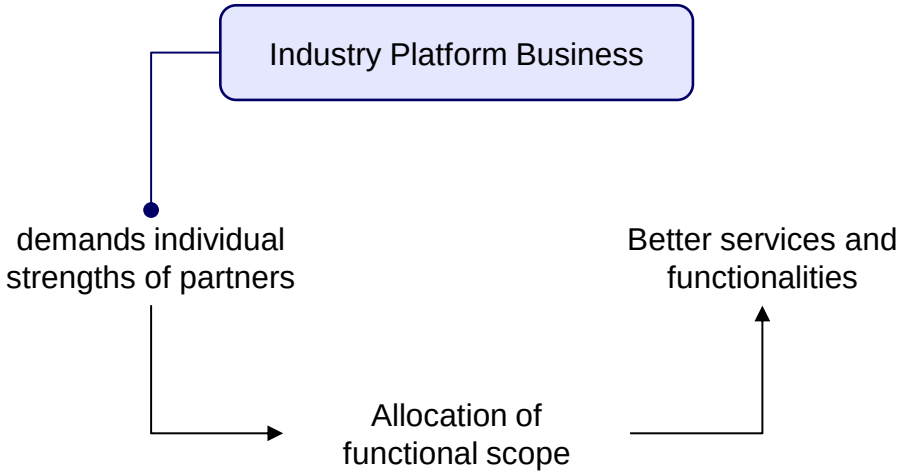

Figure 4.5 Scoping Mechanism

4.6.2 Platform governance

Governance Mechanism (AFM 3)

Ongoing sales activities must be complemented by appropriate platform governance, which determines the conditions under which participation in the industry platform is possible. The starting point of the governance mechanism (Figure 4.6) is the emerging business network of network members of the maritime supply chain. It represents, together with the platform owner, the industry partners and the potential complementors the ecosystem of the industry platform. By actively managing the industry platform, the platform owner must ensure that a collective identity is created and that the companies involved can be confident that their data is exchanged securely via the industry platform with regard to data security and data integrity. In addition, it is the responsibility of the platform owner to ensure that only network members and complementors who meet the defined access criteria are admitted to the industry platform, and that transactions are carried out in accordance with the

General Terms and Conditions. The goal is that such platform governance contributes to sustainable growth of the business network with high user acceptance.

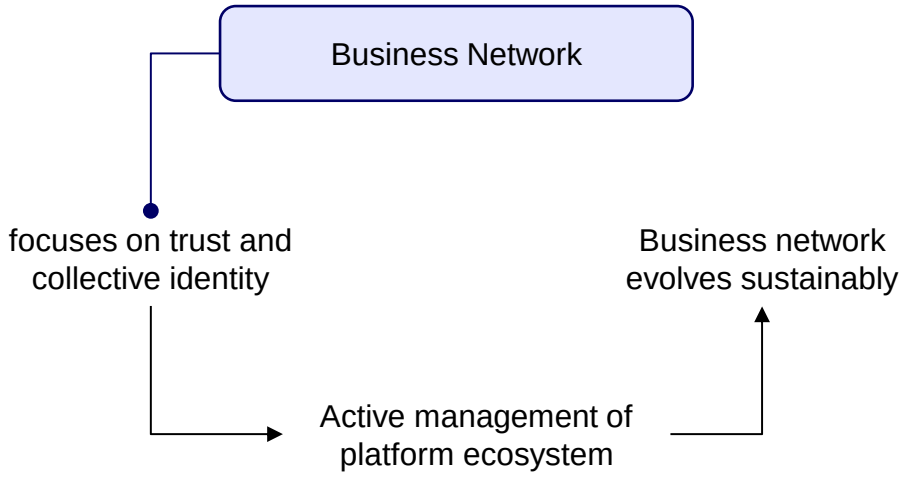

Figure 4.6 Governance Mechanism

4.6.3 Standardisation of processes and data

Self-reinforcing Innovation Mechanism (TM 1)

The self-reinforcing innovation mechanism (Figure 4.7) developed by Bygstad and Munkvold (2011b) can be easily applied to industry platforms as technical information infrastructures. The starting point is the blockchain-based industry platform, the open architecture of which offers new possibilities for innovative services. These services can either be developed by the platform owner based on new industry requirements, or provided by external complementors. IT service providers have a commercial interest in the development and provision of new services, as they increase the attractiveness of the industry platform and can be commercialised for an additional fee. Overall, this is a self-reinforcing mechanism where new services and functionalities lead to more users and higher service charges, which, in turn, creates opportunities for further innovation.

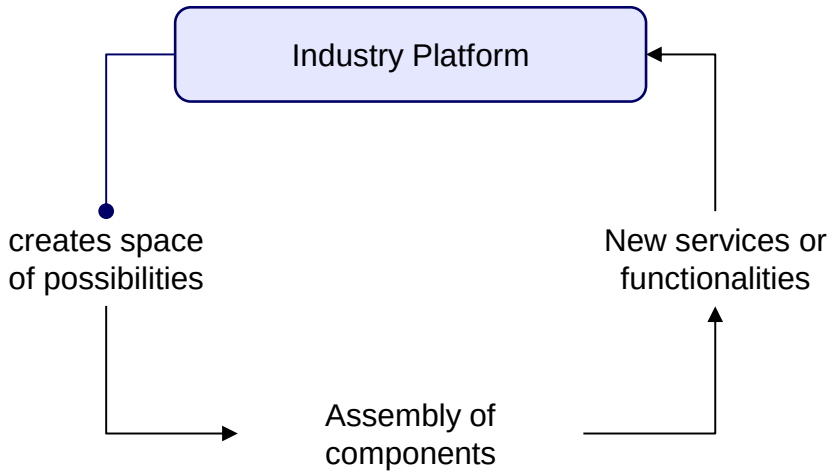

Figure 4.7 Self-reinforcing Innovation Mechanism

Standard reinforcement Mechanism (TM 3)

The standard reinforcement mechanism complements the self-reinforcing innovation mechanism. Additional innovative data services from the platform owner or external complementors increase the confidence of users that the industry platform is becoming a standard in the industry (Grindley, 1995). The prerequisite for this mechanism is that the industry platform is technically designed as an open architecture with accessible interfaces, so that external solution providers can easily develop and commercialise complementary value-added platform services. To the extent that new innovative services are offered on predefined data formats by external complementors, existing platform users and potential new users perceive that an industry standard is emerging. This standards-oriented collaboration between platform owner and its complementors leads to an increasing use of the industry platform, which in turn is a trigger for the self-reinforcing innovation mechanism.

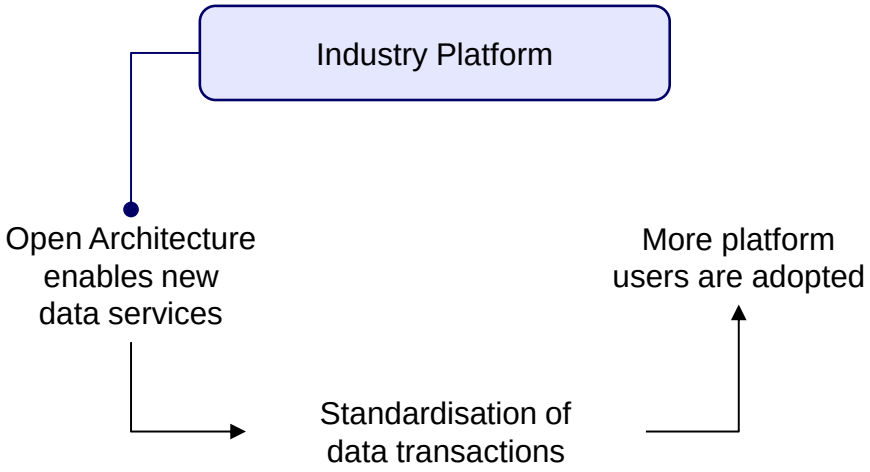

Figure 4.8 Standard Reinforcement Mechanism

4.6.4 User adoption

Pricing and Subsidy Mechanism (AFM 1)

Comprehensive business networks consisting of network members involved in the maritime supply chain are the decisive starting point for the provision and use of data. Even though entities aim to improve supply chain efficiency and achieve seamless supply chain transparency in the maritime supply chain through a collaborative approach, commercial interests play a role. The price mechanism also works in collaboration networks, since these function like markets in which the supply of data by the providers of data meets their demand. While global freight forwarders orchestrating the supply chain and shippers are willing to pay for the benefits of improved supply chain transparency, the carriers undertaking the transportation expect compensation for collecting and providing their data. An essential measure of the actors of the consortium is to balance the supply of data and the demand for data via a fixed usage price. While usage-based pricing models depend on transactions or a monthly subscription fee, the provision of data may also be subsidised by the platform operator to create an incentive for carriers to make their data available to the business network. In the context of validating the research results, V-1 (Validation 1, with reference to the overview of informants in Table

3.6) has come to the conclusion that certain user groups of the platform "pay with data" instead of money. By correctly applying the pricing and market mechanism (Figure 4.9), successful sales activities are enabled to achieve the goal of a constantly growing business network.

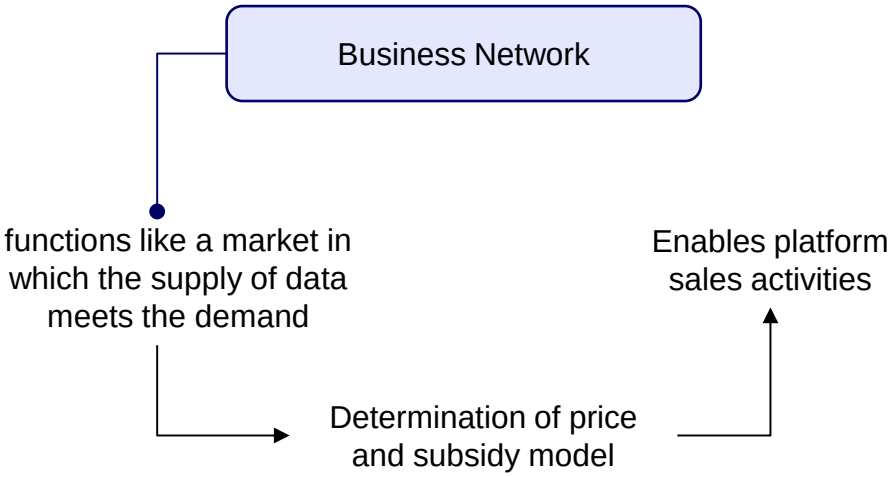

Figure 4.9 Pricing and Subsidy Mechanism

Sales Management Mechanism (AFM 2)

Pricing is an essential aspect that is taken into account in the sales management mechanism (Figure 4.10). However, for business networks to emerge in a multi-stakeholder environment, a completely new sales approach is required. This differs significantly from the typical software and services sales of a global information technology company. In order for the business network to grow rapidly and sustainably, targeted sales activities are required, which must be coordinated between the global information technology company as the platform provider and the industry partners via the partnership model. Industry platforms in maritime freight logistics address globally operating logistics service providers whose decision-making functions are globally distributed. Therefore, the challenge is to use different global and local sales channels and, in particular, to incentivise the local sales teams, which have long-standing established relationships with the relevant decision-makers in the industry. However, selling globally provided industry platform

services requires a different sales management system. Furthermore, since blockchain-based industry platforms can sustainably transform the processes of the logistics service providers involved and a new collaboration approach is created in a competitive environment, a critical success factor is to involve the right industry expertise in the sales process. Only if the right large key stakeholders from the maritime sub-sectors (liner shipping companies, global freight forwarders, ports and customs administrations) are acquired from the very beginning, when setting up the business network, can the desired network effects occur. However, the aim should be to simplify the onboarding process over time in order to reduce the initially necessary high sales effort.

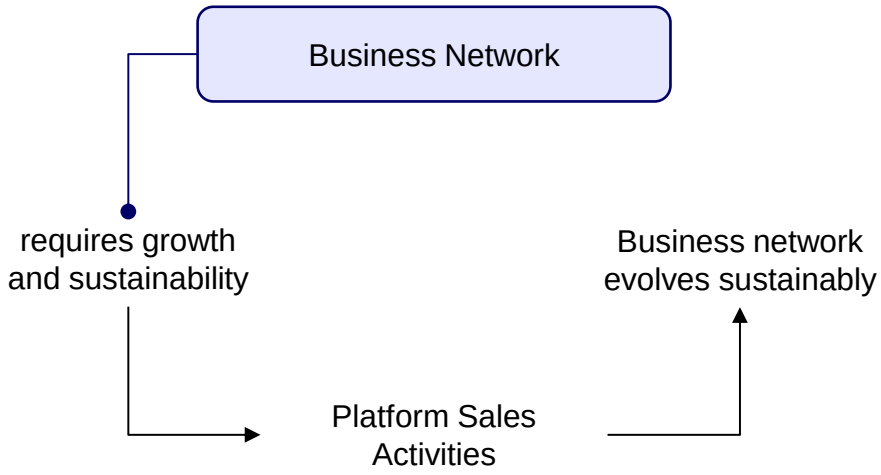

Figure 4.10 Sales Management Mechanism

Self-reinforcing Adoption Mechanism (TM 2)

Another self-reinforcing mechanism is the self-reinforcing adoption mechanism (Figure 4.11), which assumes that successfully established industry platforms in maritime freight logistics are more attractive for data providers than other platforms. The more supply chain data is made available to the industry platform by transport service providers, ports and customs administrations, the greater the benefit for the involved users of data such as global freight forwarders or shippers. This creates the intended direct and indirect network effects (see Section 2.4.1), which contribute to reinforcing this

mechanism itself. According to Bygstad and Munkvold (2011b), the self-reinforcing innovation and adoption mechanism complement each other. While the innovation mechanism ensures that more services are created, making the industry platform more attractive, the adoption mechanism helps to generate more profits, which in turn enables the development of additional services.

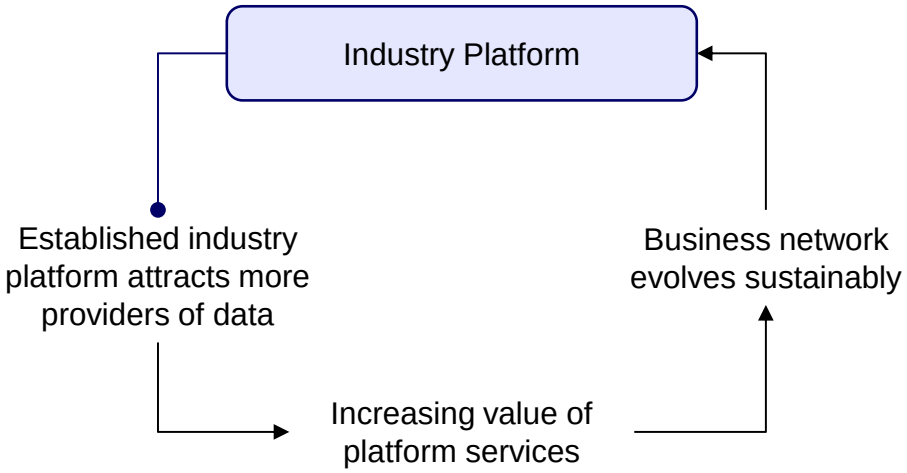

Figure 4.11 Self-reinforcing Adoption Mechanism

4.6.5 Relationships between causal mechanisms

Figure 4.12 now illustrates the relationships between the causal mechanisms. Based on the conditions (C) in the maritime freight logistics industry, strategic goals (G) are derived by the global information technology company and its industry partners, which are then operationalised and this leads to a certain behaviour (B) among the individuals involved. The outcome (O) depends on whether the value proposition of the industry platform is accepted by the network members and network effects occur as a result. Based on the mechanism-based approach by Hedström and Wennberg (2017) the causal mechanisms are brought into a logical relationship, whereby the *situational mechanisms* arise from the conditions of the macro-environment. The cross-sector partnership mechanism results from the industry platform strategy and is activated by the corporate entrepreneurship mechanism, which describes how executives implement new business models and innovations.

Furthermore, the scoping mechanism has an impact on the cross-sector partnership mechanism, as the required and desired platform services influence the selection of suitable industry partners and complementors. The cross-sector partnership mechanism then triggers the sales management mechanism, which controls the sales activities of the stakeholders involved towards the potential network members of the industry platform. An essential influencing factor here is the price and subsidy mechanism, which commercially balances data supply and demand in data-driven platforms. Once an initial business network has been created through sales activities, the governance mechanism plays an important role by controlling the governance of the platform and ensuring that trust is built, and a common identity is established among the different network members of the platform (*action-formation mechanisms*). The *transformational mechanisms* then lead to the outcome described above. The self-reinforcing innovation mechanism leads to the iterative integration of new innovative platform services, which, in turn, activates the self-reinforcing adoption mechanism. Network effects then cause a steady growth of the platform, especially if the users have the perception that the industry platform is becoming a standard in the maritime supply chain.

In the following model of the interactions of mechanisms, the dotted line represents the boundaries of TechCorp's sphere of influence.

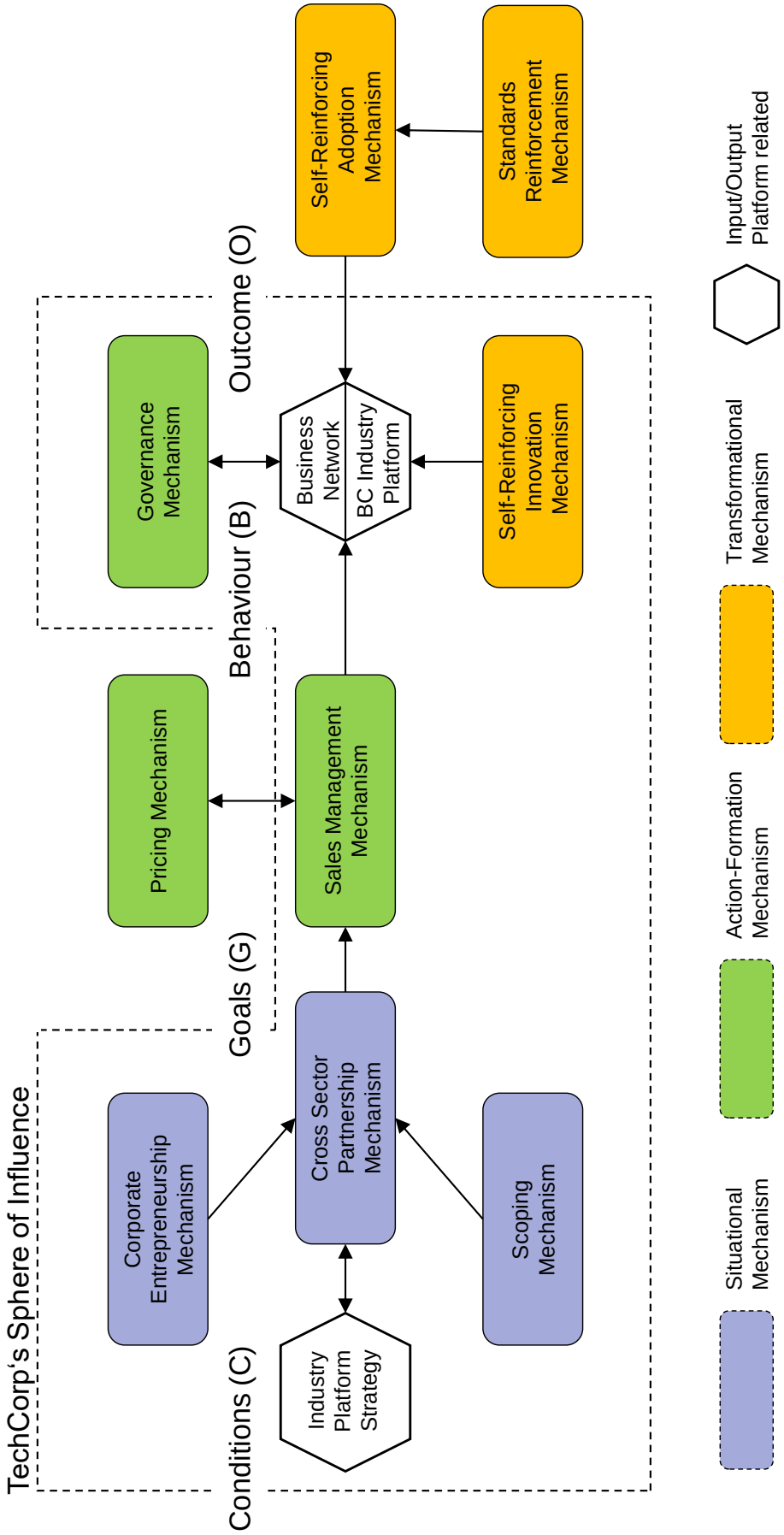

Figure 4.12 Illustration of relationships between the causal mechanisms

4.7 Elimination: Identification of the most important mechanisms influencing the platform business model transformation

In the fourth phase of the RRR**E** Model – **E**limination - a plausible justification is provided for the key mechanisms from the multitude of mechanisms identified in the third phase that “have better explanatory power than alternatives” (Bygstad et al., 2016, p. 4). The principle here is to discover those mechanisms that have both a sufficient causal effect and “better explanatory power than alternative explanations for the focal phenomenon” (Wynn Jr & Williams, 2012, p. 801). Besides an analytical derivation on the basis of the identified causal mechanisms, the informants' statements are used as a further technique for validation (Bygstad & Munkvold, 2011a).

From the perspective of the researcher, it is meaningful to conduct an analysis of the mechanisms presented in the previous section in order to investigate their causal effect on the platform business model transformation. The *self-reinforcing adoption mechanism* only takes effect when the industry platform has a certain market reputation and a business network has already developed. Similarly, with regard to the *standards reinforcement mechanism*, an industry standard only develops once a significant number of users have already adopted the industry platform. Therefore, these two mechanisms cannot serve to explain the platform business model transformation, as they only become evident in a later development stage of the industry platform. Furthermore, these mechanisms are not within the sphere of influence of the global information technology company acting as platform provider, but only work with the participation of potential network members of the industry platform. The *innovation mechanism* is also not a suitable explanation, as it only comes into play when the industry platform is on a growth path and additional revenues enable innovations by the platform owner or attract external platform service providers. This mechanism directly affects the functional scope of the industry platform and its value proposition and, thus, indirectly activates the adoption of the industry platform by users. The *governance mechanism* does not affect the technical functional scope of the industry platform but instead regulates the conditions under which potential

users or complementors can use the platform. From this the initial business network develops, which is the basis for direct and indirect network effects. Especially in a strong competitive environment such as the maritime industry, potential users therefore pay more attention to the governance of the industry platform, which is specified by the platform stakeholders and thus the platform owner, as well as the industry partners involved. This mechanism can, in this way, be seen as a key mechanism that has a significant impact on the successful launch of the industry platform.

The *sales management mechanism* has a direct impact on the emergence of the business network by acquiring new users for the industry platform or by contracting new services with users already participating. Superficially, it could be argued that the phenomenon described can be explained by the fact that the sales activities are not carried out in a target-oriented way or successfully. Instead, the sales management mechanism is influenced by two other mechanisms that may have a stronger causal influence on the platform business model transformation. Notwithstanding, the interviews with the informants and the observable results of negotiations with potential network members suggest that price negotiations are of secondary importance and that, therefore, the price mechanism that balances data supply and demand has not yet been effective. Instead, the interviews and observations show that the *cross-sector partnership mechanism*, which resides in the entities of the platform owner and its partners, has a considerable impact. A key aspect of the cross-sector partner model is the regulation of platform ownership resulting from the partners' financial participation in the industry platform, for example as part of a strategic industry partnership or joint venture. The platform owners then define not only sales strategy and the sales targets that the partners' sales activities must follow in order to build the business network, but also the conditions for using the industry platform. Even if blockchain technology ensures that only an authorised company can access their proprietary data, this data is hosted on an industry platform owned by one or a few competitors as platform owner. Therefore, there is a fundamental mistrust or resistance of potential network members to participate in the industry platform with

company-sensitive data such as customer data, transport conditions and cargo information. The *scoping mechanism* must be considered, as it regulates which tasks and services should be performed by industry partners or third-party providers involved in the industry platform in order to ensure the best possible success. This is a mechanism that iteratively changes the partner model when new partners are added to the original partner structure. In principle, it is crucial whether potential industry partners or third-party providers demand an equity stake in the industry platform for their participation or the provision of services, which then changes ownership and co-determination. The analysis of the interviews showed that the informants generally evaluate the functional scope of the industry platform and not which partner provides individual platform services. Also, possible extensions of the functional scope by new services of third-party providers in the future are of secondary importance, since the primary goal is to develop a fast, interacting business network. Finally, the *corporate entrepreneurship mechanism* is certainly of great importance in the global information technology company under consideration, as it has an influence on the cross-sector partnership mechanism. Driven by the emerging industry platforms, corporate entrepreneurship is necessary in the organisation to enable executives to enter into new business models with industry partners. Even though corporate entrepreneurship is a necessary prerequisite for new cross-sector partner models, this study shows that decisions on the form of the partner model determine the success of the industry platform in the multi-stakeholder environment of maritime freight logistics.

Table 4.11 summarises the causal effects of the mechanisms identified, classified according to their intensity of impact on the platform business model transformation.

Mechanisms	Causal Effect on Platform Business Model Transformation		
	High	Medium	Low
Situational Mechanisms			
Corporate Entrepreneurship Mechanism		✓	
Cross-Sector Partnership Mechanism	✓		
Scoping Mechanism			✓
Action Formation Mechanisms			
Pricing and Subsidy Mechanism/ Market Mechanism			✓
Sales Management Mechanism		✓	
Governance Mechanism	✓		
Transformational Mechanisms			
Self-Reinforcing Innovation Mechanism			✓
Self-Reinforcing Adoption Mechanism	not applicable		
Standards Reinforcement Mechanism	not applicable		

Table 4.11 Causal effects of mechanisms active in platform business model transformation

4.8 Towards an explanatory model for the platform business model transformation

After completing the analytical RRRE cycle in the previous sections, the explanatory model of causal entities and mechanisms will be developed in this section. For this purpose, the causal entities with their underlying mechanisms and their relations to each other are presented. Subsequently, it is shown in

tabular form which stakeholders and network members are involved in the various mechanisms.

4.8.1 Assignment of causal mechanisms to causal entities affecting the platform business model transformation

After the identification of the causal entities (resolution stage) and their redescription (redescription stage) the causal mechanisms underlying them were identified in the retrodiction stage. Given the different identified causal mechanisms, the question of the key causal mechanisms that can be regarded as having the most significant impact on the platform business model transformation was answered finally in the elimination stage. Although several mechanisms were active, the findings of the data analysis emphasises explicitly the causal capacity of the *Cross-Sector Partnership Mechanism* and the *Governance Mechanism* within the open organisational system of the global information technology company. In contrast to Figure 4.2, Figure 4.13 illustrates the resulting explanatory model, in which the causal entities of platform ownership, platform governance, standardisation of processes and data and user adoption are presented with their underlying mechanisms and their relationships to each other.

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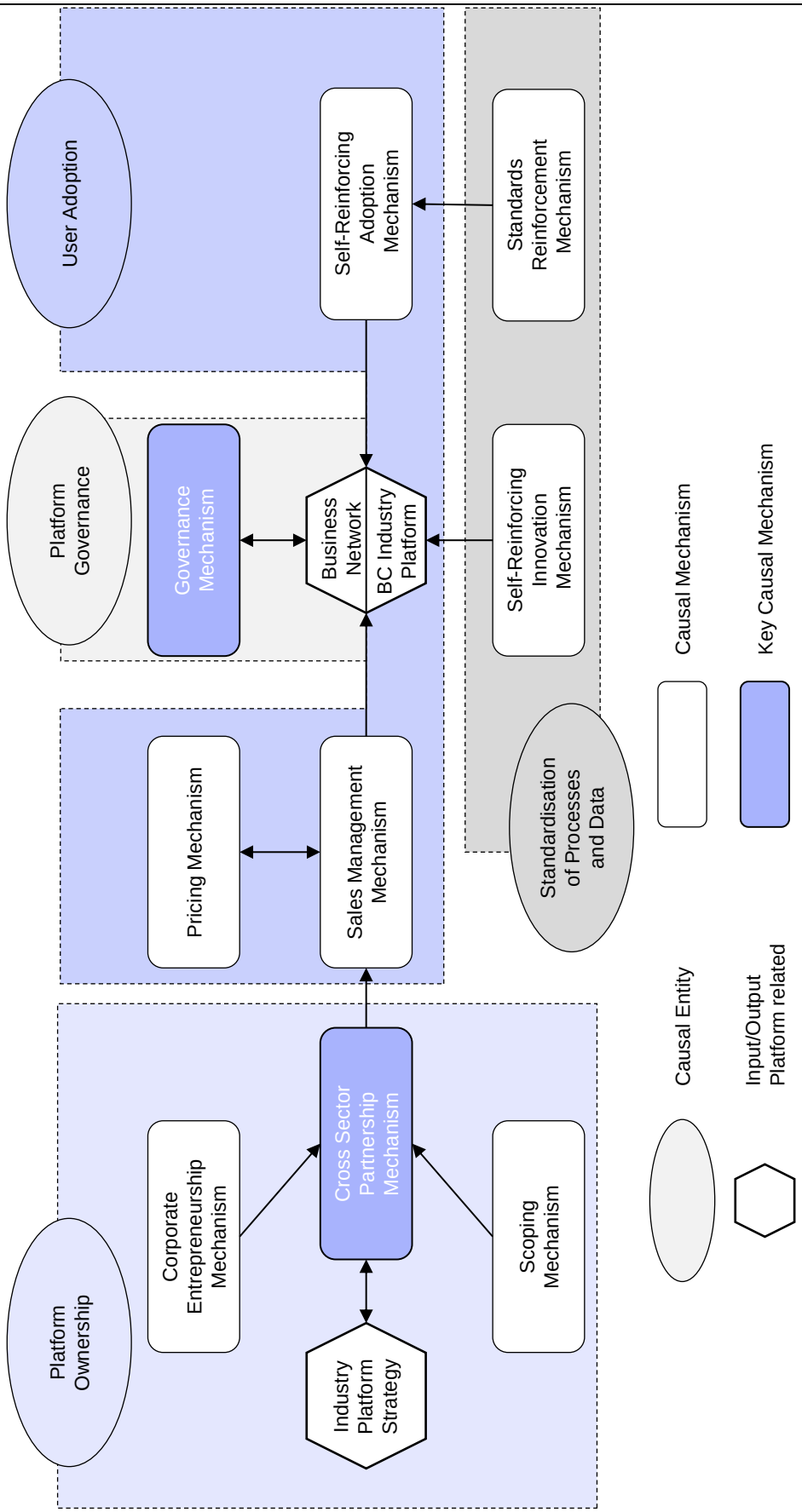

Figure 4.13 Explanatory model with causal entities and underlying causal mechanisms and their relationships to each other

When validating the explanatory model, V-3 pointed out the importance of feedback loops - represented by two-sided arrows – between certain mechanisms. While the platform strategy defines the business model, and, thus, the partnership model with potential industry partners, the platform strategy must also be adapted if market requirements make it necessary. The pricing mechanism and the sales management mechanism are also interdependent, to the extent that sales success necessitates an adjustment of the pricing model. While platform governance ensures the emergence of the business network, it must respond equally to network member feedback to ensure the long-term success of the industry platform.

4.8.2 Activities of stakeholders and network members involved in causal mechanisms

Based on the explanatory model presented in the previous section, the analysis is completed in Table 4.12 by an overview of the participants actively involved in the mechanisms of the industry platform (Fleetwood *et al.*, 2017). Here, the four functions (platform owner, industry partner, provider of data and user of data) are engaged with different activities. While the platform owner and the industry partners provide the industry platform, the transactions in this multi-sided market take place between providers of data and users of data (Hagiu & Wright, 2015).

Mechanisms	Platform Participant			
	Platform Owner	**Industry Partner**	**Provider of Data**	**User of Data**
Platform Ownership				
Corporate Entrepreneurship Mechanism	active			
Cross-Sector Partnership Mechanism	active	active		
Scoping Mechanism	active	active		
Platform Governance				
Governance Mechanism	active	active		
Standardisation of Processes and Data				
Self-Reinforcing Innovation Mechanism	active	active		
Standards Reinforcement Mechanism			active	active
User Adoption				
Pricing and Subsidy Mechanism Market Mechanism	active		active	active
Sales Management Mechanism	active		active	active
Self-Reinforcing Adoption Mechanism			active	active

Table 4.12 Activities of entities engaged in causal mechanisms

4.9 Chapter conclusion

In this chapter the causal entities have been identified that have significantly contributed to explaining the transformation of the software- and service-oriented business model of a global information technology company into a platform business model – focusing on the industry context of maritime freight logistics. Following the layered ontology of critical realism, the RRRE model

(**R**esolution, **R**edescription, **R**etrodiction, **E**limination) of Bhaskar (2013a, p. xvii) was used as explanatory framework. This was well suited to investigating the mechanisms and structures in the domain of the real, which are unobservable, but which trigger the platform business model transformation. In the case of the global information technology company considered in this study, the “possible mechanisms were systematically evaluated against empirical evidence” (Bygstad *et al.*, 2016, p. 10). However, the findings of this study showed that although several mechanisms were active, only the cross-sector partnership mechanism and the governance mechanism were consistent with all data and the statements of the informants. But how must conditions change in order for the causal mechanisms to function in such a way that new business models for maritime freight logistics can emerge?

Chapter 5 Application of a New Platform Business Model Framework for Maritime Freight Logistics

5.1 Introduction

This chapter presents the framework derived from the findings of this study. Based on the explanatory model presented in Chapter 4, the relevant components for a new platform business model framework are elaborated and validated by evidence from literature research and primary research in Section 5.2. Built on these components, a new business model framework for industry platforms in maritime freight logistics - the “4/9 Platform Business Model Canvas” - is developed in Section 5.3. For this, the functions of the stakeholder groups interacting with the industry platform as well as the components and their contribution to value creation will be explained. In Section 5.4 an action plan is consistently derived from the components of the platform business model framework in order to operationalise the platform business model for maritime freight logistics. In this action plan, the relevant key activities, the responsible key roles in the company, as well as the necessary resources for implementation and the resulting benefits are assigned to the concrete recommendations for action. Section 5.5 summarises the advantages for network members using an industry platform for maritime freight logistics before the results of the validation phase are presented in Section 5.6.

5.2 The platform business model components

The following methodological deduction presented in Table 5.1 aims to determine the relevant components of a new platform business model framework. Based on the *findings* of the data analysis, which are confirmed by *evidence from primary research and literature* research, platform business model components are extracted, which cluster the different findings in a thematically meaningful way.

Mechanism	**Findings**	**Evidence from Primary Research***	**Evidence from Literature**	**Platform Business Model Component**
Corporate Entrepreneurship Mechanism	Enable Intrapreneurship / Enable Start-Up Culture	1 / 1	Entrepreneurial drive of executives to generate new business models (Berglund & Sandström, 2017; Bygstad *et al.*, 2016; Geradts & Bocken, 2019) to overcome the Innovator´s dilemma (Christensen, 2013)	**RESOURCES**
	Allocate Investment Budget	4 / 5	Disruptive Technologies to ensure growth and sustainability of the company (Berglund & Sandström, 2017)	**RESOURCES**
	Acquire Venture Capital	1 / 1	No evidence	**RESOURCES**
Cross-Sector Partnership Mechanism	Define Platform Business Model	1 / 2	Central logic to achieve values within a business network (Dahan *et al.*, 2010)	**VALUE PROPOSITION**
	Form strategic Industry Partnership with Key Partners	9 / 19	Strategic cross-sector industry partnership with industry partners (Andoni *et al.*, 2019; Mingers & Standing, 2017; Tan *et al.*, 2016)	**PARTNERSHIP MODEL**
	Form Partner Model with IT Solution Providers	4 / 9	Aligned with industry requirements to increase benefit for platform users (Gassmann *et al.*, 2015) and minimises investments (Dahan *et al.*, 2010)	**PARTNERSHIP MODEL**
	Participate in Associations	1 / 1	No evidence	**SALES**
Scoping Mechanism	Define functional Scope and Technological Design	2 / 5	Derived from platform ownership model (Ghezzi, 2012)	**VALUE PROPOSITION**

* 1 / 1: Number of Interview Participants / Number of Mentions

Table 5.1 Determination of platform business model components

Mechanism	Findings	Evidence from Primary Research*	Evidence from Literature	Platform Business Model Component
Scoping Mechanism	Define Platform Ownership Model	3 / 3	Revenue sharing and IP are derived from financial configuration (Gawer & Cusumano, 2008)	**PARTNERSHIP MODEL**
Pricing and Subsidy Mechanism	Define Pricing Model	6 / 10	Pricing and subsidy mechanism of industry platforms for direct control of interaction between users (Gawer, 2014)	**PRICING**
	Define Payment Model (free usage, subscription, transaction fee)	6 / 10	Different price categories for platform users (Filistrucchi, Geradin, van Damme, & Affeldt, 2014; Fjeldstad & Snow, 2018; Täuscher & Laudien, 2018)	**PRICING**
Sales Management Mechanism	Change Go-to-Market Model	3 / 3	No evidence	**SALES**
	Change Revenue Model	5 / 8	No evidence	**REVENUE**
	Reorganise Client Assignment	2 / 5	No evidence	**SALES**
	Change Sales Measurements	7 / 16	Success factors of platforms such as positive network effects or performance of complementary services (Parker, Van Alstyne, & Choudary, 2016)	**SALES**
Governance Mechanism	Establish Platform Governance	5 / 8	Central function to build trust and establish a collective platform identity (Gawer & Phillips, 2013; Tiwana, Konsynski, & Bush, 2010); Platform rules and usage fees (Gawer & Cusumano, 2014)	**GOVERNANCE**
	Select third-party Service Providers to add Services	2 / 2	Additional platform services by complementors (Chesbrough & Van Alstyne, 2015; Eisenmann, Parker, & Van Alstyne, 2011; Gawer & Cusumano, 2008); Higher complexity due to interactions and dependencies (Boudreau & Hagiu, 2008)	**GOVERNANCE**

* 1 / 1: Number of Interview Participants / Number of Mentions

Table 5.1 Determination of platform business model components (2)

Mechanism	Findings	Evidence from Primary Research*	Evidence from Literature	Platform Business Model Component
Governance Mechanism	Select Key Partners of Platform Ecosystem	3 / 3	Strategic industry partnership with key partners (Tan, Tan, & Pan, 2016)	**GOVERNANCE**
Self-Reinforcing Innovation Mechanism	Use Blockchain Technology	9 / 22	Immense importance for direct data provider and data consumer transactions (Subramanian, 2017); transactions without intermediaries (Swan, 2015)	**RESOURCES**
	Develop new Services	2 / 3	Open architectures offer the opportunity to design new services (Gawer & Cusumano, 2007); integrated innovations stimulate new innovations (Bygstad, Munkvold, & Volkoff, 2016)	**RESOURCES**
Self-Reinforcing Adoption Mechanism	Promote active Usage and User Commitment	4 / 6	"User commitment and active usage" are the true mechanisms of customer adoption (Parker, Van Alstyne, & Choudary, 2016, p. 85).	**ADOPTION/ COMMITMENT**
	Enable external Service Providers to integrate Services	3 / 4	More services make the platform more valuable to users, which creates network effects (Cusumano, 2010; Evans, 2011; Gawer & Cusumano, 2014; Parker *et al.*, 2016)	**ADOPTION**
Standards Reinforcement Mechanism	Establish Industry Standard for Data Exchange	6 / 12	Complementary innovations increase the user's confidence that the platform will become an industry standard (Grindley, 1995)	**ADOPTION**
	Enable Collaboration with third-party Vendors based on Standards	3 / 8	Open architecture as prerequisite that third-party service providers can easily develop or integrate services	**PARTNERSHIP MODEL**

* 1 / 1: Number of Interview Participants / Number of Mentions

Table 5.1 Determination of platform business model components (3)

From this systematic analysis, the following nine business model components of a platform business model framework are identified:

- ❑ Value Proposition
- ❑ Partnership Model
- ❑ Governance
- ❑ Sales
- ❑ Pricing
- ❑ Revenue
- ❑ Adoption
- ❑ Commitment
- ❑ Resources

5.3 The 4/9 Platform Business Model Canvas

This section presents a new platform business model framework: *The "4/9 Platform Business Model Canvas" (4/9 PBM-C) for maritime freight logistics (*Figure 5.1). It is built on the four (4) entities of the platform ecosystem and the nine (9) business model components derived from the systematic analysis of the mechanisms in the previous section in Table 5.1. This platform business model framework represents a consistent further development of the Platform Business Model Canvas introduced by Walter (2016):

- The industry platform as a collaboration platform for maritime freight logistics has an important, integrative function by linking the stakeholders (platform owner and industry partners) and network members of the user groups (providers of data, users of data) with the goal of improved supply chain transparency and increased supply chain efficiency
- At the centre of the Platform Business Model framework is the Value Proposition component, to which all activities of the platform owner and industry partners must be aligned
- The components on the left side (light grey; resources, partnership model, governance, sales, pricing) of the Platform Business Model framework are controlled by the platform owner and its industry partners, and serve to design and create the industry platform in such a way that a high value contribution for the network members results.

- The components on the right side (dark grey; revenue, adoption, commitment) are oriented towards the network members and must be designed in such a way that the direct and indirect network effects are created, and the industry platform is constantly growing.
- The concentric circles with the corresponding arrows illustrate the relationship between the components related to a platform economy with a variety of stakeholders and network members and their interaction:
  - The platform governance - defined by platform owner and its industry partners - has an impact on the commitment of the network members to use the platform permanently
  - Sales activities lead to an adoption of the platform by the platform users
  - Pricing generates revenue

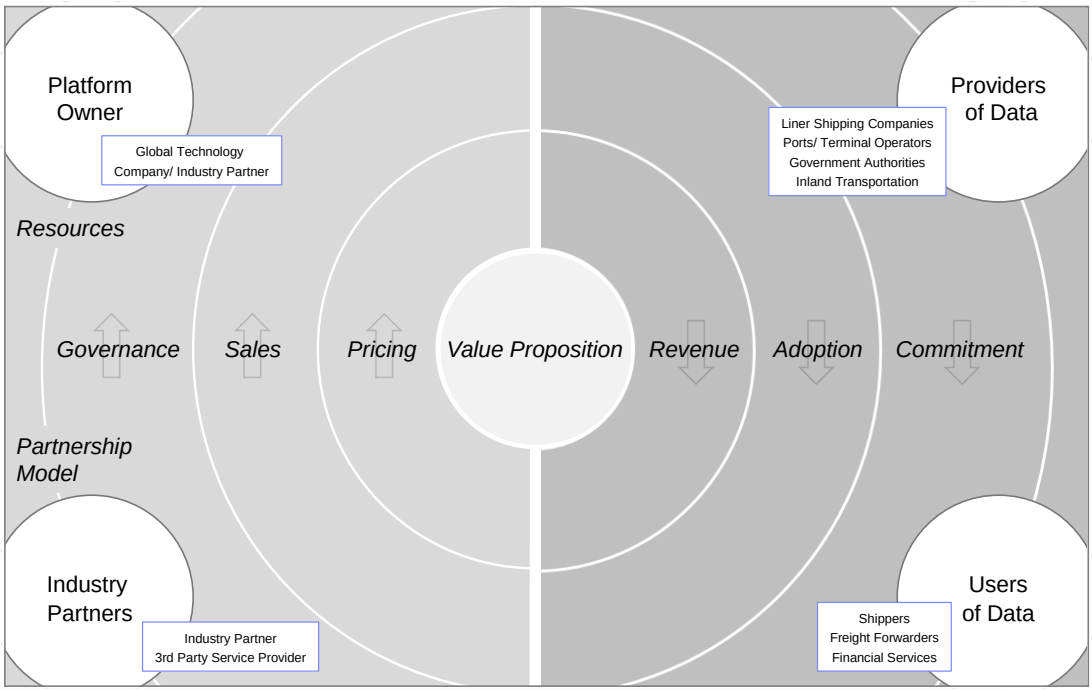

Figure 5.1 The 4/9 Platform Business Model Canvas for enhancing efficiency of freight logistics in the maritime supply chain

When validating the “4/9 Platform Business Model Canvas”, V-2 pointed out the importance of change management. In his view, it is not only crucial to establish a platform business (steady state), but also to continuously adapt it

to the changing market conditions. Change management must accompany this transformation from a software- and service-oriented business model to a platform business model. These considerations can be transferred visually to the feedback loops - represented by the arrows - within the concentric circles. The market side (revenue, adoption, commitment) continuously influences the design of the industry platform by the platform owner and his industry partners (governance, sales, pricing) through reaction and feedback.

Table 5.2 shows in detail in which function and in which way the stakeholders and actors interact with the industry platform:

Platform Owner	
Global Information Technology Company	**Controls** the platform ecosystem by defining platform rules and architecture and implements new processes in the platform ecosystem as an interface to users and complementors. **Owns** the intellectual property rights together with industry partners

Industry Partner	
Powerful Industry Partner	**Owns** the intellectual property rights together with the global information technology company. **Specifies** the platform functionalities through industry and process expertise. **Influences** industry companies through existing alliances and standards organisations, so that they become users of the industry platform
Third-Party Service Provider	**Develops** or provides external services that are integrated into the industry platform with the aim of increasing its performance and thus its attractiveness for users

Provider of Data/ User of Data	Acts as ***Provider of Data***	Acts as ***User of Data***
Liner Shipping Companies	**Provide** information about the status of shipments during transport from port to port	**Get** E2E shipment events and immutable records of source documents (freight documents, commercial invoice)
Ports/ Terminal Operators	**Provide** information about the status of shipments within the port or terminal	**Get** E2E visibility across shipping corridors, and real-time access to more information to improve terminal planning
Government Authorities	**Provide** information about the export and import clearance status for shipments into and out of the country	**Get** data for better risk assessments and information sharing
Inland Transport Companies	**Provide** information on the status of shipments carried on rail, trucks or barges	**Get** E2E supply chain events from shipments through real-time access for better planning and asset utilisation
Shippers	**Provide** all relevant freight and customs information necessary for the service providers involved in the E2E supply chain.	**Get** E2E supply chain events from shipments in real-time allowing for greater predictability and data to validate fees and surcharges
Freight Forwarders	**Provide** freight and customs documents, the transportation plan, inland transportation events and information on intermodal handovers.	**Get** real-time access to the E2E supply chain data to improve effectiveness of track-and-trace services
Financial Services		**Get** access to real-time E2E supply chain data for import and export payment processing and trade credit insurance

Table 5.2 Stakeholders and network members interacting with industry platform, Source: IBM (2018) [Adapted]

In the following, the components presented in the business model framework are those which are relevant for the development and operation of an industry platform for maritime freight logistics and they are described according to the logic of value creation:

Business Model Component	Description
Value Proposition	The industry platform links the network members with the goal of improved supply chain visibility and increased supply chain efficiency in maritime freight logistics
Revenues	By using the industry platform, revenues for the platform owner and industry partners are generated
Sales	Targeted sales activities are necessary to form and grow the business network
Governance	Governance is the central function for defining platform rules and usage fees, building trust and establishing a common platform identity
Resources	The platform owner requires specific financial, technical and human (skills) resources to develop and operate the industry platform
Partnership Model	The Partnership Model agreed between platform owner and industry partners defines the commercial model and go-to-market approach
Pricing	The Pricing and subsidy model is based on the value contribution for the users and controls their interaction with each other
Adoption	Network effects lead to a steady growth of the platform, especially if the users have the perception that the industry platform will become a standard for the maritime supply chain
Commitment	User Commitment and active usage of the industry platform must be promoted so that the necessary network effects arise

Table 5.3 Description of platform business model components

5.4 Towards the operationalisation of the 4/9 Platform Business Canvas

The action plan is derived consistently from the components of the platform business model framework shown in Figure 5.1. To each business model component specific recommendations for action are assigned, which resulted from the analysis of the key mechanisms in Table 5.1. From this, key activities were defined, and relevant key roles identified that are responsible for their implementation in a global information technology company. The action plan will be complemented by the necessary resources and the intended benefit related to the key activity.

Business Model Component	Recommendation for Action	Key Activity	Key Role and Responsibility	Resources Commitments	Intended Benefit
VALUE PROPOSITION	Define Platform Business Model	Describe individual value proposition for each stakeholder and network member of the industry platform	Head of Platform Strategy, Industry Consultant	Workshops with relevant stakeholders, Strategic corporate guidelines	Creating value within a business network
	Define functional Scope and Technological Design	Describe functionalities and architecture of industry platform	Technical Platform Lead, Solution Architect	Architectural skills, Availability of technological software components	Attracting new network members through value-generating industry platform
PARTNERSHIP MODEL	Form strategic Industry Partnership with Key Partners	Identify potential partners for joint initiative and select key partners	Head of Platform Strategy, Industry Consultant	Company-specific information on potential key partners	Risk sharing and value proposition enhancement
		Define platform ownership, IP rights and investments between stakeholders	Head of Platform Strategy, Legal Adviser	Corporate guidelines on general terms and conditions, Internal investment commitments	Clear contractual and financial commitment to platform growth
	Form Partner Model with Platform Solution Providers	Identify and cooperate with solution providers of platform services	Technical Platform Lead, Solution Architect	Company-specific information on potential solution provider, Information about marketability of platform services	Increasing benefit for platform users

Table 5.4 Action plan to implement the industry platform business model

Business Model Component	Recommendation for Action	Key Activity	Key Role and Responsibility	Resources Commitments	Intended Benefit
PARTNERSHIP MODEL	Form Partner Model with Platform Solution Providers	Enable collaboration through open architecture based on standards	Solution Architect	Available architectural skills	Easy integration of platform services from external solution providers
GOVERNANCE	Select Key Partners of Platform Ecosystem	Identify industry partners with strong market impact in maritime freight logistics	Head of Platform Strategy, Industry Consultant	Company-specific information on potential key partners engaged in maritime freight logistics	Industry market leaders motivate other logistics service providers to join the platform.
	Select Third-Party Service Providers to add Services	Identify third-party providers with value-added services	Technical Platform Lead, Solution Architect	Company-specific information on potential solution provider, Information about marketability of platform services	Increases attractiveness of industry platform for network members
	Establish Platform Governance	Set terms of use for using the industry platform	Offering Manager, Legal Adviser	Corporate guidelines on general terms and conditions	Terms of use enable successful growth of industry platform
		Establish industry advisory board	Business Development Executive	Regular (quarterly) face-to-face meetings	Provides industry expertise to support platform strategy

Table 5.4 Action plan to implement the industry platform business model (2)

Business Model Component	Recommendation for Action	Key Activity	Key Role and Responsibility	Resources Commitments	Intended Benefit
RESOURCES	Enable Intrapreneurship / Enable Start-Up Culture	Encourage entrepreneurial spirit, set targets for investments in innovations	Executives at corporate level	Change management skills	Generating new business models for future growth
	Allocate Investment Budget	Determine financial investments and human resources required for initial development and operation of industry platform	Head of Product Development, Solution Architect	Available developers and members of operation team	Fostering of sales activities through prototype of an industry platform
	Use Blockchain Technology	Identify blockchain relevant use cases	Head of Product Development, Solution Architect	Technical expert knowledge	Creates trust among platform users through traceable and tamper-proof transactions
	Develop new Services	Plan development roadmap and assign development resources for implementation	Head of Product Development	Internal Staffing Commitments for Developers and Architects	Enables industry feedback to optimise implemented processes based on prototype
	Establish Industry Standard for Data Exchange	Define data interfaces for the various data transactions between network members - based on an open architecture	Solution Architect	Available architectural skills	Enables industry standard through simplified and standardised data exchange

Table 5.4 Action plan to implement the industry platform business model (3)

Business Model Component	Recommendation for Action	Key Activity	Key Role and Responsibility	Resources Commitments	Intended Benefit
SALES	Change Go-to-Market Model	Align go-to-market approach with industry partners	BDE, Sales Managers	Regular (weekly) meetings or calls on sales progress	Targeted sales activities and scaling of sales coverage
	Change Sales Measurements	Set sales KPIs for positive network effects or performance of complementary services	Sales Managers	Annual sales target agreements with account managers	Incentivising the sales organisation to sell platform services
	Reorganise Client Assignment	Assign network members from the transport and logistics industry to the internal industry sales matrix	Sales Managers	Annual realignment meetings	Achieving industry-related targeted global and local sales activities
	Participate in Associations	Identify relevant industry associations of maritime freight logistics for participation	Business Development Executive	Internet research, survey at industry partners	Influencing the strategic agenda of maritime freight logistics with regard to industry platforms
PRICING	Define Pricing Model (free usage, subscription, transaction fee)	Define the pricing model - transaction-based or as subscription - and a subsidy model for the different network members	Head of Platform Strategy, Business Development Executive	Pricing tools, projections by controlling	Transparent pricing model to motivate usage of industry platform
REVENUE	Change Revenue Model	Change measurement system to incentivise long term transactional sales	Sales Manager	Annual sales target agreements with account managers	Stable revenue flow instead of one-time payments
	Generate IT Services revenue	Define revenue potential of required consulting and IT services for integrating industry platform services	Business Development Executive, Business Analyst	Business case calculation tools, projections by controlling	Use industry platform as enabler for additional IT services revenue

Table 5.4 Action plan to implement the industry platform business model (4)

Business Model Component	Recommendation for Action	Key Activity	Key Role and Responsibility	Resources Commitments	Intended Benefit
COMMITMENT	Promote active Usage and User Commitment	Establish a platform governance to accomplish desired activities on platform	Head of Platform Strategy, Offering Manager	Regular (weekly) meetings on platform usage	Achieving loyalty and user commitment to the platform
ADOPTION	Onboard network members, enable external service providers	Onboard new network members, integrate external platform services that add value to the platform	Customer Onboarding Manager, Integration Specialist	Open interfaces with developer access for service providers	Creating positive network effects
	Mediate value proposition to employees	Support a change management process to positively influence the mindset of affected employees	Change Management Expert	Series of change management workshops	Positive mindset for change leads to a successful implementation of the industry platform

Table 5.4 Action plan to implement the industry platform business model (5)

The key roles listed in Table 5.4 belong to the following business functions:

Platform Strategy (head of platform strategy, industry consultant, legal adviser): The platform strategy must focus on business and technology aspects in such a way that competitive advantages can be achieved through the successful acquisition of industry platform users. This includes the selection of the industry segment targeted by the industry platform and the definition of partner models with industry partners and third-party service providers.

Product Development and Application Support (head of product development, offering manager, business analyst, technical platform lead, solution architect): Product development begins with the initial idea of an industry platform and extends to its market launch. Product development includes all technical activities that lead to a marketable product. Consultants and developers build and run the industry platform based on a custom-developed set of processes, procedures, policies, and standards.

Sales (business development executive (BDE), sales manager): Industry platform sales is managed by sales representatives of the industry platform business unit with central responsibility for the acquisition of industry partners, third-party service providers and target clients. These acquisition activities are carried out in close coordination with the local key account managers, whose clients are involved in maritime freight logistics and are, therefore, potential platform users.

Customer Onboarding (customer onboarding manager, solution architect, integration specialist, change management expert): Customer Onboarding provisions access to the industry platform and supports the customer's integration project to bring the customer in production.

5.5 Benefits for users of an industry platform for maritime freight logistics

This study has practical implications, since the platform business model framework developed in this chapter and the recommendations for action derived from it can support global information technology companies in transforming their business model with a focus on maritime freight logistics.

An introduction of a blockchain-based industry platform in the multi-stakeholder environment of maritime freight logistics has clear benefits for the network members of the E2E supply chain. In the following, the identified weaknesses are contrasted with the potential benefits for network members through the use of a blockchain-based industry platform (Table 5.5).

Shippers	
Existing Pain Points	*Possible Benefits*
High administrative effort to get shipment status information	Eliminates manual processes for accessing various track and trace dashboards and requests to service providers to obtain shipment status information
Lack of confidence in charges on fees in invoices, especially surcharges, which requires costly and time-consuming validation steps.	Enables shippers to efficiently validate charges and surcharges by obtaining a comprehensive, reliable view of the E2E supply chain
High IT costs for data exchange with logistics service providers	Eliminates the costly maintenance of point-to-point connections and reduces switching costs between service providers through a single, standardised interface for data exchange
High compliance costs for international trading transactions	Eliminates freight documents (paperless trade) and thus the cost of document handling within the supply chain

Freight Forwarders	
Existing Pain Points	*Possible Benefits*
Extensive manual data collection to provide track and trace events	The E2E platform provides standardised event data for supply chain visibility
Complex development and maintenance of point-to-point connections to a large network of logistics partners and service providers	Reduces costs by eliminating the entire interface management
High dependence on status information of the contracted transport companies in order to make them visible for their customers	Several mechanisms for obtaining supply chain data (API integration, mobile apps, IOT devices) enable a value-oriented data strategy

Ports and Terminal Operators	
Existing Pain Points	*Possible Benefits*
Costly development and maintenance of point-to-point connections with shipping lines and port ecosystem	Reduces costs of data exchange with shipping lines and the port ecosystem by using an industry standard
Inaccurate arrival times lead to inadequate planning and use of port and terminal assets	Fast and reliable electronic communication of ship arrival times for the port ecosystem improves the use of port assets
Long waiting times for trucks and ships and suboptimal utilisation of the facilities impair port and terminal operations	Improved supply chain visibility leads to better planning of transport modes and thus shorter waiting times in ports, reduced environmental impact and better resource planning and use.

Liner Shipping Companies	
Existing Pain Points	*Possible Benefits*
Lack of visibility and real-time access to E2E shipping events prevents proactive customer service	Customer service representatives have access to reliable real-time status information of all shipments, freeing time for higher value services
High time and personnel effort for customer service even for simple status requests	Electronic information services of the liner shipping companies can be provided from data of the industry platform for self-service inquiries of

Liner Shipping Companies	
Existing Pain Points	*Possible Benefits*
	the customers, whereby the costs in customer service will be reduced
Significant revenue leakage due to lack of clarity about the validity of surcharges	Digital audit trail of shipment events facilitates the recording of fees and simplifies compliance with regulatory audits

Authorities	
Existing Pain Points	*Possible Benefits*
Unnecessary activities due to late or missing information	Early available cargo information and verified proofs of origin enable more targeted and effective decisions about the containers to be inspected.
Cost-intensive, paper-based work	Reduces manual paperwork so officials can focus more on risk assessment
Fraud and counterfeiting in the import and export of goods	Blockchain-based digital documents are tamper-proof and traceable, reducing the likelihood of goods being declared incorrectly.

Table 5.5 Benefits for network members using the industry platform
Source: IBM (2018) [Adapted]

5.6 Validation of research study results

As explained in Section 3.8 (Chapter 3 Methodology), a validation of the research results was carried out through semi-structured interviews with four interview participants (V-1 – V-4) as an essential step in quality assurance. In the following, relevant key statements of the informants are presented as quotations in tabular form. For clarity, the focus is on the feedback on blockchain-based industry platforms and the central research results of this study as a contribution to knowledge and practice: The explanatory model with the causal entities and its underlying causal mechanisms (Section 4.8), the new "4/9 Business Model Canvas", which was derived consistently from it (Section 5.3) and the resulting action plan (Section 5.4).

In general, the overall results of this study have been positively confirmed; meaningful suggestions have only led to minor enhancements. In the following, exemplary key statements are presented, which led to a minor enhancement of the content of this work (**Enhancement** of study result), or confirmed the result and also gave an outlook for a future application of the 4/9 Platform Business Model Canvas and the action plan in professional practice (**Confirmation** of study result).

Blockchain-based Industry Platform
Key Statement 1 (Platform Business Model):
"…. these industry platforms are disruptive. And to implement a new business model, we leverage many of our current technological capabilities and innovations to develop new architectural capabilities that drive blockchain-based industry platforms" (V-3).
Main Findings from Key Statement 1: **Confirmation** of study result
Key Statements 2a/b (Impact on maritime freight logistics industry):
a. *"Platforms based on blockchain address the biggest challenge which is a siloed industry. So, blockchain technology enables the ecosystem to come together to drive that efficiency"* (V-3).
b. *"When ocean carriers join an independent industry platform on which they have equal control over their network, they see this as a way to collaborate and at the same time as a way simply to compete"* (V-1).
Main Findings from Key Statements 2a/b: **Enhancement** of study result
Enhancement of the reciprocal relationship between Supply Chain Collaboration and the blockchain-based industry platform in Figure 2.9.

Explanatory model for platform business model transformation
Key Statement 3 (Change Management):
"I fully agree. Platform ownership, the platform governance, the standardisation of processes and data are geared to influence change; along with the adoption in the market, these are of course very crucial components. […] but for the adoption of this new industry platform, we are dealing with people whose mindset and behaviour must be influenced to accept and adopt a new industry platform and the changes that it brings" (V-3).

Main Findings from Key Statement 3: **Enhancement** of study result
Complementing the business model component "Adoption" in Table 5.4 with change management as a recommendation for action in order to positively influence the mindset of the affected employees towards a successful implementation of the industry platform.
Key Statement 4 (Key causal mechanisms):
"I agree those two [the cross-sector partnership mechanism and the governance mechanism] are the key ones" (V-1).
Main Findings from Key Statement 4: **Confirmation** of study result
Confirmation of the key causal mechanisms through systematic deduction using the RRRE model.
Key Statement 5 (Platform Strategy):
"So, our platform strategy has to be an evolving mechanism that is being driven not just by how we want to disrupt the industry but also how the industry is accepting our platform and giving us feedback on it. [...] It looks like a top-heavy disruption at least pictographically. I think an arrow from the user adoption all the way back to the industry platform strategy might be something" (V-3).
Main Findings from Key Statement 5: **Enhancement** of study result
Enhancement of relevant feedback loops between the causal mechanisms of the explanatory model in Figure 4.13.
Key Statements 6a/b (Cross-Sector Partnership Mechanism):
a. *"The first actual step that these industry platforms take, because embedded in their strategy is a partnership across sectors to build that ecosystem…"* (V-3).
b. *"When you're establishing an industry platform, you want to work with organisations that share the vision towards reducing the complexity of international trade. [...] You have to make sure you are aligned with the most important entity in the global trade process in each of these countries which are the custom authorities where the clearance process takes place"* (V-3).
Main Findings from Key Statements 6: **Enhancement** of study result
Standards organisations were considered in the description of the causal entity "standardisation of processes and data" in Section 4.5.3.
Key Statement 7 (Governance Mechanism):
"It goes back to the governance mechanism and the cross-sector partnership mechanism… It is a challenge to say that it is an industry platform that is platform agnostic and independent of any partner" (V-1).
Main Findings from Key Statement 7: **Confirmation** of study result

4/9 Platform Business Model Canvas
Key Statement 8 (Overall statement):
"This is wonderful. I fully understand it" (V-3).
Main Findings from Key Statement 8: **Confirmation** of study result
Key Statement 9 (Overall statement):
"I like the 4/9 Business Model framework more than the one from Osterwalder because it shows the dependencies of the respective components with regard to the platform business to each other better" (V-4).
Main Findings from Key Statement 9: **Confirmation** of study result
Key Statement 10 (Future application):
"What if that approach would be used for a new industry platform? .... to develop a new platform based on this concept. I find that very interesting. Because so far, it's only theory, even if it's substantiated by practical examples and interviews. Therefore, it would make sense to apply the 4/9 Platform Business Model Framework to a practical case" (V-4).
Main Findings from Key Statement 10: **Confirmation** of study result
Key Statement 11 (Feedback loops):
"Where's the opportunity for feedback loops and iteration? Is that something that's important to include in the model?" (V-2).
Main Findings from Key Statement 11: **Enhancement** of study result
Enhancement of relevant feedback loops (illustrative) between the platform business model components Governance/Commitment, Sales/Adoption and Pricing/Revenue in Figure 5.1.

Action Plan: Towards the operationalisation of the 4/9 Platform Business Canvas
Key Statement 12 (Future application):
"Wonderful. [...]. I think if I were a young entrepreneur in the supply chain business and then applied this approach, it would at least give me a deep insight into what it takes to build an industry platform in an extremely complex industry" (V-3).
Main Findings from Key Statement 12: **Confirmation** of study result

Table 5.6 Key statements of validation of research study results

5.7 Chapter conclusion

This chapter has been concerned with developing a new business model framework – the “4/9 Platform Business Model Canvas” - for enhancing efficiency of maritime freight logistics. Based on the explanatory model identified in the RRRE cycle the “4/9 Platform Business Model Canvas” is designed for the four groups of stakeholders and network members of the platform ecosystem: The *platform owner* who, together with *industry partners* such as major liner shipping companies, is responsible for platform governance and holds the intellectual property. Furthermore, the *providers of data* such as ports and terminals and the *users of data* such as shippers and global freight forwarders. The “4/9 Platform Business Model Canvas” is built on the nine business model components partnership model, platform governance, sales, pricing, value proposition, revenue, adoption, commitment and resources. In its visual representation it is a further development of the Platform Business Model Canvas (P-BMC) introduced by Walter (2016).

Chapter 6 Conclusions

6.1 Introduction

This last chapter summarises the key findings of this study. Section 6.2 describes how the aim and objectives of this study are achieved before Section 6.3 answers the research questions related to the identified key findings. The study's contribution to knowledge (Section 6.4) and practice (Section 6.5) is then explained. The chapter ends with a critical review of the limitations of this study in Section 6.6 and provides guidance for further research (Section 6.7).

6.2 Achievement of research aim and objectives

The stated research aim of this study was to develop a framework rooted in the principles of platform business modelling to enhance the efficiency of freight logistics in the maritime supply chain. Four objectives were identified in order to achieve this research aim.

The first objective required a critical review of the existing literature streams on industry platforms for maritime freight logistics and business model innovation. Academic research in general management, organisation and innovation management shows increasing interest in platform innovations (Moser & Gassmann, 2016), as platform innovations are also of strategic importance in management practice in order to exploit new business potential. As a result, two research questions were formulated based on the research gaps identified in the literature. A conceptual framework was developed that presents the main research areas systematically investigated in the literature review as well as the market conditions for platform innovations in their relationship to each other. With regard to maritime freight logistics, platform innovations in maritime supply chain networks are driving efficiency made possible by the progress of digitalisation. As supply chain collaboration (SCC) is an important prerequisite for new data-driven process innovations, established intermediaries in

maritime freight logistics are affected by disintermediation through blockchain-based industry platforms.

The conceptual framework thus provided an orientation map for data collection and data analysis in primary research.

The second objective was to identify the key causal factors underlying the current platform business model transformation of a global information technology company in respect of maritime freight logistics. Due to the novelty of this research topic an explanatory research design based on the criteria of a case study was identified as suitable approach. For this purpose, the primary data were collected through semi-structured interviews, as this method has the best possible explorative characteristics to explain the transformation of the existing service and software-oriented business model of a global information technology company into a platform business model.

In line with the philosophy of critical realism the RRRE model was applied to examine and analyse this business model transformation. This was a systematic process which, proceeding from the empirical events observed, identified the causal entities associated with them (Resolution) before these causal entities were re-described with reference to the findings of the literature review (Redescription). Following the investigation of the mechanisms underlying the business model transformation and their interrelationships (Retrodiction), those mechanisms were finally identified from the multiple causal mechanisms through which the platform business model transformation could best be explained (Elimination).

The third objective was to consider, on the basis of stakeholder perceptions and opinions, the conditions for the effective application of the principles of platform business modelling within the context of maritime freight logistics. As a result, the “4/9 Platform Business Model Canvas” (4/9 PBM-C) was developed in this study, which can be applied to the emerging industry platform business in maritime freight logistics and represents a further development of the established business model frameworks.

This platform business model framework was the foundation for achieving the fourth and last objective. Namely, which is to derive concrete recommendations from this that are based on the principles of platform business modelling and geared to the optimisation of maritime freight logistics. As a result, an action plan with concrete recommendations for action was developed, which can help executives to operationalise their platform business model.

6.3 Responses to research questions

The key findings of this study are discussed along the two research questions. In line with the research philosophy of critical realism underlying this study, research question one, which is diagnostic, aims to explain the key causal factors active in the transformation of a software- and service-oriented business model into a platform business model for maritime freight logistics, while research question two, which is solution-oriented, focuses on deriving a concrete framework for executives to operationalise the platform business model.

The first research question emerged from the investigation of potential causal mechanisms identified in the literature:

> *What are the key causal mechanisms underpinning the platform business model transformation of a global information technology company for maritime freight logistics?*

By identifying the causal mechanisms underlying the platform business model transformation, it became possible to develop an explanatory model that represents the identified mechanisms with their complex interactions. Although several mechanisms were active, the findings of the data analysis emphasises explicitly the causal capacity of the *cross-sector partnership mechanism* and the *governance mechanism* within the open organisational system of the global information technology company (Figure 4.13). But what makes these

mechanisms more plausible than others? The short answer is that these mechanisms were consistent with all the data and the statements of the informants and have the strongest explanatory power to explain the transformation from a software- and service-oriented business model into a platform business model for maritime freight logistics. This mechanism approach had two major advantages: First, the identified chain of causality has enabled the investigation of the phenomenon of business model transformation and second, the reader is able to assess the credibility of the proposed mechanisms by evaluating the documented evidence (Bygstad & Munkvold, 2011b). Therefore, this transparency is a "catalyst for future discussions" (Tan *et al.*, 2016, p. 752) that enables the research community to engage in critical debate and evaluation (Bygstad & Munkvold, 2011b).

The second research question resulted from the investigation of the existing business model frameworks identified in the literature review, which support companies strategically in their business model transformation:

> *What are the conditions for the effective application of the principles of platform business modelling that gears towards the optimisation of freight logistics in the maritime supply chain?*

In the course of the emerging platform economy and the “shift from linear value chains to value creation networks” (Walter, 2018, p. 3), the literature review has shown the evolution from pipeline oriented to network-oriented business model frameworks. As a consistent further development of Walter´s Platform Business Model Canvas (Walter, 2016), this study succeeded in developing a new platform business model framework to enhance the efficiency of maritime freight logistics – the "4/9 Platform Business Model Canvas" (4/9 PBM-C). This 4/9 Platform Business Model Canvas presented in Chapter 5 is based on the explanatory model of causal mechanisms elaborated in response to research question one. It supports the design of a platform business model for the four entities of the platform ecosystem in maritime freight logistics: The *platform owner* who, together with *industry partners* such as major liner shipping companies, is responsible for platform governance and holds the intellectual

property. Furthermore, the *providers of data* such as ports and terminals and the *users of data* such as shippers and global freight forwarders. The 4/9 Platform Business Model Canvas is built on the nine components: Partnership Model, Platform Governance, Sales, Pricing, Value Proposition, Revenue, Adoption, Commitment and Resources.

While in linear value chains the automation of processes within and between the companies involved in the maritime supply chain has been driven by increasing digitalisation, the driver in value networks is collaboration within the business network. However, such an intended collaboration is only possible through a *new form of trust* within the platform ecosystem, since sensitive data in a platform economy leave the company boundaries. The platform owner has to take this into account by designing the business model. Blockchain technology is of importance here, as it creates the necessary trust among data providers and data users to process sensitive supply chain data via protocolled, traceable and tamper-proof transactions (Wang *et al.*, 2019). With these transaction types and key features, the industry platform has a respective compelling value proposition from a commercial or operational point of view for all stakeholders and network members. This results in “openness and commitment to collaboration rather than rivalry and mistrust” within the maritime supply chain (De Martino *et al.*, 2013, p. 684). The willingness of the participants to commit to this new form of collaboration in business networks is, however, indispensable for the direct and indirect network effects to occur.

Based on the platform business model framework, a concrete action plan for the relevant business functions responsible for the design of a platform business model has been derived (Section 5.4).

6.4 Contribution to knowledge

This study makes a considerable contribution to knowledge. First, a methodological contribution by applying an analytical framework from Critical Realist research – the RRRE model (Resolution, Redescription, Retrodiction, Elimination) developed by Bhaskar (2013a, p. xvii) - to the practical case of a

platform business model transformation in the industry context of maritime freight logistics. The investigation of the platform business model transformation in a global information technology company is of academic relevance, since at the time of this research blockchain-based industry platforms are emerging in all industry sectors. In addition to the research area of platform business modelling, the industry context is also relevant, since maritime freight logistics controls the majority of world trade and is, therefore, of great economic importance.

Second, this study has a theoretical and conceptual contribution through developing the “4/9 Platform Business Model Canvas” which can be used by global information technology companies as platform owner. This platform business model framework, which can be applied to the emerging B2B platform business can extend existing research on business model frameworks. The academic starting point was Alexander Osterwalder’s Business Model Canvas, consisting of nine building blocks, which has been established in professional practice for years. From the researcher's point of view it was a remarkable academic achievement to make the Business Model Canvas one of the most recognised templates for the development and presentation of business models for companies, on the basis of his dissertation in 2004 (Osterwalder, 2004) and his later book "Business Model Generation" (Osterwalder, 2011). However, as digitalisation and new technologies, such as the blockchain technology, are shifting established pipeline business models (Parker *et al.*, 2016; Van Alstyne *et al.*, 2016) into business models of a networked economy (Palo & Tähtinen, 2013), the traditional business model frameworks must also be further developed to reflect these developments. Therefore, the “4/9 Platform Business Model Canvas” proposed in this study represents a first step in this direction.

6.5 Contribution to practice

“Critical realists try to explain and criticise” observed conditions (Fletcher, 2016, p. 191). Therefore, this study proposes a framework for global

information technology companies that intend to successfully enter the emerging platform business as platform operator - the “4/9 Platform Business Model Canvas”. The resulting recommendations for action enable these companies to develop and operate industry platforms in order to implement more efficient processes in the multi-stakeholder environment of maritime freight logistics. It is argued that the partnership model and the platform governance are the most important strategic success factors for the successful implementation of an industry platform, as they are the only way to create the prerequisites for a functioning business network of data users and data providers, as well as complementors for additional platform services.

Although the derived recommendations for action may be fallible under various conditions or lead to unexpected results, they are rooted in the explanatory model of causal mechanisms developed in Chapter 4 in line with the CR approach (Fletcher, 2016). Therefore, this study contributes to practice by providing a valid framework that can be used by global information technology companies engaged in the emerging platform business. V-1 and V-4 gave feedback during the validation of the research results, that it would be useful to apply the "4/9 Platform Business Model Canvas" as well as the derived action plan - developed in this research - to future platform developments of the global information technology company.

6.6 Limitations of study

This study attempts to provide new insights in the field of platform business modelling. In view of the novelty of this field of research, however, this research also reaches its limitations.

First, the findings of a single case study are not representative or statistically generalisable in the traditional positivist sense (Eisenhardt & Graebner, 2007; Flyvbjerg, 2006), but the identified causal mechanisms can explain an outcome in more detail than other methodological approaches (Bygstad & Munkvold, 2011b). In line with the research philosophy of critical realism “a method cannot replace the need for domain knowledge and research

experience” (Bygstad & Munkvold, 2011b, p. 12). The aim is not to explain the organisational phenomenon of a platform business model transformation through assumptions, but through experience and knowledge in the in-depth investigation of the complex organisational situation (Lincoln & Guba, 1985). It is the in-depth description of the mechanisms in the industry context of this study that allows the findings to be applied also to other situations (Langley, 1999).

Secondly, the interview data are constrained in terms of completeness as the researcher's ability to fully consider the entire dynamic system of maritime freight logistics is limited. The research was restricted in the selection of the informants identified by snowball sampling. However, the resulting biases were mitigated by conducting interviews with informants from different business units of the global information technology company and the results were confirmed by more than one data source.

A third limitation is that this study was conducted in the industry context of maritime freight logistics. A transfer of the findings of this study, the application of the “4/9 Platform Business Model Canvas”, as well as the recommendations for actions to operate industry platforms in other multi-stakeholder environments (airline industry, …) must therefore be evaluated precisely. On the other hand, this has the advantage that this study contributes to the - still limited – research field of B2B industry platforms and platform business model innovation.

6.7 Implications for further research

The limitations underlying this study also offer new opportunities and directions for further research.

"Business model research is still at an early stage" (Wirtz *et al.*, 2016, p. 48). Therefore, firstly, this study can only be an initial step in extending the existing business model literature by a new platform business model framework for blockchain-based industry platforms - with the aim of establishing it sustainably in business practice. Although the “4/9 Platform Business Model Canvas” was

systematically derived from the analysis of causal mechanisms, a detailed scientific investigation of business models derived from it in a comprehensive test would provide important insights (Palo & Tähtinen, 2013). This becomes relevant precisely because blockchain-based industry platforms and corresponding business models are still in their early stages at the time of this research and are only beginning to assert themselves in a networked economy (Wang *et al.*, 2019).

Secondly, based on the research position of critical realism, the “4/9 Platform Business Model Canvas” was developed analytically through a detailed, qualitative approach using a single case study. Such a theoretical or conceptual approach is common for relatively new research areas where there is a low level of academic knowledge (Wirtz *et al.*, 2016). Further research could validate the developed and proposed business model components of the blockchain-based business model framework by a more complex, confirmatory empirical work, for example in the form of an industry-wide investigation using a quantitative approach. In this way, the findings of this study may become more robust and the presented platform business model framework can be applied universally and industry-independently for the development and operation of industry platforms. Overall, the mechanism approach applied in this study has the potential to improve these empirical studies, by providing ontological depth and more precise explanations (Bygstad & Munkvold, 2011b).

Thirdly, the Business Model framework was developed in the industry context of maritime freight logistics. Therefore, it may be useful to apply the chosen research approach in another industry context in order to verify the validity of the causal mechanisms identified. This may allow important conclusions to be drawn regarding the transferability of the findings and recommendations for actions identified in this study to comparable industry platforms in other industries.

Finally, the validation of the research results with the interview participants has revealed another important aspect. While the results of this study refer to the transformation of a software- and service-oriented business model into a

platform business model, future research can provide interesting insights into the establishment of the industry platform. From the point of view of V-2, in the early phases, the aspects of the partnership model and the governance model identified in this study stand in the foreground, while in a later phase functionality of the blockchain-based industry platform and adoption by the ecosystem might become relevant. Therefore, future research could focus on how market shares can be gained in order to assert oneself in the market with an industry platform. The question arises as to whether "razor and blades" business models can be successful in which the industry platform is made available free of charge and global information technology companies acquire revenue through the indirect licensing of third-party services or the integration of the platform services into the backend systems.

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Appendices

Appendix 1: Participant information

Participant Information

Platform Business Modelling for Enhancing the Efficiency of Freight Logistics in the maritime Supply Chain

1. Invitation

You are being invited to take part in a study. Before you decide, it is important for you to understand why the research is being carried out and what it will involve. Please take time to read the following information carefully. Please ask if there is anything that is not clear or if you would like more information. Take time to decide whether you wish to take part.

2. What is the purpose of this study?

This study is being conducted as part of a DBA programme (Doctor of Business Administration) at the Edinburgh Napier University (UK). The research aim is to develop a B2B platform business model for a global information technology company to enhance the efficiency of transport logistics.

3. Why have I been chosen?

You have been chosen because you have been recognised as being an expert in understanding (platform) business model components and how to deliver industry services to the market. It is appreciated if you could contribute to the topic which will be valuable to the research results.

4. Do I have to take part?

You are under no obligation to take part in this research. Your participation in the interview is completely voluntary. If you do decide to take part, you should indicate your agreement on the consent form. You can still withdraw at any time without giving a reason.

5. What do I have to do?

You are asked to take part in an interview (face-to-face or phone interview) which lasts approximately 60 minutes. The time and place of the interview will be agreed with you separately. Please make sure you are available in the scheduled timeframe in a quiet environment and free of any avoidable distractions (phone calls, messages, etc.).

6. What are the possible disadvantages and risks of taking part?

Participating in the research is not anticipated to cause you any disadvantages or discomfort. The potential physical and/or psychological harm or distress will be the same as any experienced in everyday life

7. What are the possible benefits of taking part?

Whilst there are no immediate benefits for those people participating in the research project, it is hoped that this work will have a beneficial impact on how to successfully develop and implement platform business models in transport logistics successfully.

8. What will happen if I don't want to carry on with the interview?

You can withdraw at any time during or after the interview. However, you will be asked if all data collected up to the point of your withdrawal can be used, subject to the confidentiality procedures (see 10.)

9. What will happen to the data and the results of the study?

The data recorded from the interview will be analysed and used for the final DBA dissertation. Parts of the study may also be submitted for publication. A summary of the research findings is offered to you. If you are interested in this summary, it will be sent to you by email immediately after compiling the results.

10. Will my data be kept confidential?

All the information collected during the research will be kept strictly confidential. Data will be anonymised, and you will not be identifiable in any reports or publications. Nobody other than the researcher will have access to the data, which will be saved securely on a password-protected notebook with encrypted hard disc. For possible publications, the data is then saved on a hard disk for a maximum period of 5 years in accordance with the Napier University's ethics guidelines (Edinburgh Napier University, 2017).

11. Who do I contact if I have any further questions or concerns?

There are no problems being anticipated during this study. If you do have any further questions or concerns, however, about any aspect of this study please feel free to contact the researcher:

Oliver Weisshuhn, Email: [redacted] Phone: [redacted]

If you have read and understood this participant information sheet and you agree to be an interview participant in this study, please now see the research consent form.

Appendix 2: Research consent form

Edinburgh Napier University Research Consent Form

Platform Business Modelling for Enhancing the Efficiency of Freight Logistics in the maritime Supply Chain

Edinburgh Napier University requires that all persons who participate in research studies give their written consent to do so. Please read the following and sign it if you agree with what it says.

1. I freely and voluntarily consent to be a participant in the research project on the topic of a platform business model for enhancing the efficiency in transport logistics to be conducted by Oliver Weisshuhn, who is a DBA student (Doctor of Business Administration) at Edinburgh Napier University (UK).

2. The broad goal of this study is to explore key factors that are crucial for a platform business model of a global information technology company to operate industry platforms in transport logistics successfully. Specifically, I was asked to participate in an interview (face-to-face or telephone interview), which takes about 60 minutes.

3. I have been told that my responses will be anonymised. My name will not be linked with the research materials, and I will not be identified or identifiable in any report subsequently produced by the researcher.

4. I also understand that if at any time during the interview I feel unable or unwilling to continue, I am free to leave. That is, my participation in this study is completely voluntary, and I may withdraw from it without negative consequences. However, after data has been anonymised or after publication of results it will not be possible for my data to be removed as it would be untraceable at this point.
5. In addition, should I not wish to answer any particular question or questions, I am free to decline.
6. I have been given the opportunity to ask questions regarding the interview and my questions have been answered to my satisfaction.
7. I have read and understand the above and consent to participate in this study. My signature is not a waiver of any legal rights. Furthermore, I understand that I will be able to keep a copy of the informed consent form for my records.

_____ _____

Participant's Signature Date

I have explained and defined in detail the research procedure in which the respondent has consented to participate. Furthermore, I will retain one copy of the informed consent form for my records.

_____ _____

Researcher's Signature (Oliver Weisshuhn) Date

Appendix 3: Interview guide

a Opening

- Brief recap of the purpose of the research
- Confirmation, that the “informed consent form” has been signed
- Request to record the interview (audio recording)

b Context

Introduction of the business model framework by Osterwalder and Pigneur (2011).

b1 (Market requirements) How important is the increasing digitisation in transport logistics (process efficiency,...)?

b2 (Strategy) What is the importance of industry platforms that might enable new transaction types in the multi-stakeholder environment of maritime freight logistics?

b3 (Decision Making) Who in your organisation is involved in the design and implementation of a platform business model in maritime freight logistics (function, local/global level,…)?

c Research Question 1 (diagnostic):

What are the key causal mechanisms underpinning the platform business model transformation of a global information technology company for maritime freight logistics?

c1 (Customer Segments) How do the needs of customers who use industry platforms differ from typical software and service clients? (Customer segments, customer assignments,..)?

c2 (Value Propositions) How do you evaluate the importance of global information technology companies in providing and operating industry platforms for maritime freight logistics? What are the characteristics of their value proposition?

c3 (Channels) What is the difference between the sales channels in order to achieve a participation or an investment in an industry platform? (Sales measurements,…)?

c4 (Customer Relationships) Are there differences in customer relationship management? How are the relationships with industry platform customers in maritime freight logistics maintained?

c5 (Revenue Streams) What is the difference between the revenue models used for industry platforms (transactional, monthly fee,…) and the typical software and service business? (Contract Model, Payment Model, …)?

c6 (Key Activities) Please describe the changed requirements to key activities that are performed in providing and operating industry platforms? (platform owner, promote network effects, monitoring, maintenance, risk management...)?

c7 (Key Resources) Are there differences in key resources that are needed to sell, provide and operate solutions/ industry platforms?

c8 (Key Partnerships) Please describe the changed requirements to relevant partnership models (industry partners, IT partners,...) in the platform ecosystem of maritime freight logistics?

c9 (Cost Structure) What are the differences on the cost structure (investments, ongoing costs,…) associated with the solution/ platform business?

d Research Question 2 (solution oriented):

What are the conditions for the effective application of the principles of platform business modelling that gears towards the optimisation of freight logistics in the maritime supply chain?

d1 Please describe industry platform projects that have been successfully implemented or failed. What were the critical success factors (GTD, Bluemix,…)

if not: Describe a business model of an external platform that has been provided successfully to the market (Amadeus, iTunes,..)

d2 What are the advantages or disadvantages of a global information technology company versus a start-up in terms of the platform business? (Innovators Dilemma, …)?

d3 What are the advantages or disadvantages of IT technology companies compared to public institutions such as port authorities or companies from the logistics sector? (e.g. in terms of trust, partnering with others,..)?

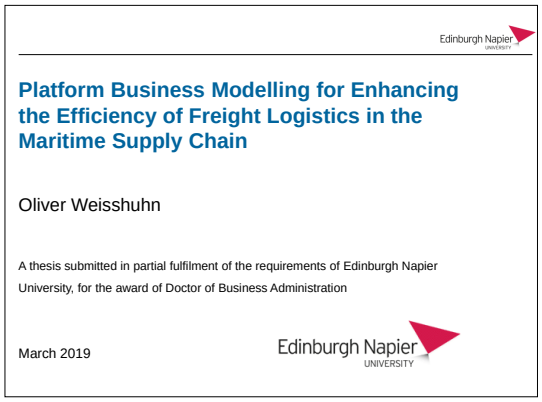
d4 How should the components of the business model framework be adapted to successfully sell and operate industry platforms in maritime freight logistics?

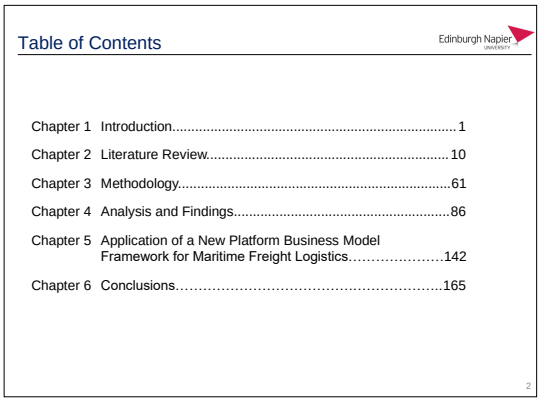
e Closing

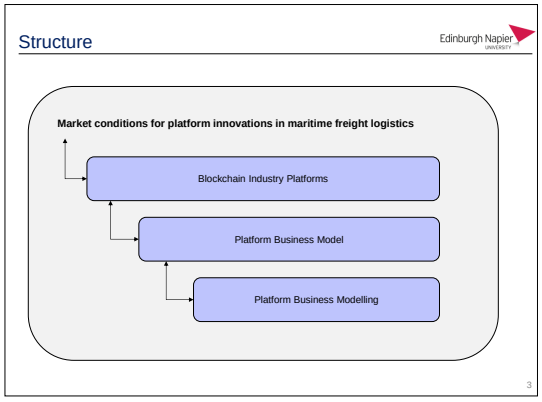
- Is there anything else that you want to add?
- Do you have any further questions to the study?
- Do you have any further remarks how to improve the interview process?
- Would you like to receive a summary of the research results?

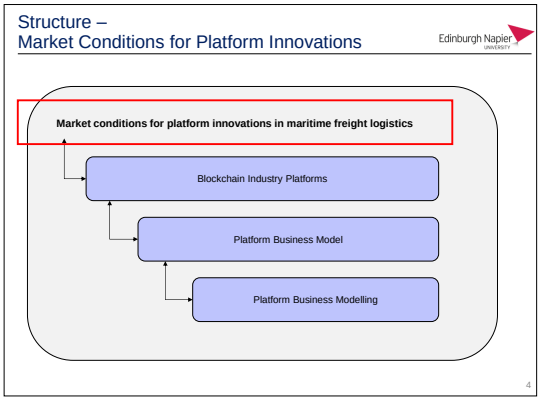
Appendix 4: Presentation for validation of research results

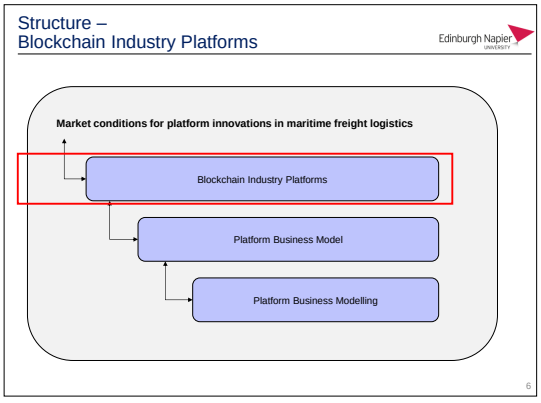
The following presentation consisting of 24 pages was used to validate the approach and the results of this study with selected interview participants. In order to accurately reproduce the contents and to achieve the best possible understanding among the interview participants, the procedure and the research results were conveyed using the graphics created for this thesis - embedded in the previous chapters.



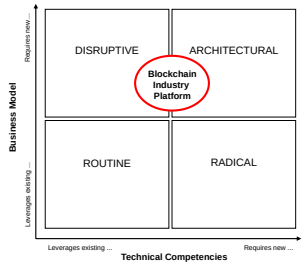








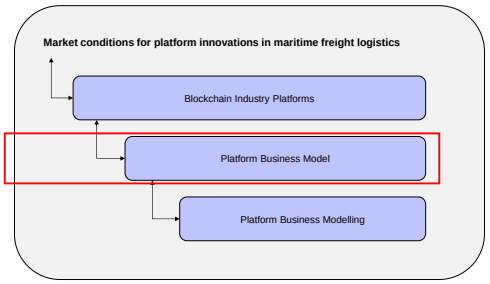
Innovation Landscape Map



Source: Pisano, G. P. (2015)

7

Structure – Platform Business Model



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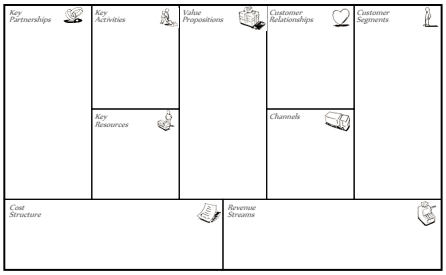
Business Model Canvas



Source: Osterwalder, A. (2011)

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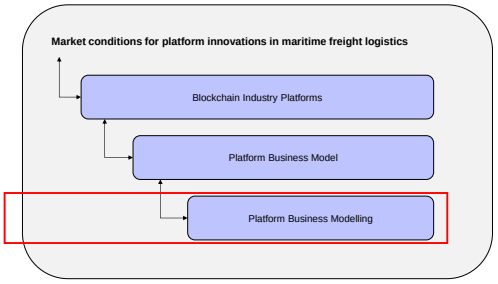
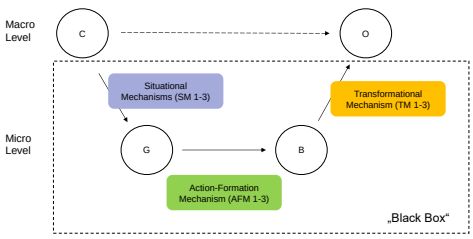
Structure – Platform Business Modelling



10

Types of Mechanisms: Activity System of a Company



Source: Hedström, P., & Wennberg, K. (2017)

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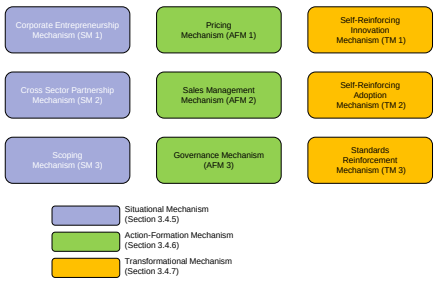
Mechanisms relevant in Platform Business Model Transformation



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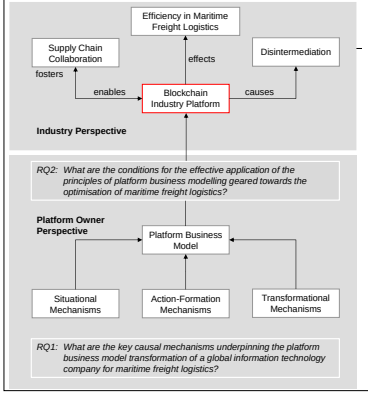
Conceptual Framework



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Interviews

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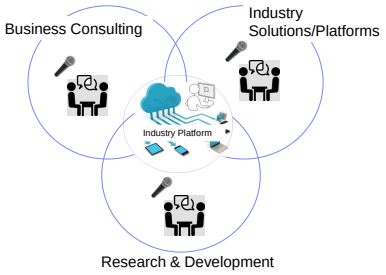
Business Units from which Interview Participants are selected



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Interviews conducted

A	S-1	SME – Freight Logistics	2017/04	Industry Solution Sales
B	S-2	SME – Freight Logistics	2017/04	Industry Solution Sales
C	C-1	Business Analyst	2017/07	Business Consulting
D	S-3	SME Maritime Freight Logistics	2017/07	Industry Solution Sales
E	C-2	Solution Manager	2017/07	Business Consulting
F	R-1	Research	2017/07	R&D
G	C-3	Consulting Manager	2017/07	Business Consulting
H	C-4	Consulting Manager	2017/08	Business Consulting
I	S-4	Solution Manager	2017/09	Industry Platforms
J	R-2	Research	2018/02	R&D
K	IND-1	SME - SCM	2018/07	Supply Chain Management
L	V-1	Industry Leader T&T	2019/02	Industry Platforms
M	V-2	Blockchain BDE	2019/02	Industry Platforms
N	V-3	Consulting Manager	2019/02	Business Consulting
O	V-4	Director Blockchain Solutions	2019/03	Industry Platforms

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Explanatory Model for the Platform Business Model Transformation

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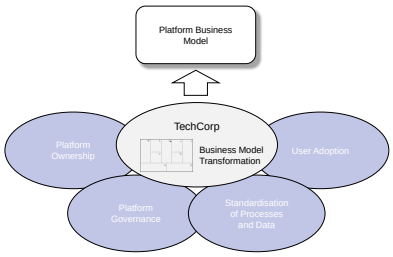
Causal Entities affecting the Platform Business Model



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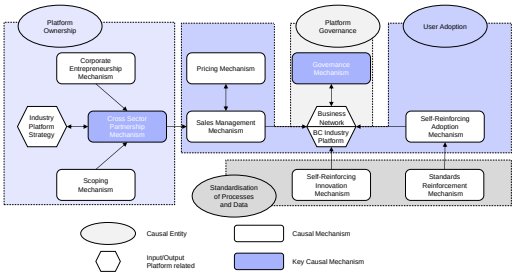
Causal Entities and Causal Mechanisms underlying them



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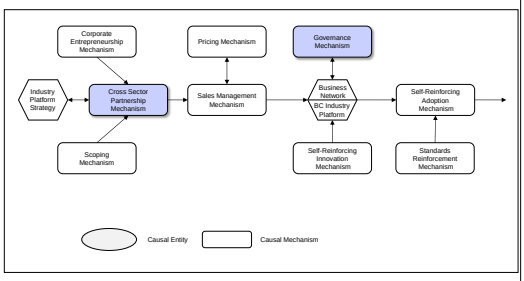
Cross Sector Partnership and Social Governance



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The “4/9 Platform Business Model Canvas”

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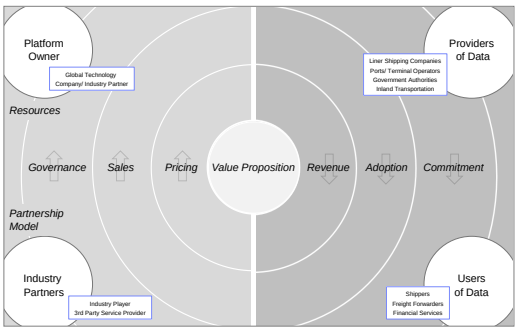
The 4/9 Platform Business Model Canvas



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Action Plan to operationalise the “4/9 Platform Business Model Canvas”

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The 4/9 Platform Business Model Canvas

Business Model Component	Recommendation for Action	Key Activity	Key Role and Responsibility	Resources Commitments	Intended Benefit
VALUE PROPOSITION	Define Platform Business Model	Describe individual value proposition for each stakeholder and network member of the industry platform	Head of Platform Strategy, Industry Consultant	Workshops with relevant stakeholders, Strategic corporate guidelines	Creating value within a business network
	Define functional Scope and Technological Design	Describe functionalities and architecture of industry platform	Technical Platform Lead, Solution Architect	Architectural skills, Availability of technological software components	Attracting new network members through value-generating industry platform
PARTNERSHIP MODEL	Form strategic Industry Partnership with Key Partners	Identify potential partners for joint initiative and select key partners	Head of Platform Strategy, Industry Consultant	Company-specific information on potential key partners	Risk sharing and value proposition enhancement
		Define platform ownership, IP rights and investments between stakeholders	Head of Platform Strategy, Legal Adviser	Corporate guidelines on general terms and conditions, Internal investment commitments	Clear contractual and financial commitment to platform growth
	Form Partner Model with Platform Solution Providers	Identify and cooperate with solution providers of platform services	Technical Platform Lead, Solution Architect	Company-specific information on potential solution provider, Information about marketability of platform services	Increasing benefit for platform users

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