Emergence of mobility market platforms

Case: Mobility as a Service in Finland

Master's thesis
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Spring 2017
Creative Sustainability master's degree program

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Abstract of master's thesis

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Title of thesis Emergence of mobility market platforms, Case: Mobility as a Service in Finland

Degree Master of Science in Economics and Business Administration

Degree programme Creative Sustainability

Thesis advisor(s) Armi Temmes

Year of approval 2017 **Number of pages** 94 **Language** English

Abstract

This master's thesis studies Mobility as a Service (MaaS) – a recent phenomenon in the Finnish public transportation industry that has gained widespread interest both in Finland and globally. At the core of MaaS are new mobility operators that facilitate interaction between transportation service providers and users by bundling existing services into mobility packages that enable so-called door-to-door travel. This bundling is facilitated by digital platforms, which allow users to compare alternative transportation services and purchase travel chains in one go.

The empirical purpose of this master's thesis was to describe and analyze the concept of Mobility as a Service and its development in Finland. Two primary research questions were asked: (1) What kind of mobility systems are currently emerging around the Mobility as a Service ideology in Finland? (2) How do the emerging mobility systems co-create value with their end users? To this end, two MaaS pilots and two startups were studied. The purpose was on one hand to describe these initiatives at a general level, and on the other hand to analyze how they co-create value with their end users. The research was conducted as a qualitative, multiple-case study, and the primary data collection method was semi-structured interviews.

The theoretical purpose of this research was to bridge two streams of literature: platform theory and Service Science. Both literatures are relevant to studying Mobility as a Service, as both are involved in exploring services and the role of ICT and data in service innovation. Both literatures were reviewed in an effort to find relevant concepts and theory frameworks that could allow creating conceptual links between the two theories. As a result, a theory framework was created that brings together the technological-managerial perspective of platform theory and the value co-creation perspective of Service Science. The framework was then tested through analyzing the MaaS cases.

The main empirical finding of this master's thesis was that the all four MaaS cases can be classified as market platforms. According to platform theory, market platforms facilitate direct interaction between two or more actors that are affiliated with the platform. The MaaS cases co-create value with their end users by facilitating efficient resource exchange and integration between end users and transportation service providers. They do so by providing information about alternatives as well as maps, ticketing and payment tools and other structures that allow the users to view alternatives, plan journeys, and purchase service bundles. The findings are in line with extant platform and Service Science theories. With that being said, the cases are all at pre-market-penetration stage, and overall, MaaS is still mostly an ideology that awaits testing. Empirically, this master's thesis increases our understanding of existing MaaS platforms and their development. Theoretically, the main contribution was the development of the platform framework that combines platform theory with Service Science.

Keywords Mobility, platforms, Service-Dominant logic, value co-creation, Mobility as a Service

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Työn nimi Emergence of mobility market platforms, Case: Mobility as a Service in Finland

Tutkinto Kauppatieteiden maisteri

Koulutusohjelma Creative Sustainability

Työn ohjaajat Armi Temmes

Hyväksymisvuosi 2017 **Sivumäärä** 94 **Kieli** englanti

Tiivistelmä

Mobility as a Service (suomeksi: liikenne palveluna) on suomalainen liikennealan ilmiö, joka on herättänyt kiinnostusta paitsi Suomessa myös kansainvälisesti. Liikenne palveluna -mallia on viety Suomessa eteenpäin julkisen ja yksityisen sektorin välisessä yhteistyössä, ja useita pilotteja on käynnistetty testaamaan ideaa käytännössä, minkä lisäksi Suomessa toimii ainakin kaksi startupia, jotka pyrkivät kaupallistamaan liikenne palveluna -ideaa.

Tutkimuksen empiirisenä tarkoituksena on kuvata ja analysoida Mobility as a Service (MaaS) -konseptia ja sen kehitystä Suomessa. Tutkimus pyrkii vastaamaan kahteen kysymykseen: Minkälaisia MaaS-järjestelmiä Suomeen on syntymässä? (2) Miten MaaS-järjestelmät luovat arvoa yhdessä (value co-creation) liikennepalveluiden käyttäjien kanssa? Tutkimuskohteena on kaksi Suomessa toimivaa MaaS-pilottia ja kaksi startupia. Tutkimuksen tarkoitus on yhtäältä kuvata MaaS-pilottien ja -startupien kehitystä yleisellä tasolla ja toisaalta analysoida miten nämä yhteisluovat (co-create) arvoa liikennepalveluiden käyttäjien kanssa. Tutkimus on kvalitatiivinen monitapaustutkimus, ja pääasiallinen tiedonkeruumenetelmä on puolistrukturoidut haastattelut.

Tutkimuksen teoreettinen tarkoitus on luoda yhteyksiä alustateorian ja palvelutieteiden välille. Molemmat kirjallisuuden haarat tutkivat palveluita sekä tietotekniikan ja datan hyödyntämisen roolia palveluinnovaatioiden kehittämisessä, ja tarjoavat siten relevantteja näkökulmia MaaSin tutkimukseen. Tutkimuksessa esitellään kummankin kirjallisuuden pääargumentit ja kehitetään teoriaviitekehys, joka pyrkii yhdistämään alustateorian teknologis-manageriaalisen näkökulman palvelutieteiden arvon yhteisluomisen -käsitteeseen. Viitekehystä hyödynnetään MaaS-tapausten analyysissä.

Tutkimuksen keskeinen löydös on, että tutkitut MaaS-tapaukset voidaan luokitella markkina-alustoiksi. Alustateorian mukaan markkina-alusta fasilitoi kahden, alustan ylläpitäjästä riippumattoman, toimijan vuorovaikusta ja mahdollistaa näiden välisen yhteistyön. Palvelutieteiden näkökulmasta MaaS-tapaukset yhteisluovat arvoa käyttäjien kanssa mahdollistamalla tehokkaan resurssienvaihdon ja integroinnin käyttäjien ja liikennepalveluntarjoajien välillä. MaaS-alustat tarjoavat käyttäjille tietoa palveluvaihtoehdoista, sekä digitaalisia työkaluja, kuten kartta-ja mobiilimaksupalveluita, joiden avulla käyttäjät voivat vertailla vaihtoehtoja, suunnitella matkoja ja ostaa matkaketjuja. Löydökset osoittavat myös, että MaaS-alustat ovat vasta varhaisessa kehitysvaiheessa, ja MaaS-idean toimivuutta ollaan testattu tähän mennessä hyvin vähän. Tutkimuksen tärkein teoreettinen kontribuutio on teoriaviitekehys, joka yhdistää alustateoriaa ja palvelutieteitä.

Avainsanat Liikenne palveluna, alustat, Service-Dominant logic, arvon yhteisluonti, Mobility as a Service

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1. Introduction

1.1. The emerging platform economy

What do campfires, bazars, harbors, and town squares have in common? All are places where people have come together to break bread, exchange resources, and share gossip. These common places have been important to the development of human societies because they have acted as platforms for facilitating human interaction. The steady introduction of practices and institutions like language, writing, code of law, and division of labor allowed humans to collaborate in more and more ways, but without platforms like the agora, the bazar, or the forum, it would have been difficult to organize human collaboration. These physical platforms were crucial to facilitating collaborative action because they established common grounds and rules of interaction that made it easier for people to find others to trade with, negotiate transactions, and form partnerships.

Key to these physical platforms was that they allowed people to efficiently communicate ideas and to exchange, process, and store information. After the introduction of writing, platforms and marketplaces allowed merchants to issue deliveries, sign contracts, and keep track of inventory. In time, effective exchange, processing, and storing of information became to lie at the heart of trade organizations, marketplaces, and stock exchanges. Over many centuries, ever more intricate and complex forms of commerce would emerge, enabled by developments in technologies and institutions like the printing press, corporations, and merchant unions.

As humanity transitioned to the industrial era in the mid 18th century, factories and smoke pipes were erected and new tools were added to the repertoire of human societies. The march of people from countryside to cities would turn large intersections into towns, towns into cities, and cities into metropoles. However, even industrialization and its world changing innovations like the steam engine, the radio, and the automobile, did not change the importance of the physical places of trade and socializing that had become central to human collaboration. By the mid 20th century, bazars, agoras, and chambers of commerce were replaced by shopping malls, stock exchanges, and the yellow pages, but the importance of physical platforms remained the same.

However, along with the rise of computers, we have witnessed the emergence of a new kind of platform: the digital platform. Digital platforms, exemplified by companies like Amazon.com, eBay, and Uber, have freed humans from the time and space constraints that dictated earlier forms of collaboration, enabling people from all over the world to come together and work together across different time zones. Because digital platforms remove time and space constraints, they increase the potential scale of collaboration exponentially and sometimes lead to equally exponential growth. This potential has become obvious with the rise of platforms like Facebook, Google, and

Apple, which have in very short time turned into juggernauts with the economic assets equivalent to small nations.

The way these platforms work is that they set up a digital, online structure – a marketplace – where different economic actors can interact with each other directly. The marketplace provides the rules of interaction, digital tools, and services to negotiate and fulfill transactions, as well as a common structure that supports the interactions. By doing so, the marketplace facilitates information exchange and lowers transaction costs for all market parties.

The force behind the growth potential of digital platforms is network effects. Network effects essentially mean that the value of the network increases in proportion to the number of actors joining the platform. When a critical mass is reached within a platform, network effects kick in, resulting in exponential growth. This scalability may sometimes result in one or two platforms taking over the whole market, leaving competitors fighting for scarps. An example of such an oligopoly is the smart phone OS marketplace, where Android OS and iOS have a combined market share of 99.6 %.

Key to all of this is data. If physical platforms were enabled by language, writing, code of law, and mathematics, digital platforms are underpinned by the increased capability of companies to gather, process, and utilize data in their product offerings. Digital technologies are now being diffused and embedded into the realm of the physical: sensors and networks are connecting physical objects online, allowing us to track, monitor, and communicate with everyday things (Cognizant, 2014). Thanks to this, platforms can connect not only people, but physical things. The Airbnb platform is built on data about available houses, Uber is built on data about available drivers, and ZipCar is built on data about available cars.

These new digital technologies and services are both giving way to and empowered by a shift in consumer values from ownership to access, also known as the rise of collaborative consumption or the Collaborative Economy (Botsman and Rogers, 2010). This transition has been called with many names, including *the sharing economy*, *the collaborative economy*, and *the platform economy*. Economists, think tanks, industry analysts, and social commentators are now drawing attention to how platforms are changing the way we interact, share our lives, and conduct our business. According to the advocates of platform economy, we are not only witnessing the rise of new marketplaces, but seeing a wholesome shift in the way corporations, economies, and societies work.

1.2. How platforms are changing mobility

"Welcome to the urban-mobility revolution"

- *McKinsey & Company*

The rise of digital platforms coincides with an emerging crisis in our urban environments, particularly mobility. By 2030, 60 percent of the world's population will live in cities and the size of the global middle class will have grown from 1.8 billion in 2009 to possibly over 3 billion (McKinsey, 2015a; National Intelligence Counsil, 2012). If business as usual continues, the increase in urban middle class population could result in a doubling of the global car fleet by 2030 (Dargay et al, 2007). At the same time, millions of people are already dying prematurely because of air pollution (WHO, 2014), and the CO2 emissions from cars are a major contributing force to global climate change. It appears obvious that decisions about transportation will have tremendous impact on people's lives in cities, and that there are already compelling reasons for thinking about mobility in new ways.

Alternatives to conventional transportation methods are already on the horizon. Important technological enablers of new mobility solutions include the rise of electric vehicles and self-driving cars (McKinsey, 2015a). As companies like Tesla continue to innovate around electric vehicles, it is possible that electric cars will soon be perceived as a viable alternative to gasoline powered cars. Furthermore, if and when companies such as Google and IBM make cognitive computers and Artificial Intelligence as common as the modern smart phone, we could eventually witness the proliferation of self-driving cars – something that only a decade ago would have seemed like science fiction. And once the human driver is made obsolete, the change can result in much more than hands-free driving: we could see cleaner, safer, quieter, and less congested cities (McKinsey, 2015b).

Digital platforms may provide another solution. According to a study by McKinsey & Company (2015a) there is a discernible transition towards new "multimodal" mobility services, which combine walking, cars, buses, bikes, trains, and shared transportation services to facilitate the user's journey. These changes are in large part made possible by digital platforms, which have already transformed the way we connect with other people, arrange meetings, exchange information, and share experiences. New digital platforms and service systems are already allowing people to gain access to the functionality of cars instead of owning one. Examples of these systems include Uber and the various ridesharing and car-sharing companies, including Zipcar and City CarShare in the US, BlaBlaCar in France, and City Car Club in Finland.

One of the most recent emerging digital platforms around mobility is a concept called Mobility as a Service (MaaS). Mobility as a Service is a very recent phenomenon that has gained increasing

interest both in Finland and internationally. The city of Helsinki has received high international acclaim for its Mobility on Demand initiative (Atkins, 2015; McKinsey, 2015a; The Guardian, 2014; Pidoux, 2014), and in Finland there are several other experimental MaaS schemes taking place in Seinäjoki, Ylläs, Imatra, Hämeenlinna, and Turku that aim to find working models for MaaS ecosystems. Mobility as a Service is even mentioned as an important area of transportation development in the strategic program of the Finnish government (Prime Minister's Office, 2015).

According to Maas Finland (2015), Mobility as a Service stands for "buying mobility services based on consumer needs instead of buying the means of mobility." This perspective changes the focus of mobility from buying transportation services and vehicles in isolation to purchasing the functional results that they offer. MaaS is often compared to Netflix and Spotify – platforms that have changed the way we watch movies and listen to music. According to Sampo Hietanen, the CEO of MaaS Global, the company's aim is to integrate all the available transportation options under one system, and to become the Netflix of transportation. Aside from MaaS Global, there is at least one other MaaS startup operating in Finland – Tuup – as well as several MaaS pilots that are being run in collaboration between private and public sector.

This master's thesis studies these mobility solutions, and aspires to bring light into what kind of digital mobility platforms are arising in the Finnish transportation sector. Although these pilots and startups have only just begun, thanks to network effects they hold the potential of transforming the way we get from point a to b. If they reach critical mass, we may find that Uber was just the beginning.

MaaS is not only important for economic reasons, as it also offers opportunities for creating more sustainable transportation solutions. MaaS schemes might enable us to decrease the number of vehicles on roads by improving asset utilization, which would also increase the overall eco-efficiency of our transportation system. Moreover, a more holistic approach to transportation can greatly reduce other inefficiencies related to transportation systems and land use, including congestion and the high amount of space allotted for parking in cities. MaaS operators may therefore serve an important role in creating an intelligent transportation system. Finally, as transportation is a major source of CO2 emissions, transitioning towards MaaS solutions can help us slow down climate change. Thus, if successful, MaaS schemes have the potential to both improve the overall customer experience of mobility and help society tackle climate change, increasing congestion, air pollution, and other social and environmental issues.

1.3. Research gap

The empirical context of this research are digital platforms, and more specifically, emerging digital platforms in the Finnish transportation industry. An interesting transition is away in the transportation and automotive industries, where the focus is shifting from products to digitally enabled services. Particularly in Finland, an idea called Mobility as a Service is being pushed by both industry and public sector advocates. Mobility as a Service combines under one digital platform different services to serve the various needs of transportation users. We could potentially see a new form of platform marketplace arising, the mobility platform marketplace. However, Mobility as a Service has only recently been tested in practice. Furthermore, because Mobility as a Service is a very recent phenomenon, there is little prior research about it (Giesecke et al, 2016). Therefore, one of the main purposes of this research is to bridge this gap in MaaS-related research by describing and then analyzing emerging MaaS platforms in Finland.

Theoretically, this thesis work attempts to bridge two distinct, yet related streams of literature: platform theory and Service Science. On one hand, scholars have been discussing platforms for decades, with the most recent research discussing the rising digital platforms. However, platform literature is focused on the managerial and technological aspects of platforms, with less attention given to end user's point of view. On the other hand, we have recently seen the incubation of Service Science, which is bringing fresh perspectives into services and how organizations and their customers interact to co-create value. However, Service Science is still at a pre-theory stage, with most attention given to theory building, leading to a pronounced lack of empirical studies. This master's thesis aims to combine aspects of platform theory and Service Science to develop a theory framework of platforms, which I will use to analyze the empirical MaaS cases. As a result, I hope to contribute empirically to Service Science, while theoretically building connections between Service Science and platform theory.

When it comes to platform theory, I have adopted a primarily managerial perspective. Although digital platforms are equally technological and organizational structures, the primary interest of this thesis work is in the business logic and implications of platforms. Technology is discussed in so far as it affects the organizational side of things in digital platforms. As for Service Science, I have focused on discussing value creation from a resource integration point of view. I draw from recent discussions regarding service platforms and ecosystems, and how these facilitate efficient resource integration as part of value creation process. Although I'm trying to understand how platforms create value to end users, I am not delving into the user's subjective point of view in this study.

1.4. Purpose of the research and research questions

To summarize, the purpose of this thesis work is two-fold. Theoretically, the main aim is to work towards bridging the technological-managerial perspective of existing platform literature with the value co-creation perspective of Service Science. I hope to achieve this by developing a theory framework that combines key elements from both literatures. However, my main point of view will be organizational, with less emphasis given to technological questions regarding platforms. Empirically, my purpose is to increase our understanding of the emerging Finnish mobility platforms. There are several pilots ongoing or finalized in Finland around the concept Mobility as a Service, including ones in Seinäjoki, Ylläs, Hämeenlinna, and Imatra. These pilots are collages of public and private actors attempting to find working business logics around MaaS and to build partner ecosystems that could enable the long-term development of new mobility services. In this thesis work, I will explore the first two mentioned pilots; Ylläs and Seinäjoki. In addition to these pilots, there are also two mobility startups, Tuup and MaaS Global, that are attempting to commercialize new mobility services under the MaaS framework. Both startups will be explored as part of this thesis work.

Towards these ends, two research questions will be answered:

(1) What kind of mobility systems are currently emerging around the Mobility as a Service ideology in Finland?
(2) How do the emerging mobility systems co-create value with their end users?

2. Platforms

2.1. Introduction

"Platforms… have redesigned our industrial landscapes, upset the balance of power between firms, fostered innovation, and raised new questions on competition, innovation, and organization."

Annabelle Gawer (2014)

The word 'platform' has become commonplace in Finnish public discussions, and the platform economy has been touted as Finland's next competitive advantage (Finnish Government, 2016). When people use the word platform, they typically refer to companies like Airbnb or Uber, both of which are seen as quintessential examples of the new platform economy. However, platforms come in many shapes and forms, and digital platforms like Airbnb represent only one kind of platform. In academia, platforms have been a topic of discussion since the 1980s, when scholars began researching technological platforms as part of new product development studies and other engineering research. Today, research on platforms has grown rapidly and expanded to cover the new platforms of the internet era (figure 1), and some scholars are attempting to bridge different lines of research into more holistic frameworks (Gawer & Cusumano, 2014; Gawer, 2014; Eaton et al, 2015).

While there is no widely agreed upon definition for platforms, it appears there are two dominant perspectives. On one hand, platforms have been viewed as technological architectures that enable product innovation. This stream of literature has been identified by Gawer (2014) as *Engineering Design* literature, and is exemplified by IBM System 360 product platform, Black & Decker, and Apple Macintosh. On the other hand, platforms can also be used as market mechanisms that enable direct interaction between different market actors. Gawer (2014) calls this stream of the platform literature the Economics Perspective of platforms, or platforms as markets, but they are also known as *multisided platforms* (Hagiu & Wright, 2015; Boudreau & Hagiu, 2009; Weyl, 2010; Tan et al, 2009) or *two-sided markets* (Eisenmann et al, 2006; Rysman, 2009). The stream of literature discussing market platforms is embedded in the fields of strategy and economics (Gawer, 2014), and is exemplified by companies such as Amazon.com, LinkedIn, Airbnb, Uber, and Alibaba.

These two points of view, one technological and embedded in the field of engineering, another managerial and embedded in the fields of economics and strategy, appear to be the most prevalent narratives of platforms. Yet, a third view is in the process of making, one which is informed by Systems Sciences and embedded in the fields of marketing and services. The science of service systems, or more shortly, Service Science, is an emerging branch of Systems Sciences that studies service systems (Spohrer et al, 2013). Service Science has only been around for a good decade or

so, and is still at a pre-theory stage (Kryvisnka et al, 2013; Vargo, 2011). Nevertheless, Service Science provides a fresh perspective into platforms with its underpinning logic of value-creation, called the Service-Dominant logic (Vargo & Lusch, 2004). Service-Dominant logic dismisses the reductionist dichotomy between producers and consumers and adopts an actor-to-actor worldview that states that value is co-created in the interactions between economic actors in service systems (Spohrer et al, 2013) or value constellations (Normann & Ramirez, 1997).

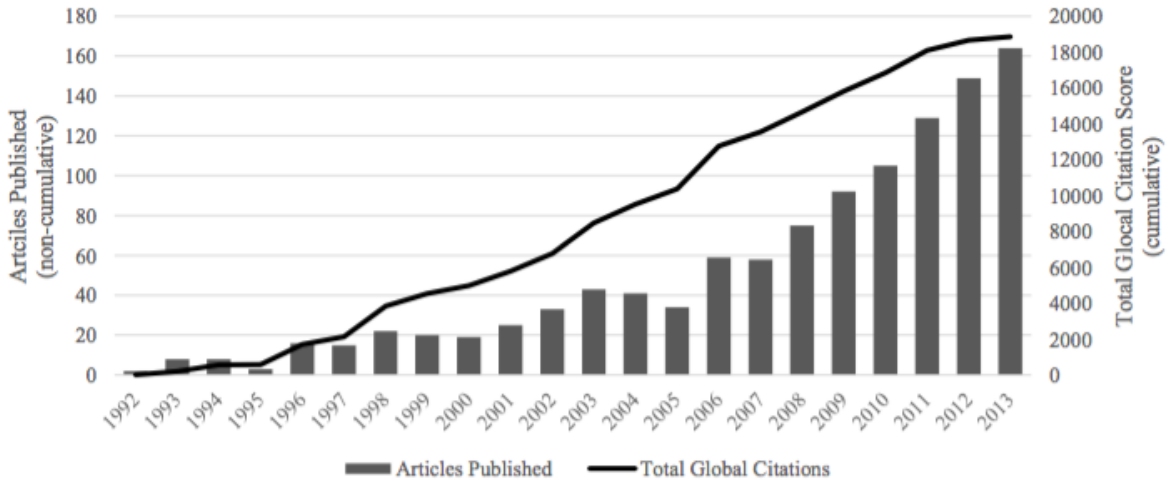

Figure 1. Platform article rate of publication and global citations. Porch et al (2015).

To understand platforms better, I will now review these three perspectives on platforms: technology, markets, and services. The first two perspectives appear to represent the core of platform literature, which is divided into two main streams: technology and market platforms (Schreieck et al, 2016; Porch et al, 2015; Gawer, 2014). The third perspective – Service Science – is s not part of the core platform literature, but has recently expanded to discuss platforms. I will discuss and highlight the most relevant concepts of the three literatures in respect to this thesis work, as well as attempt to summarize the main arguments of each discussion. Reviewing the three literatures also allows me to identify potential frameworks that I can use to build the main theoretical framework of this thesis work.

2.2. The engineering design perspective: platforms as technological architectures

Platforms balancing efficiency and variety

The key question that researchers of the internal platform literature have tried to answer is this: How can companies enable variety in offerings while maintaining efficiency in production? On one hand, manufacturing companies have felt compelled to increase variety of their product offerings to satisfy more consumer segments. The basic intuition has been that the more product categories and price points a company can offer, the wider range of different customer needs and contexts it can serve (Simpson et al, 2007). Diversification has therefore been used as a strategy for increasing revenue. On the other hand, more variety typically introduces more costs as the company must develop more product designs, manufacturing processes, and marketing approaches to accommodate the variety in customer needs. Only internal variety can absorb external variety (Ashby, 1968), and companies pursuing diversification have to deal with increasingly complex operations and higher costs.

In other words, the dilemma is to maintain both *economies of scale* and *economies of scope* (Robertson & Ulrich, 1998; Krishnan & Gupta, 2001; Simpson et al, 2007; Gawer, 2014). The answer to this dilemma has been to divide the architecture of products into two main parts: a technological core and a periphery (Wheelwright & Clark, 1992; McGrath, 1995; Simpson et al, 2007; & Lehnerd, 1997; Robertson & Ulrich, 1998; Baldwin & Woodard, 2009; Gawer & Cusumano, 2014). The core of the product would consist of standardized parts and modules that are stable and relatively unchanging, while the periphery refers to parts and modules that experience more changes and variations. The key is to use the standardized, stable core and the involved production technologies as a *platform* for derivative products in the periphery. Thanks to this division, a company can find a middle way between efficiency and variety, thus reaping the benefits of both economies of scale and the ability to target more users.

The practice of using certain products, parts and technologies as the foundation for derivative products is at the core of the internal platform literature. The roots of this idea stretch back into the 1960s and ‘70s, and to the works of scholars in several separate fields, including new product development, operations and production management, and later modularity (Gawer, 2014). One of the earliest contributions to the internal platform literature came from Herbert Simon (1962), who discussed the idea of mitigating the effects of complexity by using hierarchical and decomposable systems (Gawer, 2014). Another important contribution came from economists and management scholars who were puzzled by the question of the multiproduct firm in the 1970s and ‘80s (Teece, 1983). Prior economic theory had posited that large economies of scale enable companies to create more value than decentralized production would. However, economies of scale could not fully

explain why many companies had expanded their product offerings to seemingly disconnected sets of products (Teece, 1983). For example, the sheer scale of production capabilities and economic resources is not a sufficient explanation for why Exxon is looking for uranium and why Rolls Royce is selling both cars and airplane turbines (ibid.)

An explanation for the existence of multiproduct firms was offered by economists John Panzar and Robert Willig, who coined the term *economies of scope* in 1975. Their main argument was that the inputs procured for the production of one output would also be available for the production of other outputs (Panzar & Willig, 1981). In other words, if a company developed the knowledge and production capabilities to produce, say, family cars, it could also produce other products that required similar production capabilities and knowledge, for example trucks and motorcycles. The idea of economies of scope was further developed by Teece in 1980 and 1983, and it later became one of the core ideas underpinning the technological platform literature (Gawer, 2014).

While economists were developing the idea of economies of scope, researchers from the fields of design, operations, and management were discussing the idea of 'design hierarchy' (Gawer, 2014). The concept of design hierarchy was developed by Kim Clark (1985), the dean of Harvard Business School. Clark wrote a paper in 1985 where he developed a conceptual framework for analyzing how technological changes contribute to the development of industries. Clark's main argument was that some product design choices were more important than others, and could act as precedents to later designs. He also points towards modularity as one key enabler of economies of scope:

> *"The working out of a design involves a process of analysis, of identifying the components of the form, the major systems and sub-systems, and then grouping them in different ways to illuminate their interrelations. Not all elements or components of a system are of equal significance in function or in concept." (p. 241).*

Clark then continues to an important point:

> *"Moreover, there are choices in the development of a design that create precedents and are logically prior to other choices." (p.241).*

The above idea became foundational to the technological platform literature, and appears to underlie all later arguments about technological platforms. In essence, Clark argues that analyzing the design of a product can reveal what elements are more important than others. This is also very close to Panzar and Willig's (1981) point about certain inputs of manufacturing being used to produce several different outputs.

Technological platforms enable economies of scope within the firm

Clark's (1985) idea of design hierarchy combined with Simon's (1962) notion of hierarchical and decomposable systems laid the groundwork for the emergence of the technological platform literature. Design hierarchy first lead to the idea of creating product families, which became a well-recognized approach to balancing economies of scale and scope. Product families essentially refers to products that share some parts and manufacturing processes (Simpson et al, 2007). Companies can create product families by using a common architecture as a foundation and then varying parts of each product. For example, a product family of electric, automatic cars could all have the same battery while other parts such as the transmission system, power-trains, and exhaust system could vary. This allows for maintaining efficiency in some parts of the car, yet enabling variation in product types.

According to Gawer (2014), Wheelwright and Clark (1992) were the first to explicitly use the term *platform*. In their 1992 Harvard Business Review article, 'Creating project plans to focus product development', Wheelwright and Clark use two variables – degree of change to product, and degree of change to manufacturing process – to identify different types of product development projects. The authors identify platforms as a type of development project that companies target to meet the needs of a core group of customers. Furthermore, platforms are designed so that it's easy to create derivative products by adding, substituting, or removing features. Well-designed platforms also allow an easier migration between different product generations to avoid disrupting customers or distribution channels (ibid, 73).

Since Wheelwright and Clark (1992), platforms have been defined in various ways over the years. McGrath (1995, as cited by Simpson et al in 2007: 7), arrived at a similarly broad definition as Wheelwright and Clark (1992), and defined platforms as "collections of common elements, implemented across a range of products". Meyer and Lehnerd (1997, 39) argued in their turn that a platform is a set of subsystems and interfaces forming a common structure from which a stream of product can be developed. Robertson & Ulrich (1998), defined platforms as the collection of assets that are shared by a set of products. Gawer and Cusumano (2014: 418) define internal platforms as "a set of assets organized in a common structure from which a company can efficiently develop and produce a stream of derivative products."

All of these definitions share the idea of systematically reusing common product elements, subsystems, or other technological assets to enable the creation of derivative products (Wheelwright & Clark, 1992; McGrath, 1995; Simpson et al, 2007; Meyer & Lehnerd, 1997; Robertson & Ulrich, 1998; Gawer & Cusumano, 2014). Another important issue related to platforms is modularity, which was already pointed out by Clark in 1985. Modular product architecture has been viewed as

an enabler for enhancing the economic performance of a company (Ulrich, 1995; Baldwin & Clark, 2004; Baldwin and Woodard, 2009).

External platforms enable economies of scope across supply-chains and ecosystems

More recently, technological platform research has extended to observe the use of technological platforms across firms within supply-chains, or even across large networks of firms (Gawer, 2014). These platforms have been called *business ecosystems* (Moore, 1993; Iansiti & Levien, 2004), as well as *external* or *industry platforms* (Gawer, 2014; Gawer and Cusumano, 2014), and they extended the idea of using modular product architecture for facilitating derivative product innovation to supply-chains or innovation ecosystems.

Industry platforms were not extensively discussed in technological platform literature until Bresnahan and Greenstein (1999) published an article about competition within the personal computer industry (Porch et al, 2015). Bresnahan and Greenstein (1999) analyzed the changing structure of the PC industry and the role of platforms in the industry's competition, especially focusing on the early dominance of the IBM 360 platform and the eventual rise of the Windows-Intel, or Wintel platform. As opposed to Macintosh and IBM, which were tightly connected vertically, the Wintel platform was open and allowed outside complementors – software and hardware developers – to build on the Windows operating system and the Intel microprocessor. By doing so, the Wintel became an industry platform that complementors could use for product creation and for reaching PC end users.

External platforms expand the idea of using an architectural division between a core and a periphery to supply-chains and business ecosystems. When platforms are used across companies, members of a supply-chain or outside complementors are allowed to build new derivative products on the platform. This allows companies to harness economies of scope across a network of firms, rather than just within the focal firm.

Summary

The technological platform literature is centered around the question of balancing two contradictory goals: efficiency of production and variety in offerings. This dilemma has been solved by dividing products into two parts: a stable core and a changing periphery. The stable core consists of products, subsystems, parts, and other technologies that are maintained relatively unchanging to increase efficiency. Product variety is then introduced by building peripheral products on top of the stable core. This architectural division was first established in internal firm platforms, but more recently, researchers have observed its use also across supply-chains and even firm networks. These business ecosystems (Moore, 1993; Iansiti & Levien, 2004), or industry platforms (Gawer & Cusumano,

2014), use a technological core as their foundation, and allow complementors from the ecosystem to build derivative products on the platform, thus enabling efficient product innovation across companies.

Having now briefly discussed the technological platform literature's history and main arguments, I will now move on to review the second theoretical perspective of this thesis work: market platforms.

2.3. The economics perspective: platforms as markets

Enabling interaction among market actors

In the early 2000s, scholars from various fields, including Information Systems, Economics, and Strategy, began researching new kinds of platforms that differed from the technological platforms observed in earlier decades. These platforms, represented by companies like eBay, Amazon, and Uber, differed drastically from technological platforms in their core purpose: whereas technological platforms were used for facilitating efficient creation of derivative products, the platforms of the internet era were used for creating a marketplace between different market actors. Gawer and Cusuamno (2014) call these platforms *double-sided markets*, but they are also known as *two-sided markets* (Rochet & Tirole, 2003; Eisenmann et al, 2006; Van Alstyne et al, 2016) or *multi-sided platforms* (Evans, 2003; Boudreau & Hagiu, 2009; Weyl, 2010; Hagiu & Wright, 2015). In this master's thesis, I use the wording *market platform* to distinguish them from technological platforms.

A market platform is a type of organization that acts as a facilitator of market interaction between two or more market actors (Hagiu & Wright, 2015; Gawer, 2014; Hagiu, 2014; Eisenmann et al, 2006). The platform, whether physical or digital, decreases transaction costs by helping different parties find each other, negotiate, and fulfill transactions. The difference between a regular retailer and a platform marketplace is that a retailer takes title of the goods that they're selling, and then markets and delivers the goods to their final customers. By contrast, a market platform primarily doesn't take title of any goods, but facilitates direct interaction between suppliers and customers. For example, a shopping center acts as a platform for consumers and store owners, Amazon acts as a platform between book buyers and authors, and Uber acts as a platform for drivers and riders. Other well-known examples include the VCR, Xbox, Airbnb, Alibaba, Amazon, and Zipcar.

A central topic to the market platform literature is the existence of network effects (Van Alstyne et al, 2016, 2006; Hagiu, 2014; Porch et al, 2015; Gawer, 2014; Parker & Van Alstyne, 2005; Eisenmannn et al, 2006; Rochet and Tirole, 2003; Evans, 2003). Network effects are a well-known phenomenon in society and have been extensively discussed by economists since the 1980s (see for example Katz & Shapiro, 1986). Network effects essentially mean that the number of economic actors in a network affects the benefits that each actor can derive from being part in the network (Katz & Shapiro, 1986: 822). Or more simply, the more the merrier. A classic example of network effects is the telephone: the more people are using a telephone, the more useful it becomes to each user.

Network effects can be divided into two categories: *cross-side* and *same-side* (Rochet & Tirole, 2006; Eisenmann et al, 2006; Hagiu, 2014). In the presence of cross-side network effects, the value

to users on one side of the platform increases with the number of users participating on the other side (Hagiu, 2014: 72). For example, with each new driver in the Uber network, it becomes easier for users to find a ride at a competitive price. Same-side network effects refer to a situation where the value to users on one side increases with the number of users participating on that same side. Again, Uber provides an example: thanks to Uber's customer-review system, the more customers there are participating in the Uber network, the more driver information each user gets. As a result, with more customers, there is also better information available about Uber drivers.

Many market platforms are affected by both cross-side and same-side network effects. For example, Amazon, eBay, Airbnb, and Audible are affected by both effects. These platforms have incorporated a customer-based review system that provides information about the quality of the provided service or product. Social media platforms like Facebook and Twitter are founded on the existence of same-side network effects, but their monetization schemes usually rely on cross-side network effects (marketers paying for access to users). Many mobility services are also affected by same-side network effects. For example, BlaBlaCar, the French long distance carpool service, is affected by same-side network effects because finding a ride is easier and less expensive for all users if there are plenty of people willing to share a ride together.

Chicken-and-egg problem

While network effects can provide the platform leader with highly scalable revenues, they also come with an inherent challenge: getting all sides onboard the platform. Known as the chicken-and-egg problem (Hagiu, 2014; Rysman, 2009; Boudreau & Hagiu, 2009; Parker & Van Alstyne, 2005), the challenge is that in the beginning there is very little incentive for individual members on each side to join the platform. Imagine being the first customer in a telephone network! This is also apparent in many recent mobility services. For example, making electric vehicles compelling requires having an adequate charging station infrastructure. This in turn requires enough businesses building charging stations, but if there are no users buying the charging service, it is difficult to attract new charging station businesses. What platform leaders need to do then is to find a way to attract enough users on both sides to kick-start the network effects. This can be very challenging, and platform leaders need to consider both the design of the platform (Hagiu, 2014), the rules of access and interaction (Hagiu, 2014; Van Alstyne et al, 2016), how many sides to bring aboard as well as how to price the platform. (Hagiu, 2014).

Pricing of market platforms

Due to network effects, determining the right pricing structure for a market platform is among the most crucial decisions in platform development. This is because the different sides of the platform might not benefit from each other's presence in the platform equally (Hagiu, 2014), and one party might gain more value from gaining access to the other party. For example, Facebook advertisers are more interested in gaining access to Facebook users than vice versa. For this reason, many platforms have subsidized one party's access to the platform, either charging a lower price or offering access completely free. The side of the platform that is subsidized is usually called "subsidy-side" (Eisenmann et al, 2006) or "loss-leader side" (Hagiu, 2014), while the side that bears the cost is called "money-side" (Eisenmann et al, 2006) or "profit-making" side (Hagiu, 2014). Facebook's subsidy-side are the users and the profit-making side are the marketers, who pay for advertising on the platform. Another example is Microsoft's Xbox and other consoles, which are often sold for no profit to gamers (loss-leader side) and money is made by making game developers pay for the right to develop and sell their games for the console's users.

The more specific challenge is determining the right level of pricing for each side. Eisenmann et al (2006) have outlined five factors that need to be taken into consideration in pricing the different sides. (1) The platform's ability to capture cross-side network effects. If the subsidy-side of the network can transact with a rival platform's money-side, the giveaway will be wasted. Eisenmann et al (2006) mention Netscape as an example of a platform's failure to capture cross-side network effects. Netscape, founded in 1994, was known for its internet browser 'Netscape'. The browser was meant to act as a platform between consumers and companies with web sites, with consumers being the subsidy-side and companies being the money-side. Netscape would capture value by extracting fees from companies. However, this scheme ultimately failed because Netscape's potential money-side users were able to access the platforms' subsidy-side also through other browsers, which left Netscape without a working revenue model. (2) User sensitivity to price. If one user side is less willing to pay to for the offering, it generally makes sense to subsidize this side. For example, most social media networks subsidize the user side and make money by charging advertisers and other complementors. (3) User sensitivity to quality. If one side of the platform expects very high quality products or services, the platform should – perhaps counter-intuitively – set higher prices for the other side. This has been most apparent in the video game industry, which collapsed in the 1980s when the Atari console was flooded with cheap rip-offs because it was inexpensive to produce and sell video games on the Atari platform. Today, console platforms charge video game developers for accessing the platform to ensure that only committed developers can enter the market.

(4) The fourth factor is output costs. If bringing in new users to a platform costs nothing to the platform leader, pricing can be relatively straightforward. However, if the platform leader incurs high variable costs for each new user on the subsidy-side, there is a risk of making great losses. As an example, Eisenmann et al (2006) highlight FreePC, which in 1999 provided its subsidy-side users with free computers and internet access. However, the money-side – advertisers – were reluctant to target consumers who were so price sensitive, and Free PC ended up with 80 million in losses. (5) Finally, the fifth and final factor that Eisenmann et al (2006) identified is negative same-side network effects. With some platforms, the same-side network effects can be negative, in which case the platform leader should inhibit free entry to the platform. Especially in B2B marketplaces, the seller side might be unwilling to support the marketplace due to fear of lowering prices and decreasing profit margins. One approach to dealing with such a situation is to give out exclusive rights to one seller and extracting a high rent for this privilege.

Winner-Take-All dynamics

Because of network effects, market platforms are often subject to Winner-Take-All (WTA) dynamics (Eisenmann et al, 2006; Rysman, 2009). Winner-Take-All dynamics refer to a situation where one market leader ends up owning most, if not all the marketplace. Such is the case in the smart phone OS markets, where the Android OS had 86.8 % market share in 2016 Q3 (IDC, 2016). According to Eisenmann et al (2006: 7), three conditions influence how heavily a market platform is affected by WTA dynamics. Firstly, WTA dynamics are more probable if multi-homing costs are high for at least one user side. Homing costs refer to all those expenses that the users of a network must bear in order to establish and maintain affiliation with the platform, including adoption, operation, and the opportunity cost of time (Eisenmann et al, 2006). For example, if you switch from using Outlook to using Gmail, it takes time to learn the new service, change your work routines, and to redirect emails to your new email address. Multi-homing costs refers to the costs of using several similar services simultaneously – for example, using several email accounts. When multi-homing costs are high, users are more likely to focus on using just one, which can lead to one platform taking all customers.

The second condition for WTA dynamics is that network effects are strong and positive at least for the user side with high multi-homing costs. When the benefit of reaching users on the other side of the platform is high, the users tend to converge on one platform. Accessing a small-scale platform would only make sense if that would be the only way to reach a particular niche user (Eisenmann et al, 2006). The third and final condition for WTA dynamics is that neither side of the platform has strong preferences or special needs. If some user group has very unique needs, then there is more room for specialized platforms that can cover these needs. However, if most users don't have any unique preferences, it is more likely that one platform will come to dominate the marketplace.

Summary

The market platform literature is a related, yet distinct conversation from the technological literature of platforms (Schreieck et al, 2016; Porch et al, 2015; Gawer, 2014). It began in the early 2000s, and its roots are in the network economics and multiproduct pricing literatures of the 1980s (Rochet & Tirole, 2006. The main underpinning the market platform literature is the idea of a focal company facilitating direct interaction between different market actors (Van Alstyne et al, 2016; Hagiu, 2014; Rochet & Tirole, 2006). This happens with the help of a physical or digital platform, through which different sides of the marketplace interact. These market platforms are called two-sided markets or multi-sided platforms, and they are characterized by the potential network effects. Network effects can provide highly scalable profits to the platform leader, but also create a host of other issues that platform leaders need to take into account, including pricing issues, the chicken-and-egg problem, and winner-take-all dynamics.

There seems to be no widely agreed definition for market platforms (Hagiu & Wright, 2015). Rysman (2009) defined two-sided markets as a market where two sets of agents interact through an intermediary or a platform and where the decisions of each agent affects the outcomes of other agents. Gawer and Cusumano (2014) defined industry platforms as "products, services, or technologies developed by one or more firms, and which serve as foundations upon which a larger number of firms can build further complementary innovations and potentially generate network effects." In their turn, Hagiu and Wright (2015: 163) defined multisided platforms as platforms that have two core requirements: (1) They enable direct interactions between two or more distinct sides, (2) Each side is affiliated with the platform.

One thing that all above definitions have in common is the notion of open interaction between different agents, facilitated by the platform. Gawer and Cusumano (2014) include in their definition the potential of network effects, while Rysman (2009), and Hagiu and Wright (2015) explicitly state that direct interaction is a core element of multi-sided platforms. Direct interaction is also clearly present in the rest of the literature (for example, see Evans, 2003; Rochet & Tirole, 2003; Eisenmann et al, 2006; Armstrong, 2006; Van Alstyne et al, 2016).

2.4. Summarizing the technological and market perspectives of platforms

During my literature review of technological and market platforms, I discovered that this body of literature is highly fragmented as a whole, and there are contradictory views about the meanings of different terms and concepts. This fragmentation has also been noted by more systematic literature reviews conducted by Schreieck et al (2016), Porch et al (2015), and Gawer (2014). To the unsuspecting reader, this may cause considerable confusion at the outset, particularly because same concepts are used for different meanings, yet appear similar at a superficially level.

The contradiction between different concepts and terms exists because the two literatures have developed separately and represent two different *perspectives* to platforms (Gawer, 2014). Schreieck et al (2016) suggest that platforms should not be considered in black-and-white terms as either technological or market-oriented. Most market platforms rely on some technology, while some technological platforms, like the Wintel platform, have the characteristics of a market platform. Therefore, the two categories, technology vs market, are not mutually exclusive (ibid).

As an alternative categorization, scholars have also used the division between *internal* and *external* platforms. Recent literature reviews have employed the characterization between internal and external platforms, including Porch et al (2015), Gawer (2014), and Gawer and Cusumano (2014). However, I found that this division is not used consistently between different scholars. Porch et al (2015) use the term interior platform to refer to platforms that are used for derivative product creation *within* a single firm, and the term exterior platform to refer to platforms that are used for both derivative product creation *across* different companies AND for facilitating interaction between distinct market actors. Porch et al (2015) therefore view external platforms as both technological and market constructs. However, Gawer and Cusumano (2014) use the terms internal and external to refer *primarily* to technological platforms. According to Gawer and Cusumano (2014), external platforms are therefore *not* automatically both technological and market constructs. Furthermore, Gawer and Cusumano (2014) regard market platforms as a special case of some external platforms, but they also note that some market platforms can also be supply-chain platforms, which they, in turn, regard as a special case of internal platforms. Thus, Gawer and Cusumano (2014) view market platforms as either external or internal platforms. In another article, however, Gawer (2014) discusses market platforms primarily as a special case of external technology platforms (as opposed to internal or supply-chain platforms).

This contradictory use of the categories internal and external leads to different interpretations about what market platforms are. Depending on who you're quoting, market platforms are either exclusively market constructs, and contain no distinction between internal or external categories (Eisenmann et al, 2006, Hagiu & Wright, 2015), a special case of either internal or external

technological platforms (Gawer and Cusumano, 2014), or just categorized as external platforms, with both technological and market characteristics (Porch et al, 2015).

In this master's thesis, I adopt the distinction between technological platforms and market platforms. The key difference between the two is in their primary use: technological platforms are used for facilitating efficient derivative product creation, while market platforms are used for facilitating direct interaction between two or more market actors. I apply the distinction between internal and external platforms exclusively to *technological platforms*: internal technological platforms are used within one firm, while external technological platforms are used across supply-chains or networks of companies. However, I also maintain the view of Schreieck et al (2016), and argue that some platforms have both technological and market purposes, i.e. they are used for facilitating *both* product creation *and* direct interaction between market players. An example of this platform type is Facebook, which enables app developers to build on the Facebook technology, but also facilitates interaction between Facebook users and marketers of products and services. Figure 2 clarifies this difference.

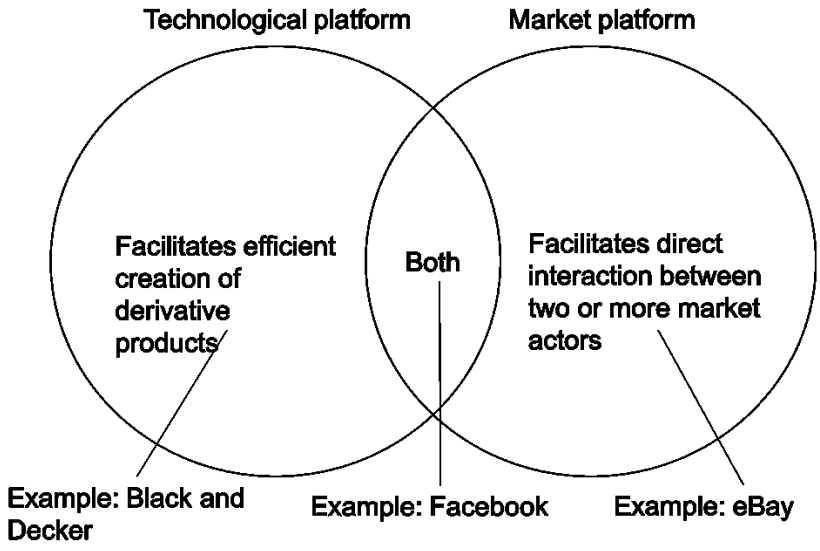

Figure 2. Classification of platforms.

In figure two, technological and market platforms are separated according to their primary use. To simplify things, I don't include the division between internal or external platforms in this classification. Instead, I recognize that some platforms may serve both purposes, which I simply refer to as technological-market platforms. I will use this division in the rest of this master's thesis. Thus, I use the following definitions of technological and market platforms:

Technological platform = A set of technological assets that facilitates efficient creation of derivative products, services, or technologies within firms, across supply-chains, or within business ecosystems.

Market platform = Organizations that enable direct interaction between two or more distinct sides that are affiliated with the platform (Hagiu & Wright, 2015).

Technological-market platform = A set of technological assets that facilitates efficient creation of derivative products, services, or technologies while also enabling direct interaction between two or more distinct sides that are affiliated with the platform.

I will use these definitions in the rest of this master's thesis, and apply them when building the theoretical framework of this thesis work. Having now (hopefully) clarified the difference between technological and market platforms, I will turn my attention to the third perspective on platforms: Service Science.

2.5. Platforms as service systems

"Service Science is an emerging branch of systems sciences with a focus on service systems… and value-co-creation" (Spohrer et al, 2013)

During the past decade or so, a number of scholars have been engaged in a new academic discussion about services and service systems. Today this conversation is known as the science of service systems or Service Science, which, in short, is the study of complex service systems (Maglio & Breidbach, 2014). Service Science has its roots in the early 1990s, when Richard Normann and Rafael Ramirez published their article, 'From value chains to value constellations: Designing interactive strategy' in the July-August 1993 issue of Harvard Business Review. The article, which was later accompanied by several books by the authors, put forth many ideas that later became some of the core tenets of Service Science, including the co-production of value (today co-creation of value) and the concept of value constellations (service systems). However, it was only a decade later when the shift in paradigm truly began, when Stephen Vargo and Robert Lusch published their article 'Evolving to a new dominant logic for marketing', released in the January 2004 issue of the Journal of Marketing. Vargo and Lusch named the new paradigm of services as 'The Service-Dominant logic', which stated that service (as opposed to goods) is the fundamental unit of economic exchange (Maglio et al, 2009; Spohrer et al, 2013; Vargo & Lusch, 2004). The authors' original intent was to understand better how markets work and what marketing is (Lusch, Vargo & Gustafsson, 2016), but the result has been a wholesome shift in the paradigm of marketing.

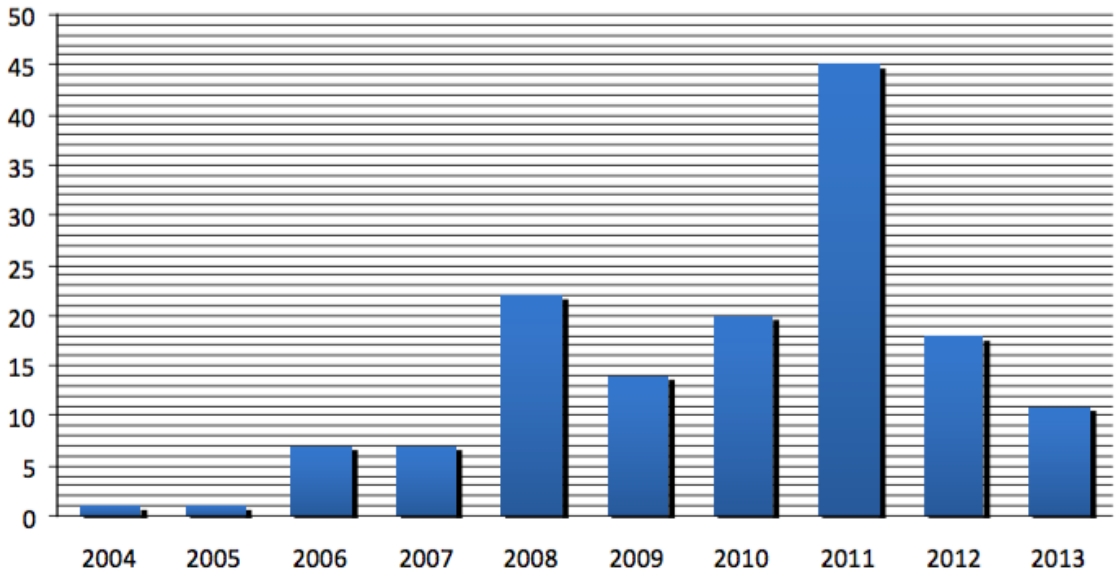

Figure 3. Number of S-D Logic publications per year (Kryvinska et al, 2013).

While this new academic conversation on marketing and services was gaining traction, there was another discussion taking place within IBM about the role of services in the 21st century economies. As a result, a research agenda for services was established by several IBM researchers (Tadahiko, 2005; Spohrer & Maglio, 2008). The simultaneous call for a science of services by IBM and the incubation of the S-D Logic by Lusch and Vargo initiated a conversation on services that is still ongoing today. Since 2004, there have been numerous revisions to S-D Logic: in 2008, the eight foundational premises of S-D logic, first introduced in 2004, were refined and an additional two were added, adding up to ten in total (Vargo & Lusch, 2008). The most recent refinements came in 2016, when an eleventh premise was added and 5 of the now 11 premises were identified as axioms that today represent the foundational core of S-D logic (Lusch, Vargo & Gustafsson, 2016.) Today, Service Science has grown into an emerging interdisciplinary field that has its own conferences, research centers, degree programs, and scientific and professional journals (Spohrer & Maglio, 2008). However, despite these developments, Service Science is not yet considered a discipline in its own right (Kryvinska et al, 2016). In 2014, Maglio and Breidbach conducted a literature review of articles published in the Service Science journal, and they concluded that there is still much uncertainty regarding the basic concepts and premises in the field.

Despite the uncertainty in core concepts, Service Science and its underlying Service-Dominant logic provide a unique perspective to platforms that is not covered in the extant platform literatures. Service Science in fundamentally customer-oriented, and it has redefined the meaning of services and value creation. While the technology and market platform literatures give us insights about platforms from the point of view of technology and markets, Service Science allows us to look at how exactly do platforms create value with different stakeholders.

I will next elaborate on two key areas of Service Science. Firstly, I will highlight how Service Science differs from conventional ways of thinking about goods and services. For the purposes of this thesis work, it is not necessary to go through the whole list of 11 premises of S-D logic. Instead, I will give a more general introduction to S-D logic by reviewing how Vargo & Lusch positioned S-D logic in their original 2004 article (see table 2). Secondly, I will introduce several key concepts of Service Science that I will later incorporate into the main theory framework. These concepts include the definition of a service, operand and operant resources, value co-creation, and service system.

How Service-Dominant logic differs from goods-dominant logic

When the proponents of Service Science talk about goods-dominant logic, they are generally referring to classical and neoclassical economics, operations management, and marketing management. Reviewing these areas of inquiry is obviously out of the scope of this thesis work,

but we can have a quick discussion about how and in what areas Service-Dominant logic is seen to differ from them. A summary of these differences can be found in table 1.

In traditional economics and marketing thought, the purpose of firms is to make and sell things (Spohrer et al, 2009). Value – or more precisely, utility – was embedded in products through manufacturing (Vargo & Lusch, 2004). Raw material was inputted into the production system of a firm, where people and machines would process the material and add value into it through labor. The output was the final product, which held more utility than the inputted raw material. What came next was marketing and distributing these valuable goods to the market and to consumers. The word *consumer* already reveals how the role of customers viewed: the destroyer of value. The primary unit of economic exchange was, therefore, goods: firms created value by producing goods, which would be exchanged for money in the marketplace, and customers would then consume the value. Services were regarded as an auxiliary function for the production and marketing of goods. According to traditional marketing thinking, customers were something to be captured or acted on. This thinking is apparent in typical marketing lingo: even today marketers want to segment the *marketplace*, *penetrate* it and *promote to* it (Vargo & Lusch, 2004.)

Whereas goods-dominant logic viewed goods as the primary unit of economic exchange, in Service Science, the fundamental unit of exchange is service (Vargo & Lusch, 2004; Spohrer et al, 2009, 2013). The basic idea is that people don't really exchange to obtain goods, but the benefits that these goods bring. I don't buy a coffee machine because I like how the machine looks, but because I want the coffee. This might seem obvious, but the subtle shift from thinking about the medium to thinking about the end result introduces profound changes to thinking about economic activity. According to previous thinking, companies embed value into goods, whereas now the goods are regarded primarily as intermediaries or vehicles of value creation. In Service-Dominant logic, value is created when customers use a product to create an end result. Because the product itself cannot produce value, a customer is regarded as a cocreator of value, as the customer is required to use her own skills and knowledge to produce the value. Proponents of Service Science describe this process of value co-creation in terms of integrating resources: customers *integrate* resources to their existing resources and competencies (Vargo et al, 2008). Therefore, the customer is no longer seen as a passive recipient of value, but an active agent of value creation.

What makes Service-Dominant logic so interesting is that it opens up new ways of thinking about value creation. Value is no longer created by processing raw material, but happens in the interactions between customers and companies (Vargo et al, 2008; Spohrer et al, 2009). These interactions can happen in different ways, and goods are only one way to facilitate them. It also helps companies orient themselves to the customer's point of view, and forces them to explore the ends and outcomes that customers desire, rather than fixating on the production of goods.

Developing deeper customer understanding can, in turn, enable service innovations, as companies can use these insights to inform their product and service development efforts.

You can find a summary of the main differences between traditional goods-dominant logic and Service-Dominant logic in the below table. I will next introduce the main concepts of Service Science that I will later use in the theory framework of this thesis work.

	Traditional goods-dominant logic	**Service-Dominant logic**
Primary unit of exchange	People exchange for goods- These goods serve primarily as operand resources.	People exchange to acquire the benefits of specialized competences (knowledge and skills), or services. Knowledge and skills are operant resources.
Role of goods	Goods are operand resources and end products. Marketers take matter and change its form, place, time, and possession.	Goods are transmitters of operant resources (embedded knowledge); they are intermediate "products" that are used by other operant resources (customers) as appliances in value-creation processes.
Role of customer	The customer is the recipient of goods. Marketers do things to customers; they segment them, penetrate them, distribute to them, and promote to them. The customer is an operand resource.	The customer is a coproducer of service. Marketing is a process of doing things in interaction with the customer. The customer is primarily an operant resource, only functioning occasionally as an operand resource.
Determination and meaning of value	Value is determined by the producer. It is embedded in the operand resource (goods) and is defined in terms of "exchange-value."	Value is perceived and determined by the consumer on the basis of "value in use." Value results from the beneficial application of operant resources sometimes transmitted through operand resources. Firms can only make value propositions.
Firm-customer interaction	The customer is an operand resource. Customers are acted on to create transactions with resources.	The customer is primarily an operant resource. Customers are active participants in relational exchanges and coproduction.
Source of economic growth	Wealth is obtained from surplus tangible resources and goods. Wealth consists of owning, controlling, and producing operand resources.	Wealth is obtained through the application and exchange of specialized knowledge and skills. It represents the right to the future use of operant resources.

Table 1. The distinction between goods-dominant logic and Service-Dominant logic. (From Vargo & Lusch, 2004).

Definition of service

The precise definition of service in Service Science is the application of specialized competences (knowledge and skills) through deeds, processes, and performances for the benefit of another actor or the actor itself (Vargo & Lusch, 2004, 2008, 2016; Spohrer et al, 2013; Lusch & Nambisan, 2015). Service Science views service as fundamental unit of exchange as opposed to goods. The role of goods is to serve as vehicles of service provision (Vargo & Lusch, 2004), meaning that they can deliver the specialized competencies in a tangible form. For example, instead of taking a taxi, I can buy a car and drive myself. In both cases, I purchase the end result of the car, i.e. mobility.

The key point here is that Service Science views service as a process, not an output: *"Put simply, service involves applying resources for the benefit of others or oneself" (Lusch & Nambisan, 2015: 158).* This process invariably involves interaction with the beneficiary, and the customer needs to use his or her skills and competencies to take part in the service. The customer is therefore seen as a resource integrator, meaning that the customer integrates the offering from a service provider to his or her exiting resources and processes. For example, if I want to benefit from owning a car, I need the skills and knowledge related to driving a car and navigating the city. Even when taking a taxi, I still need some abilities, for example, the capability of communicating with the driver (which might not always be so straightforward). Service Science also makes a clear distinction between the plural *services* and the singular *service* (Kryvinska et al, 2013). Services refer to a unit of output, and belongs to the vocabulary of goods-dominant logic, while service refers to a collaborative process, in which knowledge and resources are used to benefit others.

Operant and operand resources

The concept of resources is a key aspect of Service-Dominant logic and Service Science. In everyday parlance, resources typically refer to tangible things, such as natural resources, which can be moved, warehoused, and depleted. In Service Science, resources refer to anything that an actor can draw on for support (Vargo & Lusch, 2004; Lusch & Nambisan, 2015). According to Lusch & Nambisan (2015), resources can be tangible or intangible, and importantly, internal to an actor and under its control, or external to the actor but available for the actor to draw on for support. An individual transportation user's resources include her skills and knowledge, and anything else that she can use to support her journey. Some of these resources may be under her control, such as a bicycle, and others may be owned by someone else, for example, a metro system. Nevertheless, the metro system is at the transportation user's disposal, and is therefore her resource.

Service-Dominant logic also makes a distinction between two kinds of resources: operant and operand. Operant resources are resources that can act on other resources (Spohrer et al, 2009). For example, people and organizations are operant resources. Operand resources are resources that can

only be act upon, and don't themselves have agency (ibid). For example, money, bricks, a bridge, or a house, are operand resources. Using these terms, Vargo and Lusch (2004) argue that traditional goods-dominant logic views customers as operand resources – as static recipients of inputs from companies. By contrast, Service-Dominant logic views customers as operant resources that actively contribute to the process of service.

Value co-creation

As discussed earlier, traditional goods-dominant logic views companies as the creators of value (goods or services) that make and sell goods to markets, while customers are viewed as passive recipients of value. However, in Service-Dominant logic and Service Science value is not created by companies, but "in-use" (Vargo & Lusch, 2004). Based on this thinking, companies cannot create value by processing and adding more content or utility to products, and can only create value propositions (Spohrer et al, 2009). According to Lusch and Nambisan (2015), value occurs when an offering is useful to a customer, meaning that the value is defined based on its usefulness to a customer.

Because value is defined by the customer, in Service Science, the customer becomes an active participant in the process of value creation. In other words, value is co-created by customers and service providers when a customer integrates the value proposition – a resource – to his or her existing resources. According to S-D logic, all social and economic actors integrate resources to create value Customers buy service or product offerings from companies in order to integrate those into a larger solution they need or want (Lusch & Nambisan, 2015). As discussed earlier, these resources can either be operant or operand. For example, the customer's skills are operant resources, but a bicycle is an operant resource. If I want to get from Espoo to Helsinki, I can either use my exiting resources (biking skills and a bicycle), or I can accept a value proposition from the local transportation company and integrate the resource into my existing ones. When I take a bus, for instance, I integrate the bus and the driver into my existing skills, and as a result gain the benefit of using a bus. From this point of view, I am the one with primary agency, and the role of companies is to offer me resources that I can use to get things done.

Service system

The concept of a service system has been suggested as the basic abstraction of Service Science (Spohrer et al, 2009). Service systems are defined as "*dynamic value-co-creation configurations of resources, including people, organizations, shared information (language, laws, measures, methods), and technology, all connected internally and externally to other service systems by value propositions"* (Spohrer et al, 2007; Maglio et al, 2009). Almost all human systems can be conceptualized as service systems: for example, individuals, families, cities, companies,

universities, and schools are service systems. The key behavior of service systems is that they interact to co-create value (Spohrer et al, 2009), and value propositions are used to negotiate and agree about co-creation activities.

Platforms in Service Science

Service Science scholars have recently shifted attention from single service systems to the study of service ecosystems (Lusch et al, 2016; Koskela-Huotari et al, 2016; Banoun et al, 2016; Lusch & Nambisan, 2016; Taillard et al, 2016; Barret et al, 2015; Vargo & Akaka, 2012). The service ecosystem concept is very similar to the idea of service system. Service ecosystems are relatively self-contained, self-adjusting systems of loosely-coupled, resource integrating actors. These systems are governed by shared institutional logics and interact by mutually creating value through service exchange (Lusch & Nambisan, 2015, Vargo & Lusch, 2016). Resource integration within a service ecosystem is facilitated by common organizational structures and sets of principles (Lusch & Nambisan, 2015). This means that there are always some rules and structures that enable resource integration within a service ecosystem.

A closely related issue to service ecosystems are service platforms. Service platforms are modular structures that consist of resources and facilitate the interaction of actors and resources (Lusch & Nambisan, 2015: 162). Service platforms are used by service ecosystems to facilitate service interaction by providing a common structure and rules of exchange. The common structure and rules of exchange make it easier for an actor within the service ecosystem to integrate resources from other actors. Thus, service make resources more accessible to actors within the service ecosystem. For example, the Uber service platform provides a structure (the application, data base, user profiles etc.), and rules of exchange that enable actors within the Uber ecosystem (drivers and users) to interact more easily. From the user's point of view, it is easier for the user to integrate resources (the Uber drivers) to his or her resources and to create value.

Summary

Service Science and its underlying Service-Dominant logic are an attempt to develop a new paradigm for service and value creation. They shift us from viewing services as a unit of output to regarding service as a process and a fundamental basis of economic exchange. Service Science redefines the role of customers, and views customers as important agent in the process of value creation. In goods-dominant logic, customers were passive recipients of value from companies, but in Service-Dominant logic, customers co-create value with companies by integrating the inputs from companies into their existing resources and practices. Finally, customers and companies, and all other economic actors for that matter, are regarded as service systems: dynamic value co-creating configurations of operant resources. The economy, which is also redefined as

fundamentally *service economy,* consists of networks of these service systems, connected by value propositions.

I have now introduced the basic idea of Service Science and Service-Dominant logic, as well as discussed some of the key concepts within these frameworks of thinking. I have previously discussed the two literatures about technological and market platforms, as well as introduced a classification of technological and market platforms that will be used in the theory framework. It is now time to draw these different perspectives together, and to discuss the main theory framework of this thesis work, which I will use when analyzing the MaaS cases.

3. Theoretical framework

3.1. Introduction

I will now discuss the theory framework of this thesis work. The framework will serve two purposes. Firstly, the main theoretical aspiration of this master's thesis is to bridge the two streams of literature – platforms and Service Science – into a unified theory framework, which will allow more holistic analysis of platforms. Secondly, the empirical purpose of this master's thesis is to understand the MaaS systems that are emerging in Finland. The framework will help me analyze the MaaS cases of this master's thesis, while also allowing me to test the framework.

The theory framework consists of two core ideas. The first idea is the concept of value co-creation through resource integration from Service Science. In this master's thesis, I adopt the following definition of value co-creation: *value is co-created by the service provider and the service beneficiary through the integration of resources* (Lusch & Nambisan, 2015). The second core idea is the classification of platforms between technological, market, and technological-market platforms, introduced in chapter 2.4. The framework combines the two ideas by applying the definition of value co-creation to the platform categories. I will redefine each class of platforms from a resource integration point of view. The result is a framework that classifies platforms according to their primary use (technology vs market) and that uses Service-Dominant logic as its underlying worldview.

To maintain the scope of my work at reasonable limits and to ensure consistency in terminology and concepts, I chose not to use the concepts of service ecosystems and platforms in my theory framework. The concepts from main platform theory have been developed longer than the most recent concepts of service platforms and ecosystems, and I am hesitant to combine these yet. Furthermore, the basic ideas behind service platforms and ecosystems are similar to those of platform theory, as scholars from both sides emphasize the role of rules, structures, and governance in facilitating interaction among actors in an ecosystem. Thus, to narrow the scope of my work on one hand, and to maintain its internal consistency on the other, I chose to maintain the definitions and main arguments of platform theory and to combine these with the idea of value co-creation.

I will next discuss value co-creation from a resource integration point of view, and then proceed to redefine the platform classifications by using this perspective.

3.2. Value co-creation through resource integration

According to Service-Dominant logic, value is always co-created in interactions among providers and beneficiaries through the integration of resources and application of competencies (Vargo et al, 2008: 146). In Service-Dominant logic, and particularly in the more recent service-ecosystem discussions of S-D logic, resource integration is viewed as a central practice in value co-creation, and all social and economic actors are regarded as resource integrators (Lusch & Nambisan, 2015; Vargo & Akaka, 2012; Vargo & Lusch, 2010). Furthermore, value is always determined subjectively by the main beneficiary of value co-creation (Vargo & Akaka, 2012). Customers integrate the resources suggested by service providers into their existing resources based on their needs and context. However, discussing the subjective value of the MaaS cases from the end users' point of is out of the scope of this master's thesis. Instead, I will focus on studying the process of value co-creation primarily from a resource integration point of view.

From of resource integration point of view, the main purpose of service providers is to propose resources to customer, and by so doing, to enable customers to customize their available sets of resources (Vargo & Akaka, 2012) This perspective recognizes that customers always view the resources proposed by service providers vis-à-vis to their existing resources and potential alternatives. When the customer accepts the resource suggested by a service provider, he or she integrates that resource into this existing and potential stock of resources. Therefore, primary agency in resource integration is always with the customer.

3.3. Classification of platforms

I will now apply the concept of value co-creation through resource integration to the classification of platforms discussed earlier. I go through each class of platforms and modify their definitions to accommodate the idea of value co-creation. The resulting framework allows classifying platforms based on their primary use (technological vs market), as well as analyzing how platforms enable co-creation of value through resource integration.

Technological platforms

As discussed earlier, technological platforms are primarily used for facilitating efficient creation of derivative products, services, or technologies. Using the concept of value co-creation, I redefine a technological platform as *a set of technological assets that facilitates the co-creation of derivative products, services, or technologies by enabling efficient integration of resources.* Internal platforms are used by a single service provider to coordinate efficient co-creation of derivative products, services or technologies. The products are co-created by the service provider's internal service systems (e.g. people and production systems), and the platform enables these to efficiently integrate

operant and operand resources (e.g. knowledge, skills, tools, raw material) for the creation of new products and offerings. The platform does so by establishing a stable core of non-varying resources and service systems that can be used for creating different products, services, and technologies by integrating variable resources (the peripheral modules) to the stable core. External platforms are used by the main service provider and its supply-chain or across an ecosystem of companies for the same purpose described above. The main difference is that the core resource pool is shared across several service providers, and the co-creation of products extends from within the focal company to its partner network.

Market platform

In platform theory, market platforms are organizations that enable direct interaction between two or more distinct sides that are affiliated with the platform (Hagiu & Wright, 2015). Adopting the value co-creation perspective, I redefine market platforms as *organizations that facilitate value co-creation by enabling direct resource integration between two or more distinct actors that are affiliated with the platform*. I maintain the division between *direct* and *indirect* interaction from platform theory, but replace *direct interaction* with *value co-creation* and add *by enabling direct resource integration*, to emphasize the role of resource integration as the basis of value co-creation. By direct resource integration, I mean that the actors are exchanging and integrating each other's resources directly, as opposed to using an intermediary service or a common pool of resources to do so. For example, people depositing money into bank accounts and people taking up loans from the bank are not directly integrating each other's resources, while Uber drivers and riders are. According to this new definition, market platforms are primarily used for helping two or more distinct actors – who are affiliated with the platform – to co-create value through resource integration.

Technological-market platform

Earlier, I defined technological-market platforms as a set of technological assets that facilitates efficient creation of derivative products, services, or technologies while also enabling direct interaction between two or more distinct sides that are affiliated with the platform. Having now redefined both technological and market platforms, it follows that technological-market platforms are *a set of technological assets that facilitates efficient co-creation of derivative products, services, or technologies while also enabling direct resource integration between two or more distinct sides that are affiliated with the platform.*

To summarize, the new definitions of platforms are as follows:

Technological platform = A set of technological assets that facilitates the co-creation of derivative products, services, or technologies by enabling efficient integration of resources.

Market platform = Organizations that facilitate value co-creation by enabling direct resource integration between two or more distinct actors that are affiliated with the platform.

Technological-market platform = A set of technological assets that facilitates efficient co-creation of derivative products, services, or technologies while also enabling direct resource integration between two or more distinct sides that are affiliated with the platform.

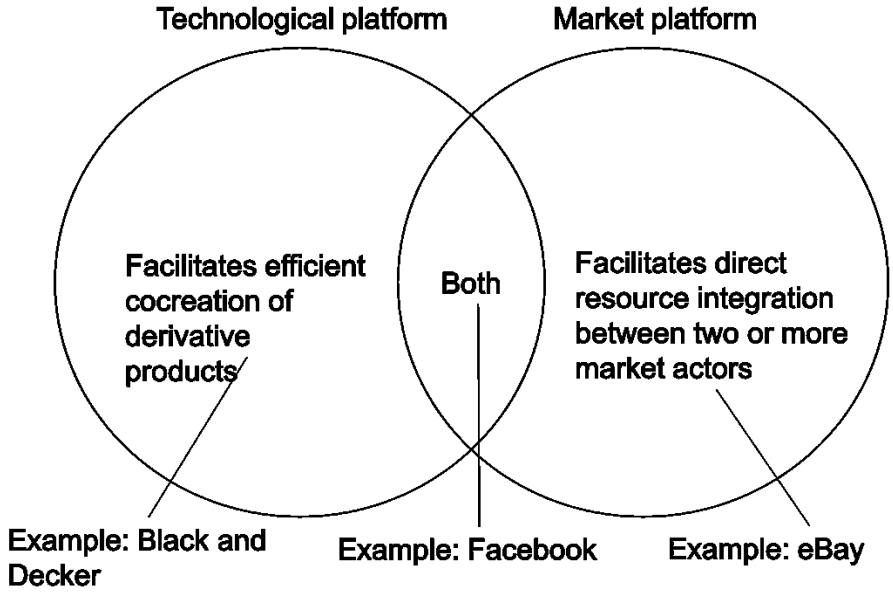

Figure 4. Theory framework.

A very similar framework that combines S-D logic and platform thinking has been suggested by Breidbach et al (2013), who put forth a framework of engagement platforms. Building on earlier research on engagement, and particularly on the works of Sawhney (2005) and Ramaswamy (2009), Breidbach et al (2013) define engagement platforms as *physical or virtual touch points designed to provide structural support for the exchange and integration of resources, and thereby to co-creation of value between actors in a service ecosystem.* Furthermore, the authors use two parameters, (1) the state of the EP (physical vs virtual), (2) the purpose of the EP (interactional vs transactional), to define four distinct categories of EPs. Taken together, the four categories form a layered and interdependent engagement ecosystem, which consists of virtual and physical touch points that enable the exchange and integration of resources between companies, companies and customers, as well as among customers.

Furthermore, in an upcoming article, Breidbach and Brodie (2017) combine concepts from service ecosystem thinking of Service Science and platform theory into a model that elaborates how platforms facilitate resource exchange and integration. In their innovative article, Breidbach and Brodie (2017) apply the meta-theoretical foundations of S-D logic and Service Science to develop a theory framework of service ecosystems, engagement platforms, and actor engagement practices. They apply the framework to sharing economy, and build and extend the theory on service ecosystems and platforms (Figure 5). This framework is very similar in its foundations to the framework that I developed, but elaborates the resource exchange and integration further. While Breidbach and Brodie's (2017) framework is relevant for this master's thesis, because of resource constraints, I have chosen not to use their framework. For the purposes of this master's thesis, the simpler framework I created will suffice. However, I want to acknowledge Breidbach and Brodie's (2017) interesting framework, and note that the two are clearly working towards same theoretical objectives as I am in this master's thesis.

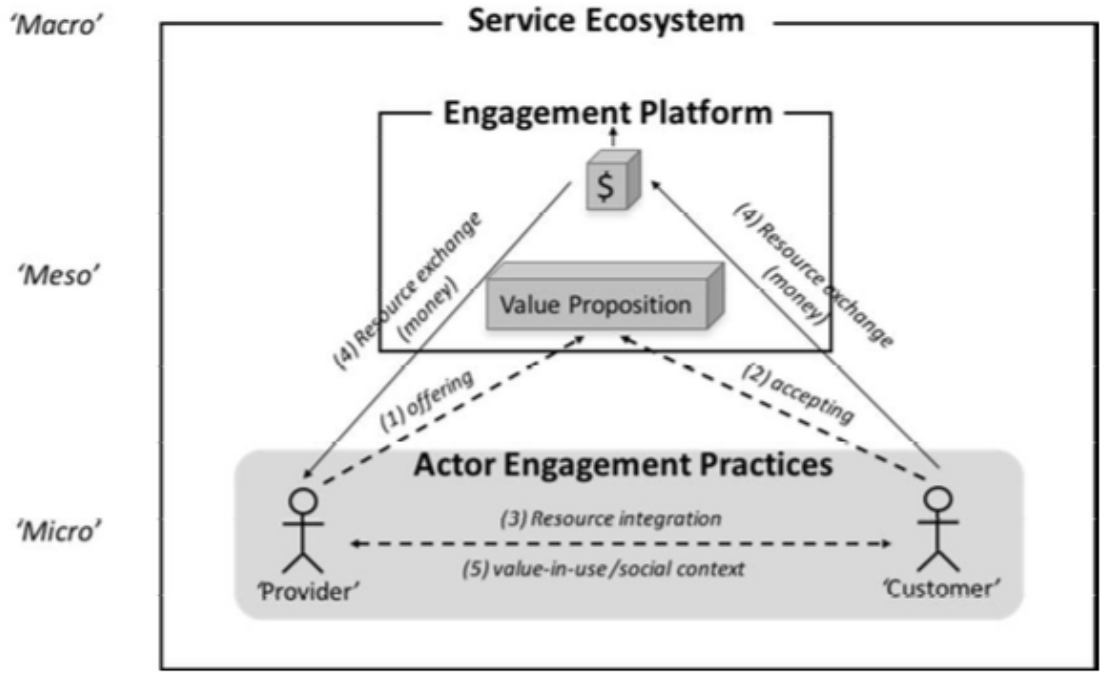

Figure 5. Theoretical Framework of Service Ecosystems, Engagement Platform, and Actor Engagement Practices in the Sharing Economy Context. Breidbach & Brodie (2017).

3.4. Applying the framework

I will use the framework (figure 4) to analyze the empirical cases of this master's thesis. The analysis will happen in two parts. Firstly, I will determine whether the MaaS cases are platforms based on two questions: (1) is the product, technology, or service being used for the co-creation of derivative products? (2) is the product, technology, or service being used for facilitating value co-creation by enabling direct resource integration between two or more distinct actors that are affiliated with the platform? If the answer to either or both questions is yes, the case is a platform. If the answer to the first question is yes, the platform is a technological platform, while a yes answer to the second question will determine the case as a market platform. If the answer to both questions is yes, then the case is a technological-market platform. The purpose is to provide answers to the research question: *What kind of mobility systems are currently emerging around the Mobility as a Service ideology in Finland*?

I will also discuss two important issues related to platforms: (1) platform access and governance, (2) platform pricing. Firstly, the access and governance of technological and market platforms is about making choices regarding who can access the platform and by what conditions, as well as what they can do there (Van Alstyne et al, 2016). As part of the analysis of the MaaS cases, I will describe who can access the platform and under which conditions, as well as what the actors on the platform are allowed to do on the platform. Secondly, the pricing of the platform is a special issue to market platforms. As discussed in chapter 2.3., platform pricing can have a big impact on the success or failure of the platform, and needs to be thought through carefully. As part of the analysis, I will discuss the pricing of the MaaS cases at a general level, and analyze the pricing structures of the cases. When possible, I will attempt to identify the potential loss-leader and profit-leader sides of each case.

The second part of the analysis is to elaborate how the cases co-create value with their main beneficiaries in terms of resource integration. I will scrutinize the process of resource integration from the transportation user's point of view, whom I define as the main beneficiary of the MaaS systems. The purpose is to provide an answer to the second research question: *How do the emerging mobility systems co-create value with their end users?* To this end, I will analyze the resource integration process that these systems facilitate. More specifically, I will attempt to identify three issues for each case: (1) The actors taking part in the integration process, (2) The main resources that are integrated, (3) The outcome of the integration for the main beneficiary. In this master's thesis, integration of resources means simply that the main beneficiary incorporates the service offering to his or her existing resources (knowledge, skills, tangible and intangible resources etc). The outcome is a change in the overall set of resources that are available to the main beneficiary after the resource integration.

While technological aspects are important to platforms, particularly to technological platforms, the primary focus on this master's thesis is the organizational and value creation perspectives of the MaaS systems. Therefore, I have chosen to leave the technology-related perspectives of MaaS systems for future research.

Summary

The theory framework of this thesis work attempts to bridge platform theory and Service Science by combining the classification of platforms with the concept of value co-creation through resource integration. The resulting framework is a classification of platforms between technological, market, and technological-market platforms, which I have redefined by incorporating the concept of value co-creation into the original definitions discussed in chapter 2.4. The framework allows me to classify platforms based on their primary purpose, and to analyze how they co-create value with their partners and main beneficiaries.

I will test this framework by using it for analyzing the four MaaS cases. The analyses will consist of two parts (1) classification of the MaaS cases according to their primary purpose, (2) analyzing how the MaaS cases co-create value. The first part will attempt to answer the research question: *What kind of mobility systems are currently emerging around the Mobility as a Service ideology in Finland*, while the second part will attempt to provide an answer to the research question: *How do the emerging mobility systems co-create value with their end users?*

Having now discussed the main theory framework of this thesis, I can now turn my attention to the empirical part of my research. In Chapter 4, I will first discuss the overall research design of the thesis work as well as the more specific data collection and analysis techniques I used. In Chapter 5, I will first discuss the Finnish MaaS landscape in general terms and give a historical overview of the development of MaaS in Finland. Secondly, I will analyze each MaaS case by using the theoretical model introduced in this chapter.

4. Research design

4.1. Introduction

Research design is an overall plan that connects a conceptual research problem with relevant empirical research (Ghauri & Gronhaug, 2002, 47). Research design should be selected according to what best allows for answering the stated research problem, while also considering possible constraints on the research, such as time, money, and skills constraints. Choosing a proper research design is important, because it will influence all later decisions about the research, including choices on individual research methods, what data is gathered, and how the data is analyzed.

I will now discuss the overall design of the research in terms of two main choices: (1) The general research approach, (2) The individual research methods. In research approach, I will consider the nature of the research problem, the chosen methodological approach, and the underlying scientific paradigm of this research. In research methods, I will elaborate on the methods of data gathering and data analysis that I used.

4.2. Research approach

Selection of the main research approach should be guided by the research problem. According to Ghauri and Gronhaug (2002, 48), there are two types of research problems: unstructured and structured. When researching a new and ill-understood phenomenon, a researcher is dealing with an unstructured research problem. For example, if we're trying to figure out why a car's engine is sputtering, we're dealing with an unstructured problem. We might have not encountered the problem before, and the research would begin by collecting relevant data while also consulting the car's manual to find a theory that could explain the phenomenon. If there is no prior knowledge about the problem, a new theory can be developed that explains it. These types of research problems call for exploratory research, where the researcher attempts to generate a clearer picture of the problem situation by flexibly exploring relevant data and theory.

By contrast, a structured research problem is something that is well understood. For example, let's say a company wants to test two kinds of social media campaigns by comparing their effects on their website views. The research question is: which campaign is more effective, A or B? In this case, we're dealing with a structured problem: the researcher is trying to understand cause and effect, where the causes can be well defined and the investigated effects are known and clearly stated.

The research problem that my thesis work attempts to investigate is an unstructured one. The purpose is to explore new kinds of mobility services in Finland. There is little if any prior

knowledge about this particular phenomenon, and I'm attempting to create a clearer picture of the overall situation. The services in question have only recently been incubated, and they are still evolving and discovering new development pathways. Given the unstructured and exploratory nature of the research problem, the research will be conducted as a qualitative study. Qualitative studies don't typically follow a tight and predetermined plan, and there is more room for surprises and changes along the way (Eriksson & Kovalainen, 2011). As the purpose is to explore and understand ill-known real-life phenomena in their own context, the object of research would be difficult to study with quantitative methods. Quantitative methods are most suited for testing and verifying hypotheses, facts, causality, and for making generalizations. By contrast, qualitative research methods are more flexible and exploratory, and allow for investigating several different aspects of the research problem. Qualitative methods are therefore highly suitable when the objectives of the study require in-depth insights into a phenomenon (Ghauri & Gronhaug, 2002.)

From the various qualitative approaches available, I have chosen to conduct the research as a case study because of its ability to present complex and hard-to-understand business problems in a simple and accessible way (Eriksson & Kovalainen, 2011, 115-137). According to Yin (1984), a case study is an empirical inquiry that investigates a contemporary phenomenon within its real-life context using multiple sources of evidence. The purpose is to understand what the case is about and what can be learned from it (Eriksson & Kovalainen, 2011). This is done by studying the case in relation to its historical, economic, technological, social, and cultural context (ibid). In this research, several business cases will be explored, which also means that this thesis will be conducted as a multiple-case study. According to Eriksson and Kovalainen (2011), in multiple-case studies the cases are not the focus of interest in and of themselves, but are used as instruments for exploring specific business-related phenomena. In my research, the selected cases will serve as instruments for understanding MaaS systems and their underlying logic of value co-creation.

When conducting multiple-case studies, the themes, issues and questions to be studied are often predefined in some way (Eriksson & Kovalainen, 2011). In this research, I determined the relevant theory before and during data collection, and allowed the interplay between theory and collected data to guide my approach and refine the research questions. As there is no existing theory on Mobility as a Service, I deduced relevant issues from platform theory and Service Science. As I compared these issues with my data, I created a relevant analysis framework to use for the cases.

Aside from the academic and scientific purposes of this research, the goal of this research is to produce information that can potentially be used in practical business settings. Partly for this reason, I have chosen to follow the paradigm of critical realism in this research. According to Eriksson and Kovalainen (2011), critical realism states that there is an observable reality independent of human consciousness, but that knowledge about this reality is socially constructed. Using critical realism

as a foundational paradigm allows us to assume that we can produce at least somewhat accurate information about existing reality, although our understanding might never be fully complete. The paradigm of critical realism is reflected in the case descriptions and analyses. I collect and analyze data, as well as describe the findings assuming that, through good research methods, I can approach reality. While I must take potential errors in data validity into account, I am primarily concerned with describing facts and phenomena as they are, not as people view them. Aside from my aspiration for producing practical information, I have chosen this approach because at this stage of MaaS development, there is much uncertainty about facts and what is generally going on. From a knowledge-creation point of view, critical realism is more practical and relevant for such an uncertain than the more constructivist approaches.

4.3. Research methods

Data collection

The research questions should always dictate the specific methods used in the research (Eriksson & Kovalainen, 2011). In this thesis work, I collected data on two MaaS pilots and two startups: Ylläs MaaS pilot, Seinäjoki MaaS pilot, MaaS Global startup, and Tuup startup. I collected the data by using both primary and secondary research. Primary data consists of semi-structured interviews with the key people involved in the MaaS schemes, most importantly the Chief Executive Officers of the two startups and project managers of both pilot. I recorded the interviews, which allowed me to create transcripts of the discussions and use them as basis for analysis. I also later checked the validity on certain facts through informal phone interviews with the startup founders. To understand the overall development of MaaS in Finland, I interviewed three informants: Anne Berner, the Minister of Transport and Communications, and Minna Kivimäki, the Director-General of the Services Department of the Ministry of Transport and Communications, and Sampo Hitenance, the CEO of MaaS Global. In addition, I used an older interview transcript from an interview of Sampo Hietanen, who was interviewed by Armi Temmes and Raimo Lovio on December 17, 2015. Overall, 11 interviews have been conducted for this research.

I selected interviewing as my main data collection method because interviews allow me to get detailed descriptions of each MaaS platform ecosystem. I have used secondary sources to fill in gaps in data and for ensuring validity. Internet sources, such as company websites and news articles have also been used to create a fuller picture of each case.

Data analysis

There are two main strategies of analysis (Eriksson & Kovalainen, 2011). The first strategy is to use pre-determined theory-based coding systems. The second one is to develop a case description,

which is then used as a basis for emerging research questions and frameworks for organizing the case study. The latter doesn't necessarily require the use of formal coding procedures, but relies more on direct interpretation of data (ibid).

In this master's thesis, I have followed the second strategy: I first created the case description and then organized the cases based on the theory framework that emerged later. I organized the first descriptions around the following topics: main actors involved, geographical location of the case, stated purpose and goals of the case, history, and products and services. Each case begins with a general description that includes these elements, although some elements may be more emphasized in one case then in others. Based on these descriptions and on the theory, I formulated the theory framework, discussed in chapter 3, which I used for further analyzing the cases. I used the theory framework to interpret the data and to organize the findings around the main themes of the theory framework. The primary source of data for both steps of analysis were the interview transcriptions, while available case documentation and reports were used for validation purposes and filling potential gaps in data.

The general overview of MaaS in Finland is a result of analyzing the interviews of three informants: Minna Kivimäki, Anne Berner, and Sampo Hietanen. As part of the analysis I looked for common patterns; themes and ideas that the informants had brought up. I organized the main ideas around themes and cross-checked the themes with information from secondary data sources. I also created a timeline that puts some of the main events and ideas mentioned by the informants into a historical context.

5. Case: Mobility as a Service

5.1. Introduction

I will now discuss the empirical findings of this thesis work, which I have separated into two main chapters. The first chapter presents an overview of the development of the Mobility as a Service (MaaS) concept in Finland. My aim is to describe how the concept of Mobility as a Service is viewed in the Finnish context, where the idea came from, and how it is currently being developed in Finland. Towards this end, I have interviewed three informants: (1) Anne Berner, the Minister of Transport and Communications; (2) Minna Kivimäki the Director-General of the Services Department of the Ministry of Transport and Communications; and (3) Sampo Hietanen, the ex-president of Intelligent Transport Systems Finland and the current CEO of MaaS Global.

The second chapter introduces four MaaS cases. The first two cases – MaaS Global and Tuup – are startups operating in Finland. Both startups are aiming to develop and commercialize services around the Mobility as a Service idea. The other two cases – Ylläs MaaS and Seinäjoki MaaS – are MaaS pilots that are being developed in Public-Private-Partnerships. With each case, I will first introduce the case in general terms and then analyze it using the theoretical framework discussed in chapter three. The purpose of these analyses is to develop our understanding of how these MaaS cases work and co-create value with transportation users. Finally, I will summarize the findings from both the overview and the cases in chapter six. What follows is an overview of Mobility as a Service in Finland.

5.2. What is Mobility as a Service?

Mobility as a Service is about bundles and chains

The concept of Mobility as a Service (MaaS) has gained wide-spread interest both in Finland and internationally. While few, if any real Mobility as a Service systems exist yet, Finnish actors have been particularly active in developing MaaS, and all my informants view MaaS as a Finnish idea. Whether MaaS truly is a Finnish concept cannot be said for certain, but what is clear is that Finland is already being profiled as a frontier of new mobility services. For example, Helsinki's plans for developing new mobility services have been well noticed outside Finland (The Guardian, 2014), and Deloitte (2017) regards the city as the "poster-child" of MaaS.

So, what exactly is Mobility as a Service? There is no widely shared definition for MaaS (Giesecke et al, 2016; Holmberg et al, 2016), but typically MaaS refers to a mobility service that bundles existing means of transportation into packaged mobility solutions which users can access according to their individual needs and preferences. ITS Finland defines (2013) MaaS in the following way:

"Mobility as a Service (MaaS) is a mobility distribution model in which all of customer's major transportation needs are met from a single platform by a single service provider that orchestrates each individual transport service component to meet a customer's end-to-end service expectations."

Bundling the services into holistic travel chains, also known as "door-to-door" travel, is a central aspect of MaaS. From the end users point of view, this would mean that instead of dealing with each transport service provider individually, the user gains access to all the different means of transport through one service provider, the MaaS operator. The different services are accessed through one service interface, typically a smart phone application, which combines different services into complete travel chains. MaaS operator doesn't take part in actual service production, but orchestrates the ecosystem of partners that contribute to the overall service.

Two general types of MaaS have been suggested. The first model of MaaS is a pay-as-you-go model, which focuses on connecting different transportation services into travel chains, thus enabling and door-to-door travel. The second general MaaS type is a subscription model, often compared to Netflix of Spotify. In the subscription model, the user pays a monthly (or other time-bound) fee, and in return receives access to a corresponding level of mobility services. Travel chains and door-to-door travel are also an integral part of the subscription model.

According to the CEO of Tuup, Pekka Möttö, there are two main benefits for users in the pay-as-you-go MaaS model. The main benefit is easy access to information about alternative transportation services. Secondly, the model allows users to combine and pay for the services through one service

interface, making journey planning and service provision easier. The subscription, or Netflix model, of MaaS offers essentially the same benefits, but there is higher emphasis on providing a service level comparable to a private car. According to the CEO of MaaS Global, Sampo Hietanen, a key component of the subscription model is the service promise: users need to be able to trust that they can get the same convenience and reliability that a private car can offer.

Mobility as a Service is about increasing the efficiency of assets

MaaS advocates often point out that private cars are most of the time sitting on parking lots, doing nothing. Sampo Hietanen, one of the most well-known proponents of MaaS, has repeatedly pointed out that the asset use rate of private cars is only between 1-5 %, which is of course very low for such an expensive investment.

> *"... I think this is the greatest achievement of marketing, that we have been convinced to buy ourselves a car, which is unbelievably lazy capital. Approximately 4 per cent asset utilization rate, and it's calculated based on one person, and considering that you could fit five people in a car, the actual utilization rate is hovering somewhere around 1 per cent…. Imagine going to a banker to explain that if we work really hard, we can achieve a 5 per cent utilization rate."*
>
> - *Sampo Hietanen*

Mobility as a Service is thought to bring a solution to this issue by enabling private car owners to rent, lease, and share their cars through MaaS platforms. This concept has already been proven by existing mobility platforms, like the US-based ZipCar and Helsinki-based City Car Club, and MaaS is seen as the next phase in this development. Furthermore, when automatic cars begin to proliferate, MaaS makes it theoretically possible to have cars in use most of the time, increasing their utilization rate.

The idea of putting existing assets to better use is a theme that has been given many names, including peer-to-peer economy, the Sharing Economy, Collaborative Economy (Botsman & Rogers, 2010), and Platform Economy. The underlying premise is that digital platforms are effective mechanisms for putting existing resources into new uses. They lower transactions costs by creating a marketplace that helps individuals and organizations sign up their services, products, and resources, as well as negotiate and fulfill transactions.

Mobility as a Service is about data

MaaS, like other digital platforms, is all about data. As discussed in earlier chapters, platforms like Uber are possible thanks to developments in digital technologies, the wide-spread use of fast

internet connections, and the increased capacity of companies to gather, analyze, and utilize data in creating products and service offerings. Digital technologies and big data analytics allow platform leaders to orchestrate an ecosystem around the platform by connecting people, products, organizations, and resources.

Mobility as a Service is the most recent manifestation of these competencies being used in the transportation sector. According to the Director-General of the Services Department of the Ministry of Transport and Communications, Minna Kivimäki, Mobility as a Service is a combination of technology, open data, and services, connected through the internet.

> *"In the beginning, the message was strongly about… the meaning of services, utilizing data, open data – which was the government's policy anyway – and services building on open data."*
>
> *Minna Kivimäki*

The central role of open data behind the MaaS ideology is also apparent when looking at recently created policies in the Finnish transportation sector. The Transportation Code (Liikennekaari), set forth by the Minister of Transportation and Communications, Anne Berner, is a key legislative initiative that is meant to help renew the transportation sector and enable Mobility as a Service. According to Minister Berner, Transportation Code is built around the idea that all transportation service providers are required to provide open access to data about timetables, prices, routes, and possibly locations.

> *"The heart and fundamental premise of Transportation Code is that all providers have their data accessible through open interfaces. In practice, it means that every provider gets to utilize the data via the open interface, including timetables, prices, availability, possibly location-based data. On top of this you would be able to create data-driven mobility operators, like the MaaS Global, that create new, demand-based services. These are also enabled by mobile devices and applications. However, this also allows incumbent companies to develop entirely new services."*
>
> *Minister of Transport and Communications, Anne Berner*

The Finnish law makers and officials are therefore trying to enable MaaS by legally obligating service providers to provide data openly to other service providers. By doing so, they hope to enable mobility service providers to flexibly combine and develop new service layers on top of existing data and infrastructure.

Mobility as a Service is about market design

MaaS is also an intriguing example of how ideas can be developed in close collaboration between private and public sectors. Although credit for the MaaS concept is often given to individuals like Sampo Hietanen, MaaS emerged slowly at the intersection of government policy-making and private sector initiatives. The history of MaaS has also heavy ties to organizational changes and renewing policy-making practices within the Ministry of Transport and Communications. The changes within the Ministry of Transport and Communications played an important role in the emergence of MaaS.

According to director-general Minna Kivimäki, these changes began around mid-2000s:

> *"You could say that the biggest shift in thinking began somewhere in the mid-2000s, when the Ministry's Chief of Staff, Harri Pursiainen, was assigned to investigate the role of intelligent transport in transportation policy. Later, in 2008, Finland's strategy for intelligent transport was accepted, which was the first in Europe, possibly first in the world…*
>
> *"…perhaps the biggest shift was that we started thinking more about what are the needs of the end users in transportation."*

The intelligent transport strategy was later accompanied by organizational changes within the Ministry, which had previously been organized around different modes of transportation, e.g. railways, aviation, and seafaring. According to the new blueprint, the Ministry would be organized based on functional wholes, with emphasis on customers and solutions.

> *"The organizational changes were a big stepping stone along the transition from infrastructure-based thinking to customer-centric and solution-centric thinking. These changes happened in the early 2010s, and they were a big deal."*
>
> *Director-general Minna Kivimäki*

While the organizational changes were taking place, the Ministry had begun scenario planning in late 2010 and 2011 in preparation for the upcoming parliamentary elections. As part of this work, the Ministry had taken part in a joint development program, called the Transport Revolution (Liikennerevoluutio), which was aimed at developing new mind-sets for urban and transport planning as well as policies and policy implementation. One of the key insights from the program was that user-centric transport services was not only a topic in Finland, but was in fact being discussed all around the world. Although the report also noted that there was little evidence of anyone implementing this kind of policy-planning, the move away from infrastructure-centric planning was clear. According to Kivimäki, the Transport Revolution program was an important

milestone in the development of Mobility as a Service. Although the term MaaS was not present in the program, the seeds of MaaS, i.e. the use of data, ICT, and services in transportation – were already coming together.

The year 2013 was another important milestone, and a year when the actual wording *Mobility as a Service* appeared. The emergence of MaaS happened in the backdrop of a series of meetings by the New Transport Policy Club, which was an initiative by then Minister of Transport and Communications, Merja Kyllönen. The club's purpose was to inform and provide new perspectives to transport policy-making, and meetings were organized and chaired by director-general Kivimäki. The club brought together actors from across different sectors and industries to have an open dialogue around topics like automatic cars, servitization, and the idea of travel chains. These discussions would turn out to play a major role in the development of MaaS.

> *"I can tell you that I've rarely seen such an open discussion, where everyone contributed without agendas or special interests. I don't quite remember when exactly did we start using the MaaS term, but… I remember in February 2013, that there was a brainstorming session in Mustio, where we gathered to discuss transportation policy. The message was that we should begin experimenting and piloting. The importance of services, using open data, and building services on open data was also highlighted."*

Sampo Hietanen, who attended the club's meetings in his role as the president of ITS Finland, also views the Transport Policy club's meetings as important stepping stone for MaaS. Hietanen regards the meeting in Mustio Manor as a particularly important event along the path towards MaaS:

> *"I think the reason MaaS became so big in Finland was the Transport Policy Club, held around three years ago. It was preceded by the Transport Revolution program, or something like that, where these ideas had already been discussed. There was also a meeting in Mustio Manor, where we even stayed overnight and had time to think what was really going on."*

In the Mustio meeting, Hietanen gave a talk about subscription-based mobility services – an idea that he had been tinkering with for some time already. According to Hietanen, the meeting in Mustio and his ideas about the subscription-based mobility services aroused a lot of interest and excitement, and later lead to the formation of a conglomerate of various actors around MaaS. This conglomerate would eventually result in the founding of the startup MaaS Global.

The final breakthrough for MaaS came in 2014. MaaS was heavily promoted in the June 2014 Intelligent Transport System Europe conference in Helsinki. The European Commission also took notice, and new mobility services have later become an important topic of discussion also at the

EU level. MaaS also gained world-wide news coverage thanks to Sonja Heikkilä, a well-known MaaS advocate who had published a master's thesis about MaaS in May 2014. As part of her MaaS-related thesis, Heikkilä created a vision of what MaaS could look like and laid out a roadmap and policy suggestions for reaching that vision. Her ideas gained wide interest among both private and public sector decision makers, and after publishing her thesis, Heikkilä and MaaS were discussed on the pages of Business Insider (2014), Time (2014), the Guardian (2014), and Bloomberg (2014). According to Kivimäki, Heikkilä had an important role in synthesizing the different strands of thinking behind MaaS into a coherent idea, which helped communicate the concept effectively.

At the surface, MaaS is often personified into people like Sampo Hietanen and Sonja Heikkilä, who are among the most well-known advocates of MaaS. While both have hand an important role in the making of MaaS, there have been many smaller strands of development and thinking that have slowly come together over the years to enable MaaS. The core elements behind MaaS – data, ICT, and services – have been developing for years, and according to Kivimäki, officials in the Ministry had been expecting something like Uber to arise eventually. MaaS has emerged from the work of many people, including government officials, academics, and private sector actors.

Hietanen also emphasizes that the idea of Mobility as a Service cannot be attributed to any one person. Although he is often regarded as the father of the concept, he himself argues that the concept is too elusive to be claimed for anyone's own.

> *"I think it's pretty difficult for anyone to say that this is his or her idea, because this hasn't really been invented, I think it's well said that no one can own this change… this is only a forecast of how the things that today's technologies enable will turn out for consumers in its mature stage. I think you can't compare this to an invention."*
>
> *Sampo Hietanen*

The CEO of Tuup, another MaaS startup, goes even further and views MaaS as a term invented by consultants. He himself would use the term "digital mobility services" to refer to what MaaS points to:

> *"Honestly speaking, MaaS is a consultant-term. I think MaaS is useful in the sense that it brings a broad set of things under one term, and brings attention to it… the logic why markets are now changing is that digital tools enable reaching the customer directly."*
>
> *Pekka Möttö*

Perhaps more than anything else, Mobility as a Service is about market design. Public sector actors, especially the Ministry of Transport and Communications, appear to have been central to enabling MaaS. The work that started in mid-2000s by Chief of Staff Harri Pursiainen was later carried on by ministers Kyllönen and Berner, who both contributed to renewing the Finnish transport industry. The Ministry has been particularly active in bringing various actors from across different sectors and industries to share their perspectives.

> *"When I was giving a talk in Taiwan, they told me that Finland is very good at market design, that we know how to plan how markets work. I think it was a good term, and it describes what we need to do now. An American who was giving a talk about this said that once the easy problems have been solved, we need political leadership to solve the big and difficult problems. The marketplace cannot solve alone the problems that we're facing now… I really think that the biggest innovations will come from regulation in the future."*
>
> *Sampo Hietanen*

Hietanen points towards what the essence of MaaS is: cross-sectoral collaboration combined with the potential of technology and the initiative of entrepreneurs. What began as small torrents of thinking gradually merged into a larger discussion across different sectors, and finally lead to an ideology that is now being driven through legislation in the public sector and by startups and pilots in the private sector. Today MaaS is even included as one of the key development sectors in the Finnish government's strategic program (Prime Minister's Office of Finland, 2015). In the public discourse, MaaS is regarded as the next fundamental paradigm shift in transportation (Giesecke et al, 2016) comparable to the introduction of gasoline-powered cars in the early 21st century.

However, as strong and compelling as the idea of MaaS is, we have very little evidence of how it works in practice. The concept has only recently been tested with actual users, and it's too early to announce MaaS as a breakthrough concept. In the next chapter, I will introduce and analyze two MaaS startups and two MaaS pilots that are trying to test the concept and turn MaaS from a vision into a reality.

5.3. Cases

5.3.1. MaaS Global

General information

Founded in 2015, MaaS Global is a Finnish, Helsinki-based startup and a so-called Mobility as a Service operator. The founding of MaaS Global has indirect ties to new transportation policy development within the Ministry of Transport and Communications. The founder and CEO of MaaS Global, Sampo Hietanen, states that the roots of the company are in 2006, when Hietanen claims to have first started seeing analogies between transportation industry and telecom industry. However, the wording for MaaS emerged only six years later. By 2012, Hietanen had become the manager of Intelligent Transport Systems Finland (ITS Finland), a nonprofit that promotes the development and deployment of transport and logistic telematics services in Finland (ITS Finland, 2013). As the manager of ITS Finland, Hietanen was invited to attend the meetings of the Transport Policy Club (uuden liikennepolitiikan klubi) held by then Minister of Transportation, Merja Kyllönen. The Transport Policy Club brought together representatives from various private and public sector organizations to discuss the future of transportation, with the purpose of helping prepare transportation policy. As discussed earlier, the term Mobility as a Service was created during one of these meetings – a seminar in Mustio Manor.

Hietanen regards the meeting in Mustio Manor as a major stepping stone in the development of Mobility as a Service. According to Hietanen, the seminar lead to further discussions about MaaS between ITS Finland and other private sector collaborators. ITS Finland would later gather a conglomerate of partners to found a startup that was meant to put the idea of MaaS into action, and to begin developing a Finnish MaaS operator. MaaS Finland was finally founded in 2015, with Sampo Hietanen taking charge as the CEO in early 2016. MaaS Finland was renamed MaaS Global in fall 2016, and the company began testing its first MaaS service, named Whim, with a closed test group of users in late 2016. What follows is an analysis of how the Whim service platform works.

Platform analysis

The purpose of the first part of the analysis is to determine whether Whim is a platform or not. To do so, two questions need to be answered: (1) is Whim being used for the co-creation of derivative products? (2) is Whim being used for facilitating value co-creation by enabling direct resource integration between two or more distinct actors that are affiliated with the platform?

Whim is a digital service that aggregates different transportation services into one, unified mobility service, facilitated by the Whim application. Here's how Whim works from the user's point of view: a user pays a monthly fee, ranging between 89 euros (light) to 389 euros (premium), and in return for the fee, the user gets access to a corresponding level of transportation services. For each service level, users are provided with a certain amount of Whim points, which can be used for purchasing individual transportation services. These transportation services are provided by the Whim partner ecosystem, which by April 2017 included a taxi company, a local public transportation company, a car dealership, and a car rental company. Provision of the services is facilitated by the Whim application, which provides an interface for planning journeys, selecting and buying individual transportation services, and for navigating.

Whim differs in two major respects from a traditional transportation ticket sales office. Firstly, Whim does not buy the bus or other transportation tickets into stock like a regular ticket sales office does. Although MaaS Global is a customer to its partners in the sense that it pays for the tickets that it sells to its users, the tickets and services are paid and delivered based on user demand. Sampo Hietanen claims that the purpose of Whim is not to only sell tickets, but to provide a holistic and dependable mobility service. Hietanen also emphasizes the psychology behind the service promise of Whim as foundational to the service: the stated aim is to create the same sense of freedom as owning a car does. It's not possible to make conclusive statements whether these aims are realized or not, but the fact that Whim doesn't take title of any tickets does set it apart from conventional ticket sales offices. Secondly, Whim also differs from traditional ticket intermediaries in its revenue logic. Because Whim is priced as flat, monthly fee, each ticket being sold introduces a cost to MaaS Global, rather than a profit. MaaS Global purchases and delivers the tickets based on demand, and the company profits whatever is left after subtracting ticket costs from the monthly fee. However, users are limited to certain number of journeys per month, which also caps the costs of a user to a certain maximum level. Therefore, while the profitability of a user is dependent on the services he or she ends up using each month, a certain profit margin can be guaranteed by using the maximum journey limits. Whereas a ticket intermediary would profit most by selling as many and as expensive tickets as possible to users, MaaS Global profits most when users use public transportation, walking, or cycling.

As for the first question, *is Whim being used for the co-creation of derivative products, services, or technologies?* – the answer is no, at least not yet. According to the CTO of MaaS Global, Sami Pippuri, building complimentary applications on the Whim app is possible, and it has even been tested. Pippuri emphasizes that currently the startup is not looking for partnerships with 3rd party software developers, and is instead focused on improving the user experience of Whim. However, Pippuri also stated that the philosophy of MaaS Global is to be as open as possible, and in the future building 3rd party apps on Whim might become a reality.

The answer to the second question, *is Whim being used for facilitating value co-creation by enabling direct resource integration between two or more distinct actors that are affiliated with the platform?* – is yes. Whim facilitates direct resource integration between transportation users and transportation service provider. Whim doesn't take title of tickets to any services, but facilitates the resource exchange and integration through its platform based on user demand. MaaS Global doesn't also take part in transportation service production, but only acts as the orchestrator of the Whim platform.

Based on the answers to the two questions, I conclude *that Whim is primarily a market platform*. Whim is not currently being used for the co-creation of derivative products, although this is technically possible. However, Whim is being used for facilitating direct resource inegration between two market actors that are affiliated with Whim: transportation users and service providers, and therefore, can be categorized as a market platform.

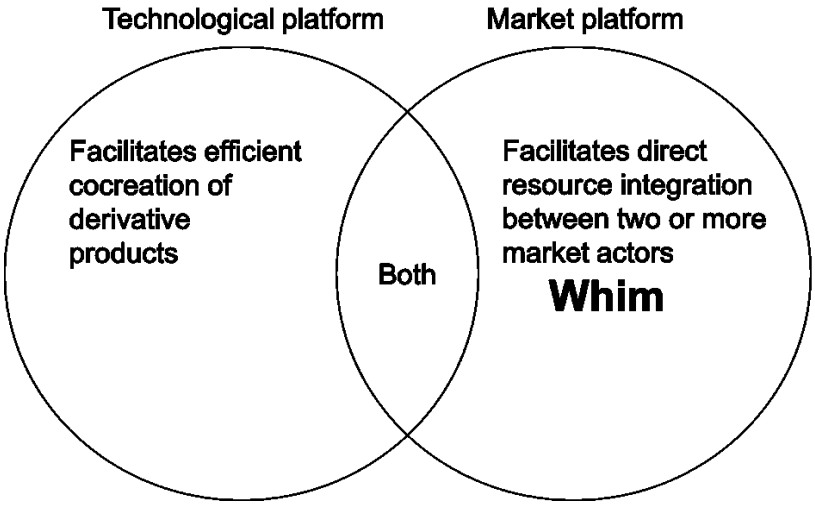

Figure 6. Classification of Whim platform.

Having now determined that Whim is a market platform, I will now analyze the governance and pricing of Whim platform.

Access and governance

Whim is still a somewhat closed platform. Transportation providers' access to and interaction within the Whim platform is contractually governed: according to Sampo Hietanen and Sami Pippuri, the company negotiates with each service provider individually. Connecting the service provider's IT systems and databases to the integration interface of Whim happens as part of the negotiation. Moreover, according to Sampo Hietanen, MaaS Global becomes a customer for each service provider. According to Sampo Hietanen, the rules of Whim come from the service providers:

> *"The rules that they (transportation providers) have for providing their service will be applied to our service as well. We're not in power so far to tell you how it goes. Of course, we like to have the business rules and the logic for the end user as similar across different transportation providers as possible. But it might be hard trying to… that's the thing that we do, we kind of take over some of the liabilities to make it easy to understand and use for the end user. But we can't change the taxi laws. Normally with monopolies it's too hard to try to change their rules."*
>
> *Sampo Hietanen*

Whim is currently closed form public, and accessing the platform requires signing up to test user. According to the terms and conditions of Whim, becoming a user requires having reached the age of legal competence, registering and creating a MaaS Global account, as well as providing certain personal and other information. Therefore, accessing the platform does not require any special conditions. Interaction between Whim users and the transportation providers is governed by the terms and conditions of Whim service, and appears to be relatively straightforward. Users are allowed to interact with other users, and sharing location, status, content, materials or personal information is also allowed.

Pricing

Whim is based on the subscription pricing model of MaaS. There are currently three subscription packages: Light (89 euros / month), Medium (249 euros / month), and Premium (389 euros / month). Additionally, there is a pay-as-you-go pricing scheme, which doesn't contain any pre-paid services, but allows users to use Whim for buying mobility services on the go. Each pre-paid package contains a corresponding level of Whim points services, which can be used for purchasing mobility services. For example, the premium version of Whim gives users unlimited local public transportation and 10,000 Whim points per month, which amounts to approximately 10 taxi rides and 5 days of car rental.

Aside from the pay-as-you go pricing option, Whim's pricing doesn't follow the usual pricing schemes of market platforms. For example, marketplaces like Amazon and Airbnb don't include special points system. I don't have information whether the transportation providers on Whim have committed to providing their services at special rates through Whim. Unless this is the case, the actual prices of the transportation services should vary according to pricing decisions by the transportation providers.

The loss leader side of Whim are the transportation providers, and the profit leader side are the users. Whim makes money by subtracting the cost of purchased services from the revenue of the subscription packages. According to CEO Sampo Hietanen, MaaS Global is a customer to its partners in the sense that it pays for the tickets and services bought through Whim. The more services are bought through Whim, the less profit is left for MaaS Global.

Value co-creation process

I will now describe and analyze how Whim co-creates value with end users in terms of resource integration. Three main issues will be addressed: (1) The actors taking part in the integration process, most importantly, the service provider and the main beneficiary, (2) The main resources that are integrated, (3) The outcome of the integration for the main beneficiary. Integration of resources means that the main beneficiary incorporates the service offering to his or her existing resources (knowledge, skills, tangible and intangible resources etc). The outcome is a change in the overall set of resources that are available to the main beneficiary after the resource integration.

There are three main actor groups taking part in the value co-creation process of Whim: transportation users, the Whim platform, and transportation service providers within the Whim partner network. The transportation users are the main beneficiary of the resource integration process. Their role is to receive resource offerings from service providers, accept or reject the offered resource, and to integrate the accepted resource with their existing pool of resources. The resources of the end users include both operand (no agency) and operant (agency) resources. The main operand resources include vehicles and IT tools, most importantly, a smart phone or other device that can be used for accessing the Whim platform. The most important operant resources include the knowledge and skills that are required to use a smart phone, navigate the cityscape, operate different vehicles, and access various infrastructure services (e.g. bus stops, train stations, gas stations, parking lots).

The Whim platform has two main roles in the process. On one hand, the Whim application provides software resources - digital tools and services – that can be used for planning journeys and navigating the city landscape. On the other hand, Whim acts as a facilitator of resource integration between transport service providers and users. Whim does so by providing an important resource:

information about different transportation alternatives and the tools to select, pay, and fulfill service transactions. Moreover, the bundled subscription services that Whim provides bring several resources into one place, and the subscription payment scheme can be regarded as an information resource. All of this happens through the Whim application, which provides the digital service interface that users can use for viewing the available Whim partners, select a service, and pay with either cash (in pay-as-you-go model) or Whim points, depending on subscription package. After a service is paid through Whim, a user proceeds to the selected service provider and uses the selected service. The resources provided by Whim are a mix of operand and operant resources. For example, some of the software tools and services may have some agency, in that they can act on other resources. However, maps and information about alternative services, which are the key resources of the service, are operand, i.e. they cannot act on other resources.

The transportation service providers of the Whim partner network provide transportation-related resources to end users of Whim. These resources are both operant and operand, and include personnel (drivers, customer service), equipment (communication tools, payment systems, IT systems, and vehicles), and infrastructure (e.g. rail roads and bus stations). These resources are packaged into services and offered through the Whim platform, service actual provision happens through various customer contexts and channels. Most of these transportation resources can also be accessed through other means than Whim.

Outcome of the integration

The main outcome of the integration from the user's point of view is that the information resource of the user is increased. The customer can add information about alternative modes of transport, and new routes into his or her existing pool of information. Moreover, by using the Whim software tools, the end user also increases his or her capability to select and accept resource offerings from transportation service providers. The value of these resources depends on the user's knowledge and skill level as well as existing modes of transport, such as bikes or private cars. For example, if the user cannot use a smart phone and doesn't have anyone to help use one, the value of Whim is near zero to the user. However, with sufficient knowledge and skills, the Whim platform as a whole offers users information resources and digital tools that can improve the user's capability to accept a wider range of resource offerings easier. In short, the outcome of the integration is that the user's stock of available mobility resources is increased.

5.3.2. Tuup

General information

Tuup Oy is another Helsinki-based Finnish startup, and a so-called Mobility as a Service operator. Tuup was founded in 2015 by Johanna Taskinen, and in April 2016, Tuup launched a beta version of its service, which included a map service, links to several partner applications, and a simple CO2 calculator. The beta version was launched as part of a collaboration with the city of Turku and the city's public transportation company, Föli. The service, also known as Turku MaaS, allowed users to use the beta version of Tuup application to plan their journeys and purchase public transportation tickets within Turku area. In April 2016, Tuup gained public attention as the founder of Onnibus, Pekka Möttö, joined Tuup and took charge as CEO. Later in 2016, Tuup announced that the company would be bringing robot busses into traffic in 2017 in collaboration with Vinka Oy and the Sohjoa program. Vinka Oy is specialized in loud based software for smart mobility systems, while the Sohjoa program is exploring the possibilities of robot busses. In their collaboration with Sohjoa, Tuup and Vinka are aiming to launch demand-based robot bus services to Finland (Tuup Oy, 2016).

In March 2017, Tuup launched a budget taxi service called Kyyti, in Oulu, Finland. The service is accessible through the Tuup application, and the service logic is based on using routing technology to combine rides based on demand. The service includes three service levels: Express, Flex, and Smart. Express is the most expensive of the three and takes the customer directly to selected destination, while the other two levels involve matching rides with other passengers to enable less expensive rides. Also in March 2017, Tuup announced a new partnership with an American service provider, DemandTrans Inc, an American mobility technology company. The two companies are aiming to collaborate on building new, demand-based mobility services based on the MaaS ideology (Tuup, 2017).

By April 2017, the basic Tuup application is still in its beta version, and doesn't yet include payment and ticketing functionalities, aside from the Kyyti taxi service. The company currently employs 12 people, and is continuing to develop the Tuup application.

Analysis of Tuup

The purpose of the first part of the analysis is to determine whether Tuup is a platform or not. To do so, two questions need to be answered: (1) is Tuup being used for the co-creation of derivative products? (2) is Tuup being used for facilitating value co-creation by enabling direct resource integration between two or more distinct actors that are affiliated with the platform? To find answers to these questions, I will now describe how Tuup works.

Tuup is a digital service that aggregates different transportation services into the Tuup application. Unlike, Whim, which is based on subscription-based packages, Tuup will (once the required functionalities are ready) primarily help users to view different options and build travel chains. The CEO of Tuup, Pekka Möttö, doesn't believe the subscription-based packages will be a viable option for many years. Instead, Möttö argues that the main benefit of using Tuup will be that it makes planning and purchasing mobility services easy by providing users with all available alternatives and an easy-to-use payment system. This is how Möttö describes Tuup:

> *"Tuup is a service that is commonly referred to as a MaaS operator. We are a digital platform that brings different mobility service providers and transportation users together. From the customer's point of view, it solves primarily the information problem: it brings different alternatives to one place. You can view different options, choose what you need, and pay the whole travel chain in one go."*
>
> *Pekka Möttö*

The various mobility services found on the Tuup application are provided by the Tuup partner ecosystem, which by April 2017 included the train company VR, the public transport companies of Oulu, Helsinki, Hyvinkää, and Turku, car rental companies 24Rent, gonow!, Shareit Blox Car, and City Car Club, as well as the Finnish Taxi Union, a parking service called Rent-a-Park. Provision of the services is facilitated by the Tuup application, which provides an interface for planning journeys, selecting and buying individual transportation services, and for navigating. However, the current beta version of Tuup doesn't yet allow buying services directly from the application interface, but redirects users to other applications. Möttö claims that once the technical capabilities are ready, users will be able to buy all services using the Tuup application, and he emphasizes the importance of making the payment easy.

The answer to the question: *is Tuup being used for the co-creation of derivative products?* – is *no.* According to the founder, Johanna Taskinen, building derivative products or 3rd party applications and systems is not a closed option, but is not a current concern for Tuup. Taskinen emphasizes that the purpose of Tuup is to build a network of collaborators, but the question about potential

complementor applications is not relevant, as Tuup is still in the early stages of its development. However, Taskinen also states that this is something that remains to be seen in the future.

As for the second question: (2) *is Tuup being used for facilitating value co-creation by enabling direct resource integration between two or more distinct actors that are affiliated with the platform?* – is yes. Tuup enables direct resource integration between two main actor groups: transportation service providers and transportation users. Tuup isn't a ticket retail office, as it doesn't purchase and own tickets to any services, but facilitates the resource exchange and integration through its platform based on user demand. Currently the facilitation is limited to displaying alternative modes of transportation, as payment and ticketing functionalities are not yet present in the application.

Based on the answers to the two questions, I conclude *that Tuup a market platform*. Tuup is not currently being used for the co-creation of derivative products, although this isn't a closed option according to CEO Johanna Taskinen. However, Tuup is being used for facilitating direct resource integration between transportation users and service providers, and therefore, can be categorized as a market platform. Tuup does have its own Kyyti taxi service, but this is only one service provided on the platform.

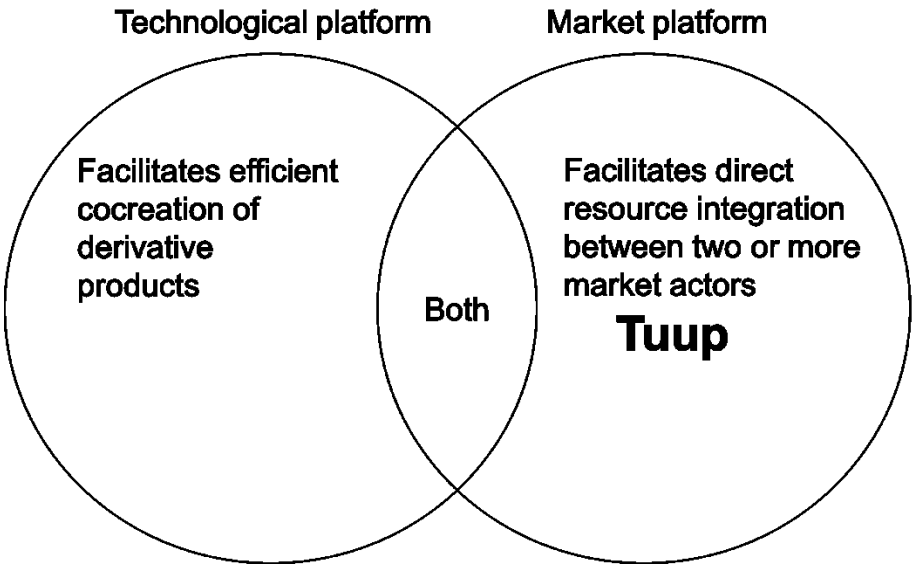

Figure 7. Classification of Tuup platform.

Having now determined that Tuup is a market platform, I will next analyze the governance and pricing of Tuup platform.

Access and governance

Transportation providers' access to the Tuup platform is contractually governed: according to CEO Pekka Möttö, Tuup negotiates with each partner in the Tuup ecosystem individually. Developing the technical capability to connect to each partner's interface happens as part of the negotiation process.

However, end users' access to the platform is much more open. Practically anyone can download the Tuup application from application stores, and using the platform only requires registration and providing personal information and payment details. End users of Tuup must agree to two sets of terms and conditions: (1) terms of Tuup service, (2) terms of each individual service provider. Unlike Whim, Tuup doesn't use a common rule template that all services in the ecosystem would follow, but users must comply to each service provider's rules. According to terms and conditions of Tuup, the company is not responsible for the actual provision of the service that user buys through Tuup. However, Pekka Möttö states that Tuup still takes partial responsibility if things go wrong during the journey, for example, if a train is late.

Pricing

Tuup doesn't take title of any transport tickets or services, but facilitates direct interaction between different service providers and users. Tuup platform follows the pay-as-you-go pricing model of MaaS. Using the Tuup platform itself is currently free, and users only pay the service fees of the services that he or she buys through the platform. According to Pekka Möttö, the revenue model of Tuup is based on transaction fees: Tuup gets a certain percentage of each payment being made through the platform.

At this stage of Tuup's development, it's not possible to identify either side as loss leader or profit leader. According to both Pekka Möttö and founder Johanna Taskinen, there are no overarching rules for how pricing works in Tuup, as different pricing models are possible in the future. By April 2017, the various services in the ecosystem hadn't yet been integrated to the Tuup application, and the user is sent to partner applications to buy the tickets and services.

Value co-creation process

I will now describe and analyze how Tuup co-creates value with end users in terms of resource integration. Three main issues will be addressed: (1) The actors taking part in the integration process, most importantly, the service provider and the main beneficiary, (2) The main resources that are integrated, (3) The outcome of the integration for the main beneficiary.

There are three main actors taking part in the value creation process: transportation users, the Tuup platform, and transportation service providers. The transportation users are the main beneficiary of the resource integration process and their role is essentially the same as in Whim platform: to receive resource offerings from service providers, accept or reject the offering, and to integrate the accepted resource with their existing pool of resources. The main operand resources of the end users include vehicles and IT tools, most importantly, a smart phone or other device that can be used for accessing the Tuup platform. The most important operant resources include the knowledge and skills that are required to use a smart phone, navigate the cityscape, operate different vehicles, and access various infrastructure services (e.g. bus stops, train stations, gas stations, parking lots).

Tuup platform has three roles in the resource integration process: firstly, Tuup provides digital resources that can be used for planning journeys and navigating the city. Secondly, Tuup facilitates resource integration between transport service providers and users. Thirdly, Tuup also provides a taxi service to users in Oulu region. In its current version, the digital resources of the Tuup application are still limited, and purchasing resources from transportation service providers cannot be done directly on the application. Instead, users are directed to third party applications provided by the Tuup partner network. According to CEO Pekka Möttö, in the future, Tuup will also provide direct access to the services from the Tuup platform and the tools to negotiate, pay, and fulfill service transactions. Currently, however, Tuup directly offers end users a map for navigating and planning journeys, as well as information resources, i.e. information about different alternatives service. The Tuup application provides the interface for transportation users to view the available Tuup partners, and in the future, users will be able to select a service and pay for the whole travel chain through the Tuup application. After a service is paid through Tuup, a user proceeds to the selected service provider and uses the service. Tuup also provides access to the new budget taxi service, Kyyti, which in April 2017 was available for users in Oulu region. The resources provided by Tuup are a mix of operand and operant resources. Maps, digital tools and information, which are the key resources of the service, are operand, while the drivers and service personnel of Kyyti service are operant.

The transportation service providers of the Tuup partner network provide transportation-related resources to end users of Tuup. These resources include operant resources, such as personnel (drivers, customer service) and some software tools, and operand resources, such as equipment (communication tools and vehicles), and infrastructure (e.g. rail roads and bus stations). These resources are packaged into services and offered through the Tuup platform, service actual provision happens through various customer contexts and channels. Most of these transportation resources can also be accessed through other means than Tuup.

Outcome of the integration

As with Whim platform, the main outcome of the integration from the user's point of view is that the information resource of the user is increased. The customer can add information about alternative modes of transport and new routes into his or her existing pool of information resources. The end user also increases his or her capability to access the resources, as the Tuup application automatically directs the user to a relevant 3rd party application. The value of these resources depends on the user's knowledge and skill level as well as existing modes of transport. For example, if the user owns a car, he or she will compare all other available transportation resources to that resource. The Tuup platform as a whole offers users information resources and digital tools that can improve the user's capability to accept a wider range of resource offerings easier. As with Whim, the outcome of the integration is that the user's stock of available mobility resources is increased.

5.3.3. Ylläs MaaS

General information

Ylläs MaaS is a Mobility as a Service pilot based in the Ylläs ski resort area, Finland. The pilot is a Public-Private-Partership, where the piloted service is privately operated and publicly funded. The pilot is coordinated by the Ylläs Travel Association and funded by the municipality of Kolari and Finnish Transport Agency. Other collaborators include Semel Oy, who currently owns the technology behind the pilot service, as well as local taxi and bus operators. The purpose of the pilot is to launch and test a mobility service that can improve the overall mobility coverage of the Ylläs ski resort area. The resort area is characterized by geographically dispersed services and lodging areas, meaning that visiting the resort usually requires owning or renting a private car. The pilot is meant to explore ways to make other means of transportation more viable in the resort area, thus increasing the potential customer base of Ylläs. By doing so, the pilot also aims to produce information about the viability of MaaS systems in areas of dispersed settlement in Finland (Ylläs Around vaikuttavuustutkimus, 2016). The pilot is part of the AURORA project (Arktinen älyliikenteen testialue ja osaamiskeskus), which is an arctic testing ecosystem for intelligent transport and automated driving in the Finnish Lapland.

More specifically, the pilot had four objectives (translated from Finnish): (1) To plan and execute a mobility system that optimally serves the transportation user so that the user can access services in the resort area without owning a private car, (2) Provide users with pre-priced, easy-to-purchase travel chains that conform to the MaaS ideology, (3) Assess how a customer-friendly mobility service concept and a profitable MaaS operator business could be establish in the Ylläs resort area, (4) Ylläs MaaS may also entail goods transportation and municipal transportation services (e.g. school-related transport for pupils) (Ylläs Around vaikuttavuustutkimus, 2016: 5).

The pilot was conducted in two phases. The first phase took place in spring 2016, and introduced a mobile application called Ylläs Around, which entails mobile payment and ticketing functionalities, allowing users to purchase local bus tickets and taxi services through the application. Ylläs Around application and service was originally developed and owned by Sonera (Telia Company), but was sold to Semel Oy in December 2016. According to Sonera's Jouni Sintonen, Sonera originally became involved in the Ylläs pilot because the company wanted to explore the MaaS concept and understand better the ongoing changes in the Finnish transportation industry. Sonera originally adopted the role of the MaaS operator in Ylläs, but with Ylläs Around assets now sold to Semel, it is unclear who the operator will be. The second pilot phase began in December 2016 and lasted until May 2017. During the second phase, another service was introduced called Ylläs Tiketti,

which allows users to purchase mobile bus tickets that can be used in busses in the Ylläs ski resort area.

Analysis of Ylläs MaaS

The purpose of the first part of the analysis is to determine whether Ylläs MaaS is a platform or not. To do so, two questions need to be answered: (1) is Ylläs MaaS being used for the co-creation of derivative products? (2) is Ylläs MaaS being used for facilitating value co-creation by enabling direct resource integration between two or more distinct actors that are affiliated with the platform? To find answers to these questions, I will now describe how Ylläs MaaS works.

Unlike Whim and Tuup, the Ylläs MaaS pilot is not centered around one application. Firstly, there are two applications with different functionalities: Ylläs Around and Ylläs Tiketti. The former allows users to combine available transportation services (busses and taxis) into travel chains and pay for the selected travel chain in one go. The latter enables users to buy individual bus tickets to local bus services, but doesn't allow combining different mobility services into travel chains. Secondly, the project manager of Ylläs MaaS, Joanna Karinen, claims that Ylläs Around is not about the application, but about creating a strong brand around Ylläs Around. Karinen views Ylläs Around as an umbrella term that, aside from the two applications, could cover services like Valopilkku (a taxi hailing application), and ShareitBloxCar (a Finnish peer-to-peer car rental). According to Karinen, the main purpose of Ylläs Around is to make it easier for tourists to move around in the resort area, which may involve the use of several 3rd party applications and services.

Currently there are only two transportation services available on the Ylläs Around application: busses and taxi services. The bus companies include Rundgren Oy busses (going to the airport and train stations), and the ski-busses of Ylläs Express Oy. Ylläs Tiketti also allows users to buy tickets to local busses, but doesn't allow combining travel chains. An important part of Ylläs Around is that it has made easier for users to utilize the ski-busses, which drive between the Äkäslompolo and Ylläsjärvi villages. According to Karinen, the ski-busses have not typically been used on shorter distances because users have not been aware this is possible. Ylläs Around application also entails a map, but it cannot be used for navigating unless a specific destination, starting point, and a transport service have been selected. As part of the second phase, an entirely new bus route was created, called Ylläs Shuttle, which takes visitors to Lainio Snow Village on Mondays and Thursdays. The shuttle route utilizes the Ylläs Around application and a new pricing scheme, where taxi drivers are paid by the hour (instead of according to the meter). The shuttle route combines separate service requests from users into shared taxi or bus rides, depending on demand. The taxi and bus drivers get paid the same hourly rate even if there are little or no users, and the Ylläs Travel Association bears the financial risk.

A central element of Ylläs MaaS is an open database that contains information about local companies operating in Ylläs resort area, as well as their opening hours, addresses, and other basic information in a structured format. For the purposes of the pilot, data about bus routes, bus stops, and timetables were also added to the database. According to Karinen, the open database is the core of the Ylläs MaaS, and everything else builds on top of it. Karinen believes that building a brand around Ylläs Around and allowing 3rd party developers and service providers to use the database freely is the best way to build the Ylläs MaaS, as opposed to building one application.

> *"The thing that is really valuable here in my opinion is the open database. We have all the opening hours and everything else there, and that's what Ylläs Around (application) utilizes… But this Ylläs Around, even though this is an application, I think it's more like an umbrella that covers all the available mobility services."*
>
> *Joanna Karinen*

To conclude, Ylläs MaaS is a loosely connected and still somewhat fragmented system of different services that all utilize the open database. The main system entails an open database containing information about local services, and two applications that have been built on the database: Ylläs Around and Ylläs Tiketti. The two applications facilitate interaction between two groups: transportation users and transportation service providers, and they are owned and maintained by a 3rd party: Semel Oy and Ylläs Travel Association.

The answer to the question: *is Ylläs MaaS being used for the co-creation of derivative products?* – is *yes and no*. The open database discussed above enables 3rd party complementors to build new systems, services, and technologies by using the database, and indeed this is encouraged by the Ylläs Travel Association. However, the database is not a technological platform, as it doesn't provide complementors with other stable technological resources (aside from data) that could be used for service or product co-creation. The two applications, Ylläs Around and Tiketti, are owned by two separate companies, Semel Oy and PayiQ, respectively, and I don't have information whether they are being used for derivative product development by the two companies or their partners. According to Joanna Karinen, Ylläs Travel Association cannot make changes to the applications without negotiating with the two companies. Based on this information, I assume that the two applications aren't currently being used as platforms for internal or 3rd party product development.

As for the second question: (2) *is Ylläs MaaS being used for facilitating value co-creation by enabling direct resource integration between two or more distinct actors that are affiliated with the platform?* – is yes. Ylläs MaaS contains elements that work like a market platform, most importantly, the Ylläs Around application. Ylläs Tiketti also facilitates direct resource exchange and integration between users and service providers, but is more limited in its functionality.

However, both applications are used for facilitating direct resource integration, and based on my framework, should therefore be regarded as market platforms.

Based on the answers to the two questions, I conclude *that Ylläs MaaS is a market platform*. Ylläs MaaS is not currently being used for the co-creation of derivative products. However, Ylläs Around and Tiketti applications are being used for facilitating direct resource integration between transportation users and service providers, and therefore, can be categorized as a market platform.

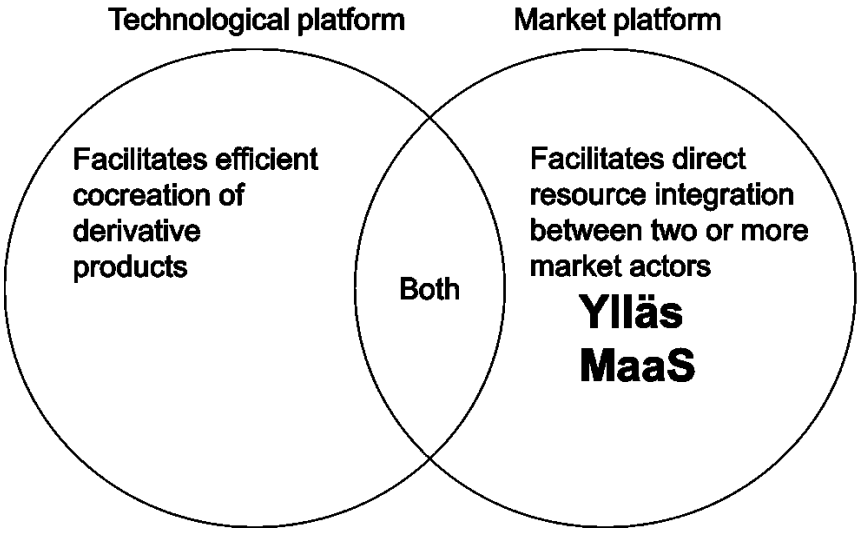

Figure 8. Classification of Ylläs MaaS platform.

Having now determined that Ylläs MaaS is a market platform, I will next analyze the governance and pricing of Ylläs platform.

Access and governance

The transportation providers' access to the Ylläs MaaS pilot is contractually governed. The pilot was initiated as a collaborative Research and Development project between Ylläs Travel Association, municipality of Kolari, Tunturi-Lapin kehitys Ry and the Finnish Transport Agency. According to Joanna Karinen, all service providers have gone through negotiations with Sonera and Ylläs Travel Association to become part of the piloted platform.

However, while building the partner network has been done through contractual negotiations, users are free to access the platform as long as they accept the terms and conditions of Ylläs Around and Tiketti applications. According to terms and conditions of the Ylläs Around and Tiketti applications, users are required to make a user profile and input their names, emails and phone numbers to the application. There are no special rules of interaction between the two sides, and interaction follows typical taxi and bus service terms and conditions.

Pricing

The Ylläs MaaS pilot follows the pay-as-you-go pricing model. There are two pricing schemes, one for Ylläs Around and another for Ylläs Tiketti. Downloading and using the two application is free, and users only pay for the services that they purchase through the applications. According to Joanna Karinen, users pay a small transaction fee to Semel Oy (originally to Sonera) when they pay for tickets and services through Ylläs Around. The bus tickets and taxi rides bought through Ylläs Around follow the normal service pricing, expect when users buy a travel chain. When users buy a travel chain (taxi + bus) through Ylläs Around, they receive a discount for the taxi ride. For example, when a user buys a bus ticket costing 7 euros, and a taxi ride that would normally cost 20 euros, a 7-euro discount is applied and a user ends up paying only 14 euros. Ylläs Tiketti can only be used for buying mobile tickets to busses in Ylläs resort area. These tickets are normally priced, and don't include any discounts. However, the only transaction fee users pay when using Tiketti is the credit card service charge.

The Ylläs Shuttle is a special bus/taxi route that runs between Ylläs resort area and Lainio Snow Village. The Shuttle is coordinated by Ylläs Travel Association and operated by the taxi companies in Ylläs resort area. The Shuttle is a shared taxi ride or a bus depending on user demand. Users pay a fixed 10 (from Ylläsjärvi) or 15 (from Äkäslompolo) euro price for a ride to the Lainio Snow Village. The taxi drivers are paid by the hour by Ylläs Travel Association.

Identifying the loss leader and profit leader sides of Ylläs MaaS is not possible at this stage of the platform's development. According to Karinen, Ylläs Around collects transaction fees from each service transaction, but I don't have information about whether the fee is paid by users or by service providers. Furthermore, as both Ylläs Around and Tiketti are owned by Semel Oy and PayiQ, respectively, I don't have information about what profits and costs are incurred by the two companies.

Value co-creation process

I will now describe and analyze how Ylläs platform co-creates value with end users in terms of resource integration. Three main issues will be addressed: (1) The actors taking part in the integration process, most importantly, the service provider and the main beneficiary, (2) The main resources that are integrated, (3) The outcome of the integration for the main beneficiary.

There are three main actors taking part in the value co-creation process: transportation users, the Ylläs MaaS platform (Ylläs Around and Tiketti applications and the Ylläs-tieto databas), and transportation service providers. The transportation users in Ylläs resort area are the main beneficiary of the resource integration process and their role is to receive resource offerings from

service providers, accept or reject the offering, and to integrate the accepted resource with their existing pool of resources. As with Whim and Tuup, the main operand resources of the end users include vehicles and a smart phone or other device that can be used for accessing the Tuup platform. The most important operant resources include the knowledge and skills that are required to use a smart phone, navigate the resort area, operate different vehicles, and access various infrastructure services (e.g. bus stops, train stations, gas stations, the airport).

Ylläs platform has three roles in the resource integration process: firstly, Ylläs platform provides digital resources that can be used for planning journeys and navigating the resort area. Secondly, Ylläs platform facilitates resource integration between transport service providers and users. Thirdly, Ylläs platform provides data of local services and transportation services for 3rd party mobile application development purposes. Ylläs MaaS platform provides users with two primary digital resources: Ylläs Around and Ylläs Tiketti. These applications entail tools for selecting, paying, and fulfilling service transactions. The Ylläs Around application facilitates direct interaction between users and service providers by providing an interface for transportation users to view the available Ylläs MaaS partners, as well as selecting and paying for these services. Ylläs Tiketti provides users with the tool for buying bus tickets that can be used within the Ylläs resort area. After a service is paid through Ylläs Around or Tiketti, a user proceeds to the selected service provider and uses the service. The third role that Ylläs MaaS fulfills is to provide data to 3rd party service development. While I argue that Ylläs is not a technological platform, the data base does provide information resources that outside companies can integrate into their service offerings. The resources provided by Ylläs platform are a mix of operand and operant resources. Information, which is the key resources of the service, is operand, while some of the software tools and all the personnel involved in operating the platform are operant.

The transportation service providers of the Ylläs MaaS partner network provide transportation-related resources to end users of Ylläs platform. As with the other two platforms, Whim and Tuup, these resources include operant resources, such as personnel (drivers, customer service) and some software tools, as well as operand resources, such as equipment (communication tools and vehicles), and infrastructure (e.g. rail roads and bus stations). These resources are packaged into services and offered through the Ylläs platform, service actual provision happens through various customer contexts and channels. Most of these transportation resources can also be accessed through other means than Ylläs platform.

Outcome of the integration

Again, as with Whim and Tuup, the main outcome of the integration from the user's point of view is that the information resource of the user is increased. The customer can add information about alternative modes of transport and new routes into his or her existing pool of information resources. Additionally, by using the Ylläs platform payment tools, the end user can increase her capability to access the transportation resources in the Ylläs area. As with Whim and Tuup, the value of these resources depends on the user's capability to use a smart phone and the digital resources provided by Ylläs platform. However, Ylläs platform's value is even more affected by users' existing transportation resources, most importantly, their private cars. When users arrive to Ylläs with their own cars, they already have a strong substitute resource to any other transportation resource available in the Ylläs resort area. When users do use the Ylläs platform, the outcome of the integration is that the user's stock of available mobility resources is increased.

5.3.4. Seinäjoki MaaS

General information

Seinäjoki MaaS is a public-private partnership pilot project coordinated by Sito, a company specialized in issues of infrastructure, logistics, land use, the environment, and digital services. Aside from Sito, main collaborators in the pilot include the city of Seinäjoki, the Pohjanmaa Centre for Economic Development, Transport and the Environment, two bus companies; Härmän Liikenne Oy and Pohjakankaan Liikenne, as well as local taxi entrepreneurs, coordinated by the central taxi company Seinäjoen Keskustaksi Oy. The pilot is funded by Tekes, and other stakeholders include Appmill and DDS Wireless, who are helping with the technical implementation of the pilot.

Preparing the pilot was officially initiated at the end of 2015 with the signing of service contracts between Sito and the transport operator collaborators (bus operators and taxis). Ramping up the service and production capabilities of the pilot took place between March 2016 and November 2016, and the first 20 test users took part in the service beginning from November 14, 2016. Second test user phase was started in February 2017.

According to Sito's senior expert Jaakko Rintamäki, the pilot has three main commercial objectives: (1) Increasing the customer base and revenue for local bus and taxi companies, (2) Identifying the production and commercial enablers of Mobility as a Service, (3) Driving change in the transportation sector by providing an example of alternative models to private car ownership. From the perspective of end users, the pilot aims to provide an economically viable alternative to owning a second car.

Founded in 1798, Seinäjoki is a small city located in Southern Ostrobothnia, Finland. Expanding over 1,469 square kilometres and home to around 61,000 people, the city of Seinäjoki is the 17th largest city in terms of population in Finland. The population density of Seinäjoki is relatively low (43.07/km2), and like in most places in Finland, private car ownership is the preferred mode of travel.

Analysis of Seinäjoki MaaS pilot

The purpose of the first part of the analysis is to determine whether Seinäjoki MaaS is a platform or not. To do so, two questions need to be answered: (1) is Kätevä Seinäjoki being used for the co-creation of derivative products? (2) is Kätevä Seinäjoki being used for facilitating value co-creation by enabling direct resource integration between two or more distinct actors that are affiliated with the platform? To find answers to these questions, I will now describe how Kätevä Seinäjoki works.

Kätevä Seinäjoki is a digital service that aggregates different transportation services available in the Seinäjoki area. The service is based on the subscription model of MaaS: users pay a monthly fee and in return gain access to a certain package of mobility services available in Seinäjoki area. The service includes the Kätevä Seinäjoki application, which entails a map that shows bus routes and local services (such as ATMs, parking, car rental, car cleaning, entertainment, night clubs etc) within Seinäjoki area, and the map lets users plan their journeys. The application provides discounted access to transportation services based on the service level of the chosen package. The purchased services are provided by the Kätevä Seinäjoki partner network, which include the regional public transportation company liikenne (Komia-liikenne), a local bus company, called Pahkakankaan liikenne (supplies the demand responsive busses), and the central taxi company, Seinäjoen keskustaksi. The Kätevä Seinäjoki application provides an interface for planning journeys, viewing different alternatives, and navigating the Seinäjoki area. The application doesn't include the functionality to order and purchase tickets or services, as the final service order is placed by calling the service provider (taxi or the demand responsive bus).

The answer to the first question - *is Kätevä Seinäjoki being used for the co-creation of derivative products?* - is no. The Kätevä Seinäjoki application and service are in their early stages of development, and according to Sito's Petri Launonen, it is still unclear what the final operating model of the system will be and who will be the final operator. Co-creating derivative products or 3rd party applications, services, or technology is not a current concern for Kätevä Seinäjoki.

The answer to the second questions – *is Kätevä Seinäjoki being used for facilitating value co-creation by enabling direct resource integration between two or more distinct actors that are affiliated with the platform?* – is yes. There are two main actor groups that Kätevä Seinäjoki connects: transportation service providers and transportation users. Kätevä Seinäjoki isn't a ticket retail office, as it doesn't take title of tickets to any services, but facilitates direct resource exchange and integration through its platform based on user demand.

Based on the answers to the two questions, I conclude *that Kätevä Seinäjoki is a market platform*. Kätevä Seinäjoki is not currently being used for the co-creation of derivative products. However,

Kätevä Seinäjoki is being used for facilitating direct resource integration between transportation users and service providers, and therefore, can be categorized as a market platform.

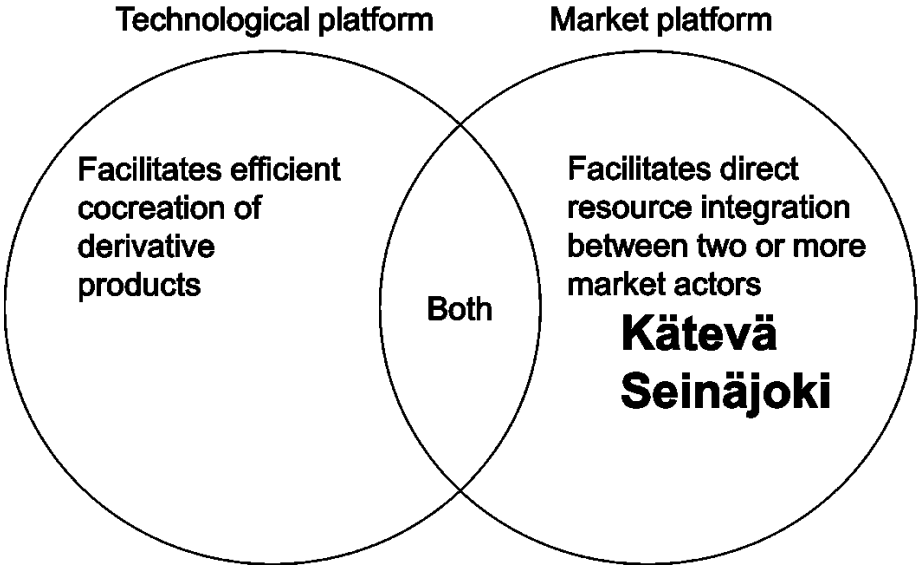

Figure 9. Classification of Kätevä Seinäjoki platform.

Having now determined that Kätevä Seinäjoki is a market platform, I will next analyze the governance and pricing of Kätevä Seinäjoki platform.

Access and governance

The service providers' access to the Kätevä Seinäjoki platform is contractually governed. All partners have signed contracts and shared responsibilities as part of the application process for Tekes funding. According to Jaakko Rintamäki, there is low hierarchy among the different partners, and the contracts are relatively loose and collaboration is still taking shape. Rintamäki also states that long term production contracts can be signed later, when the platform becomes better established. The users' access to Kätevä Seinäjoki are also currently contractually governed. While the The Kätevä Seinäjoki application can be freely downloaded from application stores, the MaaS service itself is still closed from public and becoming a user requires signing up as a test user. Therefore, accessing the platform is not possible without negotiating with the platform coordinator, Sito. The terms and conditions of Kätevä Seinäjoki don't include any special rules about interaction between actors in the platform, aside from describing the times during which taxis and demand responsive busses need to be ordered.

Pricing

The pricing of Seinäjoki platform is based on the subscription model of MaaS. Users have three different packages choose from: Mukava 29 € / month (comfortable), Sopiva 39 € / month (suitable), and Menevä 49 € / month (outgoing). Each package provides a service level corresponding with the price. For example, Mukava package allows users to buy unlimited amount of discounted tickets to a demand responsive bus (Kutsubussi), 20 pre-ordered shared taxi rides at 7€ / trip, and 8 discounted taxi rides at 10€ / trip. The Menevä package provides unlimited access to public transportation in the Seinäjoki area, unlimited access to buy discounted tickets to Kutsubussi at 4€ / trip, 20 pre-ordered shared taxi rides at 7€ / trip, and 8 discounted taxi rides at 10€ / trip.

At its current stage, it's not possible to determine the loss leader or profit leader sides of the platform. According to Rintamäki, Sito is not yet aiming to make a profit from the platform, but later a small transaction fee may be collected. Currently, all the fees go directly to the partner companies.

Value creation process

I will now describe and analyze how Kätevä Seinäjoki platform co-creates value with end users in terms of resource integration. Three main issues will be addressed: (1) The actors taking part in the integration process, most importantly, the service provider and the main beneficiary, (2) The main resources that are integrated, (3) The outcome of the integration for the main beneficiary.

There are three main actor groups taking part in the value creation process: transportation users, the Kätevä Seinäjoki platform, and transportation service providers. The transportation users in Seinäjoki area are the main beneficiary of the resource integration process and their role is to receive resource offerings from service providers, accept or reject the offering, and to integrate the accepted resource with their existing pool of resources. As with the other platforms we've discussed so far, the main operand resources of the end users include vehicles and a smart phone or other devices that can be used for accessing the Kätevä Seinäjoki platform. The most important operant resources include the knowledge and skills that are required to use a smart phone, navigate the Seinäjoki area, operate different vehicles, and access various infrastructure services.

The Kätevä Seinäjoki platform has three primary roles in the resource integration process: firstly, Kätevä Seinäjoki platform provides digital resources that can be used for planning journeys and navigating the city area. Secondly, Kätevä Seinäjoki platform facilitates resource integration between local transport service providers and users. Thirdly, the platform bundles these resources into packages that users can subscribe to, which makes these resources more accessible. The Kätevä

Seinäjoki application entails a map that can be used for navigating the city and for finding local services, such as ATMs. The application also entails digital tools that can be used for viewing and purchasing alternative transportation resources in the area. By introducing the subscription schemes that bundle different resources, users are also allowed to buy a discounted access to a bundle of resources in one go. This may also remove some psychological barriers to using the service by making the available services more tangible. In this sense, the packages can also be regarded as information resources. Seinäjoki users are in a similar position as Ylläs visitors in that they are accustomed to getting around with private cars, and therefore compare all alternatives to this primary resource. The resources of Kätevä Seinäjoki platform include operand resources, maps, some digital tools and information, and operant resources, such as personnel responsible for customer service. As with the other platform cases discussed earlier, the key resource that is provided is new information and the tools to utilize this information.

The transportation service providers of the Kätevä Seinäjoki partner network provide transportation-related resources to the end users of Kätevä Seinäjoki platform. As with the other platforms, these resources include operant resources, most importantly personnel (drivers, customer service) and some software tools, as well as operand resources, most importantly equipment (communication tools and vehicles) and infrastructure (bus stations and taxi stands). These resources are packaged into services and offered through the Kätevä Seinäjoki platform, while service actual provision happens through various customer contexts and channels. All the transportation resources provided through Kätevä Seinäjoki can also be accessed through other means.

Outcome of the integration

The main outcome of the integration for the main beneficiary, transportation user, is that the information resource of the user is increased. The customer integrates new information about alternative modes of transport and new routes into his or her existing pool of information resources. Additionally, by using the Kätevä Seinäjoki platform payment tools, the end user can increase her capability to access the transportation resources in the Seinäjoki area. The value of these resources depends on the user's capability to use a smart phone and the digital resources provided by Kätevä Seinäjoki platform. Similar to Ylläs, the platform's value is affected by users' existing transportation resources, most importantly, their private cars. Furthemore, Kätevä Seinäjoki offers users with packaged mobility services, which I regard as a form of information resource. The primary outcome of the integration from the end users' point of view is that the user's stock of available mobility resources is increased.

6. Discussion

6.1. The emergence of mobility market platforms

In this master's thesis, I have studied the concept of Mobility as a Service – a recent phenomenon in the Finnish transportation industry that also has relevance for the global transportation markets. Two specific research questions were outlined for the thesis: (1) What kind of mobility systems are currently emerging around the Mobility as a Service ideology in Finland? (2) How do the emerging mobility systems co-create value with their end users? The research was conducted as a qualitative, multiple case study, where the case was on one hand the development of the idea of Mobility as a Service, and on the other hand the four MaaS initiatives. The overarching empirical purpose was to understand the ongoing development of MaaS systems in Finland, including the history and origins of the concept as well as how it is being currently implemented in practice. Theoretically, the main aim was to bridge the technological-managerial perspective of existing platform literature with the value creation perspective of Service Science. To this end, I reviewed and summarized the main arguments of both literatures. Based on the review, I created a theory framework that built on a classification of platforms adapted from previous reviews of platform theory (Gawer, 2014; Schreieck et al, 2016), which I combined with the Service Science concept of value co-creation through resource integration.

Previous research on platforms has fallen roughly between two main streams: technological platforms and market platforms (Gawer, 2014; Schreieck et al, 2016). While the literature has also been divided between internal and external platforms (Porch et al, 2015; Gawer and Cusumano, 2014), I chose to follow the classification between technological and market platforms because I found that the internal and external platform classes were used inconsistently between different literature reviews. In some reviews, external platforms were regarded as automatically both technological and market platforms (Porch et al, 2015), while in others – where the author is primarily focusing on technological platforms – external platforms were regarded first and foremost technological, and in some special cases also as market platforms (Gawer, 2014). Conversely, market platforms were regarded as purely external by some researchers (Porch et al, 2015; Gawer, 2014), but others argued that they could also be internal (Gawer & Cusumano, 2014). A small but significant distinction is whether external platforms are *both* market platforms *and* technological platforms or if they can also be either or. Porch et al (2015) state that external platforms inherently have both technological and market related purposes, while Gawer and Cusumano (2014) argue that they can be either technological or market oriented. Because of this inconsistency, I chose to follow Schreieck et al's (2016) view, according to whom platforms are not black and white, but can be fall anywhere between the two categories.

Platform research has primarily focused on the managerial-technological aspects of platforms. Proponents of technological platform theory seem to agree that the purpose of technological platforms is to enable efficient creation of derivative products within firms, across supply-chains, or between companies in an ecosystem (Wheelwright & Clark, 1992; McGrath, 1995; Simpson et al, 2007; Meyer & Lehnerd, 1997; Robertson & Ulrich, 1998; Moore, 1993; Iansiti & Levien, 2004; Gawer & Cusumano, 2014). The underlying aim is to enable variety in product offerings while maintaining efficiency in production. This is achieved by dividing technological assets used in product creation into a stable technological core and a changing periphery (Wheelwright & Clark, 1992; McGrath, 1995; Meyer & Lehnerd, 1997; Robertson & Ulrich, 1998; Simpson et al, 2007; Baldwin & Woodard, 2009; Gawer & Cusumano, 2014). Using the technological core as a foundation allows efficient production while also enabling companies to offer variety to consumers through the peripheral modules. By contrast, the scholars of market platform theory have been studying organizations that enable direct interaction between two or more distinct sides, which allows taking advantage of network effects (Rochet & Tirole, 2003; Eisenmann et al, 2006; Hagiu & Wright, 2015; Gawer, 2014; Hagiu, 2014; Van Alstyne et al, 2016). If variety and efficiency are the Holy Grail for technological platform researchers, network effects are it for the proponents of market platform theory. Network effects refer to a phenomenon where each new member in a network increases the value of the network for all members (Katz & Shapiro, 1986). However, because of network effects, designing, pricing, and maintaining market platforms is a tricky business. Getting all sides onboard the platform while fighting off competing platforms is a challenging task, but when successful, network effects sometimes allow one company to take over the whole marketplace (Hagiu, 2014; Rysman, 2009; Boudreau & Hagiu, 2009; Parker & Van Alstyne, 2005).

The second main stream of literature that I used was Service Science. Service Science is a new area of research, and is still at a pre-theory stage. The main argument of Service Science is that service, as opposed to goods, is the fundamental unit of economic exchange, and that value is co-created in the interaction between service provider and beneficiary (Vargo & Lusch, 2004). Service is defined as the application of competencies and resources for the benefit of another or the actor itself (Vargo & Lusch, 2004, 2008, 2016; Spohrer et al, 2013; Lusch & Nambisan, 2015). Furthermore, according to the more recent ecosystem thinking of S-D logic (Lusch et al, 2016; Koskela-Huotari et al, 2016; Taillard et al, 2016; Lusch & Nambisan, 2015), service ecosystems are relatively self-contained, self-adjusting systems of loosely-coupled, resource integrating actors. Service ecosystems are governed by shared institutional logics and they create mutual value through service exchange. Interaction within service ecosystems may be facilitated by service platforms, which provide the rules and structures that make service exchange and resource integration more efficient (Lusch & Nambisan, 2015).

While service ecosystems and platforms are a relevant area of inquiry within Service Science, I chose not to incorporate these concepts into my theory framework. I needed to narrow the scope of my work and maintain conceptual and terminological consistency with regards to platforms. The main platform theory, although itself a relatively new stream of literature, has seen more conceptual development than the most recent concepts of service platforms and ecosystems. Furthermore, the basic ideas related to service platforms and ecosystems appeared mostly similar to those of platform theory (aside from value co-creation). For example, common institutional logics, rules, and structures that facilitate interaction were mentioned by proponents of both streams of literature. For these reasons, I decided to maintain the definitions and main arguments of platform theory and to combine these with the idea of value co-creation.

Using platform theory and Service Science for analyzing the MaaS cases allowed me to approach the cases from two different angles. On one hand, I was able to draw from the concepts of platform theory and its managerial-technological background to lay the foundation for the analysis framework. This helped me assess whether the MaaS cases truly were platforms, as well categorize them according to their primary purpose. On the other hand, I embedded the Service Science concept of value co-creation through resource integration into the framework, which provided a service perspective to the analyses. In the analyses, I found that none of the MaaS cases are currently being used for facilitating derivative product, service, or technology co-creation. As discussed, the role of technological platforms is to enable increased variety in offerings while maintaining efficiency in production. From a Service Science perspective, technological platforms enable co-creation of derivative products, services, or technologies by enabling efficient resource integration between service systems, whether inside an individual firm or across different companies. This aim was not present in the MaaS platforms, however, as co-creating derivative products on the platforms neither internally nor externally was not a current concern in any of the cases. All cases are in their early phases of development, and the most pressing issue is getting enough actors onboard the platforms. This finding is in line with extant platform theory, according to which new platforms often struggle to build their initial customer base. This issue is known as the chicken-and-egg problem (Hagiu, 2014; Rysman, 2009; Boudreau & Hagiu, 2009; Parker & Van Alstyne, 2005), and it was present in all four cases, especially in Ylläs MaaS platform.

Based on my framework, I found that all four MaaS cases are market platforms. According to platform theory, market platforms enable direct interaction between two or more distinct sides who are affiliated with the platform (Hagiu & Wright, 2015). The direct interaction is facilitated by some physical or digital structure that helps actors in the marketplace find each other, and negotiate and fulfill transactions. From a Service Science perspective, market platforms support value co-creation between different market actors by enabling efficient and direct resource exchange and integration between market actors. This role is observable in all four MaaS cases. The four MaaS platforms

facilitate direct resource exchange and integration between two primary market actors: transportation users and transportation service providers. They do so by establishing a network of partner companies and providing the digital tools and structure that the partners and end users can use for exchanging and integrating resources. The MaaS networks are governed primarily contractually, and at the outset may appear like traditional supply-chains. However, the MaaS platforms do not act as assemblers, but only facilitate value co-creation between the network and the end users. Although Whim and Kätevä Seinäjoki provide packaged mobility services, the packages are primarily used as pricing schemes, and the actual service production and offering is done by the partner network. Moreover, while MaaS Global is also a customer to its partners, it appears that this has primarily legal implications, as most end user interactions happen directly between the end user and the individual partners.

Using the value co-creation perspective of Service Science, I also scrutinized how the MaaS platforms co-create value with their users. I found that they do so in two ways. Firstly, they provide information about alternatives modes of transportation. Information about alternative transportation services is a resource that the MaaS platform offers to its users, and users integrate it to their existing information on transportation options and the urban landscape. Secondly, the MaaS platforms provide users with digital resources (maps and ticketing and payment tools) that allow them to purchase travel chains. Three of the platforms (Whim, Ylläs MaaS, Kätevä Seinäjoki) employed mobile payment functionality and the ability to directly access the displayed alternatives. While the current, beta version of the Tuup application didn't yet entail mobile payment functionality, a modified version of the application has been used for payment purposes in a service pilot in Turku.

Finally, I also assessed two issues that are important to platforms: (1) the access and governance of the MaaS platforms, (2) the pricing of the platforms. All of the platforms are relatively straightforward in the governance approach, and I didn't discover any special rules of access or interaction. The platforms mostly use simple terms and conditions, and the interaction between users and service providers follow the usual terms of taxi and bus services. However, Whim and Kätevä Seinäjoki platforms are still closed from public, and are only accessible to a closed group of test users. When it comes to pricing, I found two main pricing schemes: a pay-as-you-go model, and the subscription model. Tuup and Ylläs MaaS followed the pay-as-you-go pricing scheme, while Whim and Kätevä Seinäjoki used the subscription scheme. However, as all four cases are still practically at pre-market penetration stage, it is likely that these schemes change in the future. This was also pointed out by the interviewees, and different pricing structures may be implemented at a very short notice. For the same reasons, it was not possible to identify a loss leader and profit leader sides for the cases, aside from MaaS Global. As the platforms continue to develop and begin to solidify their positions in the overall market, it will become easier to identify more defined pricing structures.

6.2. Theoretical contribution

This thesis work contributes to our understanding of platforms in two ways. Firstly, the work contributes to extant platform theory by combining platform theory and Service Science. I created a theory framework that combines aspects of platform theory and Service Science, and tested it by analyzing four empirical cases. The two literatures are studying similar issues, including service innovation, the evolving relationship between customers and companies, the role of ICT and data in services, and the emergence of business and service ecosystems. At its essence, both streams of literature are trying to grasp the rise of the service economy, and how it is changing the way companies and customers engage in mutual value creation. Despite their common interests, platform theory and Service Science have been developing mostly independently, and few attempts have been made to align the two. My theoretical framework first brings the technological and market perspectives of platforms together and clarifies the distinction between the two categories, while also acknowledging that the lines between them are blurry. The framework then embeds the concept of value co-creation through resource integration from Service Science and redefines the platform categories through it. The result is a classification of platforms that has its foundations on platform theory and Service Science, and which can be used for categorizing platforms and for analyzing how they co-create value with their end users and partners. I used the framework to analyze the empirical cases of this master's thesis. The results of the analyses were in line with the two literature streams, and provided insights into how mobility market platforms facilitate efficient resource exchange and integration.

At the same time, I acknowledge the limitations of the framework. Bridging two recent and still developing theory streams is a challenging task, and a particularly ambitious goal for a master's thesis. Conducting a truly systematic review of the two theory streams was out of the scope of this research, and I was constricted to reviewing only the most prominent articles of both literatures. In the process, I have inevitably overlooked some articles and conceptual development that could have been included if there was more time. For example, a highly similar theory framework has recently been suggested by Breidbach & Brodie (2017), which I introduced briefly in chapter 3.3. Their framework, which combiens platform theory, S-D logic, and engagement platform theory, is an important contribution towards building connections between these areas of research. However, due to time and resource constraints I had to leave their article out of this master's thesis. Therefore, I acknowledge their work, but must leave more thorough discussions about their framework for future research.

Secondly, this master's thesis provides insights into Mobility as a Service – a recent phenomenon that has been not properly researched so far. Four case companies were studied and analyzed, and as discussed earlier, I found that all four cases are market platforms. As far as I can tell, my master's

thesis is in the first line of MaaS research, and perhaps the first one to study MaaS using platform theory or Service Science. Therefore, this master's thesis contributes empirically to future MaaS research by gathering information about existing MaaS cases.

At a more general level, this thesis work also contributes to our knowledge of MaaS by recapping its history and origins, and by reviewing some of the narrative around the concept. I found that Mobility as a Service is an elusive idea that is only now being tested in action. There is still very little, if any evidence that would prove that the concept will actually work. However, I also found that there is a strong hype around MaaS, and high expectations can sometimes turn into a self-fulfilling prophesy. However, if progress is slow, expectations may also drop suddenly, which is characteristic to hyped innovation systems (Alkemade & Suurs, 2011). Thus, anything conclusive regarding MaaS cannot be stated at this time, and whether we'll actually witness the rise of new kind of transportation markets remains to be seen.

Mobility as a Service is a particularly elusive concept because MaaS is not a single idea, business model, or a technology, but rather a model of a marketplace that emerges at the intersection of several ideas, business models, and technologies. Firstly, MaaS isn't a technology, but is enabled by various technological developments, most notably, the proliferation of fast internet connections, powerful mobile devices, cloud computing, and big data. These technologies allow new mobility operators to not only connect directly with end users, but to also connect an ecosystem of partners into a single system that the end user can use for purchasing transportation services. And thanks to developments in sensors and data analytics, MaaS operators can fluidly gather, mix, and match information about maps, locations, timetables, services, and people to create new services.

Secondly, MaaS is not a specific business model, nor does its implementation rely on building one. MaaS is a way of distributing mobility services, which could very well be orchestrated by a public-sector or a third-sector actor, as we've seen in the Ylläs MaaS case. Therefore, MaaS may or may not involve a business model. The two currently prominent MaaS revenue models are the subscription-based model (MaaS Global, Seinäjoki MaaS) and the transaction-fee based mode (Tuup). Both are common business models in other digital platforms, and not unique to MaaS.

Finally, Mobility as a Service is not an invention of any one person, but has been developed in an extensive dialogue between various public and private sector actors. Although people like Sampo Hietanen and Sonja Heikkilä have been important for developing, communicating, and most recently executing the concept, public officials and politicians such as Minister Anne Berner, ex-minister Merja Kyllönen, director-general Minna Kivimäki, and Chief of Staff Harri Pursiainen have played an equally important role. MaaS would not be possible without changes to regulation or without introducing new legal platforms, like the Transport Code in Finland. The role of

government and the dialogue between public and private sectors have therefore been crucial to enabling MaaS.

What is Mobility as a Service then? Based on my findings, I argue that Mobility as a Service is about transportation market design. It's about designing a marketplace that enables the creation of mobility services that focus on the needs of the customer, instead of infrastructure. Door-to-door travel, or end-to-end service is one result of these services, but at its core, MaaS is about enabling customers to flexibly combine and take advantage of transportation resources in ways that suit their needs. Whether this happens through Netflix-like subscriptions or by ad-hoc purchases is a matter of specific circumstances and business models, but what matters is that people and things get to where they need to be when they need to be there.

6.3. Directions for future research

In this master's thesis, I have explored Mobility as a Service platforms in Finland from both technological-managerial and service co-creation perspectives. I developed a framework for analyzing the cases, which combined the two perspectives. However, more thorough reviews that compare the ontological and philosophical foundations of the two theory streams are needed. Understanding these foundations and thoroughly assessing the similarities and differences between Service Science and platform theory would help combine the two into more holistic frameworks.

As discussed earlier, proponents of Service Science and S-D logic have been recently discussing service ecosystems and platforms. In this research, I didn't use these concepts to discuss the platform structures, and only focused on using Service Science to inform the value co-creation aspect of the platforms. Combining the service ecosystem and platform concepts would allow creating holistic frameworks for analyzing service platforms and ecosystems. This line of research has already been started by Breidbach and Brodie (2017), and further theory building and empirical studies are needed to test and develop the theory.

Conducting technological analyses of the MaaS platforms was out of the scope of this master's thesis. While I concluded that the MaaS platforms were primarily used as market mechanisms, all the cases employ some technology. It is also apparent that ICT, open data and open interfaces are foundational to MaaS, which is why understanding the technological architectures of MaaS platforms is a relevant issue. There are some descriptions available here and there on how MaaS systems could be employed from a technology viewpoint, but these are mostly theoretical or conceptual (see for example, Piirainen et al, 2015). Analyzing the technological architectures of existing MaaS cases would provide further insights about the role of information technology in Mobility as a Service.

Finally, there is very little existing theory on Mobility as a Service. Few articles have been published about the concept, and the ones that are out there appear to all – justifiably – point out that the concept is very vague and requires further elaboration (see for example Giesecke et al, 2016 and Kamargianni & Matyas, 2017). One relevant research direction would therefore be to start developing MaaS theory through inductive research. Thus far, most of the thinking and conceptual development behind MaaS has been deductive and abductive. This is of course because there have been no opportunities to discuss existing MaaS systems as there haven't been any around. However, as the pilots and startups in Finland slowly work their way across the innovation chasm, scholars can begin defining MaaS based on real life examples.

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