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Stakeholder Preferences Regarding Mobility-as-a-Service: Practice and theory

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Stakeholder Preferences Regarding Mobility-as-a-Service: *Practice and theory*

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Abstract

Mobility-as-a-Service (MaaS) is increasingly being proposed as an alternative transport system which negates the negative externalities resulting from global urbanisation. This thesis defines the implementation of MaaS as a 'wicked' problem, consisting of many different uncertainties. It attempts to reduce uncertainty in one of the factors that combinedly make up for the 'wickedness' of the problem, focussing specifically on the preferences of the stakeholders on the supply side of the MaaS system. The research uses the stakeholders of the Slim Heijendaal MaaS pilot in Nijmegen as subjects. The method used to uncover the stakeholder preferences is Group Model Building. The end result of the Group Model Building session is a stakeholder model in which the preferences of stakeholders have been captured. In addition, a literature review on strategic alliances was conducted, from which a theoretical model was developed. The theoretical model allows for a comparison between theory and practice.

This study finds (and confirms) that multiple circular causalities are in effect when implementing a MaaS scheme. The research identifies several leverage points in the collaboration between parties, which need to be addressed if implementation is to be successful. In addition, several similarities and differences between practice and theory are identified regarding strategic alliances by means of comparing the stakeholder model and the theoretical model.

List of Abbreviations

MaaS	Mobility-as-a-Service
DAP	Dynamic Adaptive Policy
MSP	Multi-Sided Platform
DRT	Demand-Responsive Transport
PA	Policy Analysis
GMB	Group Model Building
NGT	Nominal Group Technique
GMC	General Model of Collaboration

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1.0. Introduction

Global urbanisation has imposed many challenges for cities trying to manage their transport system (Jittrapirom, Marchau & Meurs, 2017). Climate change, societal, and demographic changes are setting obstacles to door-to-door mobility (Camacho *et al.*, 2016; CIVITAS, 2016; Kamargianni & Matyas, 2017). The increasing urbanisation causes cities to suffer from a range of negative externalities, including poor air quality, extended travel time and congestion (Edwards & Smith, 2008; Hayashi *et al.*, 2004; Taipale *et al.*, 2012; Zavitsas *et al.*, 2010). Many globalized cities are experiencing these problems, even though they may differ significantly from each other (Zavitsal *et al.*, 2010).

Nijmegen is one of these cities. The two bridges that link the city to its surrounding area to the north have been plagued by congestion during rush hours (Jittrapirom, Marchau & Meurs, 2017). Congestion occurs when transport demand exceeds supply (Zavitsal *et al.*, 2010). As the speed of transport is, on average, half the free flow value during congestion (Zavitsal *et al.*, 2010), it is safe to say that congestion is a large problem. It is expected that level of congestion will rise in the future, as the population of Nijmegen continues to grow (Centraal Bureau voor de Statistiek, 2018), the number of students is expected to increase (Omroep Gelderland, 2017), and as the north of Nijmegen is further developed (Jittrapirom, Marchau & Meurs, 2017) for housing. This makes the need for a solution to the congestion problem ever so important. Nijmegen's transport policy addresses the negative externalities caused by urbanization (Nijmegen, 2017). Accessibility, reliability, the perceived safety of the transport system, and the economic vitality of the inner city are among Nijmegen objectives concerning transport policy, as well as clean and sustainable transport (Jittrapirom, Marchau & Meurs, 2017).

In the light of these developments, there is a need for change. However, addressing these negative externalities is easier said than done. Our transport networks are still designed on the basis of societies that looked very different than they do now (CIVITAS, 2016). The transport sector has been characterized by slow incremental change due to the high costs of infrastructure (Kamargianni & Matyas, 2017) and thus disruptive changes are not very common. What is left is a changing society that is characterized by connectivity and efficiency (CIVITAS, 2016) with a transport system that does not match these characteristics. As urban transport is crucial to economic competitiveness, social cohesion, and the sustainable growth of a city (CIVITAS, 2016), it is vital that our governments and municipalities start understanding the factors that

are driving change in our society and are causing a necessity for the changing of our urban transport networks.

There is reason to be positive though. The transport sector is transitioning to a new era, characterized by new technologies, products and services. (CIVITAS, 2016). Technological breakthroughs, including increasing digitalization of the transport sector and improved ICT, might prove to be an opportunity to improve the urban transport system by producing novel mobility services (Holmberg *et al.*, 2015; CIVITAS, 2016; Kamargianni & Matyas, 2017). Intelligent mobility is rapidly developing and an increasing number of consumers and institutions are understanding its huge potential as part of an integrated system in which complete "mobility packages" may be purchased: packages that combine different modes of transport (CIVITAS, 2016). These packages are often referred to as Mobility-as-a-Service, or MaaS (Hietanen, 2014).

MaaS is one of several new business models that emerged from recent technological breakthroughs. MaaS combines different transport modes and services into a single service (Alonso-González, 2017; Hietanen, 2014), aiming to bridge the gap between public and private transport operators (Kamargianni & Matyas, 2017). MaaS offers this through a single interface (Hietanen, 2014), in the form of a mobile app or website, and functions as a virtual marketplace for mobility (Meurs & Timmermans, 2017). Consumers pay via a monthly subscription or use a pay-as-you-go system. By integrating transport modes, services and tools, MaaS aims to deliver seamless mobility (Alonso-González *et al.*, 2017) and may potentially reduce the need for private vehicles (Holmberg *et al.*, 2015; Kamargianni & Matyas, 2017; Giesecke *et al.*, 2016), shifting the transport sector from ownership-based to consumption-based. The rise of the sharing economy has already initiated a trend of reduced car ownership. (CIVITAS, 2016; Holmberg *et al.*, 2015). The new sharing economy is a long-term cultural shift, changing attitudes and causing people to reconsider their need for ownership and how they access goods and services. Young people today are less inclined to spend money on a car, as compared to other forms of mobility. Millennials are increasingly exchanging driving for cycling and walking (CIVITAS, 2016). MaaS could be the perfect response to these trends, while solving the negative externalities of urbanization at the same time. In addition, new tailored on-demand services that complement public transport by providing a first-last mile transport, are now enabling MaaS to develop (Alonso-González *et al.*, 2017).

However, the implementation of the concept is still surrounded by uncertainty. To cope with uncertainty in policymaking, dynamic adaptive policies (Walker, Rahman & Cave, 2001), or DAP's, may be used. Jittrapirom, Marchau & Meurs (2017) formulated a DAP for MaaS, in which they mention several conditions for success. These include the preferences of public transport operators, acceptance of travellers towards Maas, the liability in case malfunctioning, concerns about privacy and security and the contributions of MaaS towards the transport system as a whole. Two of these uncertainties involve the preferences of important stakeholders (public transport operators and travellers). Paying attention to these preferences is important, as half of the decisions fail because decision makers fail to attend to interests and information held by key stakeholders (Nutt, 2008). This makes reducing the uncertainty surrounding these preferences very important if MaaS is to be a success in the future. The demand for MaaS and the willingness to pay for using MaaS services are two topics that require further research according to Kamargianni & Matyas (2017), stating that customers are "key players" to the business ecosystem. The European Commissions (2016), Jittrapirom *et al.*, (2017) & Giesecke *et al.*, (2016) also underline that studying and/or modelling users' acceptance factors represent an urgent area for further research. There is consensus that MaaS faces a 'chicken and egg' problem: gaining a critical mass of users on both the supply and demand side will proof to be a challenge but is vital to guarantee sustainable growth of the platform (Hagiu, 2014; Jullien & Caillaud, 2003; Jittrapirom *et al.*, 2017). These challenges are often referred to as 'network externalities'. Meurs & Timmermans (2017) state that MaaS is a Multisided Platform (MSP) and that a crucial characteristic of MSP's are network externalities.

Guided by the existing literature, this research expands on the research by Jittrapirom, Marchau & Meurs (2017) by investigating the acceptance of MaaS by stakeholders on the supply side. The research uses a qualitative approach, in the form of group model building (Vennix, 1996) - a participatory stakeholder method – combined with a literature review on strategic alliances. Using group model building we will identify and map the mental models in the form of a causal loop diagram (Vennix, 1996; Sterman, 2000). In addition, we will derive a similar model from existing literature. The term mental model is taken from the system dynamics field and was first coined by Forrester (1961). The term mental model describes the implicit causal maps of a system that we hold. It is the collection of relations of cause and effect that describe how we think a system operates (Sterman, 1994). These model structures represent the situation and are responsible for driving behaviour (Oliva, 2003). This research focuses on the underlying structure that drives the behaviour of stakeholder acceptance. For this, it uses Nijmegen city as

its subject. Participants in the group model building process will be experts in the field of transport, as well as representatives of transport companies that are active in the Nijmegen region. The end result of this research will be both a stakeholder model, resulting from the Group Model Building session, and a theoretical model, resulting from the literature review. Both models will be used to answer our main question, and a comparison of both models will be made in the discussion. The main question that we want to answer is:

- *How can we increase stakeholder acceptance of MaaS in Nijmegen?*

In addition, several sub-questions underlie this main question:

1. *What should the mental model of stakeholder acceptance regarding MaaS look like, according to the reviewed literature?*
    - *What is a strategic alliance?*
    - *What different perspectives are there with regard to strategic alliances?*
2. *What does the mental model of stakeholder acceptance regarding MaaS look like in the Nijmegen case?*
3. *What are the differences between what the theory prescribes, and practice, regarding the stakeholders' mental model?*

The main question will be answered in the conclusion, in which we will answer it using both a theoretical model (subquestion ond) and a stakeholder model (question two). In the discussion we will discuss the difference between both models (question three).

Before we can answer these questions, a deeper understanding of several concepts needs to be gained. In chapter two, - the preliminary literature review – we define MaaS and its business ecosystem. We present what is already known about stakeholder preferences on both the supply and demand side. We then go on to define the concept of uncertainty and present a framework for uncertainty in policy analysis. We conclude the literature review by relating this research to the policy analysis framework. At this point, we have gained a proper understanding of what MaaS is, and we have proposed a suitable theoretical framework with which we position our research.

The third chapter will elaborate on the methods used in this research. The fourth, fifth and sixth chapter will respectively present our results, conclusion, and discussion.

2.0. Preliminary literature review

2.1. What is Mobility-as-a-Service?

In order to answer the question “What is Mobility-as-a-Service, we first define the MaaS business ecosystem. Following the definition of the business ecosystem, we provide several definitions of the MaaS concept that can be found in the literature. Because many definitions exist, there is a need for a single working definition for this research. We conclude this paragraph by providing this working definition.

2.1.1. The MaaS business ecosystem

In order for an innovative business to grow and evolve, they must be able to attract resources from different actors. This means an innovative business cannot operate within a vacuum (Moore, 1993). Particularly in high technology business, the view of companies going head-to-head within a single industry, is limited. Thus, these companies should rather be seen as being part of a wider business ecosystem, that crosses a variety of industries. Within this business ecosystem, companies work together and coevolve capabilities around a new innovation (Moore, 1993). An ecosystem of multiple expertises, capabilities, and resources should be created around the innovation (Heikkilä & Kuivaniemi, 2012) so that the corroborative whole of the network creates value (Moore, 1993).

Moore (1993) describes a business ecosystem as consisting of layers. He distinguishes between the ‘core business’, ‘extended enterprise’ and the ‘business ecosystem’. The core business consists of the most important key actors (Kamargianni & Matyas, 2017); those who form the heart of the business (Heikkilä &Kuivaniemi, 2012). The second layer widens the view and comprises of second-layer suppliers, as well as standard-setting bodies. The outer layer includes actors that are not directly involved, but who may significantly affect the ecosystem, like investors and research institutes (Heikkilä & Kuivaniemi, 2012).

Moore argues for discussing ecosystems rather than isolated businesses when we discuss innovative, highly technological and growing concepts. We argue that MaaS perfectly fits with this description and agree with Kamargianni & Matyas (2017) that MaaS must be seen as a business ecosystem. Kamargianni & Matyas (2017) expanded on Moore’s description of a business ecosystem, fitting it to MaaS. This is represented in Figure 2.1.1..

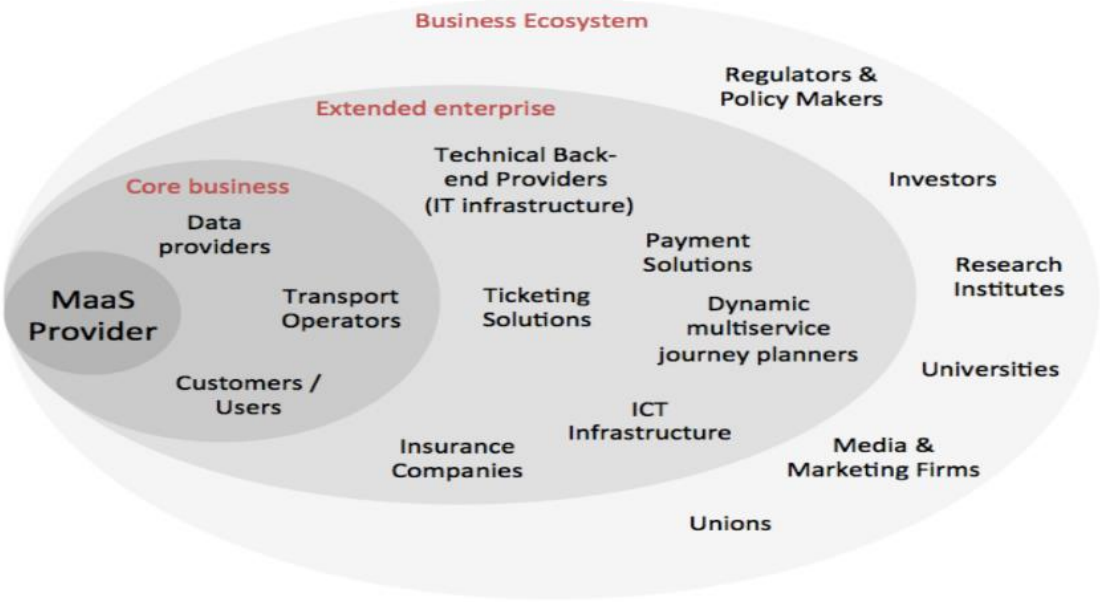


Figure 2.1.1 : The MaaS business ecosystem (Kamargianni & Matyas, 2017)

We will now use this business ecosystem to describe MaaS' key actors, as well as to narrow down the scope of this research.

Kamargianni & Matyas (2017) explain that the MaaS business ecosystem is a complex value proposition, in which every actor has a certain function. They base their description of the MaaS business ecosystem on data collected from focus groups and interviews.

The core business reflects the key actors that interact with Maas. They are the actors that enable or disable the development process of the innovation. Kamargianni & Matyas specify three main key actors, next to the MaaS provider itself:

1. Transport operators. They are one of the main suppliers to the MaaS provider by providing travel capacity and data. In the case of Nijmegen, firms that fall in this category might include Nederlandse Spoorwegen & Arriva (train operators), Breng/Connexxion/Hermes (bus operators) and the suppliers of bike- and carsharing modes.
2. Data providers. As the MaaS concept relies heavily on interoperable data availability, the role of the data provider is of critical importance. The data provider offers data and analytics to the MaaS provider. Due to the OV chipcard, a specially designed pay card

for public transport, most data collection is done by firms internally. This leads to the question of whom should be the data provider in a MaaS scheme.

3. Customers / users. MaaS is by definition (as we will confirm in the next section) a user-centric model. Thus, travellers are essential in its business ecosystem.

The MaaS provider is the actor that provides the digital platform, enabling the integration of multiple transport modes into a single transport solution for customers. In the case of Nijmegen, the role of MaaS platform provider is fulfilled by GoAbout, a start-up company which provides the app and website, as well as some car- and bike sharing modalities.

When we look at Figure 2.1.1., we see that the core business of MaaS – Customers/users, Transport operators, Data providers & the MaaS provider - shows similarities with the conditions for success – Customer preferences & Public transport operator preferences – as specified by Jittrapirom, Marchau & Meurs (2017). At this point in time it is unclear what the preferences of the actors in the business ecosystem are. This research aims to map the stakeholder preferences of the supply side, acknowledging that the key actor 'customers / users' can be considered a whole area of study on its own. Due to practicality issues and the need to narrow down the scope, this research focused on the supply key actors within the business ecosystem. These are the MaaS provider, the data providers and the transport operators, respectively GoAbout, Nederlandse Spoorwegen, Arriva and Breng/Connexxion/Hermes. In addition, this research might include regulators & policymakers. We argue that in the case of the Netherlands, this stakeholder should be part of the core business, as the Dutch government plays a very large role in public transport. We acknowledge that this might not be the fact in other countries where there is a larger degree of privatization with regards to the public transport.

Now that we have defined the MaaS business ecosystem and used it to define the scope of our research, we need to have a working definition for MaaS with which we conduct our research. This brings up our next question: How do we define MaaS?

2.1.2. How do we define MaaS?

There are many different definitions of MaaS in the literature (Jittrapirom *et al.*, 2017). MaaS can be thought of as a concept, a (social-technological) phenomenon (Giesecke *et al.*, 2016), or a new transport solution (Jittrapirom *et al.*, 2017). Even though many different definitions exist, there are also a lot of common characteristics. Jittapirom *et al.*, (2017) conducted a literature review in which they identified core characteristics of a MaaS scheme. Table 2.1.1 presents these core characteristics, including an explanation. Jittrapirom *et al.*, (2017) conclude that the core characteristics of a MaaS scheme are the integration of transport modes; a simple tariff option; the use of a single digital platform; involvement of multiple actors; a high degree of usage of different technologies; a user-centric focus; users need to registrate to be able to use the platform; the ability to personalize the offering to customers and the ability for customers to modify their offered service option.

Table 2.1.1: Core characteristics of MaaS by Jittapirom et al., (2017)

Core characteristic	Description
Integration of transport modes	A goal of MaaS schemes is to encourage the use of public transport services, by bringing together multi-modal transportation and allowing the users to choose and facilitating them in their intermodal trips. The following transport modes may be included: public transport, taxi, car-sharing, ride-sharing, bike-sharing, car-rental, on-demand bus services. Envisioning a service beyond the urban boundaries, it will also embrace long-distance buses and trains, flights and ferries.
Tariff option	MaaS platform offers users two types of tariffs in accessing its mobility services: "mobility package" and "pay-as-you-go". The package offers bundles of various transport modes and includes a certain amount of km/minutes/points that can be utilized in exchange for a monthly payment. The pay-as-you-go charges users according to the effective use of the service.
One platform	MaaS relies on a digital platform (mobile app or web page) through which the end-user can access all the necessary services for their trips: trip planning, booking, ticketing, payment, and real-time information. Users might also access other useful services, such as weather forecasting, synchronization with personal activity calendar, travel history report, invoicing, and feedback.
Multiple actors	The MaaS ecosystem is built on interactions between different groups of actors through a digital platform: demanders of mobility (e.g. private customer or business customers), a supplier of transport services (e.g. public or private) and platform owners (e.g. third party, PT provider, authority). Other actors can also cooperate to enable the functioning of the service and improve its efficiency: local authorities, payment clearing, telecommunication and data management companies.
Use of technology	Different technologies are combined to enable MaaS: devices, such as mobile computers and smartphones; a reliable mobile internet network (WiFi, 3G, 4G, LTE); GPS; e-ticketing and e-payment system; database management system and integrated infrastructure of technologies (e.g. IoT)
Demand orientation	MaaS is a user-centric paradigm. It seeks to offer a transport solution that is best from customer's perspective, to be made via a multimodal trip planning feature and inclusion of demand-responsive services, such as taxi.

Registration requirement	The end-user is required to join the platform to access available services. An account can be valid for a single individual, or, in certain cases, an entire household. The subscription not only facilitates the use of the services, but also enables the service personalisation.
Personalisation	Personalisation ensures end users' requirements and expectations are met more effectively and efficiently by considering the uniqueness of each customer. The system provides the end-user with specific recommendations and tailor-made solutions on the basis of his/her profile, expressed preferences, and past behaviour (e.g. travel history. Additionally, they may connect their social network profiles with their MaaS account.
Customization	Customisation enables end users to modify the offered service option according to their preferences. This can increase MaaS' attractiveness among travellers and its customers' satisfaction and loyalty. They may freely compose a specified chained trip or build their mobility package with a different volume of usage of certain transport modes, to better achieve their preferred travel experiences.

In addition, Jittrapirom *et al.,* (2017) established three more MaaS attributes through the review of case studies: Decision influence, the inclusion of other services, and mobility 'currency'. The final list of MaaS characteristics are summarized in Table 2.1.2.

Table 2.1.2: MaaS Characteristics, summary of Jittrapirom et al., (2017)

Maas:	Integrates transport modes;
	Offers customers two types of tariffs: a monthly subscription or a pay-as-you go system;
	Relies on a single digital platform like a mobile app;
	Is built on interactions between different groups of actors;
	Requires users to register through an account subscription;
	Gives room for personalization in order to give tailor-made solutions;
	Gives room for users to customize the offered service according to their preference;
	May influence users' decisions, for example by comparing CO2 emissions of each transport option
	May include other services, for example access to parking and park-and-ride services;
	May use mobility 'currency'. Users may convert euros to mobility points, with which they can make purchases in the app.

On top of the above, Jittrapirom *et al.,* (2017) provide an overview of existing MaaS schemes. The schemes vary in offered transport modes and related services, and functionalities. Some of them are very extensive, while others are limited.

Table 2.1.3 is derived from Jittrapirom *et al.*, (2017) and sums up the features that exist within the current Maas Schemes.

Table 2.1.3: Features of existing MaaS schemes, based on Jittrapirom et al., (2017)

Transport modes and related services	Functionalities
Public transport	Real-time info
(e-) Bike sharing	Trip planning
(e-) Car sharing	Booking (shared modes/taxi)
Taxi	Payment (bike sharing)
Ride-hailing (??)	Service alerts
Parking	Departure alarms
Shared shuttle	Stop notifications
Car rental	Congestion prediction
Regional trains	Plane's arrival-departure time info
Charging stations	Real-time congestion monitor
P-2P Car rent	Payment
Shared taxi	Invoicing
Ferry	Ticketing
Parking garages	24hr Customer service phone line
	Municipality services

We conclude that there is no single definition or type of MaaS. Instead, MaaS can be diverse in its forms. Therefore, there is a need to make a distinction to clarify which type of MaaS will be used in this research.

The MaaS scheme that will be subject of this research will be a MaaS scheme that includes public transport (both busses and trains), bike sharing, car sharing and shared shuttle. The functionalities that will be included are real-time info, trip planning, booking, payment & invoicing. From this point on, we will refer to this MaaS scheme as "Slim Heijendaal". "Slim Heijendaal" is a pilot version of MaaS consisting of a partnership between Radboud University, Hogeschool Arnhem Nijmegen, Radboud UMC and several public transport operators.

2.2. What do we already know about travellers' preferences regarding MaaS?

In this paragraph, we discuss what is already known about the customers / users of MaaS, one of the key actors in the MaaS business ecosystem (see Figure 2.1.2). Here, we discuss the existing research regarding the relationship between travellers and MaaS. Even though user perception of public transport quality has been thoroughly researched by multiple authors (Camacho *et al.*, 2016), and a lot of research has been conducted on which service attributes should be the focus for public transport operators (Van Lierop & El-Geneidy, 2018), little research has been done specifically on travellers' relation with MaaS. In this paragraph we present the little research that has been done specifically on the subject of MaaS and traveller acceptance. In addition, we present research that may not be directly linked to the subject of MaaS but is relevant nonetheless in the face of public transport research.

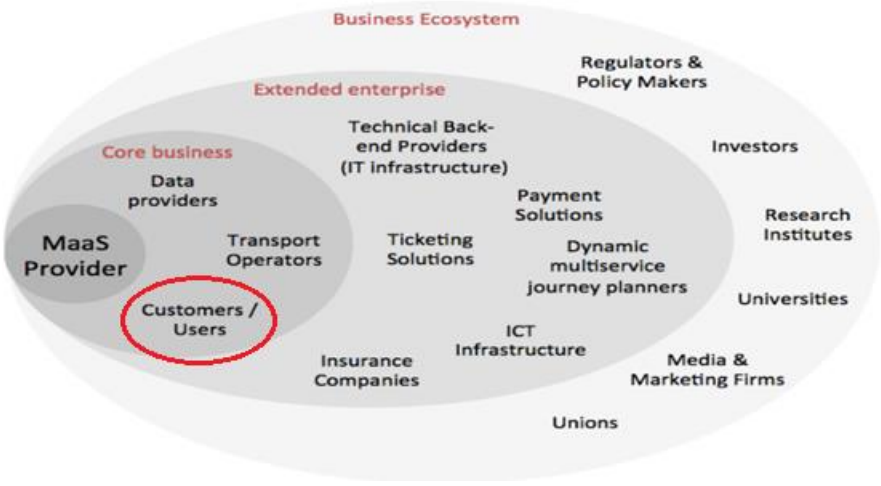


Figure 2.1.2: Travelers within the MaaS business ecosystem

Consumer preferences, and the notion of value in the context of public transportation, are complex subjects (Camacho *et al.*, 2016). Several authors have investigated travellers' preference with respect to modal choice. Alonso-González *et al.,* (2017) states that to trigger a modal shift, a change in habits is required. Based on the Transtheoretical model by Prochaska & Velicer (1997), they identify four different stages (see Table 2.2.1) that a modal shift consists of. These are the pre-contemplative stage (a stage wherein the subject does not consider a modal shift at all), the contemplative stage, the preparation/action stage, and the maintenance stage. As the implementation of MaaS induces a change in travel behaviour, the implementation can be seen as a precursor to a modal shift (Alonso-González *et al.*, 2017; Sochor, Strömberg & Karlsson, 2015)

Table 2.2.1: The four different stages in a consumer's modal shift (Alonso-González et al., 2017)

Stage 1	Pre-contemplative stage: Persons in this stage do not consider any modal shift.
Stage 2	Contemplative stage: Persons in this stage are considering the use of alternative modes of transport different from the ones used.
Stage 3	Preparation/action stage: Individuals have decided on a strategy for modal shift and/or tried the new transport alternative(s) in mind.
Stage 4	Maintenance stage: Individuals in this stage have adopted the new mode of transport in their travel pattern.

The research by Alonso-González *et al.,* (2017) focuses on demand responsive transport (DRT), which is a form of MaaS. Nijmegen actually already employs a form of DRT in the form of Breng Flex. Breng Flex in Nijmegen is a shared transport service which can be ordered and paid for through an app, functioning like public transport on demand. Alonso-González *et al.,* (2017) use a stated preference approach to determine which populations are susceptible to

a modal shift (to DRT). The research finds that socioeconomic characteristics, current mobility patterns (uni- vs. multimodal) and car ownership are important factors that determine whether an individual includes DRT in his/her choice set. A distinction is made between private car owners and non-car owners. The research finds that car owners are less prone to have DRT in their choice set, unless they are under 50 years of age, highly educated, and holding a job. Non-carholders are more likely to include DRT in their choice set, as well as multimodal individuals. This last group is also more likely to engage in DRT.

The research states that people in stage 1 are not viable to a modal shift at all. In addition, the research acknowledges that it investigates the characteristics of people who are susceptible to a model shift, but it does not investigate directly why these people are susceptible. Thus, the motivation behind the modal shift is not identified, only the characteristics of susceptible populations. This is in line with other research which identify the motivation of travellers as a knowledge gap (European Commission,2016; Jittrapirom *et al.*, 2017; Kamargianni & Matyas, 2016).

To our knowledge, there has been only one study which directly investigated traveller motivation and demand with respect to MaaS. An empirical study by Sochor, Strömberg & Karlsson (2015) uses data from the first MaaS pilot, UbiGo, in Finland to investigate traveller preferences. They too stress the importance of understanding consumers' needs and requirements. From their findings, they identify a list of attributes which are considered important by the consumer, which can be found in Table 2.2.2. To the best of our knowledge, this is the only study that directly investigated what attributes travellers deem important when they consider MaaS.

Table 2.2.2: Consumer preferences as found by Sochor, Strömberg & Karlsson (2015).

Consumer preferences	A simple packaged concept Simplicity of the service Improved access to different transportation modes Improved flexibility. Adapting mode choice to individual trip requirements. Economy. People expect MaaS subscriptions to not be more expensive than their current mobility solutions. Added value and relative benefit. MaaS has to offer relative benefit compared to the existing solution.

An interesting, additional perspective comes from Van Lierop & El-Geneidy (2018). They state that when discussing modal changes, it is important to discuss loyalty. More importantly, understanding loyalty and its components may be imperative to public transport operators, as

ridership retention is crucial if a shift to socially and environmentally sustainable modes is to be made (Van Lierop & El-Geneidy, 2018). The research by Van Lierop & El-Geneidy (2018) stresses the importance of customer satisfaction, stating that a higher satisfaction leads to a bigger tendency to use the service (loyalty) and attracts new customers through network effects, which is also in line with Meurs & Timmermans (2017). While most research is aimed at identifying the service attributes that are associated with satisfaction, these studies seldom directly measure or observe personal opinions and involvement. Additionally, the studies do not relate the image that people have of public transport to their satisfaction, even though this image can be used to assess intended future usage (Van Lierop & El-Geneidy, 2018). The research by van Lierop & El-Geneidy conducted a survey, including 450 participants. They find a strong association between image and willingness to continue using public transport. These findings are in line with earlier research (Lai & Chen, 2011; Minser & Webb, 2010; Zhao, Webb & Shah, 2014). The research synergizes existing literature into a final concept of loyalty, which can be seen in Figure 2.1.2. According to the research, image and customer satisfaction are important factors that drive loyalty. Loyalty then drives future use and recommendations to other users through network effects (Van Lierop & El-Geneidy, 2018; Meurs & Timmermans, 2017). This stresses the importance of further research into traveller's mental models.

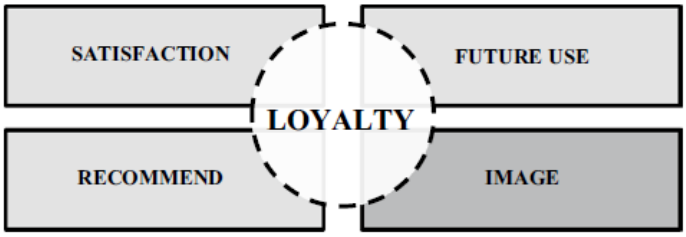


Figure 2.1.2: Loyalty and its components (Van Lierop & El-Geneidy, 2018)

From the previous research on traveller acceptance and satisfaction, we can conclude the following:

1. There are several groups that are more prone to a modal shift than others, and modal shifts theoretically occur by passing through a series of stages. Socioeconomic characteristics, current mobility patterns, and car ownership are important factors when discussing modal shifts. Especially car ownership is found to be important in this aspect. For non-car holders, socio-economic characteristics are less important: a homogenous pattern is found within this population. For car holders however, it is found that individuals below the age of 50, highly educated people, and the working

populations are more prone to a modal shift. Thus, there are large differences between car and non-car holders. With respect to the current mobility patterns, it is found that people who already have a multimodal mobility pattern are also more likely to engage in MaaS as compared to people who travel unimodal;

2. Public transport image and customer satisfaction are important drivers of loyalty and future use;
3. There are a few attributes that are considered important by travellers, according to empirical research. These are: a simple packaged concept, simplicity of the service, improved access to different transportation modes, improved flexibility, economy, and added value and relative benefit.

Due to time constraints, this research will be restricted to the investigation of stakeholders on the supply side. However, we argue that the same methods that are used for the investigation of the supply side can and should be used to investigate the demand side. We will elaborate on this in the discussion. For the reader, it should be clear that the demand side of MaaS will not be included in the scope of this research from this part on.

2.3. What do we already know about transport operator's preferences?

In this paragraph, we will cover the preferences of the transport operator, data providers and the MaaS provider (see Figure 2.1.2). We will argue why - in some cases - the public transport operator and the data provider are in fact the same institution, and we will discuss what little is known about public transport operator preferences.

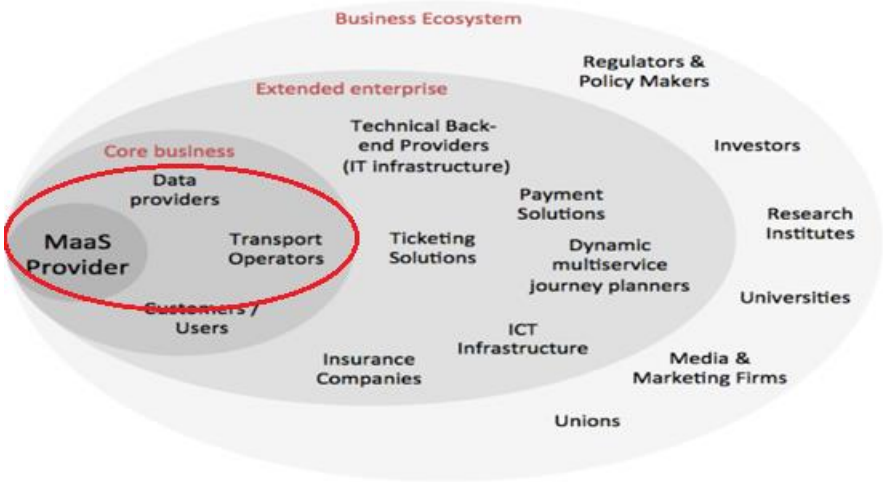


Figure 2.1.2: The MaaS provider, data provider and transport operator within the MaaS business ecosystem

Kamargianni & Matyas (2017) state that broadly, there are two ways in which the role of the MaaS provider can be fulfilled: either by a public transport authority or a private firm.
In the case of Slim Heijendaal, the role of MaaS provider has been fulfilled by a private company, named GoAbout. They provide the digital platform where all modalities should be integrated. The transport operators are a mixture of public and private firms. The public transport operators- busses and trains – are private firms which are heavily influenced by the government due to the transport operator's public significance. Thus, we argue that the public transport companies are a mixture of private and public. In addition, the car- and bike sharing companies are completely private companies. This may give the best of both – public and private - worlds. If there is a single authority responsible for transport in the city, it is easier to secure participation of extra services (like car-sharing) (Kamargianni & Matyas, 2017). In the case of Nijmegen, there is not a single public party, but the amount of transport operators is low, making the integration of services be easier in theory. In addition, the Netherlands has implemented an electronic card paying system, named the OV-Chipkaart (Translink, 2018). This allows the public transport operator to collect data (Autoriteit Persoonsgegevens, 2018), allowing them to also function as data provider within the business ecosystem. This make seamless mobility easier, as the data can be used to optimize demand and supply (Autoriteit Persoonsgegevens, 2018). A downside to having non-privately-owned public transport operators within the MaaS business ecosystem, is that these public transport operators are not-for-profit organisations and have a monopoly position (Camacho *et al.*, 2016) – take notice that in the case of the Netherlands this applies to a lesser degree and it is perhaps more appropriate to speak of an oligopoly situation with few players. Public organisations are often not very innovative or are constrained by law. They may suffer from bureaucracy, slowing innovation even more (Camacho *et al.*, 2016; Kamargianni & Matyas, 2017). However, because the public transport has been partially privatized in the Netherlands, these effects should be mostly negated, and it is expected that the MaaS market would develop faster under these circumstances (Kamargianni & Matyas, 2017).

Additionally, a lot of enabling conditions for MaaS are present in the Netherlands (Alonso-González *et al.*, 2017; Kamargianni & Matyas, 2017). The Netherlands has an excellent public transport system, which is considered a prerequisite for the implementation of a MaaS scheme (Alonso-González *et al.*, 2017; Li & Voege, 2017; UITP, 2016). In addition, there is integration with respect to the parties that enable MaaS. The business ecosystem proposed by Kamargianni & Matyas (2017) depicts the enabling parties in the MaaS business ecosystem. When we look

at the extended enterprise, we see several technology-related actors. As stated in the previous paragraph, the transport operators and the data providers are the same in the Netherlands. The introduction of the 'OV Chipkaart' has made this possible. Travellers pay using this card, and data from payments is collected by public transport operators (Autoriteit Persoonsgegevens, 2018). When we look at the business ecosystem, we see that payment solutions, ticketing solutions and data provisions have thus been accounted for already by the transport operator. The dynamic multiservice journey planner is also already active in the Netherlands (9292OV.nl), as a result of collaboration between public transport operators.

To the best of our knowledge, no research has yet been done specifically on the preferences of public transport operators regarding MaaS. Thus, little is known about the factors that actually drive acceptance of a possible implementation of MaaS. We conclude that a lot of enabling conditions are present for MaaS in the Netherlands, which have partially been implemented by the public transport operators themselves. However, little is known about what the preferences are of these public transport operators with regards to the future implementation of MaaS. Thus, investigating these stakeholder preferences should be prioritized.

2.4. Typology of problems: is the implementation of MaaS a 'wicked' problem?

Now that we have mapped out what is already known about stakeholder preferences and have identified the preferences of the supply side as a knowledge gap, we can take a closer look at the problem the supply side faces when the implementation of MaaS is the end goal. In this paragraph we aim to provide a typology of different problems and use that typology to classify the implementation of MaaS as a certain type of problem. Additionally, we find that uncertainty plays a large role in the classification of problems and therefore provide a framework with which we can assess the uncertainties surrounding the implementation of MaaS in the following chapter.

Head & Alford (2013) provide a typology of problems in the public domain, distinguishing between three different types of problems:

- Type 1: Situations in which the problem definition and solution are clear to the decision maker. These are often referred to as 'tame' problems.
- Type 2: Situations in which the problem definition is clear, but the solution is not. These problem situations fall somewhere between tame and so-called pure 'wicked' problems.

- Type 3: Situations and the solution are unknown. Extensive learning and discussion are required by involved parties.

Rittel & Webber (1973) argue that most problems in public policy can be considered wicked problems. Wicked problems are characterized by social pluralism, institutional complexity, and (scientific) uncertainty (Head & Alford, 2013), which are all characteristics not uncommon in large societal issues. We argue that these characteristics all apply to the implementation of MaaS in Nijmegen and that these characteristics are by definition intertwined.

Regarding the implementation of MaaS, complexity and social pluralism arise from the fact that multiple parties – with possibly diverging interest - are involved in the implementation of MaaS, as has been shown by Kamargianni & Matyas (2017) through their business ecosystem. To this we can add up that MaaS is a new system (there is little learning from established systems) and that there is uncertainty regarding stakeholder preferences, the reliability of technology, the positive and negative effects of the implementation of such a scheme, and many other characteristics (Jittapirom, Marchau & Meurs, 2017). The implementation of MaaS can be considered highly uncertain, as stated by Jittapirom, Marchau & Meurs (2017), who use a typology of uncertainty that we will use in the next paragraph. Concluding, we argue that the implementation of MaaS can be considered complex and uncertain, making the problem a type 3 wicked problem. We argue that uncertainty is the common characteristic in wicked problems, and is the root cause of complexity, social pluralism and other characteristics that are used to describe wicked problems (Head & Alford, 2013 provide an extensive list of wicked problem characteristics). Therefore, we will provide an additional framework for assessing MaaS in the light of uncertainty in the next paragraph. We then use this framework to position our research.

2.5. What is uncertainty, and on what dimensions is the implementation of MaaS uncertain?

Now that we have defined the scope of this research within the MaaS business ecosystem, classified the implementation of MaaS as a wicked problem, and have established what we already know regarding stakeholder preferences, we have to establish a theoretical framework with which we can position our research. We have established that the stakeholder preferences of the suppliers within the MaaS business ecosystem are surrounded by uncertainty. We have not yet defined the concept of uncertainty, nor have we established what exactly is uncertain with respect to the stakeholder preferences and what the nature of these uncertainties are. In

this section, we take these steps, defining uncertainty as a concept, and further specifying what exactly is uncertain and what we want to investigate.

2.5.1. What is uncertainty?

Before we can properly investigate stakeholder acceptance with regard to MaaS, we must first define uncertainty. We start here by making a distinction between uncertainty and risk, as there are conflicting views in the literature about what both concepts mean. We then make a distinction between approaching uncertainty from a deterministic or relativistic view and we define uncertainty as we use it in this research. In the next subparagraph present two different frameworks: the policy analysis framework as proposed by Walker (2000) and the W&H framework (Walker *et al.*, 2003), a framework used to communicate different types of uncertainty. We use both frameworks to define what exactly is uncertain with regard to stakeholder preferences regarding MaaS, and how uncertain these factors are. We conclude this paragraph by integrating the findings from the preliminary literature review. We position our research by presenting a framework for uncertainty in policy analysis, adapted to fit our research.

2.5.1.1. Uncertainty and the distinction between uncertainty and risk

Some scholars make a distinction between risk and uncertainty while others use both concepts interchangeably (Perminova, Gustafsson & Wikström, 2008). A distinction between the concepts 'risk' and 'uncertainty' is often made on grounds of epistemology: uncertain is the complete unknown, while risk means that we may make an estimate in the form of a probability (distribution). In this research, we define risk according to classical economic theory, which states that risk implies that a calculation can be made using a probability. In economic theory, risk is calculable: we can attach probabilities to the occurrence of the event and we can estimate what effect the event will have. Uncertainty however, is an event for which it is impossible to specify numerical probabilities (Knight, 2012, republication; Keynes, 1937) and for which it is impossible to quantify the effect of the event. In mathematical terms:

$$Risk = probability * effect$$

$$Uncertainty = ? * ?$$

With respect to the above, we agree with Walker (2000), who states that uncertainty entails that choices must be made with incomplete information, about unknown alternatives, in an unknown future world.

2.5.1.2. Deterministic vs. Relativistic

In addition to the abovementioned distinction, a second contraposition can be found in the literature: the deterministic vs. the relativistic view (Perminova, Gustaffson & Wikström, 2008). In this research, we adopt a relativistic lens towards uncertainty. We deem determinism in the light of uncertainty impossible, as being completely uncertain implies that there is certainty about the fact that we do not know. In addition, being completely certain implies that a lack of knowledge can simply be solved by more knowledge until one is completely certain. However, being more knowledgeable may actually cause us to become more aware of uncertainty (Van Asselt, 2000). We therefore abandon the deterministic view and use the relativistic view.

Given this relativistic view, we find that there are multiple definitions of uncertainty in the scientific literature (Walker *et al.*, 2003; Perminova, Gustaffson & Wikström, 2008; Miliken, 1987). As collected by Miliken (1987), we find that the most common definitions of uncertainty are:

1. Inability to assign probabilities to the possible occurring of future events (Duncan, 1972; Pennings, 1981; Pennings & Tripathi, 1978; Pfeffer & Salancik, 1978). Note how this relates to our distinction between (calculable) risk and uncertainty.
2. A lack of information concerning cause-effect relationships (Duncan, 1972; Lawrence & Lorsch, 1967).
3. An inability to predict accurately what the outcomes of a decision might be (Downey & Slocum, 1975; Duncan, 1972; Hickson, Hinings, Lee, Schneck, & Pennings, 1971; Schmidt & Cummings, 1976).

We argue that a broad definition of uncertainty is best used, as uncertainty has multiple aspects and can therefore not be connected to a single event or outcome. An example would be the third definition above, which precludes uncertainty about the effect of the outcome of the decision. Many a time, especially in wicked problems, not only the outcomes of a decision are uncertain, but also what the effect of these outcomes will be on the system (Head & Alford, 2013).

Considering the above, - in this research - we adopt the following definition of uncertainty, given by Walker *et al.*, (2003): Uncertainty is "any departure from the (unachievable) ideal of complete determinism". We use this definition as our working definition throughout this

research. We now turn to the two uncertainty frameworks coined by Walker (2000) and Walker *et al.*, (2003) to position our research. We use these frameworks to describe what exactly is uncertain regarding the implementation of MaaS and what the nature of these uncertainties is.

2.5.2. The policy analysis framework and different types of uncertainty

Walker (2000) proposes a policy analysis (PA) framework which can be used to integrally describe a policy field. The (to our beliefs) latest version of the framework can be found in Walker, Marchau & Kwakkel (2013) and is depicted here in Figure 2.5.1.. Walker (2000) states that a common approach to policy analysis is to create a model of the system. This may be a formal simulation model, but it does not necessarily have to be. The model (R) is intended to describe the system of interest. The result of interactions within the system model (R), the system outputs, are defined within the outcome indicators (O), which are the variables deemed relevant to evaluate policies. Valuation of outcomes is often done by giving weights (W) to the outcomes of interest. They reflect the importance given to outcomes by crucial stakeholders. If there is a discrepancy between the desired level of the outcome indicators and the actual values, policies (P) might be implemented to intervene. In a closed system, policies would then theoretically lead to improved outcomes. However, there are external factors (X) at play, which are not under the control of policy makers. Within these four primary locations (X, R, O, P) uncertainty may exist.

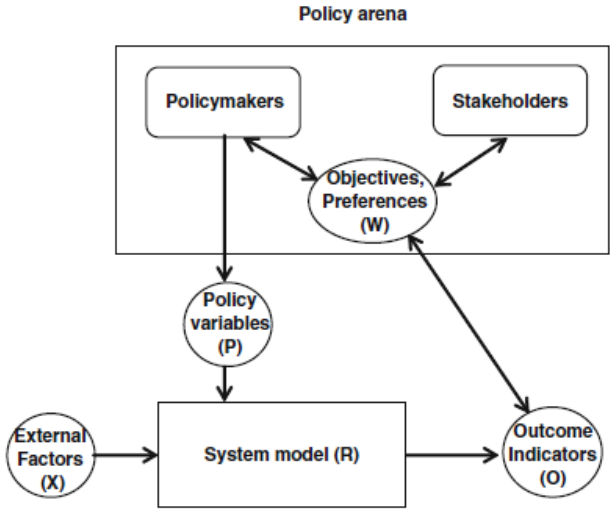


Figure 2.5.2: The policy analysis framework, as proposed by Walker, Marchau & Kwakkel (2013)

In order to properly identify and communicate these uncertainties, the Walker & Harremoës (W&H) framework was proposed by Walker *et al.*, (2003). The framework can be seen in Figure 2.5.2.. The framework is a conceptual basis for the systematic treatment of uncertainty. In the framework, three different dimensions of uncertainty exist: location, level, and nature. These dimensions can be used to describe uncertainty within the PA framework.

2.5.2.1. Location

According to the framework, the location of uncertainty can be either in the system boundary, conceptual model, the computer model, input data, model implementation or the processed output data. However, as illustrated in Figure 2.5.3., the locations in the PA framework (X, P, R, O) can also be used. E.g. if there is uncertainty in O, this means that the policy makers are uncertain about the relevant outcome indicators.

		Level				Nature		
Location		Level 1: shallow uncertainty	Level 2: medium uncertainty	Level 3: deep uncertainty	Level 4: recognised ignorance	Ambiguity	Epistemology	Ontology
System boundary								
Conceptual model								
Computer model	Model structure							
	Parameters inside the model							
	Input parameters to the model							
Input data								
Model implementation								
Processed output data								

Figure 2.5.2: The W&H Framework by Walker et al., (2003)

2.5.2.2. Nature

The framework states that the nature of the uncertainty can either be:

4. Ambiguous, meaning there is no agreement on definitions;
5. Epistemic, meaning there is a lack of knowledge causing the uncertainty;
6. Ontic, meaning that there is an inherent variability to the phenomenon (which is unknown).

2.5.2.3. Level

Figure 2.5.3. explains the different levels of uncertainty. The level of uncertainty ranges from level 1 to 5, and is bounded by the unachievable complete certainty and complete uncertainty. Level 1 uncertainty is a situation of low uncertainty, which may be approached with sensitivity analysis. Level 2 uncertainty is similar, but confidence intervals for the parameter values can be estimated. Scenario planning or trend-based forecasting is often used to approach these types of situations (Jittrapirom, Marchau & Meurs, 2017). In level 3 and 4 situations, there are multiple plausible futures to be considered. The main difference between a level 3 and level 4 uncertainty is the ability to give a ranking to each future in terms of how likely that future is to occur. This does not mean that probabilities can be attached to the different futures, only that a ranking can be specified. In a level 4 situation, ranking is also impossible. The main difference between a level 4 and 5 uncertainty is that a level 5 uncertainty is characterized by complete ignorance: when looking at the PA framework, there is uncertainty in each location. In a situation of level 4 uncertainty, there is still a known range of outcomes and weights on those outcomes. We will argue later that the implementation of MaaS can be considered a level 5 uncertainty.

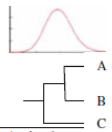
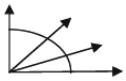
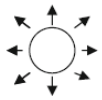
Complete Certainty		Level 1	Level 2	Level 3	Level 4	Level 5	Total ignorance
	Context	A clear enough future (with sensitivity) 	Alternate futures (with probabilities) 	Alternate futures (with ranking) 	A multiplicity of plausible futures (unranked) 	Unknown future 	
	System model	A single system model	A single system model with a probabilistic parameterization	Several system models, one of which is most likely	Several system models, with different structures	Unknown system model; know we don't know	
	System outcomes	Point estimates with sensitivity	Several sets of point estimates with confidence intervals	Several sets of point estimates, ranked according to their perceived likelihood	A known range of outcomes	Unknown outcomes; know we don't know	
	Weights on outcomes	A single set of weights	Several sets of weights, with a probability attached to each set	Several sets of weights, ranked according to their perceived likelihood	A known range of weights	Unknown weights; know we don't know	

Figure 2.5.2 : The five levels of uncertainty, by Walker, Marchau & Kwakkel (2013)

Walker, Marchau & Kwakkel (2013) present a tree diagram to illustrate how the uncertainty in each location is built up in the PA framework. This is illustrated in Figure 2.5.2:

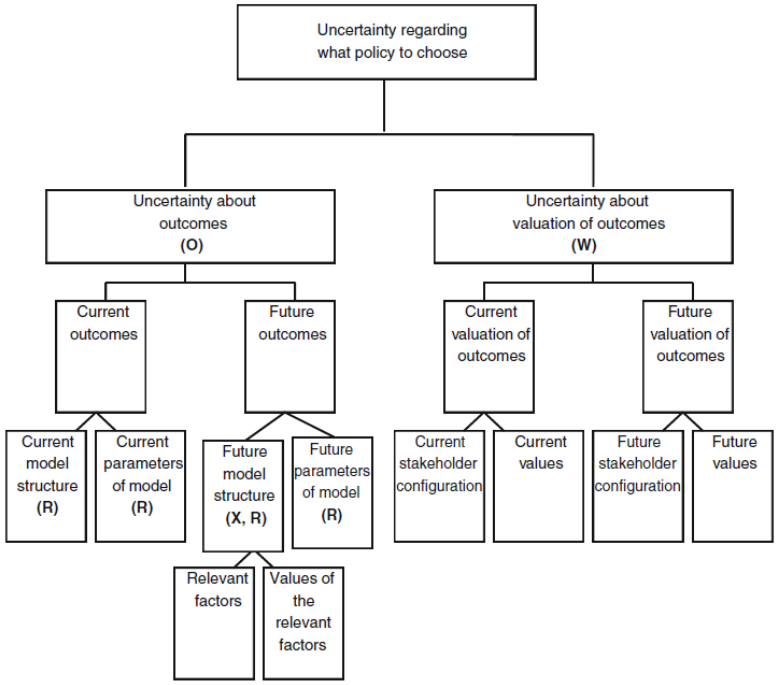


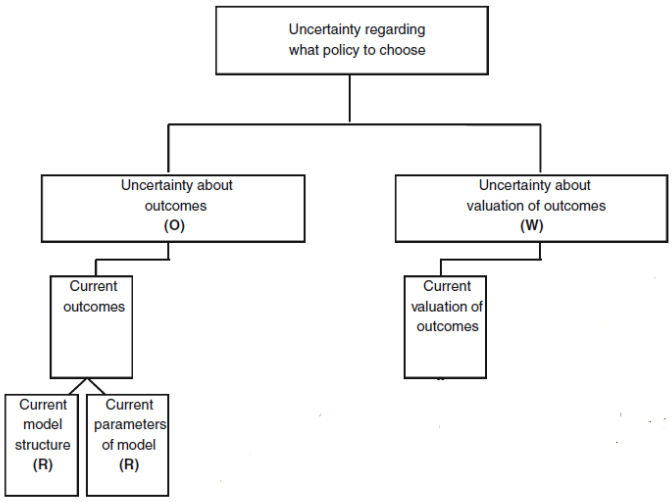
Figure 2.5.2: Locations of uncertainty (Walker, Marchau & Kwakkel, 2013)

We see that uncertainty about outcomes O originates from the possible presence of uncertainty in future outcomes and/or current outcomes. The uncertainty in these outcomes, in their turn, result from uncertainty in the model structure and parameters, combined with uncertainty about external factors that may shape the future situation. The same procedure can be followed when looking at the right side of the tree diagram: uncertainty about valuation of outcomes can eventually be traced back to uncertainty about stakeholder valuation of outcomes and their configuration.

When we relate Figure 2.5.2. to our research – stakeholder preferences regarding the implementation of MaaS – we can position our research within the PA framework and its accompanying tree diagram. We conclude that the uncertainty surrounding the stakeholder preferences lies in the model structure (the mental model) that determines the relevant outcomes (O). In addition, the valuation of outcomes (W) is also uncertain. This is implicit: If we do not know the contents of the system of interest, the mental models of stakeholders, we

do not know the outcome indicators, which means we cannot say anything about the valuation of the outcome indicators. When looking at the tree diagram, we conclude that our uncertainty lies in the structure of the mental models: we do not know what drives the acceptance of MaaS as we do not know stakeholder preferences. In addition, there is no need for a distinction between current and future model structure: As MaaS has not been implemented yet, there is only the current mental model structure of MaaS acceptance to be investigated. It is futile to investigate how the mental models will look like in the future, if we do not know the current state of these mental models. Even though we know the current stakeholder configuration, we do not know how these stakeholders will value the outcome indicators, let alone what these outcome indicators are. When we reframe the tree to match our research, we come to Figure 2.5.5.. Returning to the original PA framework, we identify uncertainty in the locations R, O and W (Figure 2.5.6.). The product of this research may in turn give recommendations for P. We have illustrated in Figure 2.5.5. that different types of uncertainty require different approaches. Therefore, we need to determine what the level of uncertainty is in W, O and R.

Figure 2.5.2: The uncertainties surrounding the implementation of MaaS that will be the scope of this research



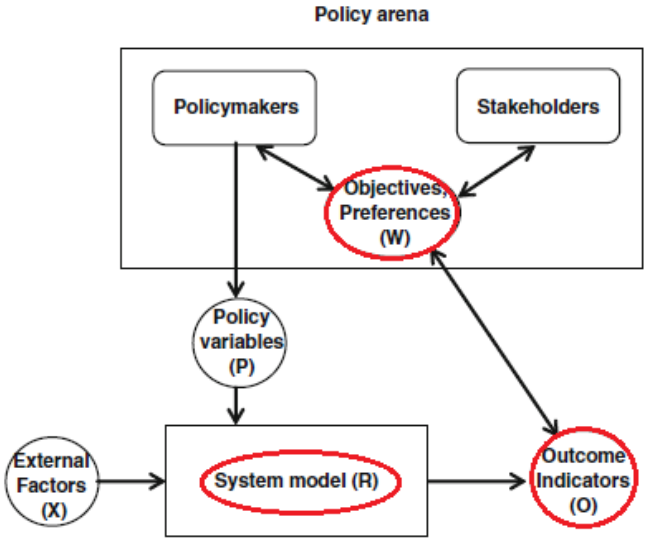
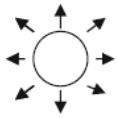


Figure 2.5.2: The scope of this research within the PA framework

2.5.3. What level and type of uncertainty does this research then address?

Now that we have positioned our research within the PA framework by identifying the location of the uncertainties, the next step is to identify the nature of these uncertainties and their level. Here, we integrate the conclusions from the literature review into the W&H framework, resulting in Table 2.5.1. We conclude that the implementation of MaaS can be considered a wicked problem, with an uncertainty level corresponding to 'recognized ignorance' (Walker Marchau & Kwakkel, 2013).

Table 2.5.1: The W&H framework adapted to the MaaS case

	Level of uncertainty?	**Nature of uncertainty?**		
	Level 5: Recognized  ignorance			
Location		Ambiguity	Epistemology	Ontology
Context (X) *Not addressed in this research*	Unknown future	There may be different views on what the future may look like	We do not know what the future will look like	X
System model (R)	Unknown system model	(Mental) Models may be different for different stakeholders	We do not know the structure of mental models of stakeholders	X
System outcomes (O)	Unknown system outcomes	Different system outcomes may be perceived relevant by different stakeholders	We do not know what outcome indicators are relevant to stakeholders	X
Weights of outcomes (W)	Unknown weights	Weights of outcome indicators may be different per stakeholder group	We do not know the weights of outcome indicators of stakeholders	X

In conclusion, we find that the implementation of MaaS can be considered a level 5 uncertainty, which is in line with (Jittrapirom, Marchau & Meurs, 2017). In terms of the PA framework, this research will investigate the system model (or mental model of stakeholder) - including the system outcomes (the outcomes deemed important by stakeholders) - and possibly the weights of the outcomes (how do the stakeholders value the system outcomes?). The method section will further elaborate on the specifics of this research.

3.0. Materials and Methods

In this chapter we introduce the methods that are used in this research. To investigate stakeholder acceptance regarding the implementation of MaaS in Nijmegen, we decided to use a two-step approach. In our first step, we conducted a literature review on the topic of strategic alliances. Here, we investigated what reasons the literature prescribes for interfirm collaboration. We cover different theoretical perspectives and integrate those perspectives into a general model of collaboration, our theoretical model. The theoretical model is the visualisation of the mental model of the stakeholders as the theory would prescribe. The group model building constitutes our second step in the research. In this step of the research, we investigated how the mental model looks like in practice. From here, we make a comparison what the theory prescribes, and what the mental model actually looks like in practice – this is done in the discussion. Due to the two-step approach, the method section has been divided into two distinct parts. Firstly, we describe our approach in the literature review. Secondly, we describe our group model building approach.

3.1. Literature review

3.1.1. Why a literature review?

A literature review paper is defined by van Wee & Banister (2016) as structured integration of literature, which provides a comprehensive overview of literature in a specific area. Even though we did not write a completely separate literature review paper, we conclude that our literature review – as part of our larger research – still aims to provide a comprehensive overview of the literature on strategic alliances. As our literature is part of a larger research – and not a separate research on its own - it is inherently incomplete. We acknowledge that our literature contains only a selection of papers within the strategic alliance literature. However, we argue that it is comprehensive enough for the purpose of our research and extensive enough for a master thesis. We aim to derive a conceptual model from the literature review; we name this our General Modal of Collaboration (GMC) or the 'theoretical model'. This is in line with van Wee & Banister (2016), who suggest an integration of literature in the form of a conceptual model as being one method of adding value using a literature review. To quote the authors: "a final alternative might be to present a conceptual model and then to explore the literature that might help support such an innovative framework. As for theme papers, not all (main) literature then needs to be reviewed, but the references discussed serve the purpose of underpinning the

conceptual model" (van Wee & Banister, 2017: p. 283). Even though we have applied this tactic in reverse, we consider the underlying idea to be the same.

3.1.2. How we conducted our literature review

Van Wee & Banister (2016) state that literature review papers are often not explicit in the methodologies used. We unfortunately have to acknowledge that our literature review also lacks proper documentation. The search for papers has mainly been done using Google Scholar, in which we used a process of 'backward snowballing'. This means that citations in a paper were used to find new papers. We acknowledge that this may lead to a bubble of publications, in which authors constantly refer to each other.

We started our search for papers in Google Scholar, searching for the key words "strategic alliances". This lead to a paper by Das & Teng (2000). From this paper, we started snowballing. Das & Teng (2000) mention several different theoretical perspectives which are used to approach strategic alliances. These theoretical perspectives, the citations in their papers and the keywords associated with these perspectives were used for further research. In this way, all theoretical perspectives were covered. In some cases, we went back to find the 'godfather' paper of a theory (e.g. Williamson's paper on transaction costs economics) to ensure that more recent literature had been interpreted properly.

All findings from the literature review have been summarized in tables. All variables and relationships that were used in the model have been properly documented, meaning that each relation and each variable can be traced back to a corresponding scientific paper. If concepts with similar meaning have been merged, this has been made explicit, showing which concepts have been merged and which variable was a result from that merger. Our end results, a general model of collaboration, and the resulting preliminary model are therefore fully supported by literature.

All papers used in the literature review have been properly documented in the references.

3.2. Group Model Building: What is it, and why do we use it?

We refer the reader to Appendix 8.1 for a full explanation on why group model building was used in this research. This includes:

1. A description of group model building as part of the system dynamics methodology;
2. A description of the benefits of group model building as compared to other participative stakeholder methods;
3. A description of the goals of group model building and an explanation why the conclusions from the preliminary literature review argue that these goals are congruent with the goals of this research;
4. An elaboration on why we use qualitative modelling, as opposed to quantitative modelling.

3.2.1. General approach

Vennix (1996) states that there are no unambiguous criteria with which we can decide what approach is optimal for each situation. However, he does provide a series of choices that have to be made in the design of a group model building project. The list of choices is a guideline and is not necessarily exhaustive. When starting a modelling project, one must ask:

1. Do we use qualitative or quantitative system dynamics? (A question we answer in Appendix 8.1.1.4)
2. How many sessions do we want to organize?
3. Who do we involve in the group model building sessions?
4. Do we employ a preliminary model, or start from scratch?
    - If we use a preliminary model, do we use interviews, document content analysis, questionnaires or workbooks (or none of these) before the sessions as inputs for the preliminary model?

Because we were faced with time constraints but believed one session would suffice to make a qualitative model, we organized one session. Who we involved in the model building sessions will be covered in a separate paragraph, under the heading ‘participants’. For the remainder of the choices, we consulted Vennix (1996). He provides a table with different circumstances and corresponding suggestions. These can be found in Table 3.2.1.

Table 3.2.1: Choices to be made in the design of group model building projects and potential consequences (Vennix, 1996)

Indicator/Circumstance	Suggestions
Large group for model-building sessions	Introduce structure in: • Communication pattern (e.g. use NGT, Delphi, workbooks) and or • Tasks (e.g. split up generating, assembling and evaluating information)
Facilitator has low experience in group-model building	• Use multiple sessions • Use preliminary model • Conduct preparatory interviews
Subject is politically sensitive	• Use preparatory interviews • Avoid politicizing and concentrate group on task
Participants have little time available	• Use preliminary model • Use workbooks to prepare meeting
Group members are geographically dispersed or meetings are difficult to schedule	• Use preliminary model • Use questionnaire and/or workbooks
Sessions have to start from scratch	• Split up steps (e.g. brainstorming variables and assembling causal loop diagrams) • Use nominal group technique to start process
Quantitative model sessions	• More persons needed to guide the process • Use model coach • Conduct part of model-building in backroom if unexperienced with system dynamics
Resources are limited	• Skip interviews • Restrict to qualitative model or decide not to conduct the project

A few of the above circumstances applied to our research. Participants had little time available, they were geographically dispersed, meetings were difficult to schedule, sessions have to start from scratch (as little is known about the mental models) and our resources are limited.

Due to the above circumstances, the following decisions were made:

1. We provided participants up front with an informational document (a 'workbook');
2. We split up the steps in the sessions through the use of scripts and used nominal group technique to start the process (we will elaborate on this later);
3. We conducted a trial session with actors to ensure that our approach to the 'real' session contains no procedural mistakes.

An extra explanation on the motivation of the use of workbooks and nominal group technique can be found in Appendix 8.1.3. For an explanation of nominal group technique itself, we refer to Hovmand *et al.*, (2011). In the Appendix we explain when to use workbooks and why it applied to our research. In addition, a copy of the workbook used in the session is also present.

3.2.2. Participants

Originally, the plan was to have participants from Nederlandse Spoorwegen, Arriva, Breng/Connexxion/Hermes, Go About and Gemeente Nijmegen. In practice, this turned out to be infeasible. Eventually one representative from Arriva was able to join. The other organisation's interests were represented by role-playing actors, who all were experts in the field of transport and infrastructure. For the sake of being able to reproduce this research with 'real' stakeholders, we have included our original method section on participants in Appendix 8.1.2. Here, the rationale behind the original selection of participants is elaborated.

3.2.3. Project team, location, room layout and equipment.

For both sessions, two facilitators (A and B) and one observer/recorder were used. Facilitator A covered the group process, eliciting information from the group and sparking discussion. Facilitator B transferred the inputs from the group into a causal loop diagram and interfered in the discussion when the first facilitator missed important dynamics in the discussion. The observer fulfilled the role of recorder, making notes. An added benefit to having multiple facilitators is that it reduces possible bias resulting from having only one facilitator.

The location of the group model building sessions was the Radboud University's VISA skills lab. This is a room made specifically for organizing participatory workshops. It is a room with the tables set up in a square, with a chalk board in the front of the room. To the left of the chalk board is a large screen, on which the modelling process was projected.

3.2.4. Agenda

The agenda for the session can be found in Table 3.2.2 below. Each time slot has an activity, a script which was used to perform that activity, and a resulting product. Broadly speaking, there were three main components in the session: Introduction, variable elicitation and causal mapping. The first half hour was dedicated to introducing the research and the method. The 45 minutes after that were used for variable elicitation using nominal group technique. The remainder of the time was used to create the causal loop diagrams, using the 'initiating and elaborating a causal loop diagram' script. The session was closed off using the script 'next steps and closing'. All scripts were retrieved from 'Scriptapedia', which was developed by Hovmand *et al.*, (2011).

Table 3.2.2: Agenda for group model building session

Time slot	Activity	Script (Hovmand *et al.*, 2011)	Product
10:30-11:00	• Introduction, making of name tags, explanation of agenda (10 minutes) • Explanation of the research, as well as system dynamics. (10 minutes) • Answering of questions about the method (5 minutes) • Introducing the preliminary model (5 minutes)		Knowledge regarding the research and methods
11:00-11:45	• Introduction to nominal group technique (5 minutes) • Nominal group technique (35 minutes) • Ranking variables according to importance (5 minutes)	'Nominal group technique'	A list of relevant variables
11:45-12:00	• Break (15 minutes)		
12:00-13:00	• Constructing the causal loop diagram (45 minutes) • Extra explanation on the concept of feedback, including examples (15 minutes)	'Initiating and elaborating a causal loop diagram'	Causal relations in diagram form
13:00-13:15	• Break (15 minutes)		
13:15-14:30	• Identify possible feedback loops • Create ranking of strongest relationships • Ending	'Initiating and elaborating a causal loop diagram' 'Next steps and closing'	A causal loop diagram

4.0. Results

4.1. Literature review: Strategic Alliances

In the following paragraphs, we present the results of our literature review on strategic alliances. Here, only results are presented; the full literature review can be found in Appendix 8.2. The following paragraphs are summarizing and are intended to present the most important results. In the first paragraph, we give answer the sub-question "What is a strategic alliance?". In the second paragraph we provide an overview of the different perspectives, answering the sub-question "What different perspectives are there with regard to strategic alliances? In the third paragraph, we answer the main question of our literature review: What should the mental model of stakeholder acceptance regarding MaaS look like, according to the reviewed literature? In the fourth paragraph, we highlight the feedback loops that were identified within the (theoretical) model of stakeholder acceptance.

4.1.1. What is a strategic alliance?

Multiple definitions of collaborative alliances exist in the literature, mainly due to the highly fragmented nature of the strategic alliance literature (Oliver, 1990). In Table 4.1.1, we provide several definitions of strategic alliances. We do not claim this table to be exhaustive and recognize that past literature has brought many more definitions.

Table 4.1.1: A collection of definitions of strategic alliances

Author	Definition	Term
Gray & Wood (1991)	An interorganizational effort to address problems too complex and too protracted to be resolved by unilateral organization action	Collaborative alliance
Das & Teng (2000)	A voluntary, interfirm agreement, designed to achieve a joint competitive advantage	Strategic alliance
Oliver (1990)	The relatively enduring transactions, flows, and linkages that occur among or between an organization and one or more organizations in its environment	Interorganizational relationships (IOR)
Devlin & Bleackley (1988)	Strategic alliances are specifically concerned with securing, maintaining or enhancing a company's competitive advantage. Strategic alliances take place in the context of a company's long-term strategic plan and seek to improve or dramatically change a company's competitive position.	Strategic alliance
Mohr & Spekman (1994)	Partnerships are defined as purposive strategic relationships between independent firms who share compatible goals, strive for mutual benefit, and acknowledge a high level of mutual interdependence. They join efforts to achieve goals that each firm, acting alone, could not attain easily.	Partnerships / Strategic relationships
Gulati (1995)	A variety of agreements whereby two or more firms agree to pool their resources to pursue specific market opportunities	Interfirm strategic alliances
Hagedoorn (1993)	Those interfirm cooperative agreements which are aimed at improving the long-term perspective of the product market combinations of the companies involved	Strategic technology alliances
Parkhe (1993)	Strategic alliances are voluntary interfirm cooperative agreements, often characterized by inherent stability arising from uncertainty regarding a	Strategic alliances

	partner's future behaviour and the absence of a higher authority to ensure compliance.

We favour a broad definition, suitable to the implementation of MaaS. We see that the combination of resources, synergy, and a need for collaboration in the face of complexity are elements that are present in most definitions. We decide to combine the definitions of Das & Teng (2000) and Gray & Wood (1991). We define a strategic alliance as 'a voluntary, interfirm agreement, designed to address problems that are too complex to solve with unilateral organizational action, and to achieve competitive advantage'.

4.1.2. What different perspectives are there with regard to strategic alliances?

Different theoretical perspectives and models have been proposed to explain the forming of strategic alliances (Das & Teng, 2000). Here we present and summarize several of these perspectives. The theoretical perspectives that have been covered are: Transaction costs economics, Game theory, the Strategic Behaviour Model, the Strategic Decision-making model, Social Exchange Theory, Power-dependence Theory and the Resource-based View. For an extensive elaboration on each individual theoretical perspective and its suitability to approach MaaS as an interfirm collaboration, we refer the reader to the full literature review in Appendix 8.2.

A summary of each theoretical perspective can be found in Table 4.1.2. We decided to use the four components (Rationale, Formation, Structure, and Performance) used in the resource-based view by Das & Teng (2000) to describe each theoretical view, as this provides a clear method of comparison.

Table 4.1.2: Summary of strategic alliance theoretical perspectives

Central question / theme	**Rationale** Why do we form alliances?	**Formation** When do we form alliances?	**Structure** What influences how we form alliances?	**Performance** How do we measure alliance performance?
Transaction cost economics Is vertical integration desirable? (Williamson, 1985; 1991; Das & Teng, 1996a)	(Minimizing) transaction costs (Preventing) opportunism	When transaction costs alliance < transaction costs market	Perceived opportunism Transaction costs Theory focuses mainly on vertical integration and does not go specifically into different alliance structures	Transaction costs
Game theory Behavioural uncertainty and cooperation:	To advance individual interests Positive pattern of payoffs (both monetary and non-monetary)	When the payoff of cooperation > payoff of opportunism (situations where opportunism does	Theory does not cover different alliance structures, but takes a broader	Fulfilment of strategic needs Net spillover effect

how do we minimize opportunism? (Parkhe, 1993) When do firms cooperate (Axelrod, 1981)	The 'shadow of the future'	not advance individual interest) When the shadow of the future is large enough When non-recoverable investments are needed When there is positive history of alliances When contractual safeguards successfully reduce opportunism	perspective: when do firms cooperate?	Relative profitability
Strategic behaviour model Why do companies cooperate in their efforts to innovate? (Hagedoorn, 1993)	To reduce, minimize and share the uncertainty and costs of R&D To battle the complexity associated with intersectoral technology To expand product range To enter geographically new markets	Theory does not provide prerequisites for alliance formation.	Theory does not cover motives for different alliance structures.	Theory does not provide measures of alliance performance.
Strategic decisionmaking model Can we explain alliance structures from a risk perspective? (Das & Teng, 1996a)	Interfirm alliances are a way to cope with risk	Transaction costs + Governance costs < Market costs When relational risk is properly evaluated ex ante When performance risk is properly evaluated ex ante	Perceived relational risk (positive relation with equity-based alliances) Perceived performance risk (negative relation with equity-based alliances) Which are caused by: Behavioural uncertainty Uncertainty about future states Perceived opportunism Trust Record of previous alliances On-going agreements Non-recoverable investments	Theory does not provide measures of alliance performance.
Power-dependence theory Alliances are a result of power differentials (Schmidt & Kogan, 1977)	Individual benefit, especially for the dominating company	When at least one party sees benefit When organization goals are compatible When the dominating firm is important to the function of the dominated firm When the dominating firm has influence over the dominated firm	Theory does not cover motives for different alliance structures.	Theory does not provide measures of alliance performance.
Resource-based view The value creation potential of pooling firm	To maximize value and gain competitive advantage through pooling and utilizing resources To acquire know-how	When resources add more value in alliance form then when internally used When resources are heterogenous When parties possess critical resources	The type of resources that are brought into the alliance, namely property-based or knowledge-based resources	The degree to which agreed objectives of an alliance are achieved

resources together is what drives the forming of strategic alliances (Das & Teng, 2000)	To benefit from the resources of others	When it is hard to imitate another firm's competitive advantage

Although Table 4.1.2 provides a comprehensive overview of the reviewed literature, it does not provide a useful way to integrate the different theories into a single framework, e.g. a conceptual model. The literature on strategic alliances provides us with several additional interesting variables and causal relations that may be used for a general model of collaboration. Table 4.1.3 provides every single variable that we retrieved from the literature that we deem relevant for a general model of collaboration. We refer the reader to appendix 8.2 for an elaboration on the variables given in the table below.

Table 4.1.3: Variables retrieved from the literature on each theoretical perspective

Theoretical perspective	**Variables**
Transaction costs economics	Opportunism; Transaction costs; Governance structures
Game theory	Individual benefit; Behavioural uncertainty; 'Shadow of the future'; Number of players; Profitability; (Perceived) opportunism; Contractual safeguards; Non-recoverable investment.
Strategic behaviour model	Sharing of uncertainty; Sharing of costs; Environmental complexity; Diversity product range; Geographical dispersion.
Strategic decisionmaking model	Opportunism; Governance costs; Alliance stability; Shared goals; (Perceived) Relational risk; (Perceived) Performance risk; Outcome-to-input ratio; Trust; Number of past alliances; On-going agreements; Cost of failure.
Power-dependence theory	(Perceived) benefit; Goal compatibility.
Resource-based view	Learning; Acquiring of know-how; Value of resource integration; Competitive advantage; Resource heterogeneity; Causal ambiguity; Risk of knowledge leak; Close collaboration; Proper resource alignment ; Resource similarity; Resource utilization; Collective strengths; Interfirm conflict; Competing interest; Goal incompatibility; Opportunistic behaviour.

The next step is to cross-reference each theoretical perspective to see if we can combine their theoretical concepts (e.g. if two variables reflect the same concept, they can be merged together). Table 4.1.4 Shows the resulting list of variables. Putting all theoretical perspectives together, we come to 24 different variables that will serve as input for a general model of collaboration. The next step is adding the causal relationships that were found in the literature.

Table 4.1.4: Merged concepts from the strategic literature - the final list of variables from the strategic literature

Concept(s)	Variable
Strategic alliance	**Need for collaboration**
Learning + Acquiring know-how	Opportunity for learning
Competitive advantage + Value of resource integration + Collective strengths	Expected alliance competitive advantage
Resource heterogeneity + Causal ambiguity	Resource heterogeneity
Resource alignment + Resource similarity + Resource utilization	Resource complementarity
Interfirm conflict + Alliance stability	Alliance stability
Competing interest + Goal incompatibility + goal compatibility + Shared goals	Goal compatibility
Opportunism (4x) + Behavioural uncertainty	Expected opportunism
Governance costs	Governance costs
Trust + (perceived) relational risk	Trust between partners
Number of past alliances + on-going agreements	Alliance history
Cost of failure + (Perceived) Performance risk	Risk of failure
Non-recoverable investments	Ex ante investments
Environmental complexity	Environmental uncertainty
Uncertainty regarding innovation	Innovation uncertainty
Sharing of costs	Costs of innovating
Diversity product range	Desire for product range expansion
Geographical dispersion	Desire for geographical expansion
Shadow of the future	Shadow of the future
Number of players	Number of firms in alliance
Profitability (+ individual benefit + Perceived benefit)	(Expected) Alliance profitability
Individual benefit + Perceived benefit	Individual benefit
Transaction costs	Transactions costs (without alliance)
Governance structures + contractual safeguards	Governance structures

After identifying all relevant variables, we collected the causal relations that are found in the literature. Table 4.1.5 provides each causal relationship (by alphabetical order) and the corresponding authors who acknowledge the existence of that relationship. These causal relations are derived from the literature review which can be found in appendix 8.2.

Table 4.1.5: All causal relations found in the strategic alliance literature

Variable	Polarity of causality	Variable	Support
Environmental Uncertainty	Positive	Need for collaboration	Gray & Wood, 1991; Olliver, 1990; Hagedoorn, 1993;
Environmental Uncertainty	Positive	Risk of Failure	Das & Teng, 1996a
Expected Alliance profitability	Positive	Need for collaboration	Parkhe, 1993
Expected Alliance profitability	Positive	Shadow of the future	Parkhe, 1993
Expected Alliance profitability	Negative	Expected opportunism	Parkhe, 1993

Alliance history	Negative	Expected opportunism	Parkhe, 1993; Das & Teng, 1996a
Alliance history	Positive	Shadow of the future	Kogut, 1989
Costs of innovating	Positive	Need for collaboration	Hagedoorn, 1993
Desire for geographical expansion	Positive	Need for collaboration	Hagedoorn, 1993
Desire for product range expansion	Positive	Need for collaboration	Hagedoorn, 1993
Environmental uncertainty	Positive	Risk of failure	Das & Teng, 1996a
Ex ante investments	Negative	Expected opportunism	Parkhe, 1993; Das & Teng, 2000; Das & Teng, 1996a
Ex ante investments	Positive	Shadow of the future	Parkhe, 1993
Ex ante investments	Positive	Risk of failure	Das & Teng, 1996a
Expected alliance competitive advantage	Positive	Need for collaboration	Das & Teng, 2000
Goal compatibility	Decreases	Expected opportunism	Das & Teng, 1996a
Goal compatibility	Positive	Need for collaboration	Schmidt & Kochan, 1977
Goal compatibility	Positive	Expected alliance profitability	Das & Teng, 2000
Goal compatibility	Positive	Alliance stability	Das & Teng, 2000
Governance structures	Negative	Expected Opportunism	Williamson, 1981; Parkhe, 1993
Governance structures	Negative	Transaction costs	Olliver, 1990
Governance structures	Negative	Shadow of the future	Parkhe, 1993
Governance structures	Positive	Governance costs	Das & Teng, 1996a
Individual benefit	Positive	Need for collaboration	Parkhe, 1993
Innovation uncertainty	Positive	Need for collaboration	Hagedoorn, 1993;
Innovation uncertainty	Positive	Risk of failure	Das & Teng, 1996a
Alliance stability	Positive	Expected alliance profitability	Das & Teng, 2000
Expected Opportunism	Positive	Transaction costs	(Williamson, 1985; Das & Teng, 1996a, Schmidt & Kochan, 1977)
Expected Opportunism	Negative	Alliance stability	Parkhe, 1993
Opportunity for learning	Positive	Need for collaboration	Kogut, 1988
Resource complementarity	Positive	Expected Alliance competitive advantage	Das & Teng, 2000
Resource complementarity	Positive	Expected alliance profitability	Das & Teng, 2000
Resource heterogeneity	Positive	Need for collaboration	Das & Teng, 2000
Resource heterogeneity	Positive	Transaction costs	Das & Teng, 2000
Resource heterogeneity	Positive	Innovation uncertainty	Das & Teng, 2000; Lippman & Rumelt, 1982
Risk of failure	Positive	Need for collaboration	Das & Teng, 1996a
Shadow of the future	Positive	Need for collaboration	Parkhe, 1993
Shadow of the future	Negative	Expected opportunism	Parkhe, 1993; Das & Teng, 1996a
Transaction costs	Positive	Need for collaboration	Das & Teng, 1996a
Transaction costs	Positive	Governance structures	Williamson, 1985

Trust between partners	Negative	Expected opportunism	Das & Teng, 1996a; Axelrod, 1981

The next step is to integrate the findings from Table 4.1.5, which allows us to construct our conceptual model.

4.1.3. What should the mental modal of stakeholder acceptance regarding MaaS look like, according to the reviewed literature?

Integrating the findings from the literature (Table 4.1.5), we present our general model of collaboration (GMC) in Figure 4.1.2.1. We will refer to this model as either the theoretical model or GMC. We refer the reader to Appendix 8.3 for an explanation of how the model was constructed. We advise reading the explanation if the desire is to fully understand the model, as the model has quite a large set of causal relations.

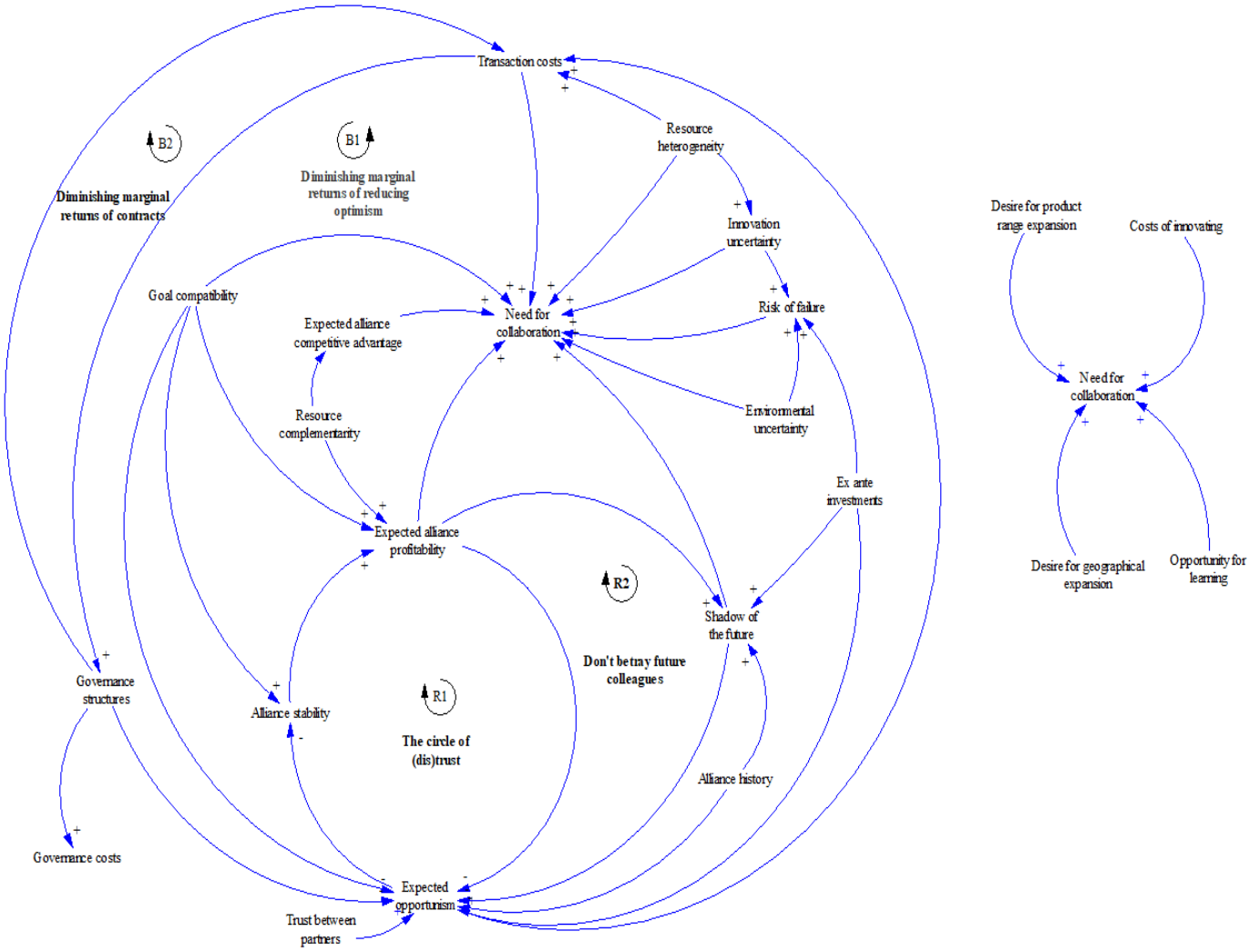


Figure 4.1.2.1.: The general model of collaboration

4.1.4. Feedback loops theoretical model

Here, we discuss the feedback loops that were identified in the GMC. We identify two reinforcing feedback loops and two balancing feedback loops. Three feedback loops involve expected opportunism between parties. We'd like to remind the reader that the support for each relation found here can be found in the previous paragraph, and that the full literature review can be found in Appendix 8.2 if there is a desire to fully understand each relationship and loop depicted here.

4.1.4.1. Reinforcing feedback loop R1: The circle of (dis)trust

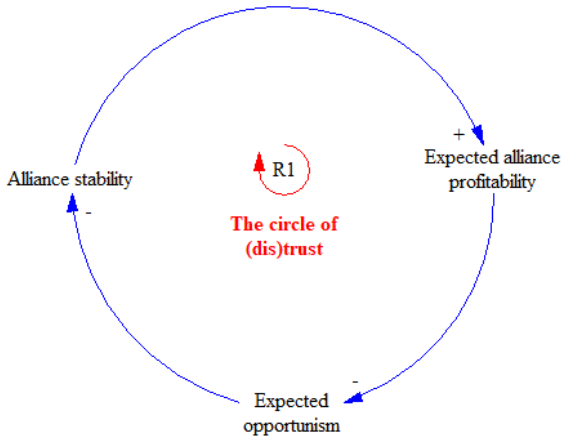


Figure 4.1.2.2. Reinforcing feedback loop R1

In reinforcing feedback loop one (R1) (Figure 4.1.2.2.), we see that an increase in the profitability that parties expect to make in the collaboration, the less opportunism they expect from other parties. This in turn increase the stability of the alliance, leading to higher profitability. The opposite may occur: when (expected) profits in a collaboration take a hit, this can destabilize organisation through an increase in opportunism.

4.1.4.2. Reinforcing feedback loop R2: Don't betray future colleagues

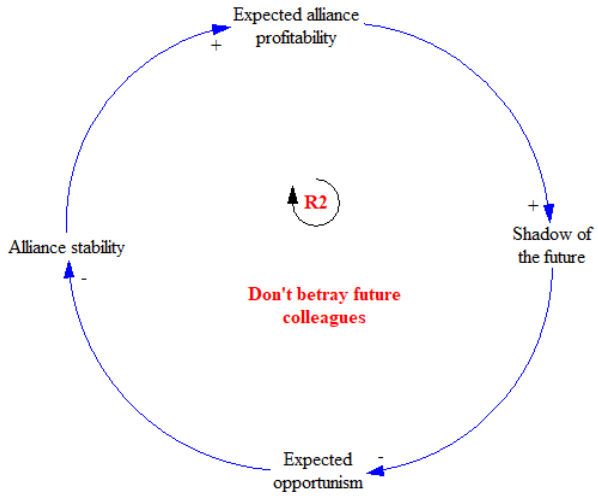


Figure 4.1.2.3. Reinforcing feedback loop R2

In reinforcing feedback loop two (R2) (Figure 4.1.2.3.), we see a similar effect occurring as in R1. Expect profitability here increases the 'shadow of the future', which refers to the effect that occurs when future interactions may reward or punish each 'player' (a term taken from game theory, see Appendix 8.2). The shadow of the future becomes longer, meaning there is more dependence between firms with regard to their future (positive) payoffs. This increases the expected opportunism within alliances, as prolonged positive payoffs reduce the

need for each individual firm to be opportunistic. This in turn increases the alliance stability, leading to higher expected profits. We named this feedback loop 'Don't betray future colleagues' as breaking the positive reinforcing effect may induce a race to the bottom: if a party decides to be opportunistic, this decrease stability, decreases profits, decreases the shadow of the future and encourages even more opportunism.

4.1.4.3. Balancing feedback loop B1: Diminishing marginal returns of reducing opportunism

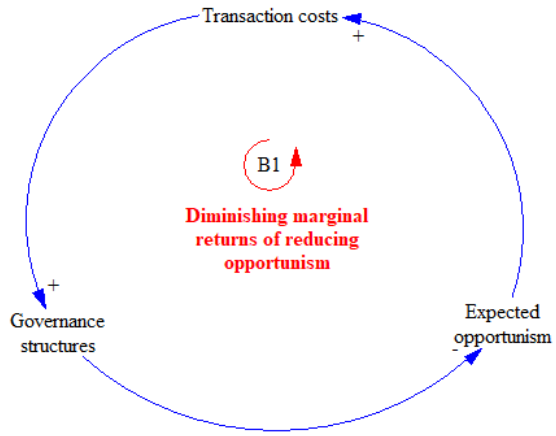


Figure 4.1.2.4. Balancing feedback loop B1

In balancing feedback loop one (B1) (Figure 4.1.2.4.) we see that high transaction costs increase the need for governance structures. These governance structures decrease expected opportunism between parties, decreasing the transaction costs. When transaction costs go down, there is in turn less need for additional governance structures. This loop can be interpreted as 'We need contracts to decrease expected opportunism, but we do not need to settle everything in formalities'.

4.1.4.4. Balancing feedback loop B2: Diminishing marginal returns of contracts

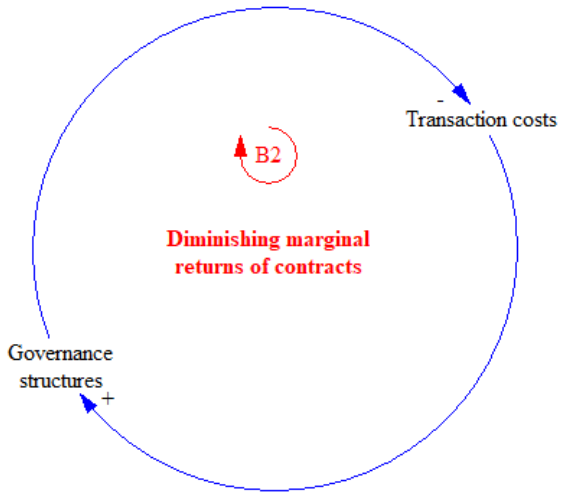


Figure 4.1.2.5. Balancing feedback loop B2

In balancing feedback loop two (B2) (Figure 4.1.2.5.), we see a similar effect occurring as in B1. We see a direct link between transaction costs and governance structures. Transaction costs increase the degree to which governance structures are needed, which in turn decreases the transaction costs, and therefore the degree to which the collaboration needs governance structures. Thus, we see in B1 that there is an indirect effect through the decreasing of opportunism, as well as a direct effect (B2) of transaction costs on governance structures and vice versa.

4.2. Results Group Model Building

In this paragraph we present our results from the Group Model Building session that took place July 17th, 2018. In the first paragraph we provide the variables that were deemed relevant by stakeholders, as well as the relations. We do this in the same fashion as we did our theoretical model that resulted from the literature review. The complete account on how each variable and relation came about can be found in both Appendix 8.4.1 and 8.4.2. We decided not to include the column "support" here (like we did in the literature review), as the support consists of quotes of each participants, making the tables below too large for the main text. We advise the reader to use Appendix 8.4.1 and 8.4.2 when reading the following paragraphs. After presenting all variables and relations, we present our stakeholder model. In the second paragraph we present the most important feedback processes that are present in the model.

We have to make an important side note when presenting our Group Model Building results: the original workshop was conducted in Dutch. Thus, all results presented here are translated. The accounts of the workshop in the Appendix are all in Dutch, and we acknowledge the distortion that arises from translating. We have tried to be as concise as possible when translating participant's input from Dutch to English.

4.2.1. What does the mental model of stakeholder acceptance regarding MaaS look like in the Nijmegen case?

In Table we present the variables that were deemed by the stakeholders to be relevant when considering a MaaS collaboration between firms. A sidenote must be made with regards to the term 'modal split car': this should be interpreted as the care share within the modal split, which is congruent with what participants discussed in the Group Model Building session (See Appendix 8.4.1 for the session's textual account).

Table 4.2.1.1.: Variables in the stakeholders' mental model

Variable:	Support:
Quality of transport services	**See Appendix 8.4.1**
Added value for travellers	
The amount of traveller kilometres	
Completeness mobility chain	
Number of modalities on offer	
Frequency of transportation services	
Trustworthiness of mobile application	
Quality of mobile application	
Data	
Sharing of data between firms	
Collective market knowledge	
Individual market knowledge	

Efficiency of operations
Collaboration
Cost benefit ratio
Accessibility of the system for travellers
Quality of life
Accessibility city
Safety
Parking tariffs
Car use in the city
Modal split car
Flexibility of contracts
Client ownership
Laws and regulations concerning public transport (PT)
Quality MaaS offering
Usefulness of market knowledge
Competition between firms

In Table 4.2.1.2. we present all the causal relations that were identified by the stakeholders during the Group Model Building session.

Table 4.2.1.2.: Relevant causal relations, according to MaaS stakeholders

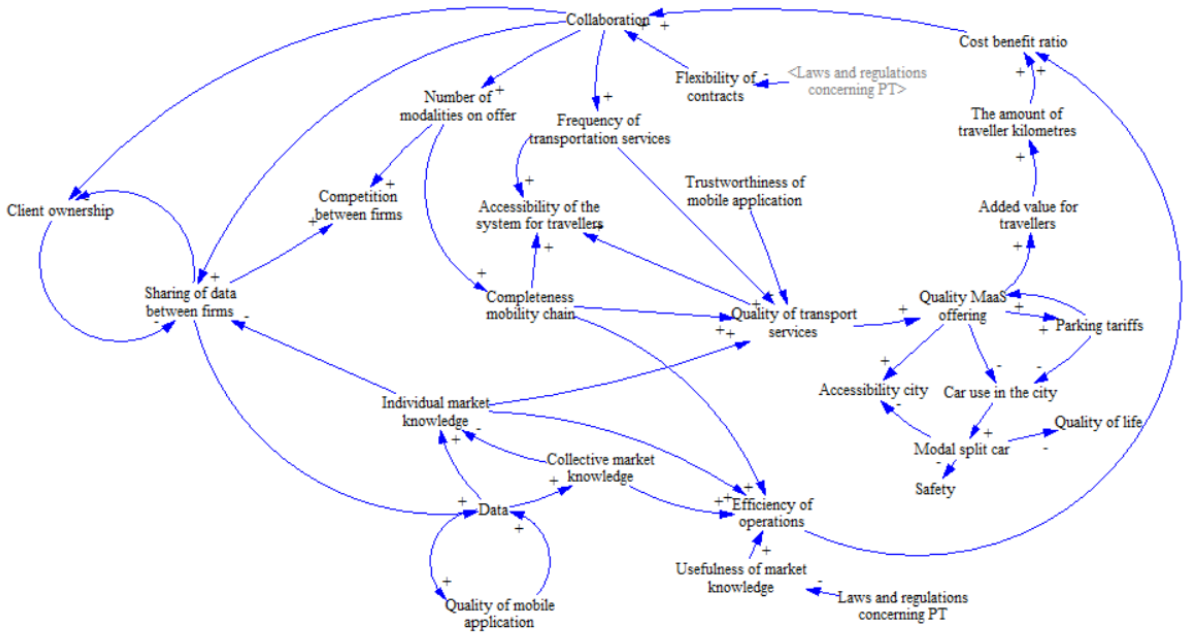
Variable	Polarity of causality	Variable	Support
Added value for travellers	Positive	Amount of traveller kilometres	**See Appendix 8.4.2**
Car use in the city	Positive	Modal split car	
Client ownership	Negative	Sharing of data between firms	
Collaboration	Positive	Frequency of transportation services	
Collaboration	Positive	Sharing of data between firms	
Collaboration	Negative	Client ownership	
Collaboration	Positive	Number of modalities on offer	
Collective market knowledge	Positive	Quality of transport services	
Collective market knowledge	Positive	Efficiency of operations	
Collective market knowledge	Negative	Individual market knowledge	
Completeness mobility chain	Positive	Quality of transport services	
Completeness mobility chain	Positive	Accessibility of the system	
Completeness mobility chain	Positive	Efficiency of operations	
Cost benefit ratio	Positive	Collaboration	
Data	Positive	Quality of mobile application	
Data	Positive	Individual market knowledge	
Data	Positive	Collective market knowledge	
Efficiency of operations	Positive	Cost benefit ratio	
Flexibility of contracts	Positive	Collaboration	
Frequency of transportation services	Positive	Quality of transport services	
Frequency of transportation services	Positive	Accessibility of the system	
Individual market knowledge	Positive	Quality of transportation services	
Individual market knowledge	Positive	Efficiency of operations	
Individual market knowledge	Negative	Sharing of data between firms	
Laws and regulations concerning PT	Negative	Usefulness of market knowledge	
Laws and regulations concerning PT	Negative	Flexibility of contracts	
Modal split car	Negative	Quality of life	
Modal split car	Negative	Safety	

Modal split car	Negative	Accessibility
Number of modalities on offer	Positive	Competition between firms
Number of modalities on offer	Positive	Completeness mobility chain
Parking tariffs	Negative	Car use in the city
Parking tariffs	Positive	Quality MaaS offering
Quality MaaS offering	Positive	Added value for travellers
Quality MaaS offering	Positive	Accessibility
Quality MaaS offering	Negative	Car use in the city
Quality MaaS offering	Positive	Parking tariffs
Quality mobile application	Positive	Data
Quality of transportation services	Positive	Accessibility of the system
Quality of transportation services	Positive	Quality MaaS offering
Sharing of data between firms	Positive	Data
The amount of traveller kilometres	Positive	Cost benefit ratio
Trustworthiness of mobile application	Positive	Quality of transport services
Usefulness of market knowledge	Positive	Efficiency of operations

When we map the relations into a diagram – as was done in the Group Model Building workshop – we derive Figure 4.2.1.1. For a refresher on how to read a model diagram, we refer the reader back to the method section.

The model below has been slightly altered as compared to the original model that resulted from the session. All alterations were done using the minutes of the workshop and are thus fully accounted for (see Appendix 8.4.2). The original 'raw' model can be found in Appendix 8.5.

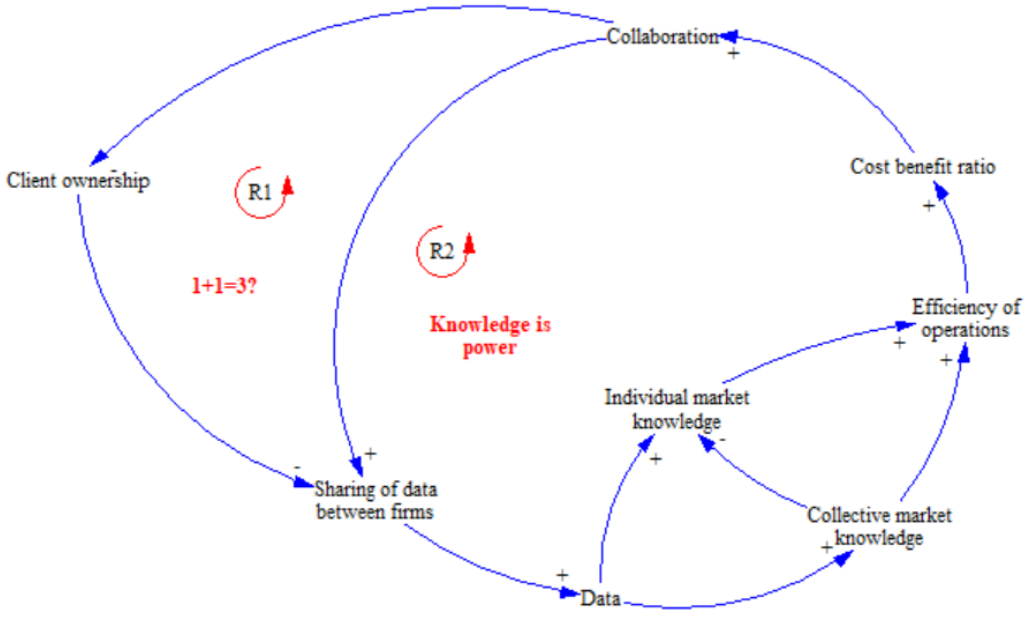
Figure 4.2.1.1.: Result of the GMB workshop, mental model of stakeholders



4.2.2. Feedback loops stakeholder model

Here we discuss the feedback loops that resulted from the group model building session. We will elaborate on each feedback loop step-by-step. When two loops are very similar in structure – meaning they both encompass a lot of the same variables – it has been decided to explain them simultaneously. The feedback loops are discussed in isolation, meaning that the other variables in the model are left out in the presented diagrams here. If the reader would like to envision the feedback loop within the larger overall model, he/she can use the original model from the previous paragraph to trace the loops back that are presented here. In addition, each variable and relation has been accounted for, and an extensive documentation on why each relation and variable is represented the way it is can be found in Appendix 8.4. Here, we discuss only the main results of the workshop. We advise the reader who's wish is to fully understand these models, to use Appendix 8.4.1 and 8.4.2 whilst reading. The documentation of each variable and relation has been done extensively, and in an accessible way.

4.2.2.1. Reinforcing feedback loops R1 and R2: 1+1=3 and Knowledge is power

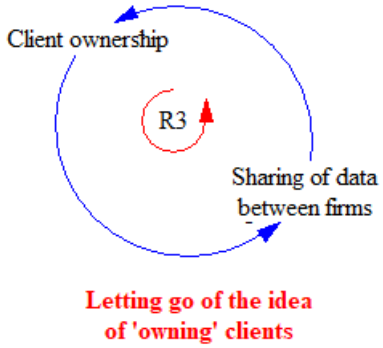


In reinforcing feedback loop one (R1), we see that collaboration leads to a decrease in client ownership. Because client ownership is negatively related to the sharing of data between firms, we see that a decrease in client ownership leads to firms sharing more data with each other. This leads to more data, increasing both individual and collective market knowledge (Please notice that in the model an increase in collective market knowledge may also lead to a decrease

in individual knowledge. The origin of this dynamic can be found in Appendix 8.4.2). More market knowledge increases the efficiency of operations within firms, improving their cost benefit ratio. An improved cost benefit ratio then leads to more collaboration.

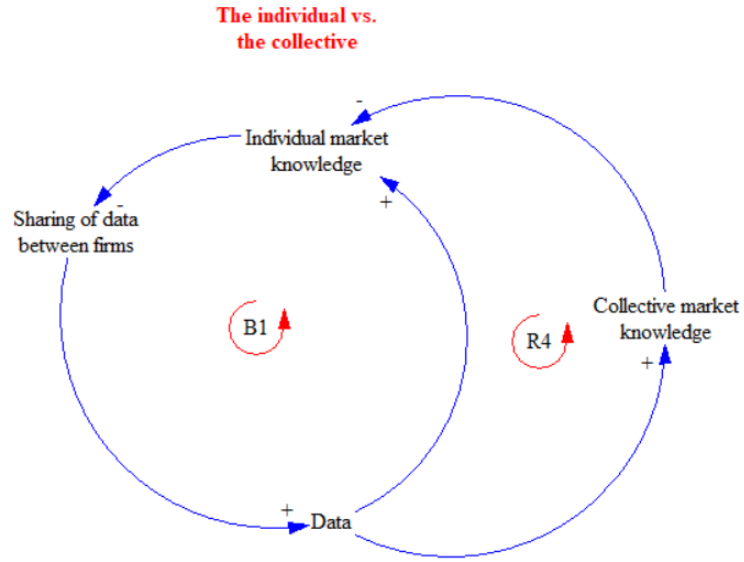
Reinforcing feedback loop two (R2) is similar to R1, except for the direct relation between collaboration and sharing of data between firms. Thus, we see that collaboration leads to more sharing of data through two different pathways: 1. Collaboration directly influences the amount of data being shared, 2. Collaboration indirectly influences the amount of data being shared, by reducing client ownership in each individual firm.

4.2.2.2. Reinforcing feedback loop R3: Letting go of the idea of 'owning' clients



In feedback loop R3, we see that a reduction in client ownership leads to more data sharing, which in turn decreases client ownership again. This dynamic entails that the more firms are willing to let go of their 'own' clients, the more data will eventually be shared in the system, causing clients to be shared, rather than to be owned. By definition, the opposite is also true. When firms hold on to their clients, this will promote a 'each for his own' culture, in which firms keep information to themselves.

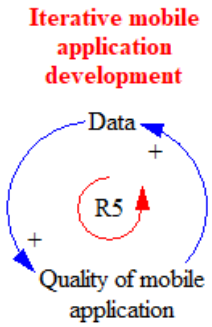
4.2.2.3. Balancing feedback loop B1 and reinforcing feedback loop R4: The individual vs. the collective



In feedback loop B1, we see that sharing of data between firms leads to more data, which may also increase a firm's individual market knowledge. This sets a balancing effect in motion: if

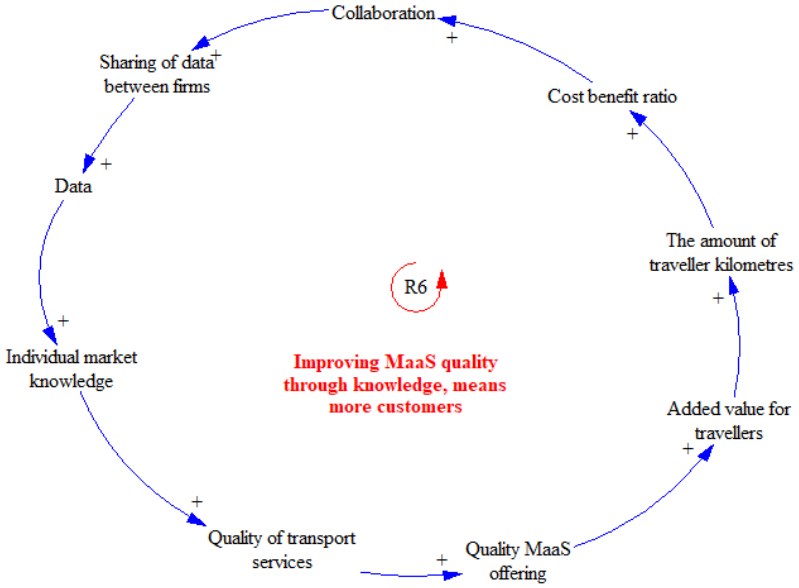
the individual market knowledge of a firm increases, it will have less incentive to share its own data with the other firms. The end result is that the sharing of data eventually may also lead to a decrease in willingness of firms to share data. Reinforcing feedback loop R4 however, provides an opposing reinforcing effect. As more data gets shared, and the amount of data firms have increases, the market knowledge of the collective increases. This leads to the individual market knowledge becoming relatively smaller, providing more incentive for firms to share their own data (in order to get access to data of the other firms). The balance between B1 and R4, and the question of which of these two dynamic effects is stronger, was a reoccurring theme in the workshop.

4.2.2.4. Reinforcing feedback loop R5: Iterative mobile application development



In reinforcing feedback loop R5, we see that when more data is provided, the quality of the mobile application can be improved. In turn, when the quality of the mobile application is improved, this may improve the quality of the data feedback the app gives, resulting in again more data. The end result is a reinforcing effect in which the mobile application gets better over time as more data is collected.

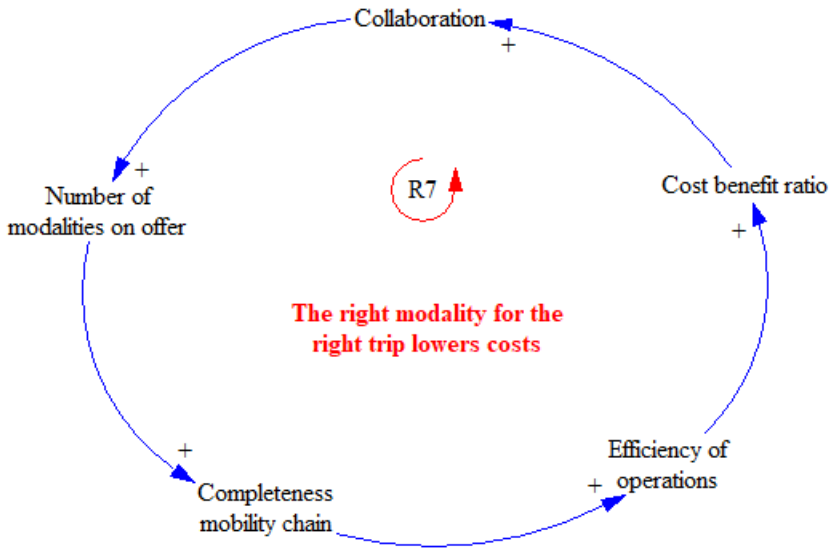
4.2.2.5. Reinforcing feedback loop R6: Improving MaaS quality through knowledge, means more customers



In reinforcing feedback loop R6, we see that collaboration increase the sharing of data, eventually leading to a larger individual market knowledge. This market knowledge can be

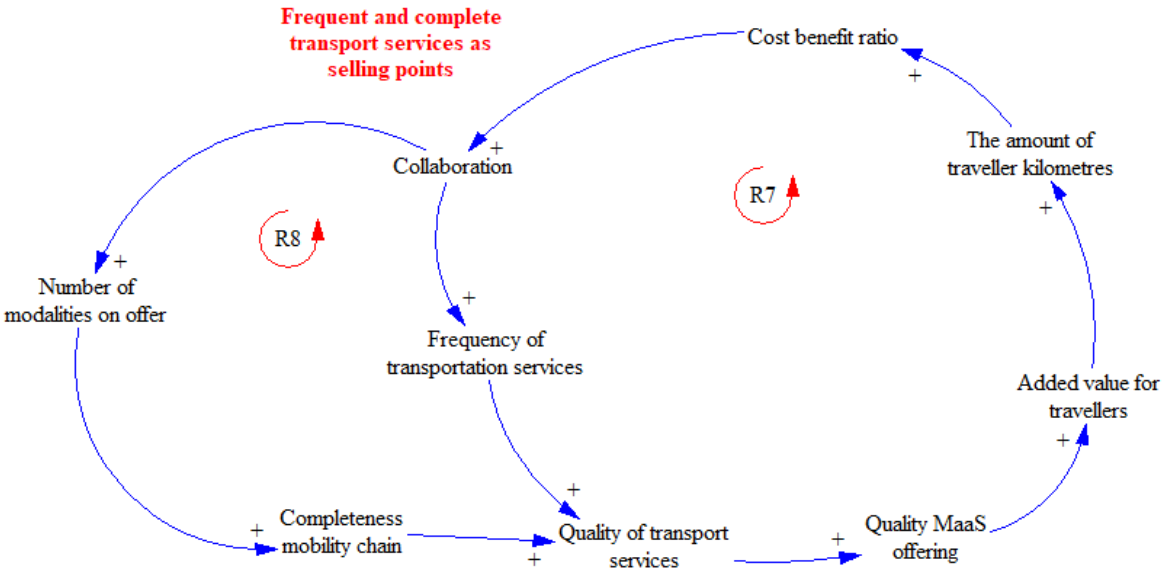
used to improve the quality of transport services, increasing the quality of the MaaS offering. When the quality of MaaS increases, it becomes more attractive to travellers; this is reflected in the variable added value for travellers. This leads to an increased amount of traveller kilometres, which has a positive effect on the cost benefit ratio of participating firms. The positive cost benefit ratio is an incentive for further collaboration, resulting in a reinforcing effect of collaboration on itself.

4.2.2.6. Reinforcing feedback loop R7: The right modality for the right trip lowers costs



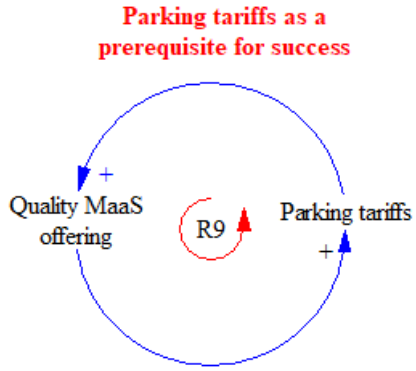
In reinforcing feedback loop R7, we see that collaboration increases the number of modalities on offer. This increases the completeness of the mobility chain, which allows the transport operators to optimize costs. An example given in the workshop, was that a complete mobility chain allowed the replacement of expensive trains by cheaper busses. Thus, an increased completeness of the mobility chain leads to a more efficient operation, which has a positive influence on the cost benefit ratio. This gives the involved parties more incentive to work together, creating a reinforcing feedback loop of collaboration.

4.2.2.7. Reinforcing feedback loop R7 and R8: Frequent and complete transport services as selling points



In reinforcing feedback loop R7 and R8, we see that a high frequency of transportation services, and a complete offer (consisting of a large offer of modalities) increases the quality of the transport services and thus the quality of the MaaS offering. Frequency and completeness thus cause the MaaS offering to have more added value for travellers, causing an increase in the amount of traveller kilometres. This has a positive effect on the cost benefit ratio of MaaS, which provides an incentive for collaboration.

4.2.2.8. Reinforcing feedback loop R9: Parking tariffs as a prerequisite for success



In reinforcing feedback loop 9, we see that a higher quality of the MaaS allows parking tariffs to be increased. This in turn may increase the quality of the MaaS offering, as public transport becomes cheaper when compared to using a car for transport. In the workshop it was made clear that the opposite effect may occur: the effects of a MaaS offering of good quality can be negated by low parking tariffs.

5.0. Conclusion

Now that we have answered several of our sub-questions, we are in a position to answer our main question: How can we increase stakeholder acceptance of MaaS in Nijmegen? We have both derived a conceptual model based on the strategic literature, and a stakeholder model based on the Group Model Building method and will use both models to answer our main question. In the discussion, we will provide a comparison between both models and discuss the differences between theory and practice.

5.1. Theoretical model

5.1.1. Profitability vs. opportunism

From the results from the theoretical model we can conclude that opportunism is a very important variable in a MaaS business ecosystem, as it may (de)stabilize an alliance through reinforcing effects (and may also increase transaction costs). Profitability, or positive expectations about profitability are means to decrease (expected) opportunism within alliances, according to the theoretical model. This works both directly – higher expected profits decrease opportunism – as indirectly – higher expected profits increase the 'shadow of the future', which means that parties expect to work with each other longer. This longer shadow of the future also decreases opportunism, as parties are 'locked in' an alliance with each other. In addition, governance structures may reduce opportunism, which we will discuss in the next paragraph.

5.1.2. Transaction costs and governance structures

We can conclude from the results that governance structures are vital for the success of an alliance. Governance structures can be used to decrease expected opportunism, leading to lower transaction costs. Additionally, decreased opportunism increase alliance stability, as was discussed in the previous paragraph. We find both an indirect effect for governance structures on transaction costs through expected opportunism, and a direct effect of governance structures on transaction costs. From the results we can conclude that governance structures are needed to reduce both transaction costs and expected opportunism, but that the marginal returns of such governance structures diminish as more are implemented.

5.2. How can we increase stakeholder acceptance of MaaS in Nijmegen, according to the theoretical model?

The findings from the literature review suggest that stakeholders will more likely engage in a MaaS business ecosystem when that ecosystem is profitable. Profitability of the alliance has a self-stabilizing effect, but additional governance structures may be used to reduce opportunism in the system. We conclude that – according to the theoretical model - profitability is the main driver of stakeholder acceptance, and that (expected) opportunism is the greatest barrier to collaboration.

5.3. Stakeholder model

5.3.1. Costs and benefits drive collaboration

From the results we find that there are several dynamics at play when considering a MaaS interfirm collaboration. Most of these dynamics origin from collaboration and are centred around two variables in the system: efficiency of operations, and quality of the transport services. This is reflected in the cost benefit ratio, which is determined in this workshop to be the driver of collaboration. Efficiency of operations lowers costs, a higher quality of transport services will eventually lead to more customers, increasing revenues. Thus, both benefits and costs are presented in the model.

The main driver behind the improvement of the quality of the services lies in that collaboration between firms allows for a more complete mobility chain, as well as more frequent transportation. In addition, individual market knowledge gives room for participating firms to improve their transportation services.

The main drivers behind efficiency operations are an increase in data (and thus a higher market knowledge) and a more complete mobility chain. In the Group Model Building session, it was stated that collaboration will lead to a higher market knowledge which can be used to increase efficiency. A more complete mobility chain increases the efficiency of operations because it allows the participating firms to offer the most efficient modality for each trip.

5.3.2. The individual vs. the collective

Not everything about MaaS seems to be positive. Stakeholders in this research have emphasized the caveat of the individual vs. the collective, which was expressed in competing feedback loops B1 and R4.

In addition, the model contains a positive relationship between collaboration and the competition between firms. Even though the competition between firms does not have any causal relations to other variables in the model (this will be covered in the discussion), the model does state that there is a tension between the individual and the collective here as well.

5.3.3. Enabling and disabling conditions

Both rules and legislation concerning public transport and parking tariffs were both suggested as enabling or disabling conditions for a MaaS scheme. Stakeholders strongly emphasized that government and municipalities put severe restrictions on the use of market knowledge that results from data. This leads to a decrease in the use of market knowledge. If this dynamic is too strong, the positive effects of data sharing can be negated.

In addition, the stakeholders converged on the fact that parking tariffs may singlehandedly cannibalize an entire public transport system, regardless of its form. This is expressed in feedback loop R9. Stakeholders stressed that the quality of the MaaS system must be high, and that parking tariffs must also be high in order for the system to work.

5.4. How can we increase stakeholder acceptance of MaaS in Nijmegen, according to the stakeholder model?

The findings from the group model building session indicate that stakeholders that may possibly engage in a MaaS system together have mixed feelings towards collaboration. There seems to be a tension between the gain of the individual company and the gain of the collective. However, overall the participating stakeholders were mildly positive that collaboration would result in a larger proverbial pie, rather than a new distribution of a pie of the same size. The stakeholders feel that collaboration may have several benefits in the form of higher market knowledge and increased efficiency, which may ultimately lead to more profit. However, the group stressed that institutional barriers impose great constraints on the benefits of collaboration. In addition, municipalities that engage in conflicting policy making (encouraging public transport, but simultaneously lowering parking tariffs) are considered to be a hazard.

From our findings we conclude that in order to increase stakeholder acceptance of MaaS, institutional barriers need to be removed first. It was strongly expressed in the session that these are a major constraint, and that they should not be underestimated. In addition, when MaaS is

implemented in Nijmegen, it should be corresponded with the municipality that parking tariffs would need to go up, or that alternative parking needs to become more attractive (for example, park & rides combined with public transport). Next to the removal of these barriers, caution must be taken that collective data sharing will not lead to individual firms deciding to keep data to themselves. In order to increase stakeholder acceptance of MaaS, it is therefore vital that data sharing will lead to a more positive cost benefit ratio - the result of loop R4 - and that this dynamic is stronger than the balancing loop B1.

6.0. Discussion

6.1. Practice vs. theory: Do the result match expectations?

In this paragraph we like to answer our last research question: What are the differences between what the theory prescribes, and practice, regarding the stakeholders' mental model?

6.1.1. Similarities between both models

6.1.1.1. Profit drives collaboration in both models

When comparing the theoretical and the stakeholder model, we see that both models depict profitability as a driver for collaboration. This was named 'expected profitability' in the theoretical model, and 'cost benefit ratio' in the stakeholder model. We feel that these two variables reflect the same thing: What does my individual firm gain from collaboration? If the individual gain from collaborating is high, collaboration increases. This was something that we expected intuitively, as firms inherently strive for profit.

6.1.1.2. Opportunism is present in both models

An additional similarity lies in opportunism, although we argue that opportunism is more heavily represented in the theoretical model than in the stakeholder model, and that the stakeholder model does not include the shadow of the future in these relations (which we will discuss in the next subparagraph). In spite of this, both models incorporate a form of opportunism. In the stakeholder model, opportunism is mostly expressed in the opposing dynamics B1 and R4. According to the stakeholders, there is a tension between the individual gain and the collective gain. This tension is presented in B1 and R4 and concerns the sharing of data. In the stakeholder model, an improved cost benefit ratio leads to more collaboration, which promote the sharing of data. In the theoretical model, profitability influences opportunism both directly, and indirectly, through the shadow of the future. It must also be mentioned that the stakeholder model does include a variable 'competition between firms'. Unfortunately, there was not enough time to elaborate further on the dynamics surrounding this variable. We argue that this (coalition-internal) competition is in many ways similar to opportunism.

6.1.2. Differences between both models

6.1.2.1. Shadow of the future

The stakeholder model does not incorporate the shadow of the future dynamic. One stakeholder did mention a "locked-in effect" of cooperation, but this referred to an inability for the business ecosystem to respond to external developments. The duration of the collaboration was thus not considered in the stakeholder model. We think that including the planned duration of the collaboration would be a contribution to the model and that possible future group model building sessions could test if this variable is part of the stakeholders' mental model.

6.1.2.2. Governance structures

Although 'flexibility' of contracts is present in the stakeholder model, it does not further address governance structures and its effects. The effect of contracts is more elaborate in the theoretical model, although it does not address flexibility. It must be noted though that in transaction costs economics, the tension between flexibility and governance structures is a dominant topic. We argue that it is possible that governance structures do have a place in the stakeholder model, especially with regard to the decreasing of internal competition or opportunism. Governance structures may possibly be the solution to the individual vs. the collective problem with regards to data sharing. Future group model building sessions could test if this variable is part of the stakeholders' mental model.

6.1.2.3. Reinforcing effects of opportunism

Although opportunism is captured in different forms in both models, we argue that the stakeholder model is relatively positive compared to the theoretical model. The theoretical model depicts a strong destabilizing feedback loop with expected opportunism at the centre. This is not reflected in the stakeholder model, in which opportunism is only reflected by a decrease in data sharing and increased competition. The model does not reflect that opportunism may stabilize the alliance or that expected opportunism may affect future pay offs (the cost benefit ratio). We argue that the stakeholder model underestimates opportunism. Because the model also does not include ways to restrict internal competition or opportunism, we argue that this is a flaw in the stakeholder model. Limited time might be the cause of this flaw, and we will discuss this in our next paragraph on limitations.

6.1.2.4. Institutional barriers

The stakeholder model includes institutional barriers to collaboration, as well as practical barriers (e.g. the parking tariffs). The theoretical model however does not incorporate this whatsoever. There are no barriers or catalysators to collaboration or profit in the form of these type of barriers. We deem this strange: we reviewed quite a lot of different perspectives on collaboration, but none of them seem to emphasize the role of the government as an agent within the system. Even though the government might be more present in a MaaS system due to the public function of public transportation, we still argue that governments, laws and regulations, and close derivatives resulting from these factors, are present in collaborations. Regulations and governments preventing the forming of cartels is an example of this.

6.1.2.5. Miscellaneous variables

In addition, there are several variables that are present in the theoretical model that are not present in the stakeholder model, that we think would be a contribution to the quality of the stakeholder model. However, we argue that the limited time we had mainly caused these differences. As we will discuss in our limitations and our recommendations for further research, we argue that more group model building sessions should be conducted in order to properly expand and finish the stakeholder model.

The most notable differences between the theoretical model and the stakeholder model with regards to variables are the following: Ex ante investments, Risk of failure, environmental uncertainty, innovation uncertainty and opportunity for learning. These variables are not present in the stakeholder model, but we argue that it is a good idea to have future sessions test their relevance to the stakeholder model.

6.2. Limitations

6.2.1. No ‘real’ stakeholders

This research did not use the actual stakeholders within the Nijmegen MaaS pilot because it was deemed infeasible due to practical issues. Only one stakeholder was able to participate in the session. The rest of the stakeholders were experts in the field of transportation. In the next paragraph we will discuss why this research still has high value, despite of this.

6.2.2. More sessions were needed

The stakeholder model that is presented in this research is the result of merely one group model building session. Although we think that this is an above-average result for a single session, we acknowledge that multiple sessions are needed in order to have a model that fully captures the complexity of a collaboration within a MaaS business ecosystem. However, in the absence of 'real' stakeholders, multiple sessions would not have a lot of marginal benefit, as we will discuss in the next paragraph.

6.2.3. Documentation of the literature review

As we acknowledged in the method section, the literature review lacks proper documentation. With this we mean that the actual research process could have been more extensively documented. We have tried to make up for this by describing our research process as accurately as we could. We have shown in the method section that we used a snowballing procedure, and that we used Das & Teng (2000) as a starting paper. We argue that because we extensively documented the results from our literature review, we have more than compensated for the lack of documentation of the research process itself. Every variable and every relation in our theoretical model can be traced back to a paper, and every theoretical perspective has been elaborated on in the literature review in Appendix 8.2.

6.2.4. This research only focusses on the supply side

This research focusses on the supply side of the MaaS business ecosystem, but we argue that the exact same setup could have been used to investigate stakeholder acceptance of consumers. This would have been a large contribution to the quality of the research, and it would have given an opportunity to compare stakeholder models between the supply and the demand side, in addition to a comparison between theory and practice. A lack of research into the demand side of the platform has made this research more incomplete than it had needed to be.

6.3. Strengths

6.3.1. Extensive documentation of results and method leads to openness and high ease of replication

Both the group model building results and the results from the literature review have been properly accounted for in the Appendix. We deem this to be a strength of this research, as it improves the trustworthiness of the results. Each alteration that was done to the stakeholder model post-session has been accounted for, and the construction of every model can be found

in the Appendix, where the reader finds step-by-step guides. This allows the reader to fully understand the logic behind the models. We think that both the documentation of the results, the alterations of 'raw' results, and the model reading guides open this research up to scrutiny to a great degree.

In addition, we think that the extensive documentation of the results, combined with the documentation of the method section allows for high reproducibility of this research. We argue that this research can easily be taken over by other researchers in order to research stakeholder acceptance with real stakeholders in another city. The added value of this research, we argue, therefore mainly comes from it being a manual for further research.

6.3.2. Research covers both theory and practice, and is the first to combine causal modelling and alliance theory

Another strength of this research is that it combines theory and practice, making the research extensive. It would have sufficed to conduct group model building sessions, derive results and conclusions, and leave it at that. This research conducted an additional literature review, allowing for an additional comparison of theory and practice in the discussion. We take pride in the extensiveness of the literature review relative to the time frame this research had to be conducted in. In addition – and we say this to the best of our knowledge – this research is the first paper to combine system dynamics causal modelling and alliance theory to derive a qualitative collaboration model. Expansion of the literature review could perhaps result in a whole research paper on its own. To the best of our knowledge, there are no collaboration models that employ this methodology, and there are no collaboration models that depict circular causality like our theoretical model does. We identify this as a knowledge gap, as circular causality dynamics are likely to be present in many collaborations.

6.4. Recommendations for further research

6.4.1. Replication of this study in other cities

This research can be seen as a manual for conducting similar studies in other cities. We deem the ease of replication high and think that it is possible to conduct similar studies in other cities in a relatively short period, and with little work. When sessions with stakeholders are conducted in other cities, and multiple stakeholders have been derived, meta-analysis can be performed. It may be possible to identify a generic model structure using meta-analysis. This generic structure can be used to derive policies on a larger scale, perhaps on the national level.

6.4.2. Quantification of the stakeholder model

In addition, we think that a possible next step in this field of research may be the quantification of the qualitative models, which enables simulation. A quantified simulation model may give a better focus on which variables are significantly sensitive within the model, and simulation enables policy makers to engage in scenario planning and simulate 'what-if' scenarios. We think a quantified system dynamics model would be a great contribution.

6.4.3. Adding a game theoretical approach

Next to a system dynamics approach, we think that a game theoretical approach would also be a suitable method for constructing a collaboration model as covered in the literature review, since game theoretical models are generally appropriate to approach multi-party problems. We believe this strongly correlates with the perceived risk of opportunism. If further research indicates that opportunism is a large factor in the collaboration of MaaS, we would suggest that game theoretical models – which take a rational actor approach to decision making – would be very much applicable to the new situation.

7.0. References

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8.0. Appendix

8.1. Appendix 8.1: Group Model Building: What is it, and why do we use it?

This chapter will cover the methods used in this research. As stated in the introduction, group model building was used in order to uncover the mental models of stakeholders with regard to their acceptance of MaaS. In the first paragraph, group model building itself is explained; what is group model building, why did we use it, and what type of group model building did we use. In the second paragraph, the general approach to our group model building sessions will be explained. In the third paragraph, we explain our population sample. In the fourth paragraph, we elaborate on the project – or research – team, the used location and the equipment used. Lastly, in paragraph 5, we present the agenda used for our group model building session.

8.1.1.1. Group model building within the system dynamics methodology

Group Model Building is a participatory stakeholder method, developed by Vennix (1996). It uses system dynamics as underlying methodology, a methodology developed by Jay. W. Forrester in the 1950's. Since its inception, system dynamics has been applied in a variety of fields, including supply chain and inventory management, health care, energy and corporate policy studies (Vennix, 1996). System dynamics studies social systems as closed loop information feedback systems (Vennix, 1996; Forrester, 1975). The most important theoretical component of the system dynamics methodology is the underlying assumption that structure drives behaviour. The behaviour of a system is driven by the interplay between elements within the system, and is thus determined by the characteristics of the whole system, and not its individual parts (Forrester, 1958; Richardson & Pugh, 1981). System dynamics models aim at identifying the dynamic structure underlying the system's behaviour (Vennix, 1996). Within this dynamic structure, feedback loops are the basic system component (Forrester, 1975). Feedback is a process in which action and information in turn affect each other. Feedback is intimately linked with the concepts of interdependence and circular causality (Vennix, 1996).

Group model building builds on the system dynamics method. It is a method used to model complex, dynamic problems together with a stakeholder group and can be a useful method for the elicitation and integration of mental models (Forrester, 1961; Sterman, 1994) of stakeholders into a single holistic view of the problem (Vennix, 1996). Group model building has several benefits compared to other methods, which we'll discuss in the next paragraph.

8.1.1.2. Benefits of group model building

The benefits of group model building arise from the use of groups, a facilitator and the system dynamics methodology. These benefits will be discussed in this subparagraph, in no particular order.

A facilitated approach like group model building is useful, as people generally lack the expertise to recognize complex causal structures and tend to disregard interconnections between elements in a system. (Dörner, 1980; Vennix, 1996). Combining perspectives with the help of a facilitator, as is done in group model building, leads to awareness of these causal structures, and can significantly alter people's perception of the problem (Vennix, 1996). The model building process can be seen as a form of problem structuring, helping to create a more adequate problem description by eliciting and integrating hidden causal assumptions. These hidden causal assumptions are present in all our mental models, as humans in general have a strong tendency to think in terms of causal processes (Weiner, 1985; Shoham, 1990). The main problem is that our cognitive abilities are bounded, and thus humans tend to think in simple causal chains (Vennix, 1996), while in reality, the observed causal structure may be more complex. This is closely related to the concept of bounded rationality (Simon, 1948; 1985). Bounded rationality states that there are cognitive limits in each of us that influence the way we make decisions. The concept of bounded rationality is characterized by premature decision making, as searching for information is terminated when a satisfactory solution is found. A facilitator partially solves this problem, preventing premature consensus in a group, and encouraging the group to think critically when marching ahead in unison (Philips & Philips, 1993). This is one of the reasons why a group's mental model may be more elaborate than the mental model of an individual.

In addition, our individual mental models are heavily subjected to our own reference systems (Ulrich, 2003) and are subject to our selective memories (Kahneman, Slovic, and Tversky, 1982). This leads to people maintaining very different mental models of the same situation (Vennix, 1996), some of them biased. Closely related to this is the notion of heuristics. Due to our bounded rationality, people tend to use heuristics to approach problems. An example of this is the availability heuristic (Kahnemann, Slovic, and Tversky, 1982; Hogarth, 1987), in which people estimate the probability of an event occurring by the ease of which they can recall similar events (e.g. one may think heart attacks are more common than they actually are when

someone close has experienced one). These heuristics may lead to biases in our mental models. Combining mental models through the use of groups is argued to reduce bias in groups (Vennix, 1996). Additionally, using a facilitator helps to reduce bias as well (Philips & Philips, 1993). An effective facilitator thus tries to reap the benefits of a group, while overcoming dysfunctional group dynamics, such as free-riding, production blocking and cognitive inertia (Franco & Montibeller, 2010). A facilitator achieves this by encouraging critical thinking (Philips & Philips, 1993) and full participation, by promoting mutual understanding and fostering inclusive solutions, and by cultivating shared responsibility (Franco & Montibeller, 2010). We conclude that a facilitated group approach to mapping mental models is a preferred approach, as using groups and a facilitator has several benefits, one of them being the reduction of bias. Specifically, group model building is preferred, because it is deemed a useful method for the elicitation and integration of mental models (Forrester, 1961; Sterman, 1994)

We will now go into the goals of group model building, as defined by Vennix (1996) and use the guidelines for group model building to determine whether group model building is an appropriate method for this research.

8.1.1.3. The goals of group model building, and when to use group model building

According to Vennix (1996), the main goals of group model building are:

1. Creating a climate for team learning in order to enhance understanding of the problem;
2. To foster consensus;
3. Acceptance of and commitment to the decisions that result from the model building process.

We argue that these goals apply to our research. In order to reduce the uncertainty regarding stakeholder acceptance of the implementation of MaaS, we needed an understanding of the 'problem'. The problem in this case was the eliciting of stakeholder preferences and converting these into a model. The group model building sessions were intended to foster consensus between stakeholder groups. The recommendations that resulted from the group model building sessions were expected to serve as a foundation for fruitful collaboration between firms in the MaaS business ecosystem. Unfortunately, it turned out that in practice it was very difficult to ensure participation of all relevant stakeholders, and thus experts in the field engaged in role-playing. The implications this has for our research are covered in the discussion.

Now that we have confirmed that the goals of group model building match the goals of our research, we are more certain that group model building will be a suitable method. Additionally, Vennix (1996) gives guidelines on when to use group model building. There are two main components when deciding on system dynamics as an appropriate methodology:

4. The problem needs to be dynamically complex, due to potential underlying feedback processes.
5. One looks for a robust long-term solution, as system dynamics commonly addressed long-term problems.

We found in Chapter 1 that there may be feedback effects involved in the implementation of MaaS, due to network effects. One can expect that when more people start using MaaS, the flexibility of MaaS will increase, as more different modes will start to become available. This in turn increases the attractiveness of MaaS, as was illustrated by Sochor, Strömberg & Karlsson (2015). Van Lierop & El-Geneidy (2018) also found similar network effects, in the form of word-of-mouth. This gives ample reason to suspect there may be underlying feedback processes at work. With regards to complexity; we confirmed in chapter 2 that the implementation of MaaS is a problem characterized by 'deep uncertainty', making it a complex problem. MaaS is implicitly a long-term 'problem' – or rather a long-term challenge – as it is a sociotechnological, new phenomenon which will develop over the coming years. Thus, we can conclude that the problem is both dynamically complex, and long term, and that the goals of group model building fit the goals of our research.

Now that we have determined that group model building is a suitable method for approaching stakeholder acceptance regarding the implementation of MaaS, we need to further specify whether our group model building intervention will be of a quantitative or qualitative nature.

8.1.1.4. Quantitative versus qualitative modelling, and the case for causal loop diagrams

The main difference between quantitative and qualitative modelling lies in the capability of simulation. Quite a few system dynamicists argue against qualitative modelling, as it may lead to erroneous conclusions about dynamic behaviour (Vennix, 1996). The argument is that one

cannot draw conclusions from qualitative models because humans are very poor predictors of dynamic behaviour. We agree with these statements. However, qualitative system dynamics may also simply refer to problem identification and system conceptualization (Vennix, 1996), for which it is a suitable method. Problem identification and system conceptualization are the first two stages of the seven stages in a system dynamics model building process (Richardson & Pugh, 1981). The remaining five stages are reserved for quantitative system dynamics and includes quantitative techniques, like sensitivity analysis. However, if the goal is limited to problem identification and system conceptualization -as it is in our research - qualitative system dynamics is considered good practice, and it is often used to construct a preliminary model in the seven-stage process. As our research is mainly focused on problem structuring – and thus the first two stages -, we conclude that qualitative system dynamics is a suitable approach to our research. This is in line with Camacho *et al.,* (2016), who advise to use qualitative approaches for user-centric innovations, like MaaS.

Causal loop diagramming (Vennix, 1996; Sterman, 2000) is the modelling form used in group model building when using qualitative system dynamics. A causal loop diagram is a reflection of the stakeholder group's input during the session, and constitutes a powerful way to express causal statements, and to identify feedback processes (Vennix, 1996). They help to provide a deeper understanding of (complex) cause-and-effect relationships and reflect the view of its constructor (Jittrapirom *et al.*, 2017), which would be the stakeholder group. Causal loop diagrams enable a social construction of a shared reality for group members (Franco & Rouwette, 2011) and may therefore function as 'transitional' objects (Eden, 1993; De Geus, 1988) or 'boundary' objects (Scott, Cavana & Cameron, 2016). King & Kraemer (1993) too state that models are a way of defining common ground. Because causal loop diagrams visualize information in a single object, they help to keep track of complex structures (Larkin and Simon, 1987; Lippit, 1983; Anderson, 1980). In addition, the process of constructing causal loop diagrams is helpful to surface and test causal assumptions, as constructing a causal loop diagram forces the group to ask and answer 'why' questions. Done correctly, a causal loop diagram is a formalisation of the group's mental image and can be used to communicate in a way that written language cannot (Wolstenholme, 1982).

The causal relationships in a causal loop diagram are depicted using arrows. The arrow shows the relationship, the direction of this relationship (A to B) and the polarity of the relationship (positive or negative). A positive causal relationship is present when two variables change in

the same direction. A negative causal relationship occurs when two variables change in opposite direction. We illustrate this, using the example from Vennix (1996, p.52):

"The statement that more cars will lead to more air pollution can be represented as in the upper part of Figure 8.1.1. The upper part of the diagram can be read as follows: the higher the number of cars, the higher the amount of air pollution. Or alternatively, the lower the number of cars, the lower the amount of air pollution. A negative relationship, on the other hand, implies that both variables change in opposite directions. An example is shown in the lower half of figure 10. It can be read as: the higher the number of cars, the lower the number of travellers by train. Or as: the lower the number of cars, the higher the number of travellers by train. The polarity of the relationship (+ or -) is solely determined by the relationship between the two variables and does *not* depend on the fact whether the effect variables actually increases or decreases (Vennix, 1996, p. 52).

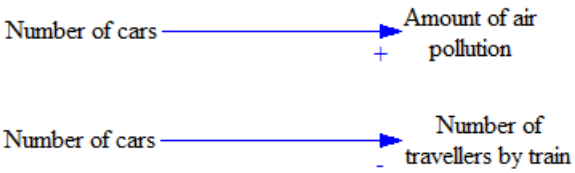


Figure 8.1.1.: Example of negative and positive relationship (Vennix, 1996)

With respect to feedback loops (recall that in the introduction we discussed feedback loops as being the main component of the system dynamics methodology), we distinguish two main types: reinforcing (positive) and balancing (negative) feedback loops. We've constructed two examples (see Figure 8.1.2. & 8.1.3.) below.

In the first example, Figure 8.1.2., we see that higher wages lead to higher production cost, causing the prices of products to rise. Because products have become more expensive, the need for higher wages increases. This in turn leads to higher wages, completing the loop. These types of feedback loops are called positive feedback loops, or reinforcing feedback loops, due to their reinforcing character.

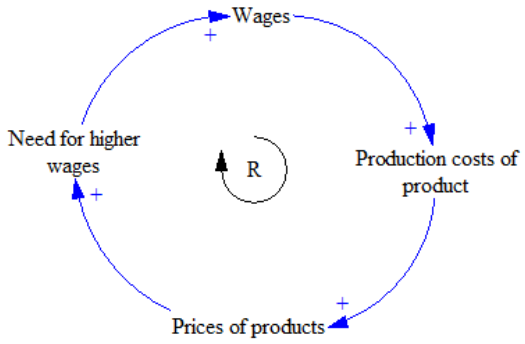


Figure 8.1.2.: Example of reinforcing feedback

In the second example, Figure 8.1.3., we see a standard supply demand equilibrium. We see that higher prices lead to less demand. Less demand then leads to lower prices, causing demand to go up again. These loops 'balance' towards a certain equilibrium (in this case, the well-known supply-demand equilibrium), hence their name: balancing loop. These loops are sometimes also referred to as negative feedback loops.

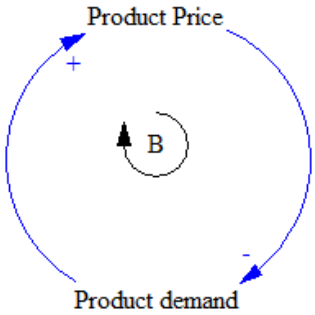


Figure 8.1.3.: Example of balancing feedback

8.1.2. Rationale behind participant selection

Vennix (1996) provides guidelines on who to include in the modelling process. These guidelines will be covered stepwise, relating our project to each guideline:

1. Select participants who have power to act, if the goal is to make a decision. Thus, we will aim to include those stakeholders who have the power to act.
2. Do not exclude persons from the process in order to keep the group small. Rather one person too many, than one too few. This guideline does not apply to our research, as finding enough participants is in itself a bottleneck.
3. Discussion in freely interacting groups may be dominated by strong personalities or high-status persons (Fox, 1987). In addition, the larger the group, the larger the tendency for a few persons to dominate the discussion (Bales *et al.*, 1951; Stephan, 1952). Satisfaction with the process decreases in large groups (Thomas and Fink, 1963). A group of five seems to be optimal for group satisfaction (Slater, 1958; Thomas and Fink, 1963). Given this information, we aim to have a group of around five people.
4. It is advised by experienced model builders to select a diverse group in terms of viewpoints (Forrester, 1980; Morecroft & Sterman, 1994; Philips, 1984). This applies to both groups but may be difficult to realize. We do not know beforehand if viewpoints are diverse. However, because participants are from different organizations, we expect there to be enough room for discussion.
5. In addition to the heterogeneity argument made above, it is clear from research (Exline and Ziller, 1959) that status incongruity within groups increases interpersonal conflict and subsequently decreases group performance. Therefore, if possible, it is preferred

that participants are relatively close to each other in terms of the formal organization hierarchy.

Thus, we will organize a session with preferably five participants. Representatives from Nationale Spoorwegen, Arriva, Breng/Connexxion/Hermes and GoAbout will be present. Diversity in viewpoints without status incongruency is preferred. However, this might proof to be difficult to achieve in practice.

8.1.3. Explanation on the use of workbooks & the workbook/informational document

Vennix (1996) advises to use workbooks to prepare meetings when participants have little time available. We used an informational document to explain the goal of the research to participants, as well as a brief introduction into the basic of causal loop diagramming. The informational document can be found in the next paragraph. The list with variables in the informational document was not used in the end. The informational document is in Dutch, as the participants were also Dutch. In the sessions, the information from the document was repeated and it was checked whether all participants understood the method. We used Nominal Group Technique (NGT, an explanation of this technique can be found in Hovmand *et al.*, 2011) to start the process, in combination with the variable list from the literature review. These formal brainstorming techniques in nominal groups have been found to be superior to free interacting groups (Bouchard, 1969, 1972). Quantity and diversity of ideas also tend to be larger in nominal groups (Vennix *et al.*, 1992) After NGT, we conducted a sequence of different steps, as will be elaborated in the agenda in the following paragraph. Scripts were used for these steps as well. We chose to use scripts because they are a way of standardizing the facilitation process, increasing the reproducibility of the research (Hovmand *et al.*, 2011). Because resources are limited, we did not do any preliminary interviews, but restricted ourselves to a literature review. In addition, the trial session with role-playing actors in order ensured a smooth process. Flaws in the preparation were identified before the actual session took place, one them being the beforementioned complex preliminary model. This reduced the chance of invalid data due to unforeseen circumstances which could have been prevented. Lastly, it is advised by Vennix to restrict the project to a qualitative model in case of limited resources. This fitted well with the scope of our research, which is of a qualitative nature.

Informatiedocument group model building 'Slim Heijendaal'

Om een efficiënt verloop van de sessie te waarborgen is een goede voorbereiding van deelnemers wenselijk. In dit document vindt de lezer een toelichting van de methode Group Model Building en een agenda voor de group model building sessie. In de introductie van de sessie zullen belangrijke punten nogmaals herhaald worden. Vragen over de inhoud van dit document en/of andere vragen met betrekking tot de group model building sessie kunnen gecommuniceerd worden naar j.remmerswaal@student.ru.nl

Dit document fungeert als eerste kennismaking met de methode. Basisprincipes zullen altijd aan het begin van de workshop nogmaals uitgelegd worden indien dit gewenst is.

Bedankt voor uw deelname,

H. Meurs (Radboud Universiteit)

V. Marchau (Radboud Universiteit)

J. Remmerswaal (Radboud Universiteit)

De methode Group Model Building

Group model building (GMB) is een ‘participatory stakeholder method’ en poogt de percepties van verschillende stakeholders van een probleem te integreren in een model. Een model bestaat uit een verzameling van variabelen en relaties tussen die variabelen. Het model wordt gebouwd door de deelnemers zelf, met behulp van een facilitator. De methode kan worden gezien als een vorm van gestructureerd brainstormen. Ons doel is de belangen en doelen van elke partij in kaart te brengen en te kijken in hoeverre er overeenkomsten zijn tussen de partijen. Een korte uitleg over variabelen en relaties vindt men op pagina 4.

GMB heeft o.a. de volgende voordelen t.o.v. reguliere kwalitatieve onderzoeksmethoden (zoals diepte-interviews, brainstormsessies en focusgroepen):

- GMB biedt deelnemers de mogelijkheid met elkaar in dialoog te treden, verschillende visies te combineren en zo tot een gedeeld beeld van kansen en uitdagingen te komen. De methode creëert daarmee consensus binnen een stakeholder groep.
- Doordat GMB gebruik maakt van groepen is de informatie vaak gedetailleerder t.o.v. diepte-interviews. Zes mensen weten immers meer dan een;
- Het gebruik van een facilitator stimuleert kritisch denken en reflectie;
- Het gebruik van een facilitator zorgt voor structuur in brainstormsessies en voorkomt eenzijdige input van enkele dominante deelnemers in brainstormsessies;
- GMB heeft een concreet product: het model, gemaakt door de deelnemers. Deze kan door de deelnemers in hun eigen organisatie gebruikt worden als communicatiemiddel.

Deelnemers zijn over het algemeen zeer positief over het proces en de uitkomsten.

Agenda

In de group model building sessie voor Slim Heijendaal zal er gewerkt worden aan een causaal kwalitatief model waarin de voorkeuren van de stakeholders zijn opgenomen.

Voor elke stakeholder geeft dit de mogelijkheid om na te gaan “what’s in it for me?” en tevens biedt het de mogelijkheid om te kijken of samenwerking voordelen biedt die individuele bedrijven niet kunnen realiseren.

Het verloop van de sessie kan men hieronder in de tabel vinden:

Time slot	**Activity**	**Product / Doel**
10:30-11:00	• Introductie, naamkaartjes maken, uitleg van de agenda (10 minuten) • Achtergrondinformatie over het onderzoek en uitleg over system dynamics (10 minuten) • Beantwoorden van vragen over de methode (5 minuten) • Uitleg variabelen lijst (5 minutes)	Iedereen is op de hoogte van het onderzoek en begrijpt de methode die we gaan gebruiken
11:00-11:45	• Discussie variabelen lijst (20 minuten) • Gezamenlijk het model bouwen	Consensus over definities van variabelen
11:45-12:00	• Pauze (15 minuten)	
12:00-13:00	• Gezamenlijk het model bouwen (60 minuten)	Causaal model waarin relaties in kaart gebracht worden
13:00-13:15	• Pauze (15 minuten)	
13:15-14:30	• Identificeren van feedback loops en verder bouwen model (60 minuten) • Afsluiting sessie (15 minuten)	Een kwalitatief model waarin de voorkeuren van de stakeholders en de redenen om wel/niet samen te werken zijn vastgelegd

Korte uitleg positieve/negatieve relaties

Het doel van de workshops is om een kwalitatief causaal (oorzaak-gevolg) model te ontwikkelen waarin de voorkeuren van de stakeholders zijn vastgelegd. Een model bestaat daarbij uit variabelen en relaties. Causale relaties woorden weergegeven met behulp van pijlen. De pijlen laten een positieve (+) dan wel een negatieve (-) relatie zien. Een positieve relatie houdt daarbij in dat de variabelen elkaar in dezelfde richting beïnvloeden. Er is sprake van een negatieve relatie wanneer de variabelen elkaar in tegengestelde richting beïnvloeden. We illustreren dit met een voorbeeld:

In Figuur 8.1.4., hieronder zien we een voorbeeld van beide relaties. De uitspraak “meer auto’s leidt tot meer vervuiling” is een voorbeeld van een positieve (+) relatie. Let op! Dit betekent ook automatisch het tegenovergestelde: minder auto’s leidt tot minder vervuiling. De relatie is nu nog steeds positief; beide variabelen bewegen in dezelfde richting, of dit nou omhoog, of omlaag is.

De onderste pijl geeft een negatieve (-) relatie weer: “meer auto’s leidt tot minder mensen die de trein gebruiken”. Hier bewegen de variabelen in tegengestelde richting: het aantal auto’s gaat omhoog, terwijl het aantal treinreizigers omlaaggaat.

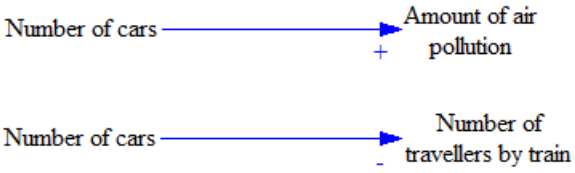


Figure 8.1.4. Voorbeeld positieve en negatieve relaties

Dit soort verbanden kunnen ook een circulair verband vormen: we spreken dan over een feedback loop. Deze verbanden kunnen ook positief (zelfversterkend) of negatief (balancerend) zijn. We geven hier twee voorbeelden die de lezer zelfstandig kan bestuderen. De uitleg van dit soort verbanden zal in de workshop uitgebreid aan bod komen.

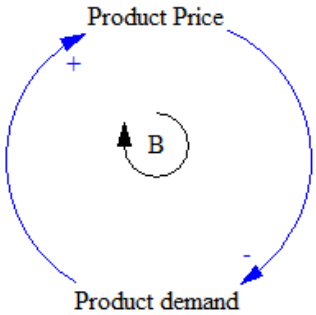


Figure 8.1.5. Voorbeeld balancing feedback loop

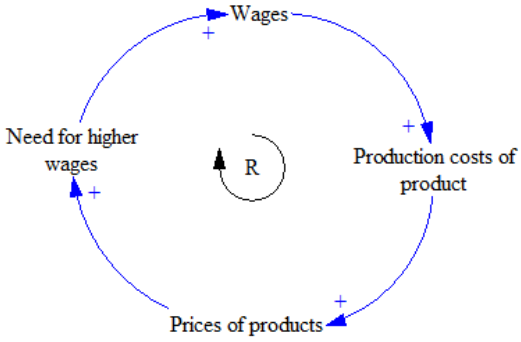


Figure 8.1.6. Voorbeeld reinforcing feedback loop

Startvariabelen

Vanuit de theorie over strategische allianties worden diverse voor- en tegenargumenten gegeven voor samenwerking. Hieronder volgt een lijst van variabelen met definities. Deze lijst zal gebruikt worden als eerste input voor het model. Dit zijn definities zoals gevonden in de literatuur. Het kan dus zo zijn dat partijen een hele andere invulling aan dezelfde begrippen willen geven. Dit mag en wordt zelfs aangemoedigd. De lijst is puur bedoeld om een discussie op te starten en een eerste handvat te bieden voor het bouwen van een kwalitatief model. Het toevoegen en veranderen van variabelen is toegestaan en wordt juist aangemoedigd.

Variabele	**Definitie**
Wens om geografisch nieuwe gebieden te betreden	Marktuitbreiding in geografische zin. Bijvoorbeeld een deelfiets bedrijf dat in regio A actief is, maar ook graag in regio B actief wilt worden.
Nieuwe reizigers	Het aantal nieuwe mensen dat gebruik maakt van MaaS.
Toegevoegde waarde reizigers	De toegevoegde waarde die MaaS biedt voor reizigers
(verwachte) winst	De winst die MaaS oplevert voor de individuele partijen
Stabiliteit samenwerking	In hoeverre de samenwerking stabiel blijft over tijd en niet onverwachts ontbonden kan worden (bijvoorbeeld door het niet nakomen van afspraken).
Transactie kosten	Alle kosten die gemaakt moeten worden om een transactie (verkoop) tot stand te brengen bovenop de prijs van het product. Denk hierbij aan verkoopkosten, promotiekosten, tijdskosten, etc.
Heterogeniteit middelen	In hoeverre elkaars middelen/resources moeilijk zijn om te kopiëren. Aardappels zijn homogeen, maar kennis binnen een bedrijf is zeer heterogeen.
Onzekerheid met betrekking tot innovatie	Een MaaS systeem implementeren is wellicht omhuld in onzekerheid: gaat het lukken om alle systemen werkend te krijgen? Dit type onzekerheid heeft vooral betrekking op de technische aspecten van innovatie.
Investeringen vooraf	Investeringen die voorafgaande aan de samenwerking nodig zijn om implementatie mogelijk te maken.
Verwacht opportunisme	In hoeverre er verwacht wordt dat andere deelnemende partijen hun individuele belang boven dat van het collectieve belang van de samenwerking plaatsen.
Verenigbaarheid van doelen	In hoeverre de doelen van deelnemende partijen op één lijn zitten.
Complementariteit middelen	In hoeverre de ingebrachte middelen in een samenwerking elkaar aanvullen. Het tegenovergestelde is overlappende middelen (twee bikesharing companies die fietsen

	inbrengen hebben op het gebied van fietsen weinig complementariteit).
Operationele efficiency	De efficiëntie van de operaties (als gevolg van de nieuwe samenwerking). Denk aan lagere kosten als gevolg van een betere dekkingsgraad (of juist andersom).
Concurrentievoordeel alliantie	In hoeverre de alliantie een uniek concurrentievoordeel biedt
Onzekerheid over de externe omgeving	In hoeverre er onzekerheid is over contextuele gebeurtenissen waar men geen invloed op heeft. Wat als contextueel wordt beschouwd kan per stakeholder verschillen. Een voorbeeld is de ontwikkeling van zelfrijdende auto's. Hier heeft een individueel taxibedrijf geen invloed op, maar de ontwikkeling is mogelijk wel van grote invloed op het taxibedrijf.

8.2. Appendix 8.2: Literature review strategic alliances

8.2.1. Literature review: Strategic Alliances

Interorganizational collaboration may serve as a way to cope with turbulent and complex environments (Gray & Wood, 1991; Olliver, 1990; Hagedoorn, 1993). From our introductory literature review, we conclude that MaaS must be considered a business ecosystem (Kamargianni & Matyas, 2017) and that implementing a MaaS scheme can be seen as a problem characterized by high uncertainty on different dimensions, making it a so-called 'wicked' or 'messy' problem (Head & Alford, 2013). Complex situations favour the forming of strategic alliances (Gray & Wood, 1991) and the reduction and sharing of uncertainty is suggested to be a major motive for companies to combine their efforts (Hagedoorn, 1993). We find that terms such as collaborative alliances, interorganizational relationships, and strategic alliances are used interchangeably in the literature (Forrest, 1990). We prefer to use the term strategic alliance where possible, but refrain from paraphrasing other author's written texts. One important distinction that we make is that strategic alliances do not include situations involving full ownership of one party by another, such as in a complete merger (Forrest, 1990; Das & Teng, 2000).

Our literature review attempts to answer the following questions:

7. *What should the mental model of stakeholder acceptance regarding MaaS look like, according to the strategic alliance literature?*
    - *What is a strategic alliance?*
    - *What different perspectives are there with regard to strategic alliances, and which one is suited to approach the implementation of MaaS?*

Given the answers to the last two questions, a conceptual general model of collaboration (GMC) can be built. In order to do this, we integrate all theoretical perspectives into a general model The GMC functions as a new, integrated theoretical framework. From the GMC we derive a model specifically for MaaS, in which the appropriate theoretical perspective is dominant.

We recognize that this literature review is relatively incomplete. The literature on strategic alliances is comprehensive, spanning a large array of different theoretical perspectives. Due to time constraints, it was deemed beyond the scope of a master thesis to integrate all relevant existing theory. However, we argue that our literature review is comprehensive enough for our purposes.

8.2.1.1. What is a strategic alliance?

Multiple definitions of collaborative alliances exist in the literature, mainly due to the highly fragmented nature of the strategic alliance literature (Oliver, 1990). Below, we provide a table (Table 8.2.1.) with several definitions of strategic alliances. We do not claim this table to be exhaustive and recognize that past literature has brought many more definitions.

Table 8.2.1. Definitions of strategic alliances

Author	Definition	Term
Gray & Wood (1991)	An interorganizational effort to address problems too complex and too protracted to be resolved by unilateral organization action	Collaborative alliance
Das & Teng (2000)	A voluntary, interfirm agreement, designed to achieve a joint competitive advantage	Strategic alliance
Oliver (1990)	The relatively enduring transactions, flows, and linkages that occur among or between an organization and one or more organizations in its environment	Interorganizational relationships (IOR)
Devlin & Bleackley (1988)	Strategic alliances are specifically concerned with securing, maintaining or enhancing a company's competitive advantage. Strategic alliances take lace in the context of a company's long-term strategic plan and seek to improve or dramatically change a company's competitive position.	Strategic alliance
Mohr & Spekman (1994)	Partnerships are defined as purposive strategic relationships between independent firms who share compatible goals, strive for mutual benefit, and acknowledge a high level of mutual interdependence. They join efforts to achieve goals that each firm, acting alone, could not attain easily.	Partnerships / Strategic relationships
Gulati (1995)	A variety of agreements whereby two or more firms agree to pool their resources to pursue specific market opportunities	Interfirm strategic alliances
Hagedoorn (1993)	Those interfirm cooperative agreements which are aimed at improving the long-term perspective of the product market combinations of the companies involved	Strategic technology alliances
Parkhe (1993)	Strategic alliances are voluntary interfirm cooperative agreements, often characterized by inherent stability arising from uncertainty regarding a partner's future behaviour and the absence of a higher authority to ensure compliance.	Strategic alliances

We favour a broad definition, suitable to the implementation of MaaS. We see that the combination of resources, synergy, and a need for collaboration in the face of complexity are elements that are present in most definitions. We decide to combine the definitions of Das & Teng (2000) and Gray & Wood (1991). We define a strategic alliance as 'a voluntary, interfirm agreement, designed to address problems that are too complex to solve with unilateral organizational action, and to achieve competitive advantage'.

8.2.1.2. What different perspectives are there with regard to strategic alliances, and which one is suited to approach the implementation of MaaS?

Different theoretical perspectives and models have been proposed to explain the forming of strategic alliances (Das & Teng, 2000). In this paragraph we cover several of these perspectives. The perspectives that we cover are the same that are mentioned in Das & Teng

(2000). We realized this list is not exhaustive and that it may give a one-sided view of theoretical perspectives. However, restricting the literature review here is a necessity in the face of time constraints. We cover seven different theoretical perspectives in total, which is arguably still quite a large dataset for our purposes. We close of this paragraph by making an argument for the resource-based view, which we think is most applicable to the MaaS business ecosystem. The theoretical perspectives that will be covered now are:

- Transaction costs economics;
- Game theory;
- The strategic behaviour model;
- The strategic decisionmaking model;
- Social exchange theory;
- Power-dependence theory;
- The resource-based view.

8.2.1.3. Transaction cost economics

The archetypical problem within the transaction costs economics perspective is the so-called 'make-or-buy' decision. This entails a decision for the firm: do we buy resources, or do we acquire the possibility to produce these resources by means of vertical integration. Central to the perspective is the preventing of opportunism through the use of pre-determined governance structures (Williamson, 1985). Here it differs from the neo-classical economic approach, in which firms are equivalated to production functions. In transaction costs economics, the firm is described as a governance structure. The unit of analysis in this perspective are the transaction costs. According to Williamson (1991 p. 552) "a transaction occurs when a good or service is transferred across a technologically separable interface". The total costs that are associated with these transactions – delays, production breakdown, time, etc – are what constitutes 'transaction costs'. Transaction costs theory dictates that if the transaction costs incurred by the market mechanism are higher than the costs of internalizing exchanges, hierarchical organisations will be created (Das & Teng, 1996a). From the transaction cost perspectives, firms should establish governance structures that minimize these transaction costs (Oliver, 1990). Strategic alliances thus serve as an effort to reduce transaction costs. In addition, transaction costs economics theory adopts the neoclassical economics of oligopoly, which means that the theory assumes that firms or partners act opportunistically. As opportunism is a major source of transaction costs, strategic alliances (mainly in the form of

equity alliances) are a means to reduce opportunism and thus transaction costs (Das & Teng, 1996a). However, as stated at the beginning of this paragraph: the archetypical problem of the transaction cost economics perspective is the make-or-buy decision. Transaction costs economics generally focusses on vertical relations (Hagedoorn, 1993) and thus may not be the appropriate focus to approach MaaS, as collaboration with the MaaS business ecosystem is arguably of a horizontal nature. We conclude that transaction costs economics mainly focuses on governance structures as a means to reduce transaction costs. Strategic (equity) alliances are a subset in this focus, existing mainly to reduce transaction costs that arise out of opportunism. Das & Teng (1996a: P. 829) argue against relying solely on the transaction costs economics perspective, stating that "transaction costs provide an inadequate explanation of alliances". Therefore, we argue that the transaction costs perspective may be more suitable to approach MaaS in the future when the stakeholder preferences and their relations have crystallized. We argue that it is too early to be discussing governance structures and transaction costs, as the business model itself has not yet been concretely defined.

8.2.2. Game theory

The game theoretic perspective focuses on behavioural uncertainty within strategic alliances. Acknowledging that alliances are formed because firms need each other to advance their individual interest, the game theoretic perspective focuses on opportunism, and how to prevent opportunism in strategic alliances ex ante (Parkhe, 1993). The ex ante structuring of alliances is therefore central to this perspective, and for this it takes elements from the transaction costs economics view.

The game theoretic perspective uses the well-known prisoner's dilemma to illustrate how there is an inherent instability in strategic alliances due to behavioural uncertainty. Because firms never know what the other firm's next move will be, it will theoretically be better for all firms in an alliance to be opportunistic and thus pursue their own interests. The question arises how to structure strategic alliances in such a way that continued, robust cooperation is possible. Axelrod and Keohane (1986) and Oye (1986) provide three structural dimensions that serve as an explanation, as well as a strategy, for cooperation:

1. The pattern of payoffs;
2. The 'shadow of the future' (Axelrod, 1984);
3. The number of players.

The pattern of payoffs – referring to the payoffs in a game matrix – influences if an alliance is formed or continued. A prerequisite for alliance formation is that the cooperating provides a

positive payoff. In addition, the payoff structure affects the forming and performance of a strategic alliance because the payoff structure determines whether cooperating is the best option compared to other options. The prisoner's dilemma is an example of a payoff structure in which opportunism, and not cooperation, is in the best interest of both firms. An environmental change may influence the payoff structure, making cooperation beneficial for both parties. Parkhe (1993) found the theoretically expected directionalities for an effect of the pattern of payoffs on alliance performance. However, this effect was not significant.

The shadow of the future (Axelrod, 1984) refers to the effect that occurs when future interactions may reward or punish each 'player'. In the case of strategic alliances, cooperation may lead to more cooperation in the future, while opportunism might lead to a form of punishment by the other firm. Other negative effects may be associated with opportunism, like a loss of reputation. In a single-play situation, these effects are not present. In the real world – and certainly with respect to strategic alliances – these single-play situations are rare. Hence, the shadow of the future entails that firms will look beyond the current pattern of payoffs and also take into account how their actions now might influence their future payoffs. According to Parkhe (1993), a longer shadow of the future promotes cooperative performance, stating that "mutually profitable, ongoing interdependence forms the very basis for assessing the shadow of the future; equivalently, a long shadows rests on sustained positive payoffs from mutual cooperation" (Parkhe, 1993: 800). Thus, the pattern of payoffs and the shadow of the future are implicitly intertwined.

The number of players – Parkhe (1993) unfortunately does not go beyond the standard two-player game which is common in game theory. He does not expand on his proposed dimension of the number of players, but one can image – especially from a game theoretical perspective – that adding players alters the game. From a mathematical perspective, more combinations arise when more players take part in the game. We argue that this influences each firm's optimal strategy. While Parkhe (1993) found significant effects for both the payoff structure and the shadow of the future on alliance performance, he did not include partner alliances with more than two firms and thus it was not investigated whether the number of players influences alliance performance.

In addition, Parke (1993) argues that alliance performance is mainly determined by the fulfilment of major strategic needs and a series of indirect performance indicators, such as net spillover effect and relative profitability. He argues for a series of mutual effects between the abovementioned performance and structure, as well as for an influence of ex ante deterrents (nonrecoverable investments), ex post deterrents (contractual safeguards), perception of

opportunistic behaviour and a firm's cooperative history. Parkhe (1993) formulates a series of hypothesis with an accompanying framework, which can be seen in Figure 8.2.1. All ten hypotheses were confirmed, with the exception of hypothesis 1. The hypotheses that were formulated by Parkhe (1993) are as follows:

1. The performance of a strategic alliance will be significantly related to the pattern of payoffs characterizing it.
2. The performance of a strategic alliance will be positively related to the length of the 'shadow of the future' that is cast.
3. The performance of a strategic alliance will be negatively related to the extent to which the parties perceive each other as behaving opportunistically.
4. The level of perception of opportunistic behaviour will be negatively related to the history of cooperation between the partners in a strategic alliance.
5. The extent of the perception of opportunistic behaviour and the level of contractual safeguards embedded in a strategic alliance will be positively related.
6. The level of commitment of nonrecoverable investments in a strategic alliance will be negatively related to the perception of opportunistic behaviour.
7. The commitment of nonrecoverable investments in a strategic alliance will be positively related to the length of time horizons.
8. The commitment of nonrecoverable investments in a strategic alliance will be positively related to performance.
9. The extent of payoffs from unilateral cooperation will be negatively related to the level of contractual safeguards embedded in a strategic alliance.
10. The extent of contractual safeguards in an alliance will be negatively related to the length of the 'shadow of the future' cast.

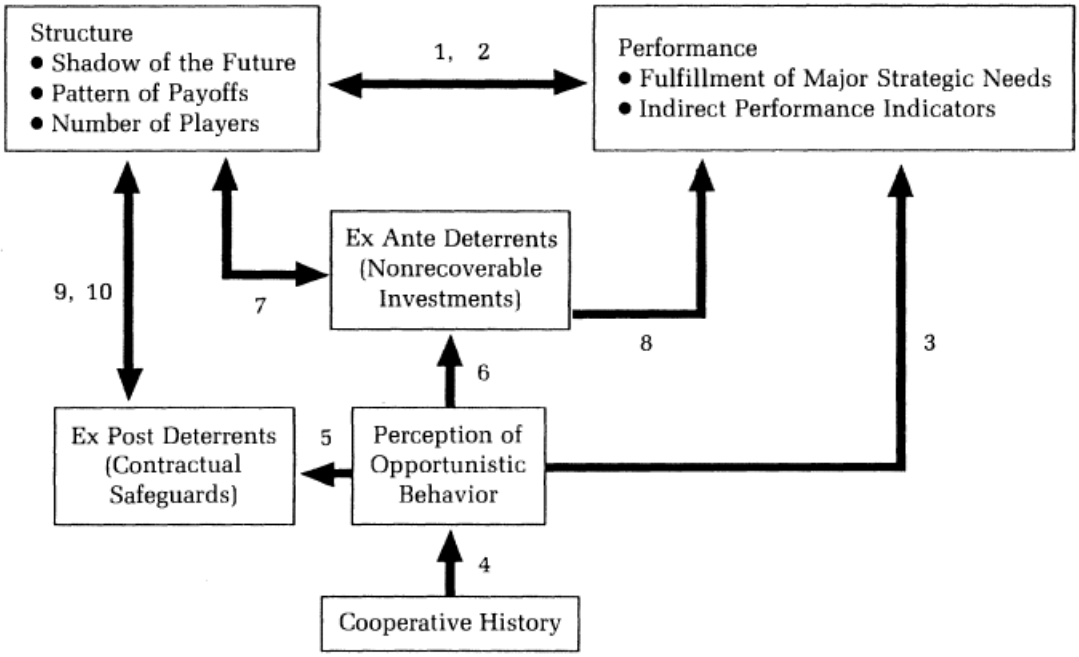


Figure 8.2.1.: Parkhe (1993) Series of hypotheses within framework

While we acknowledge that the above findings are derived from the study of alliances with two parties, we deem the statistical backing of the results powerful. The variables presented in the framework may serve as valuable input for our own preliminary model. We conclude that the game theoretical perspective is appropriate for approaching the implementation of MaaS. However, because we deem game theory to be incompatible with group model building, we will restrict ourselves to using the variables as found by Parkhe (1993). Constructing a complete game theoretical model for the MaaS business ecosystem is beyond the scope of this thesis. However, we argue that it may proof to be a valuable contribution in future research.

8.2.3. The strategic behaviour model

The strategic behaviour approach aims to answer why companies cooperate in their efforts to innovate. In contrast to, for example, the transaction cost economics approach, the strategic behaviour model surpasses the arena of vertical relationships of economic exchange and instead focusses on long-term, strategic, lateral relationships between firms. Whereas the economic rationale behind firm boundaries is mostly operational and focusses on cost minimizing through means of vertical integration, the strategic behaviour model emphasizes strategic (technology) partnering in the form of combined innovative activity (Hagedoorn, 1993). In this view, collaboration is centred around three major motives: motives related to research and technological development; motives related to concrete innovation processes and motives related to market access (Hagedoorn, 1993). These motives are further specified to

include – amongst others – the reduction, minimizing and sharing of uncertainty and costs in R&D, collaboration as a way to battle the complexity associated with intersectoral technology, and collaboration as a means to expand the product range and enter (geographically) new markets. We view MaaS as an innovative business ecosystem, which is different from innovation in the form of R&D. However, we deem many of the motives for collaboration as provided by the strategic behaviour model, which originally are centred around single technological developments, applicable to MaaS. Thus, the strategic behaviour model may provide valuable input for our theoretical framework of cooperation.

8.2.4. The strategic decisionmaking model

The strategic decisionmaking model was proposed as an alternative perspective to transaction costs economics of strategic alliances. It's main critique on the transaction cost theory perspective is that the economizing on transaction costs is just one of multiple elements that constitute the reasons for forming alliances. Das & Teng (1996a) state that transaction cost economics cannot give a rationale for a choice between governance structures of alliances because it does not recognize that there are governance costs associated with the controlling of opportunism. Das & Teng (1996a: P.828) state: "To be comprehensive, transaction costs economics should examine whether the sum of governance costs and transaction costs of internal organization exceeds that of market transaction".

Given the flaw of transaction cost economics, Das & Teng (1996a) develop an alternative perspective of interfirm alliances: an 'integrated risk perspective'. The perspective agrees with Parkhe (1993) that strategic alliances are inherently uncertain due to uncertainty regarding the future behaviour of the partners. This is caused by the partners in a strategic alliance to have only partially overlapping goals. From this base assumption, Das & Teng (1996a) propose two types of risk that need to be considered when entering into an alliance: relational risk and performance risk. Relational risk refers to the quality of the relationship between partners; will the cooperation go smoothly? Performance risks refers to the prospect of achieving the strategic goals of the alliance, given full compliance by all partners. An evaluation of both types of risks is a prerequisite for entering into an alliance. Das & Teng (1996a) couple both risks to uncertainty: performance risks can be coupled to uncertainty regarding future states, while relation risk can be coupled to uncertainty regarding whether the parties will be able to trust each other.

Relational conflict is coupled with opportunism in the strategic decisionmaking model, which is in line with transaction costs economics. A side note that is made by the strategic

decisionmaking model, is that risk perception is at play here, and thus two firms may have different perceptions of relation risk within the same alliance. Das & Teng (1996a) argue that this is related to one's proprietary know-how: the harder it is to protect the own technology and know-how, the higher the perceived relation risk will be. We note that the strategic decisionmaking model and game theory also employ a similar concept, although the strategic decisionmaking model does not separately name it. Das & Teng (1996a) state – within the notion of relational risk – that future unfair payoffs undermines confidence in cooperation, and thus perception of relation risk will be higher. We argue that this is very similar to the 'shadow of the future' effect (Axelrod, 1986), proposed by the game theoretic perspective. In addition, Das & Teng (1996a) state that (a sense of) inequity in a strategic alliance relates to the perceived relation risk. A distorted ratio of outcome to inputs gives rise to more perceived relation risk. This is true for either under-rewarded or over-rewarded firms.

Reducing perceived relation risk can be done by increasing trust among partners, say Das & Teng (1996a). This is in line with Axelrod (1984), who argues that concern about opportunistic behaviour is decreased by trust between firms, as trust increases certainty about the future. Das & Teng (1996a) propose that a record of previous alliances also mitigate perceived relational risk. Kogut (1989) makes an interesting extra support of this view, especially with regard to MaaS. He finds that on-going agreements between partners decrease the likelihood of alliance termination. MaaS, being a business ecosystem, can be seen as a system with multiple on-going agreements between different parties at the same time.

Perceived performance risk entails all kinds of risk, except that related to co-operation, that may lead to alliance failure. Performance risk refers to the risk that is inherent in the pursue of strategic objectives. Das & Teng (1996a) argue that interfirm alliances are a way to cope with risk. They propose that perceived performance risk is high in interfirm alliances with a shared R&D or international, cross-border component. In addition, a relation between non-recoverable investments (Parkhe, 1993) and perceived performance risk is made. When a firm is heavily invested, the potential loss associated with the failure of the alliance will become bigger, and thus perceived performance risk will be higher.

The strategic decisionmaking model relates perceived relation and performance risk to alliance structure. When performance risk is dominant, interfirm alliances are less likely to be equity-based. In contrast, when relational risk is dominant, interfirm alliances are more likely to be equity-based.

We conclude that the strategic decisionmaking model provides useful input for a preliminary model, mainly in the form of variables as relational and performance risk. However, as with

the game theoretic perspective, we restrict further use of the model. The strategic decisionmaking model is mainly concerned with the decision of alliance structure. As our research is focused on uncovering stakeholder preferences, we are more determined on finding out why stakeholders should collaborate, as opposed to how the alliance structure should look like. Therefore, we conclude that the strategic decisionmaking model is not suited to approach the implementation of MaaS in this stage.

8.2.5. Social exchange theory

The prisoner's dilemma provides the basis for the entire analysis in Axelrod's book (according to Axelrod himself). Hence, its basis is the game theoretical perspective. Das & Teng (2000) denote Axelrod's contribution as social exchange theory, but we find that covering it as a separate theory has low marginal contribution. The contributions made by Parkhe (1993) in this chapter are largely based on Axelrod's 'the evolution of cooperation' and thus separate discretion of social exchange theory seems superfluous.

8.2.6. Power-dependence theory

Power dependency theory implies that there is asymmetry in power relations, and that thus result in an asymmetric motivation between firms to interact (Schmidt & Kochan, 1977). Interorganizational relationships form as a result of power exertion, which means that for at least one party, the motivation to interact is externally generated. Asymmetrical power distributions, difference in goals, and conflict play a dominant role in the power dependency perspective. Schmidt & Kochan (1977) recognize that interorganizational relationships cannot be characterized by this perspective alone. Instead, interorganizational relationships constitute of mixed motives. Schmidt & Kochan (1977) formulate several hypotheses with respect to the power-dependence perspective of interorganizational relationships. These are:

1. In an asymmetrical situation – one organization perceives benefits from interacting and the other does not, the frequency of interaction will be greater than when neither organization perceives benefits and less than when both see benefits.
2. In an asymmetrical situation, the frequency of interaction between two organizations will be higher when the organization perceiving low benefits from interacting perceives the other organization as:
    a. Having goals that are compatible with its own organization
    b. Being important to the function of its own organization
    c. Having greater influence over its organization, and

d. Acting aggressively in pursuing its interests by using bargaining and conflict-oriented tactics of influence.

Hypotheses 1, 2a, 2b, and 2c were confirmed. We conclude that in asymmetrical power relations, interorganizational relationships are more likely to be formed when:

- There is benefit to at least one party, as opposed to no benefit for both parties;
- The goals between the dominating and dominated firm are compatible;
- The dominating firm is important to the function of the dominated firm;
- The dominating firm is perceived to have influence over the dominated firm.

With regards to MaaS, we deem the power-dependency perspective to be an ill-advised approach. Participation in the MaaS business ecosystem is voluntary and we deem it unlikely at this point in time that there will be individual parties that are able to coerce other parties into participating and contributing resources. However, the findings from resource-dependency theory might prove to be a useful contribution in the future when the MaaS business ecosystem has taken form and asymmetrical relationship are present within the ecosystem. At this point in time however, there is no reason to assume large power differentials that may create situations of coercion.

8.2.6.1. The resource-based view of the firm

Both lists do not include the resource-based view of the firm (a knowledge gap which was identified by Das & Teng in 2000), which is arguably the best theoretical perspective to apply to a collaborative MaaS platform, as we will explain below. The resource-based view, popularized by Wernerfelt (1984), is a theoretical perspective in which the resources of the firm are the unit of analysis, instead of their products. Wernerfelt (1984: 172) himself defines resources as "those (tangible and intangible) assets which are tied semi-permanently to the firm.". The resource-based view is a relevant theoretical perspective for the study of strategic alliances (Das & Teng, 2000) and we argue that it is a perspective applicable to strategic alliances such as MaaS, in which multiple parties bring different types assets to the table, both tangible (cars, bikes, busses, data) and intangible (technology, know-how, reputation). In this aspect we agree with Das & Teng (2000), who state that a strategic alliance is equivalent to an integration of resources among firms.

In order to apply the resource-based view of the firm to the MaaS business ecosystem, a proper general disquisition of a resource-based approach to strategic alliances, and why it is applicable to MaaS is needed. Das & Teng (2000) identify four essential theoretical components within a

resource-based view of strategic alliances. These are: rationale, formation, structure, and performance.

8.2.7. Rationale

According to the resource-based view, the rationale behind strategic alliances is value maximization through pooling and utilizing resources (Das & Teng, 2000). An alliance is an attempt to find an optimal, integrated mix of resources which creates the most value compared to other (individual) combinations of resources. One might ask the question here that is central to the transaction-cost perspective: why not simply acquire the resources through a merger or by taking an equity share in the other company? Even more simple: why not buy the needed resources on the market? Das & Teng (2000) state that efficient exchange of resources cannot always occur on the spot market. This is related to the intangibility of some resources. The resources that are of interest for other companies to acquire are usually those resource that are valuable. Valuable resources are usually hard to replicate or substitute and are frequently scarce (Barney, 1991; Peteraf, 1993). With regard to MaaS, it is easy to imagine that next to tangible assets, there are intangible resources, such as reputation and knowledge of operations, which are not easy to replicate or acquire through simple transaction or vertical integration – an argument against transaction costs economics. In conclusion, the resource-based perspective views a strategic alliance as an integration of resource to maximize value and gain competitive advantage, which is a viable strategy when this integration cannot be reached in other ways (Das & Teng, 2000). We argue that the MaaS business ecosystem is a crucible of intangible resources, brought in by many different parties, making the rationale for alliance formation similar to the one proposed by the resource-based perspective.

The resource-based view further indicates the conditions under which alliances will be preferred over mergers and acquisitions (M&As). These conditions have mainly to do with obtaining and retaining resources. Kogut's (1988) organizational learning model, which is a part of the broader resource-based view, offers a refined view of alliance formation based on firm resources such as knowledge and technology. According to Kogut, there are two possible reasons firms forge alliances: either to acquire the other's organizational know-how, or to maintain one's own know-how while benefiting from another's resources. If these two arguments for alliance formation apply, then strategic alliances will be preferred over M&As for two reasons:

1. Not all resources of the other firm are valuable to the acquiring firm. In this case, M&As create a 'slack' surplus of resources;

2. Due to asset specificity, surplus resources cannot always be disposed of without a (financial) loss (Ramanathan *et al.*, 1997)

Thus, when assets are indivisible, M&A's may result in unneeded assets (Hennart & Reddy, 1997). In contrast to M&As, strategic alliances allow the acquiring of only those resources that re needed by the firm, eliminating the risk of acquiring unwanted resources. This is a distinct advantage of strategic alliances (Das & Teng, 2000).

Das & Teng (2000) suggest that a resource-based view employs the opportunity costs of resources as the main decision criterion. When resources add more value in alliance form than when internally used, alliance are formed. When the opposite is true, alliances should not be formed.

8.2.8. Formation

Das & Teng (2000) state that possession of critical resources are a prerequisite for alliance formation. Resource heterogeneity causes a resource to be of critical importance and consists of three different components (Das & Teng, 2000): Imperfect mobility, imperfect imitability, and imperfect substitutability. Imperfect mobility suggests that resources are not perfectly tradable, making the moving of resources from one firm to another difficult. Imperfect imitability and imperfect substitutability refer to the concept of causal ambiguity (Lippman and Rumelt, 1982), which infers that it is not always clear which resources are creating a competitive advantage and in what way. This in turn makes it hard for a competing firm to imitate another firm's competitive advantage or to use substitute resources to create a similar competitive advantage.

Resource heterogeneity drives the forming of strategic alliances, as collaboration is illogical when one of the three components is not in effect: a company could simply imitate its competitor, acquire its competitor, or buy the critical resources on the market. As Das & Teng (2000) state: "only if a firm cannot efficiently get needed resources from elsewhere, will it be willing to form a strategic alliance". Here again we note the important distinction with transaction costs economics, who give the same argument for vertical integration. However, we argue that imperfect mobility, imperfect imitability, and imperfect substitutability provide an argument against vertical integration.

8.2.9. Structure

Different resources types may affect the choice of alliance structure. Das & Teng (2000) propose a typology of four different alliance structures and identify two types of resources that influence which of these four alliance structures is appropriate.

Taken from Miller and Shamsie (1996), Das & Teng suggest that resources can roughly be divided between two distinct categories: property-based resources and knowledge-based resources. Property resources refer to legal properties of a firm, such as financial capital and physical resources. These resources cannot legally be taken away from the firm without consent. With regards to the MaaS business ecosystem, we deem resources such as data, bicycles, busses, trains, mobile applications etc. to be in this category. Knowledge-based resources refer to intangible resources such as know-how and skills. They are not easily copied due to a lack of transparency and ambiguity. The table below (Table 8.2.2.) – retrieved from Das & Teng (2000) – gives an overview of the two different resource types with respect to the three previously mentioned characteristics that make a resource heterogenous.

Table 8.2.2. Das & Teng (2000)

Resource Characteristics	*Resource Types*	
	Property-Based Resources	*Knowledge-Based Resources*
Imperfect Mobility	Human resources	Organizational resources (e.g., culture)
Imperfect Imitability	Patents, contracts, copyrights, trademarks, and registered designs	Technological and managerial resources
Imperfect Substitutability	Physical resources	Technological and managerial resources

One can imagine how this relates to a platform such as MaaS, in which many different parties contribute tacit, unpatentable knowledge and technology to an alliance. Lippman & Rumelt (1982) state that imitating these knowledge-based resources is inherently uncertain because the process of creating that knowledge is inevitably uncertain. This is in line with our own findings from chapter two.

The resource-based view emphasizes that partners both bring in resources. Alliance are an integration of resources and do not depend on a single resource brought in by one firm. From this perspective, the type of resources that are contributed and integrated constitute a predictive element in the structural preference of firms considering their alliances.

Das & Teng (2000) provide a typology of four different alliances structures:

- Joint ventures;
- Minority equity alliances;

- Bilateral contract-based alliances;
- Unilateral contract-based alliances;

Unilateral contracting are contract-based agreements, such as licensing, distribution agreements and R&D contracts. Firms operate independently and the level of integration of resources is relatively low (Mowery *et al.*, 1996). Bilateral contracts differ from this in that the same type of activities are performed jointly. Examples are joint marketing and promotion, joint production or a joint research project. Bilateral contracts are generally more incomplete and open-ended, as opposed to unilateral contracts. Das & Teng (2000) state that bilateral contracting is preferred when the resources that are brought into the alliance by both firms are knowledge-based. Unilateral contracts are preferred when both resources are property-based.

In contrast, in equity joint ventures, partners work together in a 'shoulder to shoulder' way. Working together closely provides opportunity to acquire tacit knowledge and knowledge-based resources (Kogut, 1988), giving rise to a dilemma. Working together closely provides a firm the benefit of acquiring new knowledge, while simultaneously giving rise to the risk of the other firm acquiring their knowledge as well. Das & Teng (2000) state that equity joint ventures are preferable to a firm if its partner's contribution to the alliance constitutes of mostly knowledge-based resources (as opposed to property-based resources).

Minority equity alliances constitute a form of a strategic alliance in which one (or more) partners takes an equity position in others. The complexity that arises from these agreements makes that these types of alliances are usually long-term. The equity position reduces the chance of opportunistic behaviour. This is in line with strategic decisionmaking model, which states that when perceived relational risk – including the risk of opportunism – is high, equity alliances are preferred. According to Das & Teng (2000), minority equity alliances are preferable to a firm when the other firm mainly contributes property-based resources.

Table 8.2.3. gives an overview of what alliance types are suited from a resource-based perspective.

Table 8.2.3. Suited alliance types from resource-based perspective

	Partner Firm (B)	
Firm (A)	*Property-Based Resources*	*Knowledge-Based Resources*
Property-Based Resources	Unilateral Contract-Based Alliances	Equity Joint Ventures
Knowledge-Based Resources	Minority Equity Alliances	Bilateral Contract-Based Alliances

8.2.10. Alliance performance

The successful integration of resources is what eventually drives the alliance's competitive advantage. What is left to discuss is the way in which the contributed resources are aggregated within the strategic alliance and how this effects alliance performance.

Alliance performance is a whole topic of research on its own (Das & Teng, 2000). Several authors have provided different measures of alliance performance, including profitability (Reuer & Miller, 1997), longevity (Beamish, 1987), the meeting of individual objectives (Dollinger & Golden, 1992; Thomas & Trevino, 1993) and the achievement of shared goals (Deeds & Hills, 1996; Cullen, Johnson & Sakano, 1995). In this thesis, we adopt the same approach as proposed by Das & Teng (2000), and measure alliance performance by the degree to which agreed objectives of an alliance are achieved. This implicitly requires an alliance to agree on objectives, which we pointed out is one of the uncertain factors in a MaaS scheme, as stakeholder preferences are unknown.

In addition, Das & Teng argue that the alignment of resources - cg. proper integration of resources – may influence alliance performance. They state that the notion of resource alignment encompasses both resource similarity and resource utilization. They define resource similarity as the degree to which two partners firms contribute comparable resources to an alliance. Resource utilization refers to the degree in which each resource is used for the goals of the alliance, instead of the goals of the individual firm. Here, a distinction is made between both performing and non-performing resources. Performing resources are the resources that are fully used in the alliance. Non-performing resources are those resources that are accessory to essential resources, but who do not necessarily have a function themselves. The fact that they can't be separated from other resources causes them to be contributed to the alliance. Table 8.2.4. gives the resulting table.

Table 8.2.4. Resource similarity versus resource utilization

Resource Similarity	*Resource Utilization*	
	Performing Resources	*Nonperforming Resources*
Similar Resources	Supplementary [Similar-Performing]	Surplus [Similar-Nonperforming]
Dissimilar Resources	Complementary [Dissimilar-Performing]	Wasteful [Dissimilar-Nonperforming]

Das & Teng make a distinction between four types of resource alignment:

- Supplementary, in which both parties contribute similar, but performing resources;

- Surplus, in which both parties contribute similar resources, creating an excess of nonperforming resources. This is often not a positive resource alignment;
- Complementary, in which both parties contribute dissimilar resources, that complement each other;
- Wasteful, in which both parties contribute nonperforming, dissimilar resources. These are the alliances in which resource alignment is poor.

We argue that a complementary resource alignment is the aim of a MaaS business ecosystem. Das & Teng state that proper resource alignment influences alliance performance through both collective strengths and interfirm conflict. Collective strengths refer to the alliance's overall resource endowments and capabilities. Interfirm conflict, in the form of competing interests, incompatible goals, and opportunistic behaviour influences alliance performance. It is recognized that a certain degree of conflict is inevitable, as it is an unachievable ideal that the goals of each firm are completely compatible. Das & Teng suggest that interfirm conflict is detrimental to alliance performance, and that it should be minimized. addition, Das & Teng argue that both supplementary and complementary alignment have a positive effect on alliance performance through the notion of collective strengths. These types of resource alignment provide the most synergetic forms of alliances, creating a stronger resource base of the alliance as a whole.

We conclude that the MaaS business ecosystem should best be approached with a resource-based perspective. A strategic alliance involving the parties that constitute the MaaS business ecosystem is mostly an integration of knowledge-based resources. We argue that also tangible resources are brought into the MaaS strategic alliance, but that these resources are not imperfectly mobile, imperfectly imitable or imperfectly substitutable and thus do not constitute the 'core' part of the resource integration. They are however important from a financial point of view, as most of these tangible resources are expensive. A cycle-sharing company may not have the financial capital to employ busses or expand to car-sharing. However, it is not these tangible resources themselves that constitute the added value of each of these parties to the alliance. According to Das & Teng, a strategic alliance in which knowledge-based resources are the primary resources that are shared, a bilateral contract-based alliance is best used. Taking this into account, if we want to make a strategic alliance of this form to succeed, proper resource alignment is a prerequisite.

8.3. Construction of the theoretical model

Here, we integrate the findings from the literature to construct our general model of collaboration (GMC). We can construct the GMC with a step-by-step approach. In this way, a model that may seem overly complex can be communicated in a concise way.

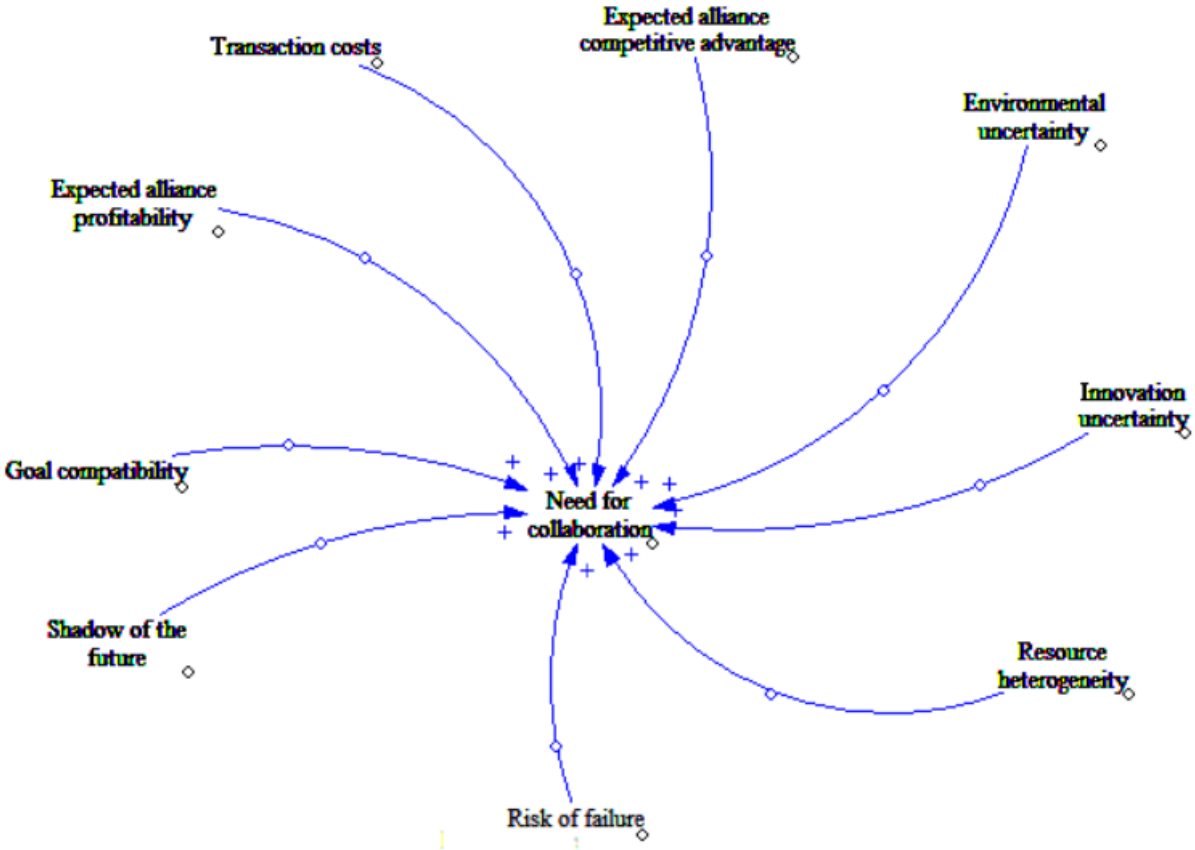
We leave out all 'simple' causal relations at first. These simple relations refer to the nodes that have only one in- or outgoing arrows. An example is the desire for geographical expansion, which positively influences the need for collaboration. If the desire for geographical expansion increases, so does the need for collaboration. This is denoted in our model by an arrow with a (+) sign. For a thorough explanation on causality and the basics of causal loop diagramming, we refer the reader back to the method section.

All variables that denote only one causal relation will be left out at first, to simplify the diagram. Later on we will add them to the diagram.

We start with our main variable, 'need for collaboration', which denotes thirteen causal relations. Of these thirteen causal relations, nine are related to variables that multiple causal relations themselves (thus four causal relations are left out for the moment). These are the following, sorted by the amount of relations each variable has:

- Expected alliance profitability (6 – 1 = 5 relations left)
- Shadow of the future (6 – 1 = 5 relations left)
- Transaction costs (5 – 1 = 4 relations left)
- Goal compatibility (4 – 1 = 3 relations left)
- Risk of failure (4 – 1 = 3 relations left)
- Innovation uncertainty (3 – 1 = 2 relations left)
- Resource heterogeneity (3 – 1 = 2 relations left)
- Expected alliance competitive advantage (2 – 1 = 1 relation left)
- Environmental uncertainty (2 – 1 = 1 relation left)

Mapping these variables and their relation to the need for collaboration leads to a first version of the diagram:



From here, there are close to infinite combinations to constructing the diagram. For each new diagram T+1, we aim to keep as close to the original diagram T as possible. In our next step, we introduce the following relations:

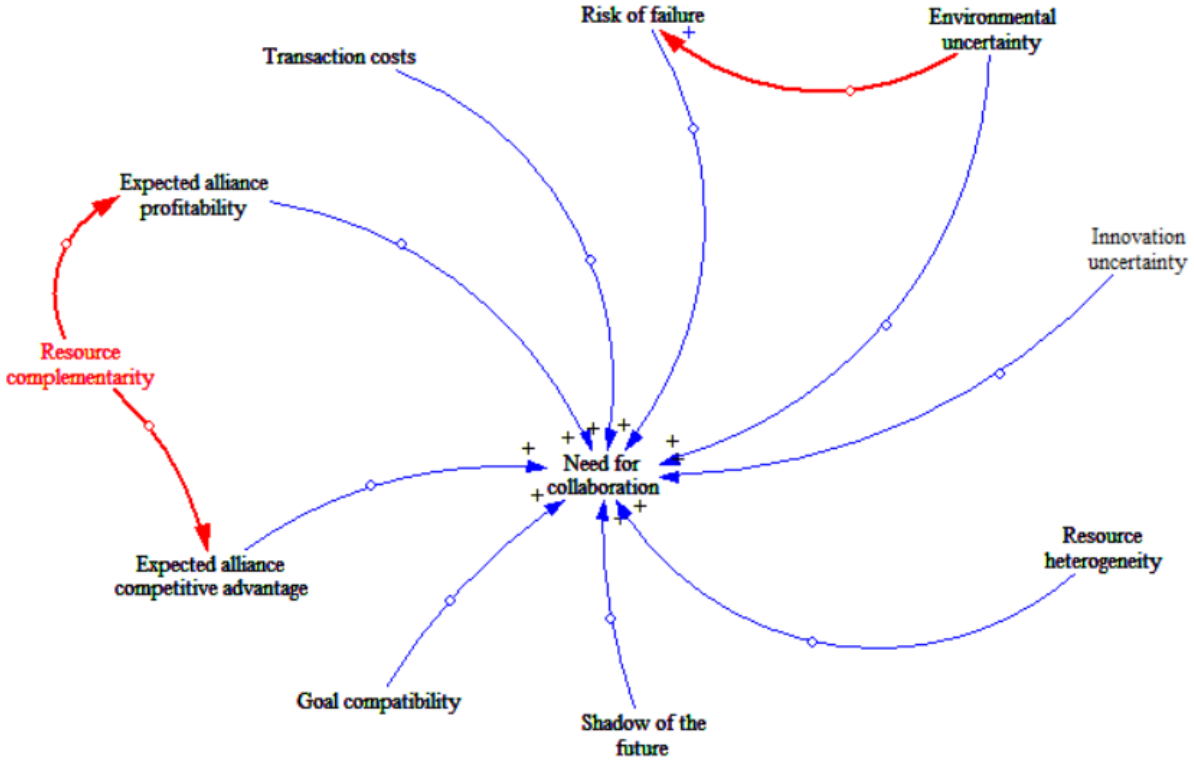
- Environmental uncertainty increases risk of failure

  (1 – 1 = 0 relations left for environmental uncertainty, 3 – 1 = 2 relations left for risk of failure)
- Resource complementarity increases expected alliance competitive advantage

  (2 -1 = 1 relations left for resource complementarity, 1 – 1 = 0 relations left for alliance competitive advantage)
- Resource complementarity increases expected alliance profitability

  (1 -1 = 0 relations left for resource complementarity, 5 – 1 = 4 relations left for expected alliance profitability)

To provide clarity, the new introduced relations and variables have been given a red color. This leads to the following diagram:



From here, we introduce the following relations:

- Resource heterogeneity increases transaction costs

  (2 -1 = 1 relation left for resource heterogeneity, 4 – 1 = 3 relations left for transaction costs)

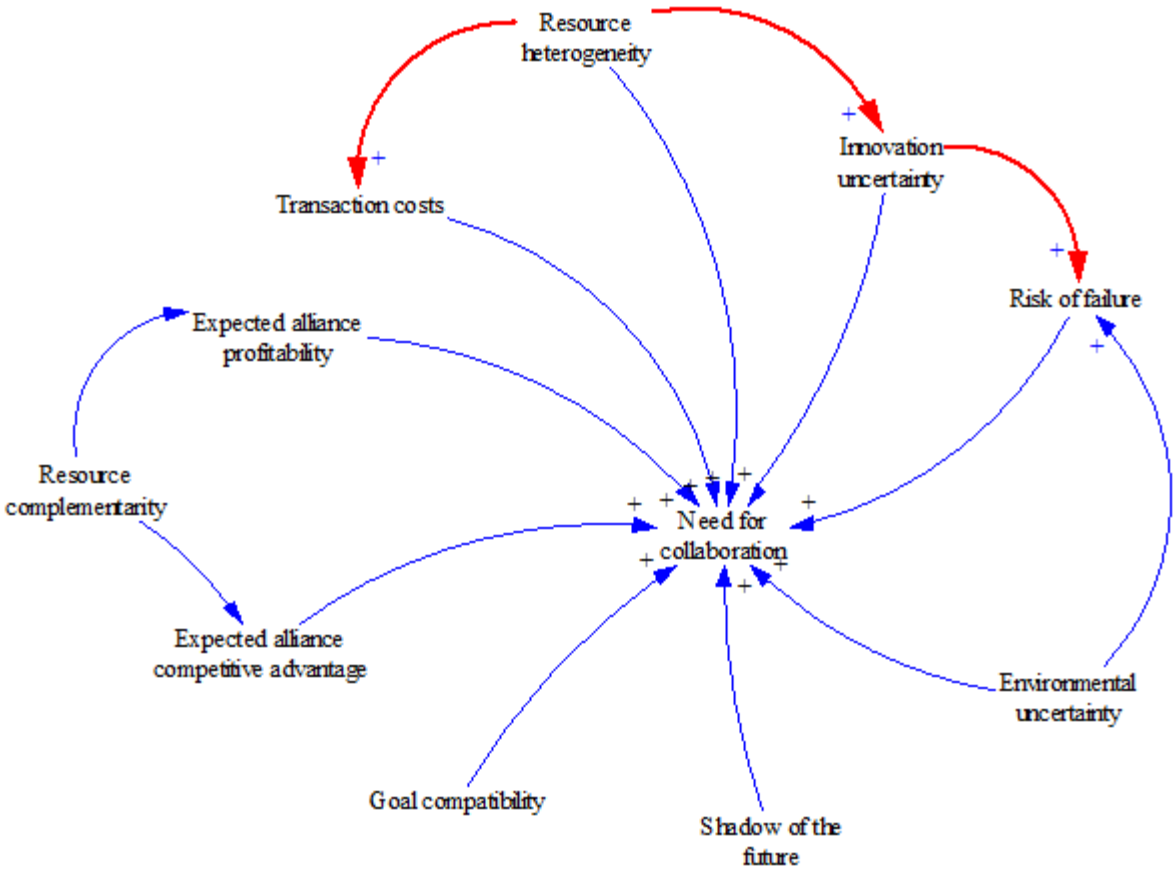
- Resource heterogeneity increases innovation uncertainty

  (1 -1 = 0 relations left for resource heterogeneity, 2 – 1 = 1 relation left for innovation uncertainty)

- Innovation uncertainty increases risk of failure

  (1 – 1 = 0 relations left for innovation uncertainty, 2 -1 = 1 relation left for risk of failure)

This leads to the following diagram:



From here, we introduce the following relations:

- Ex ante investments increase the risk of failure

  (3 -1 = 2 relations left for ex ante investments, 1 – 1 = 0 relations left for risk of failure)

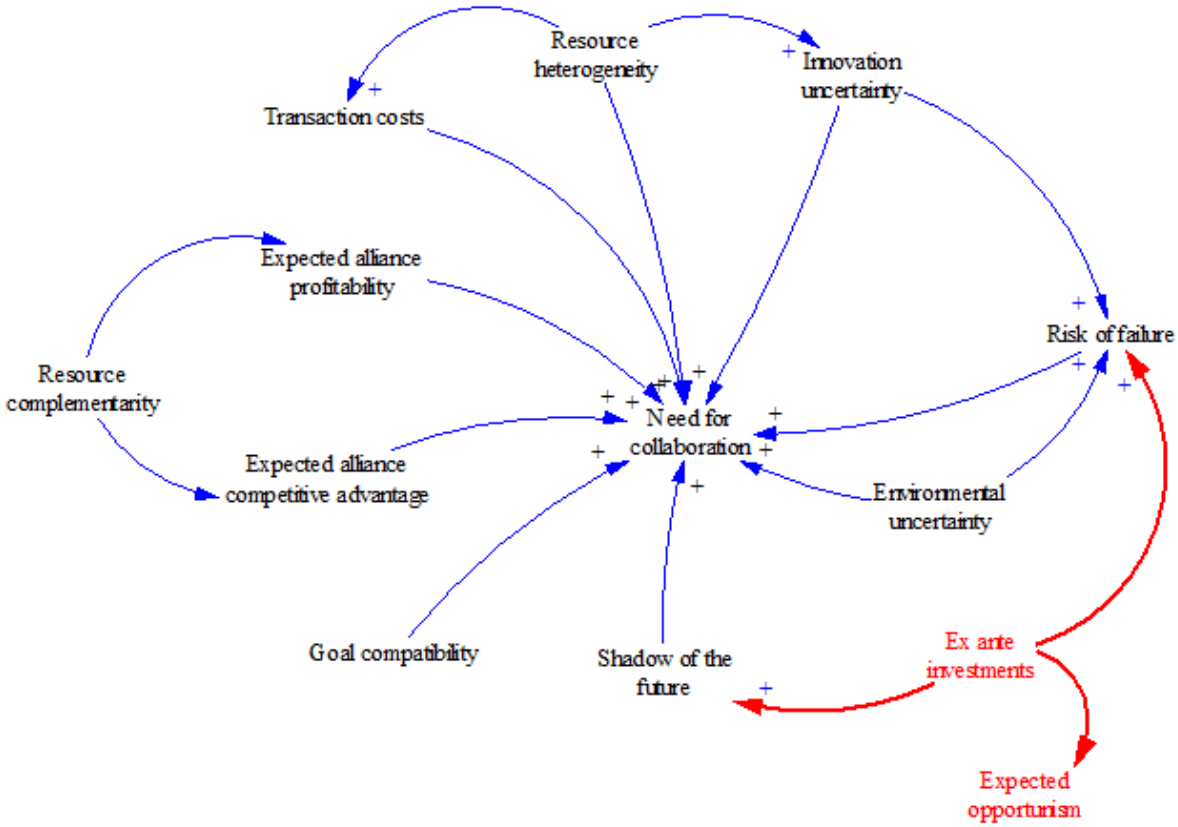
- Ex ante investments increases shadow of the future

  (2 – 1 =1 relation left for ex ante investments, 5 – 1 = 4 relations left for shadow of the future)

- Ex ante investments reduces expected opportunism

  (1 – 1 = 0 relations left for ex ante investments, 9 – 1 = 8 relations left for expected opportunism)

This leads to the following diagram:



From here, we introduce the following relations:

- Goal compatibility reduces expected opportunism

  (3 – 1 = 2 relations left for goal compatibility, 8 – 1 = 7 relations left for expected opportunism)

- Goal compatibility increases expected alliance profitability

  (2 – 1 = 1 relation left for goal compatibility, 4 – 1 = 3 relations left for expected alliance profitability)

- Goal compatibility increases alliance stability

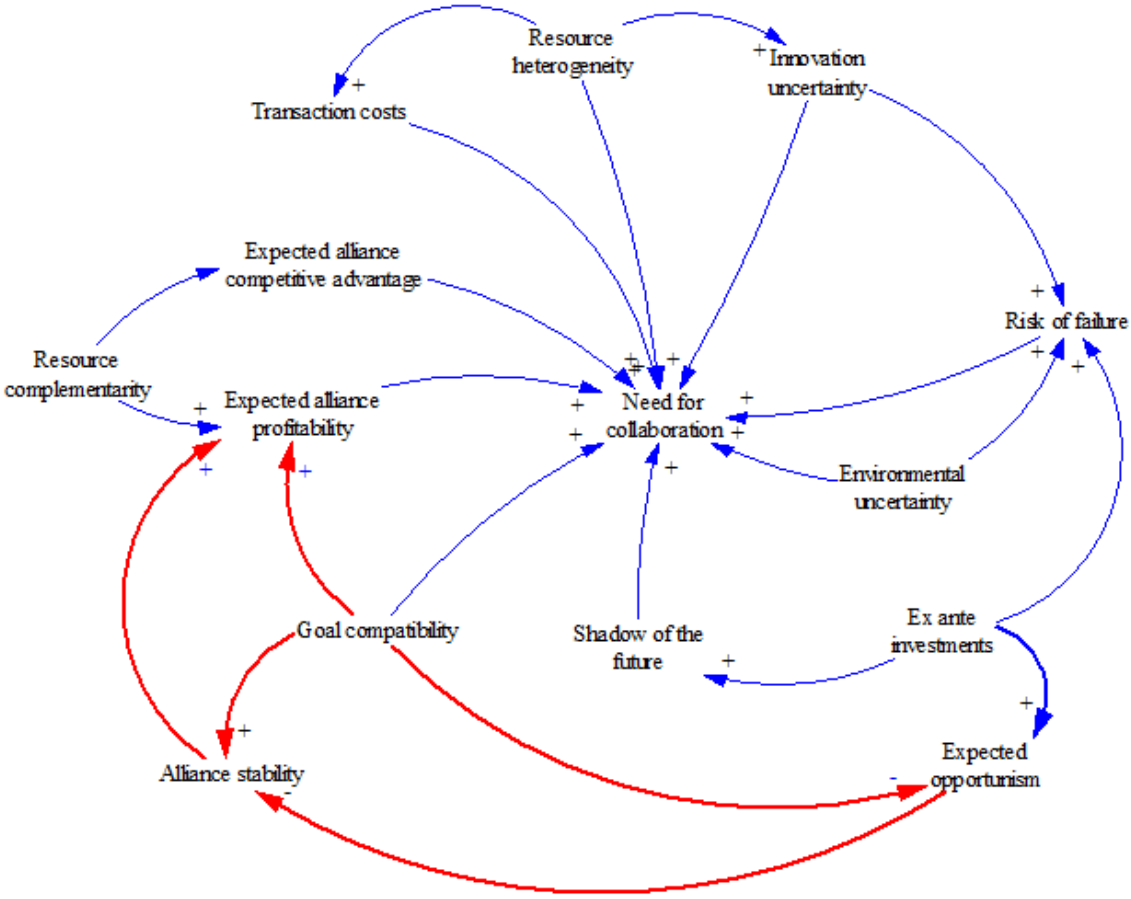
  (1 – 1 = 0 relations left for goal compatibility, 3 – 1 = 2 relations left for alliance stability)

- Alliance stability increases expected alliance profitability

  (2 – 1 = 1 relation left for alliance stability, 3 -1 = 2 relations left for expected alliance profitability)

- Expected opportunism reduces alliance stability (7 -1 = 6 relations left for expected opportunism, 1 – 1 = 0 relations left for alliance stability)

This leads to the following diagram:



From here, we introduce the following relations:

- Expected alliance profitability increases shadow of the future

  (2 – 1 = 1 relations left for expected alliance profitability, 4 – 1 = 3 relations left for shadow of the future)

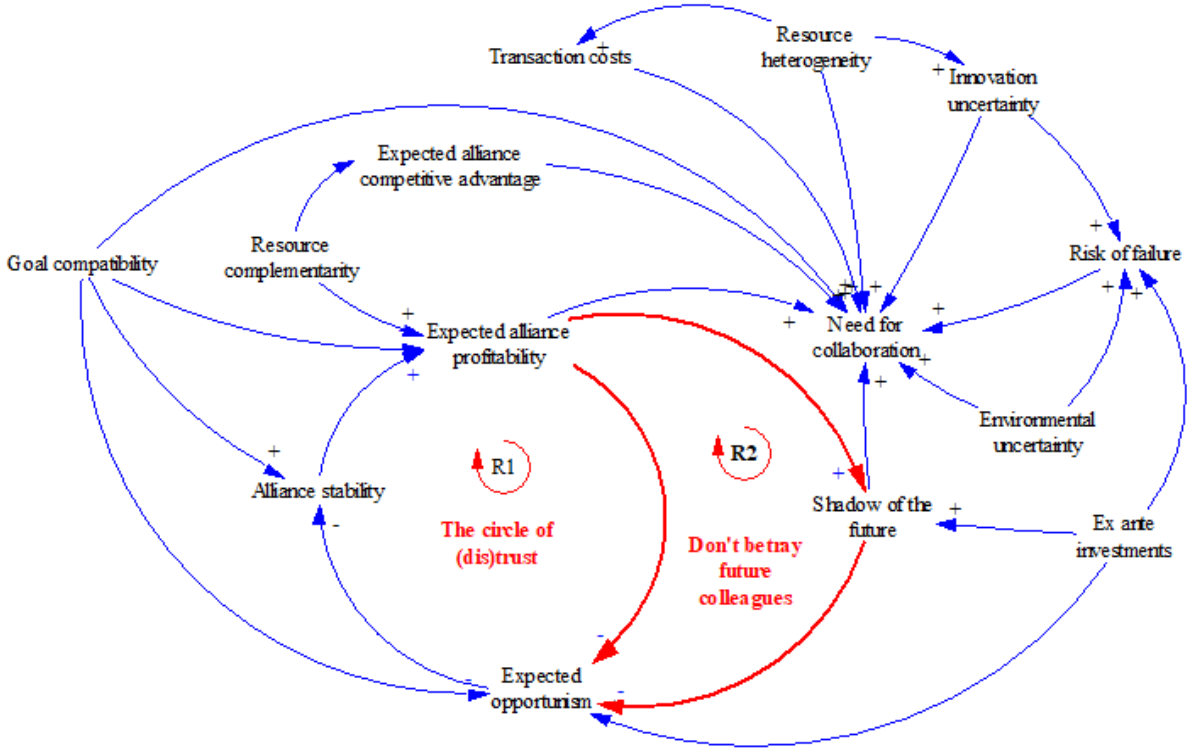
- Expected alliance profitability reduces expected opportunism

  (1 – 1 = 0 relations left for expected alliance profitability, 6 – 1 = 5 relations left for expected opportunism)

- Shadow of the future reduces expected opportunism

  (3 – 1 = 2 relations left for shadow of the future, 5 – 1 = 4 relations left for expected opportunism)

This leads to the following diagram:



Introducing these relations to the model creates our first two (reinforcing) feedback loops, which we coined the "circle of (dis)trust" (R1) and "don't betray future colleagues" (R2). The feedback loop R1 indicates that (de)stabilization in an alliance will be self-reinforcing. If the alliance is stable, this will have a positive effect on expected profitability, which is a disincentive for parties to be opportunistic. Thus, expected opportunism among parties will decrease, leading to more alliance stability, closing the loop. However, by definition this means that the opposite is also true, hence the affix "dis". The same logic applies to feedback loop R2: the longer the shadow of the future, the less parties will be inclined to be opportunistic and hence expected opportunism will be low. This will lead to a more stable alliance, which will lead to more expected profitability. This in turn will have a positive effect on the longevity of the alliance.

From here, we introduce the following relations:

- Expected opportunism increases transaction costs

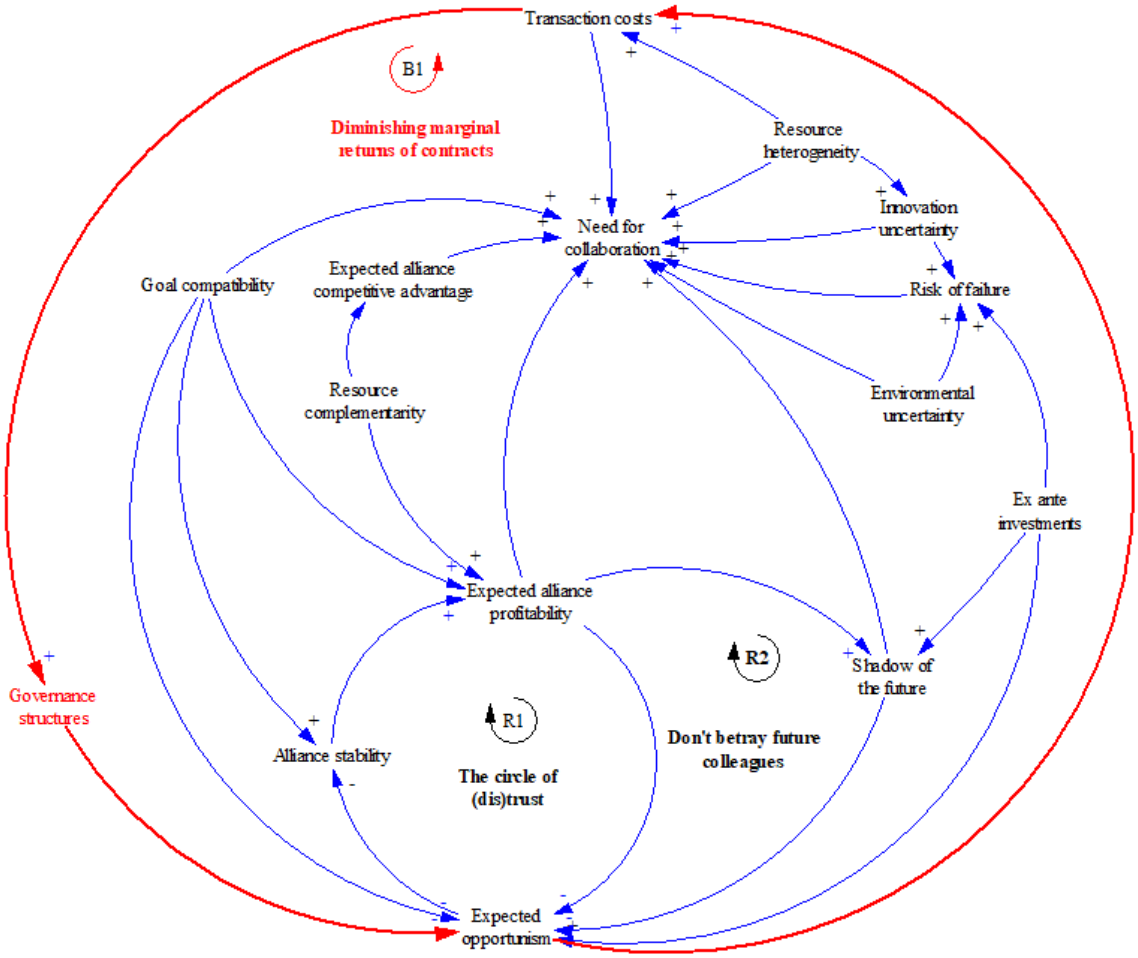
  (4 – 1 = 3 relations left for expected opportunism, 3 – 1 = 2 relations left for transaction costs)
- Transaction costs increases governance structures

  (2 – 1 = 1 relation left for transaction costs, 6 – 1 = 5 relations left for governance structures)

- Governance structures reduces expected opportunism

  (5 – 1 = 4 relations left for governance structures, 3 – 1 = 2 relation left for expected opportunism)

This leads to the following diagram:



Introducing these relations to the model creates a new (balancing) feedback loop. The feedback loop "diminishing marginal returns of opportunism" indicates that governance structures reduces opportunism and therefore transaction costs, eliminating further need for governance structures. An explanation for this is that all opportunism has simply been resolved, or that it is too difficult to formalize new constrictions of opportunism in the form of contracts. The relation expected opportunism increases governance structures was removed at this point, because feedback loop B1 already captures this relation. This means there are three relations left to add to the model for governance structures.

From here, we introduce the following relations:

- Governance structures reduce transaction costs

  (3 – 1 = 2 relations left for governance structures, 1 – 1 = 0 relations left for transaction costs

- Governance structures reduce the shadow of the future

  (2 – 1 = 1 relation left for governance structures, 2 – 1 = 1 relation left for shadow of the future)

- Governance structures increases governance costs

  (1 – 1 = 0 relation left for governance structures, 1 – 1 = 0 relations left for governance costs)

- Alliance history reduces expected opportunism

  (2 – 1 = 1 relation left for alliance history, 2 – 1 = 1 relations left for expected opportunism)

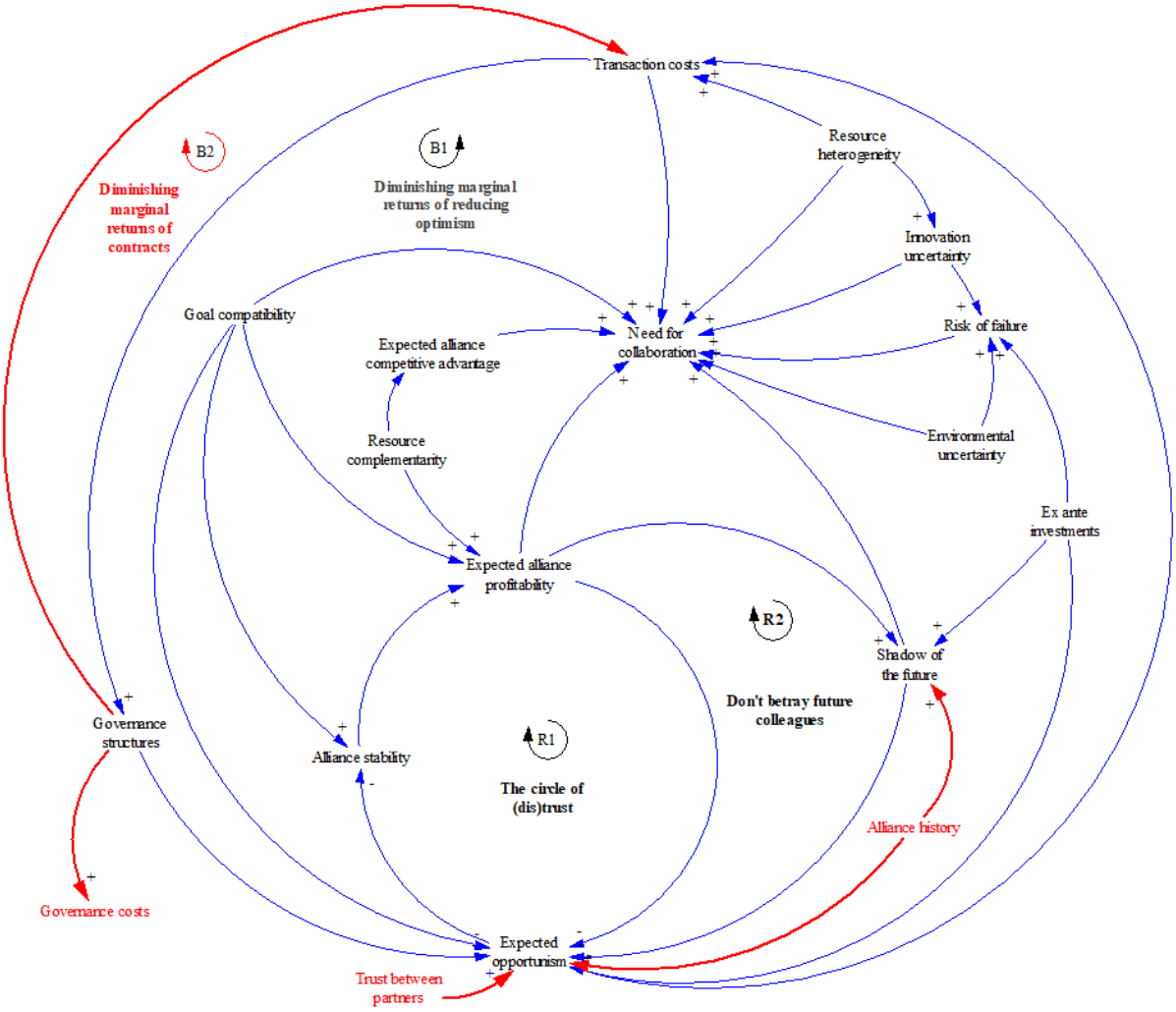
- Alliance history increases the shadow of the future

  (1 – 1 = 0 relations left for alliance history, 1 – 1 = 0 relations left for shadow of the future)

- Trust between partners reduces expected opportunism

  (1 – 1= 0 relations left for trust between partners, 1 – 1 = 0 relations left for expected opportunism)

This leads to the following diagram:

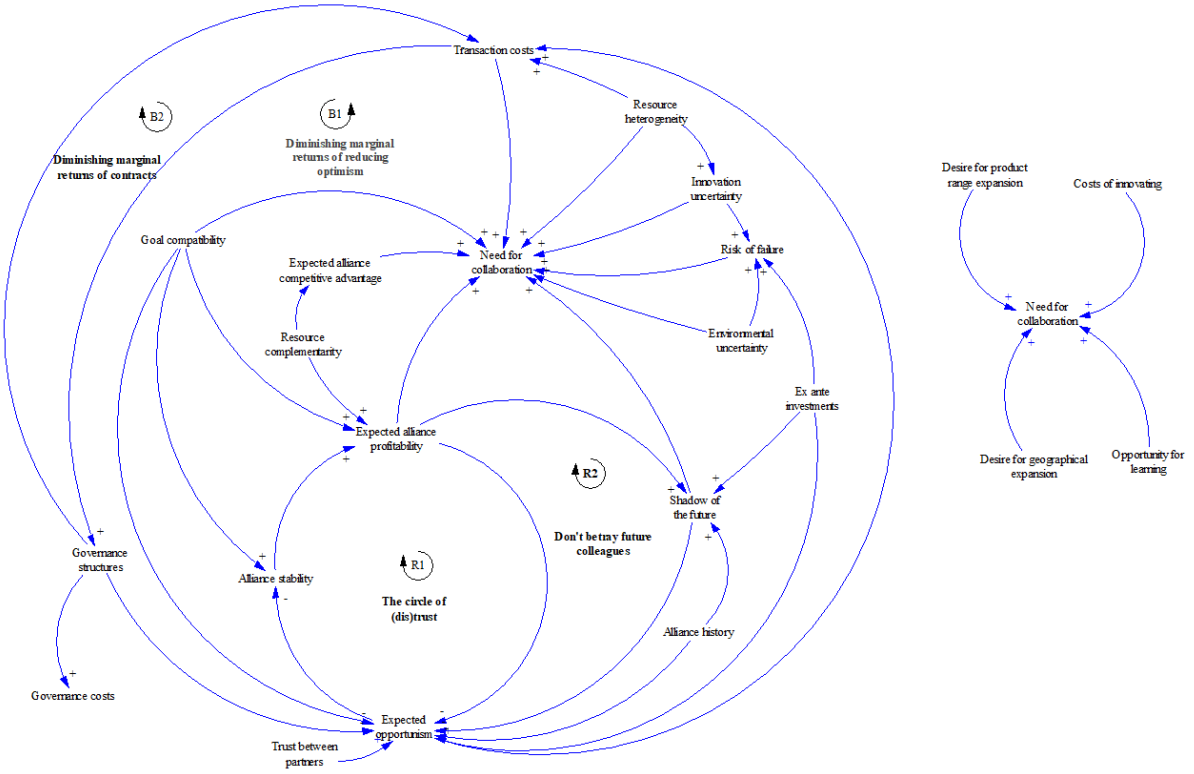


We introduce one new feedback loop (B2), which entails a similar principle to B1. Here, diminishing returns are based on factors other than opportunism. Additionally, we found that we misinterpreted the causal relationship between governance structures and shadow of the future, therefore this relation is not present in the model as it is not in line with Parkhe's (1993) hypothesis.

This above entails the general structure of our model. There are still four variables left who directly influence the need for collaboration and have no further causal relations with other variables. These variables are:

- Costs of innovating
- Desire for geographical expansion
- Desire for product range expansion
- Opportunity for learning

We decided to add these separately, to ensure that the diagram stays readable. Below we present our general model of collaboration:



The reader must take note that this diagram is an integration of the theoretical perspectives that were covered in this thesis. The model is not meant to be exhaustive but should serve as a general model which can be compared to case-specific models, or which can be used as a basis to develop case-specific models.

8.4. Account on variables and relations

8.4.1. Justification of variables

Aanwezig in het model

Kwaliteit diensten

HM: "Voor NS is ongetwijfeld kwaliteit belangrijk"
RH: "Vanuit Go About gedacht wil je meerdere mogelijkheden aanbieden om een reis te kunnen accommoderen. Dat is één element van kwaliteit maar het heeft natuurlijk ook te maken met de frequentie"
PB: "Betrouwbaarheid (van de applicatie) en frequentie leiden tot hogere kwaliteit"
HM: "De kwaliteit diensten wordt bepaald door het aantal diensten en de kwaliteit voor reizigers. Dat bestaat uit extra dingen, keuzemogelijkheden; de compleetheid van de verplaatsingsketen. Dat is positief tot een bepaald niveau. Ook de betrouwbaarheid van het platform (app). Al deze dingen bepalen het serviceaanbod (refereert naar kwaliteit)"
Onderstaande is onderdeel van een discussie waaruit uiteindelijk de variabele kwaliteit diensten voortvloeit:
HM: "Ik zou een pijltje zetten van serviceaanbod naar toegevoegde waarde klant
BW: "Service aanbod is een intermediaire variabele"
HM: "Service aanbod is meer het aantal diensten, zou aparte variabele moeten zijn".
JR: "Service aanbod wordt opgesplitst in kwaliteit services en het aantal diensten (modaliteiten)?"
Group akkoord met splitsing.

Toegevoegde waarde klant

PB: "De klantwaarde moet omhoog, anders is het geheel waardeloos (..), je moet de klantwaarde optimaliseren"
HM: -In reactie op PB- "Mee eens"
HM: "Toegevoegde waarde is wat de consument ervaart"
RH: "misschien dat het juist wel de toegevoegde waarde van de klant is die beïnvloed wordt door kwaliteit diensten en kwaliteit platform (app)"
RH: "Toegevoegde waarde moet leiden tot meer reizigers, moet leiden tot meer winst, meer samenwerking"
PB: "Als de klant vindt dat hij meer in de winkel kan shoppen verhoogd dat zijn beleving van toegevoegde waarde"
HM: "Fietsen aanbieden naast de bussen want de bussen zitten al zo vol in de spits. Meer modaliteiten dus meer klantwaardering"

Aantal reizigerskilometers

RH: "Toegevoegde waarde moet leiden tot meer reizigers, moet leiden tot meer winst, meer samenwerking" – Groep stemt in
HM: "Aantal reizigerskilometers" – in NGT

Compleetheid verplaatsingsketen

HM: "Compleetheid verplaatsingsketen is onderdeel van dat serviceaanbod en betrouwbaarheid service ook. Allemaal plusjes richting service aanbod" (Service aanbod wordt later veranderd in "Kwaliteit diensten")
BW & FS bevestigen bovenstaande.
RH: "Vanuit Go About gedacht wil je meerdere mogelijkheden aanbieden om een reis te kunnen accommoderen"
HM: "samenwerken met BRENG en dan een trein ARRIVA is compleetheid verplaatsingsketen (door aantal aangeboden modaliteiten) en aantal services is ook bijvoorbeeld het aantal treinen die rijden etc."
HM: "Ik zou zeggen dat samenwerking leidt tot betere toegankelijkheid van het systeem door meer services, kwaliteit diensten, compleetheid"
RH: - loopt naar het bord - "Meer modaliteiten leidt tot completere ketens leidt tot meer waardering"
BW: "Daarom is die last mile zo belangrijk. Je wilt geen auto's in de binnenstad"
HM: "NS will ook full service carrier zijn. Ik werk alleen samen omdat het te duur is om alle diensten aan te bieden. We bieden het alleen aan om meer reizigers te denken te trekken. We verdienen niet op die fiets. Compleetheid leid tot meer klanten. We zitten alleen in MaaS omdat we de keten willen complementeren - want meerwaarde voor klanten betekent meer reizigers in de trein."
HM: "Het gaat me erom dat je de First en last miles ook goed hebt"
HM: "We kunnen ook kosten besparen door dure treinen omzetten in bussen"

Aantal aangeboden modaliteiten (Niet in het originele model)

RH: "Vanuit Go About gedacht wil je meerdere mogelijkheden aanbieden om een reis te kunnen accommoderen"
HM: "samenwerken met BRENG en dan een trein ARRIVA is compleetheid verplaatsingsketen (door aantal aangeboden modaliteiten) en aantal services is ook bijvoorbeeld het aantal treinen die rijden etc."
RH: "Hoeveel modaliteiten zitten erin en wat is de frequentie ervan"
PB: "Als de klant vindt dat hij meer in de winkel kan shoppen verhoogd dat zijn beleving van toegevoegde waarde"
HM: "Ik zou zeggen dat samenwerking leidt tot betere toegankelijkheid van het systeem door meer services, kwaliteit diensten, compleetheid"

HM: "Fietsen aanbieden naast de bussen want de bussen zitten al zo vol in de spits. Meer modaliteiten dus meer klantwaardering"
RH: - loopt naar het bord - "Meer modaliteiten leidt tot completere ketens leidt tot meer waardering"
PB: "Dat is goed, dan heeft de klant meer te kiezen en dan blijft de klant binnen de markt"
HM: "Maar stel ik ga met BRENG, maar die trein is te duur. Ik knikker hem eruit en we doen het met de bus. We gooien een dure eruit maar we doen minder soorten modaliteiten"

Frequentie vervoersdiensten (In het originele model o.a. in "Aantal services")

HM: "Samenwerking leidt tot meer services"
JR: - reagerend op HM - "wat is het verschil tussen aantal services en compleetheid keten?
HM: "samenwerken met BRENG en dan een trein ARRIVA is compleetheid verplaatsingsketen (door aantal aangeboden modaliteiten) en aantal services is ook bijvoorbeeld het aantal treinen die rijden etc."
RH: "Hoeveel modaliteiten zitten erin en wat is de frequentie ervan"
HM: "Ik zou zeggen dat samenwerking leidt tot betere toegankelijkheid van het systeem door meer services, kwaliteit diensten, compleetheid"
RH: "Met meer partijen goed samenwerken leidt tot meer diensten"

Betrouwbaarheid MaaS app (In het originele model "Betrouwbaarheid platform")

BW: "Er moet betrouwbare info zijn ten aanzien van het verwachtingspatroon"
PB: "Betrouwbaarheid (van de applicatie) en frequentie (diensten) leiden tot hogere kwaliteit (van platform)"
PB: "Het platform op zichzelf moet goed werken".

Kwaliteit MaaS app (In het originele model "Kwaliteit platform")

HM: "Betrouwbaarheid service hangt samen met betrouwbaarheid platform (applicatie)"
JR: "Betrouwbaarheid service formuleren als betrouwbaarheid platform (applicatie)" → Groep bevestigt.
PB: "De klant kijkt de vervoerder erop aan als de app niet werkt maar de data is eigenlijk overal gelijk. Het is aan de appbouwer hoe dat (de data) gepresenteerd wordt en of dat goed is"
JR: "Betere app, meer data, betere app?" – Groep bevestigd
PB: "Het platform op zichzelf moet goed werken".

Data

PB: "De klant kijkt de vervoerder erop aan als de app niet werkt maar de data is eigenlijk overal gelijk. Het is aan de appbouwer hoe dat (de data) gepresenteerd wordt en of dat goed is"
PB: "Er wordt ook feedback gegeven vanuit de algoritmes over de diensten, om je aanbod te optimaliseren"
BH: "Dat heeft invloed op het interne proces"
HM: "Datastroom is de macht"
PB: "Je wilt weten wat de klant wilt, dat is marktkennis. Maar als ik aan data kan komen van autoverplaatsingen, kan ik ook weer mijn product verbeteren"
JR: "Betere app, meer data, betere app?" – Groep bevestigd
BW: "Die analyses die bij bijvoorbeeld Bol.com worden gemaakt zijn goud waard"
RH: "Data leidt tot aanpassing omdat de kosten van de bedrijfsvoering omlaaggaan"
RH: "Data zorgt voor: 1. meer klanten, 2. de meest kostbare componenten kun je verwijderen"

Delen van data tussen partijen (In het originele model "Beschikbaarheid stellen van data")

PB: "De klant kijkt de vervoerder erop aan als de app niet werkt maar de data is eigenlijk overal gelijk. Het is aan de appbouwer hoe dat (de data) gepresenteerd wordt en of dat goed is"
PB: "Er wordt ook feedback gegeven vanuit de algoritmes over de diensten, om je aanbod te optimaliseren"
HM: "Bij samenwerking gaat het ook over data uitwisseling. Soms is dit moeilijk"
RH: "Je gaat pas data uitwisselen als er vertrouwen is, een langdurige relatie"
HM: "Meer communicatie met platform leidt tot het gevoel van een verlies van klanteigenaarschap"
PB: "Je wilt weten wat de klant wilt, dat is marktkennis. Maar als ik aan data kan komen van autoverplaatsingen, kan ik ook weer mijn product verbeteren"
HM: "Ik kan wel meer kennis krijgen maar als ik er niks mee mag." (..) "Ik heb nu niks aan mijn marktkennis"
RH: "Er zijn beperkende institutionele kaders"
PB: "Mensen die hun product bovenaan in het algoritme willen zetten, hoe bescherm je je belangen goed zodat je die transformatie goed kunt maken? (...) Partijen niet tegen elkaar uitspelen "
RH: "Door die concurrentie kan het zijn er een negatief effect is van data. Meer samenwerking kan leiden tot meer concurrentie tussen de aanbieders"

Collectieve marktkennis (toevoeging "collectieve" zit niet in het originele model)

PB: "Er wordt ook feedback gegeven vanuit de algoritmes over de diensten, om je aanbod te optimaliseren"

BH: "Dat heeft invloed op het interne proces"
PB: "Je wilt weten wat de klant wilt, dat is marktkennis. Maar als ik aan data kan komen van autoverplaatsingen, kan ik ook weer mijn product verbeteren"
RH: "Het heeft een positief effect op de kwaliteit van de dienst. Marktkennis kan twee richtingen uitgaan. Jouw individuele marktkennis kan omlaaggaan, maar in zijn totaliteit weet je meer. Hoe dat uitpakt moet je afwegen. Jouw reductie in marktkennis kan leiden tot een besluit om geen data meer te delen"
VM: "Marktkennis per modaliteit neemt af"
HM: - in reactie op VM – "Maar het totaal neemt toe"
VM: "Marktkennis keten gaat omhoog"
BW: "Die analyses die bij bijvoorbeeld Bol.com worden gemaakt zijn goud waard"
BW: "Je gaat optimaliseren"
RH: "Data leidt tot aanpassing omdat de kosten van de bedrijfsvoering omlaaggaan"
RH: "Dit is op de collectiviteit gericht he. Maar denk om individuele spelers. Denk ook om individueel modaliteit. Eigen gedrag." – In de discussie over marktkennis
PB: "Als je het goed speelt, kun je nieuwe info naar je toe spelen"

Efficiëntie bedrijfsvoering (zit niet in het model)

PB: "Er wordt ook feedback gegeven vanuit de algoritmes over de diensten, om je aanbod te optimaliseren"
BH: "Dat heeft invloed op het interne proces"
PB: "Je wilt weten wat de klant wilt, dat is marktkennis. Maar als ik aan data kan komen van autoverplaatsingen, kan ik ook weer mijn product verbeteren"
BW: "Die analyses die bij bijvoorbeeld Bol.com worden gemaakt zijn goud waard"
BW: "Je gaat optimaliseren"
RH: "Data leidt tot aanpassing omdat de kosten van de bedrijfsvoering omlaaggaan"
RH: "Data zorgt voor: 1. meer klanten, 2. de meest kostbare componenten kun je verwijderen"
PB: "Dan moet je regelgeving vrijgeven". – Verwijst naar uitspraak van BW om data te gebruiken voor optimalisatie
HM: "Maar dat mag niet van de overheid/gemeentes" – In reactie op RH's uitspraak dat data gebruikt kan worden om kostbare componenten binnen de keten te verwijderen
HM: "Maar stel ik ga met BRENG, maar die trein is te duur. Ik knikker hem eruit en we doen het met de bus. We gooien een dure eruit maar we doen minder soorten modaliteiten"
HM: "We kunnen ook kosten besparen door dure treinen omzetten in bussen"

Samenwerking

HM: "Samenwerking leidt tot meer services"
RH: "Toegevoegde waarde moet leiden tot meer reizigers, moet leiden tot meer winst, meer samenwerking"
RH: "Als je een systeem ontwikkeld dat de winst verhoogt, willen mensen wel samenwerken"
HM: "Ik zou zeggen dat samenwerking leidt tot betere toegankelijkheid van het systeem door meer services, kwaliteit diensten, compleetheid"
RH: "Met meer partijen goed samenwerken leidt tot meer diensten"
HM: "Bij samenwerking gaat het ook over data uitwisseling. Soms is dit moeilijk"
RH: "als je weet dat je samen je contracten kunt wijzigen, ga je sneller samenwerking aan"
RH: "Door die concurrentie kan het zijn er een negatief effect is van data. Meer samenwerking kan leiden tot meer concurrentie tussen de aanbieders"
HM: "Geen samenwerking is sowieso concurrentie"

Kosten baten ratio

RH: "Toegevoegde waarde moet leiden tot meer reizigers, moet leiden tot meer winst, meer samenwerking"
PB: "Winst moet meer gezien worden als positieve bedrijfsvoering (..) kosten baten balans noemen?"
Discussie over de te gebruiken term resulteert in consensus over het gebruik van kosten baten ratio.
RH: "Als je een systeem ontwikkeld dat de winst verhoogt, willen mensen wel samenwerken"
RH en BW: "Kosten en baten zijn beiden van invloed op samenwerking"
HM: "Je hebt het steeds over Kostenbaten ratio. Kosten hebben we nog niet echt besproken. Kosten platform. We kunnen ook kosten besparen door dure treinen omzetten in bussen"

Toegankelijkheid van het systeem

HM: "Ik zou zeggen dat samenwerking leidt tot betere toegankelijkheid van het systeem door meer services, kwaliteit diensten, compleetheid". Groep stemt in.

Leefbaarheid

VM: "leefbaarheid, bereikbaarheid, veiligheid, kan er ook nog wel bij". Groep stemt in.
RH: "Je kunt wel zeggen dat als de modal split omlaaggaat, dat dit de leefbaarheid ten goede komt"
JR: "Samenvattend: Minder autogebruik leidt tot een lagere modal split. Die lagere modal split leidt tot meer leefbaarheid, veiligheid en bereikbaarheid?" Groep stemt in.

Bereikbaarheid

VM: "leefbaarheid, bereikbaarheid, veiligheid, kan er ook nog wel bij". Groep stemt in.
BW: "Daarom is die last mile zo belangrijk. Je wilt geen auto's in de binnenstad"
BW: "Ik wil bereikbaar zijn voor de ondernemers, voor de inwoners. Geen dode stad 's avonds. Het moet economisch en sociaal"
HM: "Het moet makkelijk zijn voor klanten om ondernemers in de stad te bereiken"
RH: "Bereikbaarheid is niet persé alleen afhankelijk van de auto. MaaS met meer mogelijkheden zou de bereikbaarheid verbeteren"
VM: "Minder autogebruik leidt tot meer bereikbaarheid"
JR: "Samenvattend: Minder autogebruik leidt tot een lagere modal split. Die lagere modal split leidt tot meer leefbaarheid, veiligheid en bereikbaarheid?" Groep stemt in.

Veiligheid

VM: "leefbaarheid, bereikbaarheid, veiligheid, kan er ook nog wel bij". Groep stemt in.
RH: "Veiligheid is daar ook bij gebaat" - verwijst naar modal split –
JR: "Samenvattend: Minder autogebruik leidt tot een lagere modal split. Die lagere modal split leidt tot meer leefbaarheid, veiligheid en bereikbaarheid?" Groep stemt in.

Parkeertarieven

HM: "Een collegegemeente Arnhem, stelde in het Gelredome een groot park en ride in. Niemand gebruikte dat want de parkeertarieven werden gehalveerd. Je kan dan niet verwachten dat mensen het openbaar vervoer gebruiken"
HM: "Als je dus een aantrekkelijk MaaS aanbod levert, is het misschien acceptabel om de parkeertarieven te verhogen".
RH: "Hogere tarieven leidt tot minder autogebruik"
PB: "Lage parkeertarieven is het kannibaliseren van je eigen OV-systeem".

Autogebruik in de stad

VM: "Minder autogebruik leidt tot meer bereikbaarheid"
HM: "Als autogebruik binnen de stad daalt dan daalt dus ook de modal split maar niet automatisch. Het kan ook zo zijn dat mensen dan helemaal niet meer reizen. Je kan niet alle daling in het autogebruik ten goede van het OV rekenen".
JR: "Samenvattend: Minder autogebruik leidt tot een lagere modal split. Die lagere modal split leidt tot meer leefbaarheid, veiligheid en bereikbaarheid?" Groep stemt in.

Modal split auto

HM: "Als autogebruik binnen de stad daalt dan daalt dus ook de modal split maar niet automatisch. Het kan ook zo zijn dat mensen dan helemaal niet meer reizen. Je kan niet alle daling in het autogebruik ten goede van het OV rekenen".
RH: "Je kunt wel zeggen dat als de modal split omlaaggaat, dat dit de leefbaarheid ten goede komt"
RH: "Veiligheid is daar ook bij gebaat" - verwijst naar modal split –
JR: "Samenvattend: Minder autogebruik leidt tot een lagere modal split. Die lagere modal split leidt tot meer leefbaarheid, veiligheid en bereikbaarheid?" Groep stemt in.

Flexibiliteit contracten

RH: "Nou, het punt is, eigenlijk wil je als platformontwikkelaar flexibiliteit houden en dit staat tegenover strakke contracten"
RH: "Die regelgeving leidt tot een reductie in de flexibiliteit van contracten en daarmee tot minder samenwerking" – Verwijst naar wet- en regelgeving rondom OV
RH: "als je weet dat je samen je contracten kunt wijzigen, ga je sneller samenwerking aan"

Klanteigenaarschap

HM: "Meer communicatie met platform leidt tot het gevoel van een verlies van klanteigenaarschap"
VM: "Je bent afhankelijk van wat anderen doen. Er is geen controle"
HM: "Ik ben bang dat ik als NS, klanten verlies aan Arriva"
VM: "In de keten ben je afhankelijk van wat anderen bieden"
HM: "Het verschil is dat klanteigenaarschap verschuift van het bedrijf naar het platform"
PB: "Je wilt weten wat de klant wilt, dat is marktkennis. Maar als ik aan data kan komen van autoverplaatsingen, kan ik ook weer mijn product verbeteren"
RH: "Als je klanteigenaarschap omlaaggaat, kan de marktkennis wel omhooggaan"
HM: "Klanteigenaarschap is meer dan alleen kennis over de klant".

Wet- en regelgeving overheid

PB: "Overheid legt tarieven op aan OV. Bedrijven kunnen niet even onderhandelen over tarieven om meer mensen te kunnen aantrekken".
HM: "Ik kan wel meer kennis krijgen maar als ik er niks mee mag." (..) "Ik heb nu niks aan mijn marktkennis"
RH: "Er zijn beperkende institutionele kaders"
PB: "Dan moet je regelgeving vrijgeven". – Verwijst naar uitspraak van BW om data te gebruiken voor optimalisatie
HM: "Maar dat mag niet van de overheid/gemeentes" – In reactie op RH's uitspraak dat data gebruikt kan worden om kostbare componenten binnen de keten te verwijderen
JR: "De complementariteit wordt tegengewerkt door de overheid?" – Groep stemt in
RH: "Privatisering wordt vaak niet doorgetrokken. Als een bedrijf bijvoorbeeld de prijzen verhoogd, bemoeit de 2e kamer zich daar weer mee"
VM: "Wet- en regelgeving rondom OV is een betere variabele" – Groep stemt in met VM's voorstel om de variabele Wet- en regelgeving rondom OV te noemen.
BW: "Er zijn privacy bezwaren".
RH: "Die regelgeving leidt tot een reductie in de flexibiliteit van contracten en daarmee tot minder samenwerking"

Kwaliteit MaaS aanbod (Niet in het originele model)

RH: "Bereikbaarheid is niet persé alleen afhankelijk van de auto. MaaS met meer mogelijkheden zou de bereikbaarheid verbeteren"
HM: "Als je dus een aantrekkelijk MaaS aanbod levert, is het misschien acceptabel om de parkeertarieven te verhogen"

Individuele marktkennis (Niet in het originele model)

RH: "Marktkennis heeft een positief effect op de kwaliteit van de dienst. Marktkennis kan twee richtingen uitgaan. Jouw individuele marktkennis kan omlaaggaan, maar in zijn totaliteit weet je meer. Hoe dat uitpakt moet je afwegen. Jouw reductie in marktkennis kan leiden tot een besluit om geen data meer te delen"
PB: "Er wordt ook feedback gegeven vanuit de algoritmes over de diensten om je aanbod te optimaliseren"
RH: "Dit is op collectiviteit gericht he, maar denk om individuele spelers. Denk ook om individuele modaliteiten, het eigen gedrag. – in de discussie over marktkennis
VM: "Marktkennis per modaliteit neemt af"
BW: "Je gaat optimaliseren"
PB: "Als je het goed speelt, kun je nieuwe info naar je toe spelen"

Bruikbaarheid marktkennis (Niet in het originele model)

HM: "Ik kan wel meer kennis krijgen maar als ik er nis mee mag (..) ik heb nu niks aan mijn marktkennis".
RH: "Er zijn beperkende institutionele kaders"
PB: "Dan moet je regelgeving vrijgeven" – In reactie op uitspraak BW om data te gebruiken voor optimalisatie
PB: "Overheid legt tarieven op aan OV. Bedrijven kunnen niet onderhandelen over tarieven om meer mensen te kunnen aantrekken"
HM: "Maar dat mag niet van de overheid/gemeentes" – In reactie op RH's uitspraak dat data gebruikt kan worden om kostbare componenten binnen de keten te verwijderen.
RH: "Privatisering wordt vaak niet doorgetrokken. Als een bedrijf bijvoorbeeld de prijzen verhoogd, dan bemoeit de 2de kamer zich daar weer mee".
BW: "Er zijn privacy bezwaren".

Concurrentie tussen aanbieders (Niet in het originele model)

HM: "Maar eigenlijk bouw je meer mogelijkheden die ook kunnen concurreren. Busmaatschappijen kunnen als de dood zijn voor meer modaliteiten"
PB: "Mensen die hun product bovenaan in het algoritme willen zetten, hoe bescherm je je belangen goed zodat je die transformatie goed kunt maken? (...) Partijen niet tegen elkaar uitspelen "
PB: "Het openbreken van markten leidt tot meer klanten. Alleen de weg ernaartoe."
RH: "beide effecten zit nu in het model. Maar er zit ook gevaar. En hoe die uitpakt in de praktijk weet je niet" – Als antwoord op HM's uitspraak over de balans tussen concurrentie die leidt tot meer/minder klanten en samenwerking die leidt tot meer/minder klanten als gevolg van interne concurrentie en PB's uitspraak over het openbreken van markten.
RH: "Door die concurrentie kan het zijn er een negatief effect is van data. Meer samenwerking kan leiden tot meer concurrentie tussen de aanbieders"
HM: "Geen samenwerking is sowieso concurrentie"
HM: "Ik ben bang dat ik als NS, klanten verlies aan Arriva"

Vertrouwen in elkaar/ duur van het samenwerkingsverband (Niet in het model):
RH: "Je gaat pas data uitwisselen als er vertrouwen is, een langdurige relatie"

Gezamenlijke doelen (Niet in het model):
BW: "en gezamenlijke doelen" – Reactie op RH's uitspraak "Je gaat pas data uitwisselen als er vertrouwen is"

8.4.2. Justification of relations

Variabele	*Richting relatie*	*Variabele*	*Verantwoording*
Aantal aangeboden modaliteiten	Positief	Concurrentie tussen aanbieders	*HM: "Maar eigenlijk bouw je meer mogelijkheden die ook kunnen concurreren. Busmaatschappijen kunnen als de dood zijn voor meer modaliteiten"* *RH: "beide effecten zit nu in het model. Maar er zit ook gevaar. En hoe die uitpakt in de praktijk weet je niet" – Als antwoord op HM's uitspraak over de balans tussen concurrentie die leidt tot meer/minder klanten en samenwerking die leidt tot meer/minder klanten als gevolg van interne concurrentie en PB's uitspraak over het openbreken van markten.* *HM: "Ik ben bang dat ik als NS, klanten verlies aan Arriva"*
Aantal aangeboden modaliteiten	Positief	Compleetheid verplaatsingsketen	*RH: - loopt naar het bord - "Meer modaliteiten leidt tot completere ketens leidt tot meer waardering"* *HM: "Fietsen aanbieden naast de bussen want de bussen zitten al zo vol in de spits. Meer modaliteiten dus meer klantwaardering"* ***(Post-workshop wordt de variabele "aantal modaliteiten" toegevoegd. Gedurende de workshop komen diverse intermediaire variabelen naar voren tussen "aantal modaliteiten" naar "toegevoegde waarde klant". Wij beschouwen bovenstaande quote als een bevestiging van de relaties" aantal modaliteiten" tot aan "toegevoegde waarde klant")***
Aantal reizigerskilometers	Positief	Kosten baten ratio	*RH: "Toegevoegde waarde moet leiden tot meer reizigers, moet leiden tot meer winst (...)"*
Autogebruik in de stad	Positief	Modal split auto	*JR: "Samenvattend: Minder autogebruik leidt tot een lagere modal split. Die lagere modal split leidt tot meer leefbaarheid, veiligheid en bereikbaarheid?" Groep stemt in.* *HM: "Als autogebruik binnen de stad daalt dan daalt dus ook de modal split maar niet automatisch. Het kan ook zo zijn dat mensen dan helemaal niet meer reizen. Je kan niet <u>alle</u> daling in het autogebruik ten goede van het OV rekenen".*
Betrouwbaarheid app	Positief	Kwaliteit vervoersdiensten	*HM: "De Kwaliteit vervoersdiensten wordt bepaald door (...) Ook de betrouwbaarheid van het platform (app)".* *RH: "misschien dat het juist wel de toegevoegde waarde van de klant is die beïnvloed wordt door (...) en betrouwbaarheid platform (app)"* ***Hier wordt post-workshop de intermediaire variabele "Kwaliteit vervoersdiensten: tussen geplaatst*** PB: "Betrouwbaarheid (van de applicatie) (…) leiden tot hogere kwaliteit" *PB: "De klant kijkt de vervoerder erop aan als de app niet werkt"* ***(Origineel in het model als relatie tussen Kwaliteit MaaS app en toegevoegde waarde klant. Dit lijkt een misinterpretatie en gezien de input van de groep en de uitspraak van PB zelf hiervoor, is besloten een aanpassing door te voeren, met "kwaliteit vervoersdiensten" als intermediaire variabele tussen toegevoegde waarde klant")***
Bruikbaarheid marktkennis	Positief	Efficiëntie bedrijfsvoering	**Verantwoording ligt in de combinatie van de verantwoording van de volgende relaties:**

			- **Individuele- en collectieve marktkennis tot effficiëntie bedrijfsvoering.** - **Wet- en regelgeving rondom OV**
Collectieve marktkennis	Positief	Kwaliteit vervoersdiensten	*PB: "Er wordt ook feedback gegeven vanuit de algoritmes over de diensten, om je aanbod te optimaliseren"* *PB: "Je wilt weten wat de klant wilt, dat is marktkennis (...)"* *RH: "Het heeft een positief effect op de kwaliteit van de dienst (...)".* ***("Het" verwijst naar marktkennis)***
Collectieve marktkennis	Positief	Efficiëntie bedrijfsvoering	*BW: "Dat heeft invloed op het interne proces"- verwijst naar data en marktkennis* *PB: "Maar als ik aan data kan komen van autoverplaatsingen, kan ik ook weer mijn product verbeteren"* *BW: "Die analyses die bij bijvoorbeeld Bol.com worden gemaakt zijn goud waard"* *BW: "Je gaat optimaliseren"* *PB: "Er wordt ook feedback gegeven vanuit de algoritmes over de diensten, om je aanbod te optimaliseren"* *RH: "Data leidt tot aanpassing omdat de kosten van de bedrijfsvoering omlaaggaan"* *PB: "Als je het goed speelt, kun je nieuwe info naar je toe spelen"* ***(Post workshop is de variabele "efficiëntie bedrijfsvoering" toegevoegd. Gedurende de workshop is "marktkennis" gebruikt als intermediaire variabele, welke post-workshop is opgesplitst in "individuele marktkennis" en "collectieve marktkennis")***
Collectieve marktkennis	Negatief	Individuele marktkennis	*RH: "Dit is op de collectiviteit gericht he. Maar denk om individuele spelers. Denk ook om individueel modaliteit. Eigen gedrag." – In de discussie over marktkennis* *RH: "Het heeft een positief effect op de kwaliteit van de dienst. Marktkennis kan twee richtingen uitgaan. Jouw individuele marktkennis kan omlaaggaan, maar in zijn totaliteit weet je meer. Hoe dat uitpakt moet je afwegen. Jouw reductie in marktkennis kan leiden tot een besluit om geen data meer te delen"* *VM: "Marktkennis per modaliteit neemt af"* *HM: - in reactie op VM – "Maar het totaal neemt toe"* *VM: "Marktkennis keten gaat omhoog"* ***(Bovenstaande discussie geeft aan dat er een spanningsveld is tussen de marktkennis per modaliteit ("individuele marktkennis) en de "collectieve marktkennis")***
Compleetheid verplaatsingsketen	Positief	Kwaliteit vervoersdiensten	*- RH: "Vanuit Go About gedacht wil je meerdere mogelijkheden aanbieden om een reis te kunnen accommoderen. Dat is één element van kwaliteit (...)"* *HM: "De Kwaliteit vervoersdiensten wordt bepaald door (...) keuzemogelijkheden"*

			HM: "Compleetheid verplaatsingsketen is onderdeel van dat serviceaanbod (…) Allemaal plusjes richting service aanbod" BW & FS bevestigen dit ***(Service aanbod wordt later veranderd in "Kwaliteit vervoersdiensten" en post-workshop in "Kwaliteit vervoersdiensten")*** *HM: "Fietsen aanbieden naast de bussen want de bussen zitten al zo vol in de spits. Meer modaliteiten dus meer klantwaardering"* ***Hier wordt later de intermediaire variabele "Kwaliteit vervoersdiensten" aan toegevoegd*** *PB: "Als de klant vindt dat hij meer in de winkel kan shoppen verhoogd dat zijn beleving van toegevoegde waarde"* ***Hier wordt later de intermediaire variabele "Kwaliteit vervoersdiensten" aan toegevoegd*** *PB: "Dat is goed, dan heeft de klant meer te kiezen en dan blijft de klant binnen de markt"*
Compleetheid verplaatsingsketen	Positief	Toegankelijkheid van het systeem	*HM: "Ik zou zeggen dat samenwerking leidt tot betere toegankelijkheid van het systeem door (…) compleetheid"*
Compleetheid verplaatsingsketen	Positief	Efficiëntie bedrijfsvoering	*HM: "Ik werk alleen samen omdat het te duur is om alle diensten aan te bieden"* *HM: "Je hebt het steeds over Kostenbaten ratio. Kosten hebben we nog niet echt besproken. Kosten platform. We kunnen ook kosten besparen door dure treinen omzetten in bussen"* ***("Efficiëntie bedrijfsvoering" is post-workshop toegevoegd als intermediaire variabele tussen "compleetheid verplaatingsketen" en "kosten baten ratio")*** *HM: "Maar stel ik ga met BRENG, maar die trein is te duur. Ik knikker hem eruit en we doen het met de bus. We gooien een dure eruit (…)"*
Data	Positief	Kwaliteit MaaS app	*PB: "(…) Het is aan de appbouwer hoe dat (de data) gepresenteerd wordt en of dat goed is"* *JR: "Betere app, meer data, betere app?" – Groep bevestigd*
Data	Positief	Individuele marktkennis	*PB: "Er wordt ook feedback gegeven vanuit de algoritmes over de diensten, om je aanbod te optimaliseren"(****Post workshop is "individuele marktkennis" toegevoegd, welke fungeert als intermediaire variabele tussen "data" en "efficiëntie bedrijfsvoering")*** *BW: "Dat heeft invloed op het interne proces" – verwijst naar data en marktkennis*
Data	Positief	Collectieve marktkennis	*PB: "Je wilt weten wat de klant wilt, dat is marktkennis (…)"* *BW: "Dat heeft invloed op het interne proces" – verwijst naar data en marktkennis* ***Verantwoording bij de volgende drie relaties kan deels gebruikt worden om deze relatie te bevestigen. Tevens bevatte het originele model de relatie tussen "data" en "collectieve marktkennis".***
Delen van data tussen aanbieders	Positief	Concurrentie tussen aanbieders	*PB: "Mensen die hun product bovenaan in het algoritme willen zetten, hoe bescherm je je belangen goed zodat je die transformatie goed kunt maken? (…)*

			RH: "Door die concurrentie kan het zijn er een negatief effect is van data. Meer samenwerking kan leiden tot meer concurrentie tussen de aanbieders"
Delen van data tussen partijen	Negatief	Klanteigenaarschap	*HM: "Meer communicatie met platform leidt tot het gevoel van een verlies van klanteigenaarschap"*
Delen van data tussen partijen	Positief	Data	**Het oorspronkelijke model bevatte de relatie tussen "Data beschikbaar stellen" en "data". Omdat er in de workshop frequent werd gesproken over het "delen van data" is besloten om deze variabele aan te passen.**
Efficiëntie bedrijfsvoering	Positief	Kosten baten ratio	*BW: "Die analyses die bij bijvoorbeeld Bol.com worden gemaakt zijn goud waard"* *RH: "Data leidt tot aanpassing omdat de kosten van de bedrijfsvoering omlaaggaan"* *RH: "Data zorgt voor: 1. meer klanten, 2. de meest kostbare componenten kun je verwijderen"* ***(Post workshop is de variabele "efficiëntie bedrijfsvoering" toegevoegd. Gedurende de workshop is "marktkennis" gebruikt als intermediaire variabele, welke post-workshop is opgesplitst in "individuele marktkennis" en "collectieve marktkennis")***
Flexibiliteit contracten	Positief	Samenwerking	*RH: "als je weet dat je samen je contracten kunt wijzigen, ga je sneller samenwerking aan"* *RH: "Die regelgeving leidt tot een reductie in de flexibiliteit van contracten en daarmee tot minder samenwerking" – Verwijst naar wet- en regelgeving rondom OV*
Frequentie vervoersdiensten	Positief	Kwaliteit vervoersdiensten	*RH:" (...) dat is één element van kwaliteit maar het heeft natuurlijk ook te maken met de frequentie* *PB: "(...) en frequentie leiden tot hogere kwaliteit"* *HM: "De Kwaliteit vervoersdiensten wordt bepaald door het aantal diensten (...)"*
Frequentie vervoersdiensten	Positief	Toegankelijkheid van het systeem	*HM: "Ik zou zeggen dat samenwerking leidt tot betere toegankelijkheid van het systeem door meer services, (...)"*
Individuele marktkennis	Positief	Kwaliteit vervoersdiensten	*PB: "Er wordt ook feedback gegeven vanuit de algoritmes over de diensten, om je aanbod te optimaliseren"* *PB: "Je wilt weten wat de klant wilt, dat is marktkennis (...)"* *RH: "Het heeft een positief effect op de kwaliteit van de dienst (...)".* ***("Het" verwijst naar marktkennis)***
Individuele marktkennis	Positief	Efficiëntie bedrijfsvoering	*BW: "Dat heeft invloed op het interne proces" – verwijst naar data en marktkennis* *PB: "Er wordt ook feedback gegeven vanuit de algoritmes over de diensten, om je aanbod te optimaliseren"* *BW: "Die analyses die bij bijvoorbeeld Bol.com worden gemaakt zijn goud waard"*

			BW: "Je gaat optimaliseren" *RH: "Data leidt tot aanpassing omdat de kosten van de bedrijfsvoering omlaaggaan"* ***(Post workshop is de variabele "efficiëntie bedrijfsvoering" toegevoegd. Gedurende de workshop is "marktkennis" gebruikt als intermediaire variabele, welke post-workshop is opgesplitst in "individuele marktkennis" en "collectieve marktkennis"***
Individuele marktkennis	Negatief	Delen van data tussen aanbieders	*RH: "(...) Marktkennis kan twee richtingen uitgaan. Jouw individuele marktkennis kan omlaaggaan, maar in zijn totaliteit weet je meer. Hoe dat uitpakt moet je afwegen. Jouw reductie in marktkennis kan leiden tot een besluit om geen data meer te delen"*
Klanteigenaarschap	Negatief	Delen van data tussen partijen	*RH: "Als je klanteigenaarschap omlaaggaat, kan de marktkennis wel omhooggaan" – doelt hiermee op marktkennis van het geheel* ***Post workshop is de variabele "delen van data tussen partijen" als intermediaire variabele tussen de relatie klanteigenaarschap en collectieve marktkennis geplaatst***
Kosten baten ratio	Positief	Samenwerking	*RH: "Toegevoegde waarde moet leiden tot meer reizigers, moet leiden tot meer winst, meer samenwerking"* *RH: "Als je een systeem ontwikkeld dat de winst verhoogt, willen mensen wel samenwerken"* *RH en BW: "Kosten en baten zijn beiden van invloed op samenwerking"*
Kwaliteit app	Positief	Data	*JR: "Betere app, meer data, betere app?" – Groep bevestigd*
Kwaliteit MaaS aanbod	Positief	Toegevoegde waarde klant	*RH: "misschien dat het juist wel de toegevoegde waarde van de klant is die beïnvloed wordt door Kwaliteit vervoersdiensten (...)"* *HM: "Ik zou een pijltje zetten van service aanbod naar toegevoegde waarde klant"* *BW: "Service aanbod is een intermediaire variabele"* *HM: "Service aanbod is meer het aantal diensten, zou een aparte variabele moeten zijn"* *JR: "Service aanbod wordt opgesplitst in kwaliteit services en het aantal diensten?"* *Groep akkoord met splitsing, waardoor relatie kwaliteit services/diensten ontstaat met toegevoegde waarde klant.* *PB: "Dat is goed, dan heeft de klant meer te kiezen en dan blijft de klant binnen de markt"* ***Post-workshop wordt de intermediaire variabele "kwaliteit MaaS aanbod" aan het model toegevoegd.***
Kwaliteit MaaS aanbod	Positief	Bereikbaarheid	*RH: "Bereikbaarheid is niet persé alleen afhankelijk van de auto. MaaS met meer mogelijkheden zou de bereikbaarheid verbeteren"*
Kwaliteit MaaS aanbod	Negative	Autogebruik in de stad	*BW: "Daarom is die last mile zo belangrijk. Je wilt geen auto's in de binnenstad"*
Kwaliteit MaaS aanbod	Positief	Parkeertarieven	*HM: "Als je dus een aantrekkelijk MaaS aanbod levert, is het misschien acceptabel om de parkeertarieven te verhogen".*

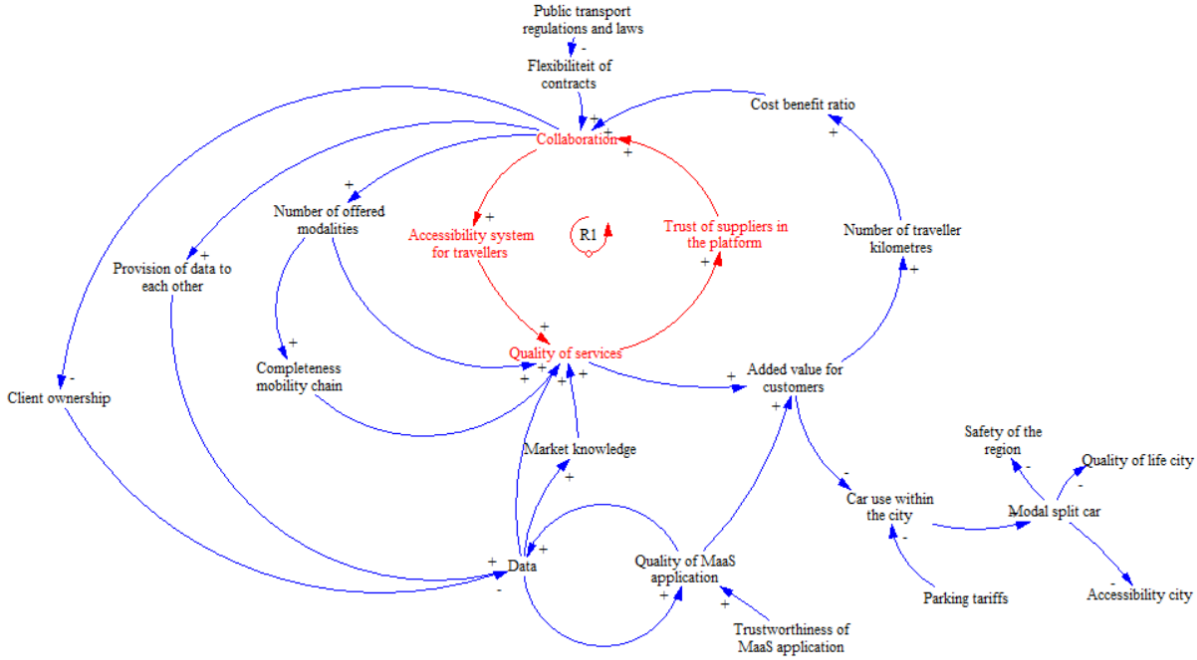
Kwaliteit vervoersdiensten	Positief	Toegankelijkheid van het systeem	*HM: "Ik zou zeggen dat samenwerking leidt tot betere toegankelijkheid van het systeem door meer services, Kwaliteit vervoersdiensten, compleetheid"*
Kwaliteit vervoersdiensten	Positief	Kwaliteit MaaS aanbod	**Intermediaire variabele "Kwaliteit MaaS aanbod" tussen "Toegevoegde waarde klant" en "Kwaliteit vervoersdiensten" is post-workshop toegevoegd om een onderscheid te kunnen maken tussen "kwaliteit MaaS aanbod" en parkeertarieven, bereikbaarheid en autogebruik in de stad.**
Modal split auto	Negatief	Leefbaarheid	*RH: "Je kunt wel zeggen dat als de modal split omlaaggaat, dat dit de leefbaarheid ten goede komt"* *JR: "Samenvattend: Minder autogebruik leidt tot een lagere modal split. Die lagere modal split leidt tot meer leefbaarheid, veiligheid en bereikbaarheid?" Groep stemt in.*
Modal split auto	Negatief	Veiligheid	*RH: "Veiligheid is daar ook bij gebaat" - verwijst naar modal split –* *JR: "Samenvattend: Minder autogebruik leidt tot een lagere modal split. Die lagere modal split leidt tot meer leefbaarheid, veiligheid en bereikbaarheid?" Groep stemt in.*
Modal split auto	Negatief	Bereikbaarheid	*VM: "Minder autogebruik leidt tot meer bereikbaarheid* *JR: "Samenvattend: Minder autogebruik leidt tot een lagere modal split. Die lagere modal split leidt tot meer leefbaarheid, veiligheid en bereikbaarheid?" Groep stemt in.*
Parkeertarieven	Negatief	Autogebruik in de stad	*RH: "Hogere tarieven leidt tot minder autogebruik"* *HM: "Een collegegemeente Arnhem, stelde in het Gelredome een grote park en ride in. Niemand gebruikte dat want de parkeertarieven werden gehalveerd. Je kan dan niet verwachten dat mensen het openbaar vervoer gebruiken"* *PB: "Lage parkeertarieven is het kannibaliseren van je eigen OV-systeem"*
Parkeertarieven	Positief	Kwaliteit MaaS aanbod	*HM: "Een collegegemeente Arnhem, stelde in het Gelredome een grote park en ride in. Niemand gebruikte dat want de parkeertarieven werden gehalveerd. Je kan dan niet verwachten dat mensen het openbaar vervoer gebruiken"* *PB: "Lage parkeertarieven is het kannibaliseren van je eigen OV-systeem"*
Samenwerking	Positief	Frequentie vervoersdiensten	*HM: "Samenwerking leidt tot meer services"* *RH: "Met meer partijen goed samenwerken leidt tot meer diensten"*
Samenwerking	Positief	Delen van data tussen partijen	*HM: "Bij samenwerking gaat het ook over data uitwisseling. Soms is dit moeilijk"* *RH: "Je gaat pas data uitwisselen als er vertrouwen is, een langdurige relatie"* ***(HM en RH geven aan dat een positieve relatie bestaat, maar dat er kanttekeningen geplaats moeten worden)***
Samenwerking	Negatief	Klanteigenaarschap	*VM: "Je bent afhankelijk van wat anderen doen. Er is geen controle"*

			HM: "Ik ben bang dat ik als NS-klanten verlies aan Arriva" *HM: "Het verschil is dat klanteigenaarschap verschuift van het bedrijf naar het platform"* ***Alle uitspraken verwijzen naar het effect van samenwerking***
Samenwerking	Positief	Aantal aangeboden modaliteiten	**Intermediaire variabele "Aantal aangeboden modaliteiten" tussen "Samenwerking" en "Compleetheid verplaatingsketen" is post-workshop toegevoegd om een onderscheid te kunnen maken tussen het effect van "aantal aangeboden modaliteiten" op "concurrentie tussen aanbieders".**
Toegevoegde waarde klant	Positief	Aantal reizigerskilometers	*RH: "Toegevoegde waarde moet leiden tot meer reizigers (...)"* *HM: "(...) Compleetheid leidt tot meer klanten. We zitten alleen in MaaS omdat we de keten willen complementeren. Want meerwaarde voor klanten betekent meer reizigers in de trein"*
Vertrouwen/Langdurige relatie	Positief	Delen van data	*RH: "Je gaat pas data uitwisselen als er vertrouwen is, een langdurige relatie* ***Te weinig discussie om te bevestigen. Wel belangrijke kanttekening die in lijn is met de theorie.***
Wet- en regelgeving rondom OV	Negatief	Bruikbaarheid marktkennis	*HM: "Ik kan wel meer kennis krijgen maar als ik er niks mee mag.." (..) "Ik heb nu niks aan mijn marktkennis"* *RH: "Er zijn beperkende institutionele kaders"* *PB: "Dan moet je regelgeving vrijgeven". – Verwijst naar uitspraak van BW om data te gebruiken voor optimalisatie* *HM: "Maar dat mag niet van de overheid/gemeentes" – In reactie op RH's uitspraak dat data gebruikt kan worden om kostbare componenten binnen de keten te verwijderen* *PB: "Overheid legt tarieven op aan OV. Bedrijven kunnen niet even onderhandelen over tarieven om meer mensen te kunnen aantrekken".* *RH: "Privatisering wordt vaak niet doorgetrokken. Als een bedrijf bijvoorbeeld de prijzen verhoogd, bemoeit de 2^{e} kamer zich daar weer mee"*
Wet- en regelgeving rondom OV	Negatief	Flexibiliteit contracten	*RH: "Die regelgeving leidt tot een reductie in de flexibiliteit van contracten en daarmee tot minder samenwerking" – Verwijst naar wet- en regelgeving rondom OV*

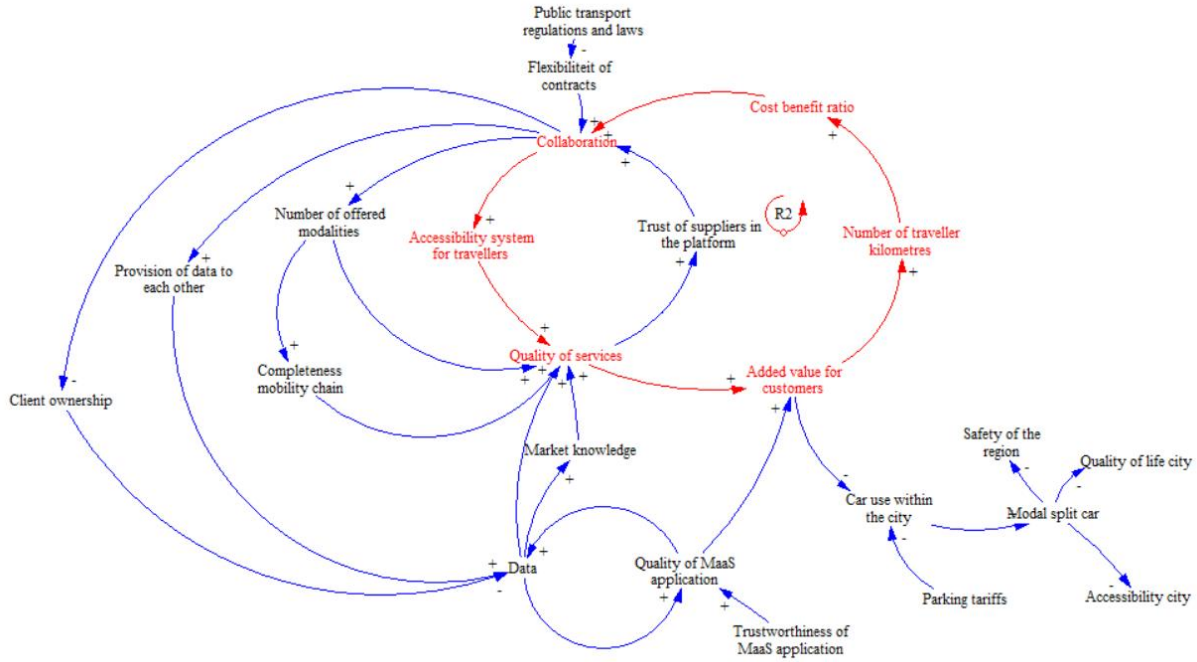
8.5. Original stakeholder model, with highlighted feedback loops

Original model with loops, translated to English

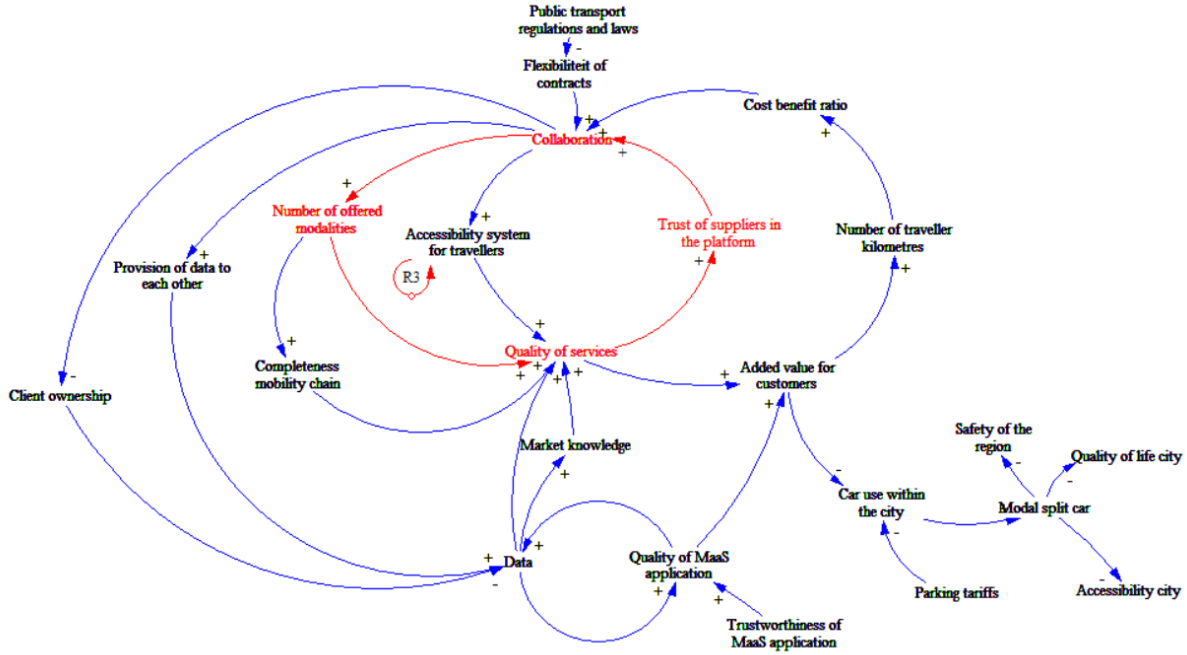
R1 = Collaboration → Accessibility system for travellers → Quality of services → Trust of suppliers in the platform → Collaboration



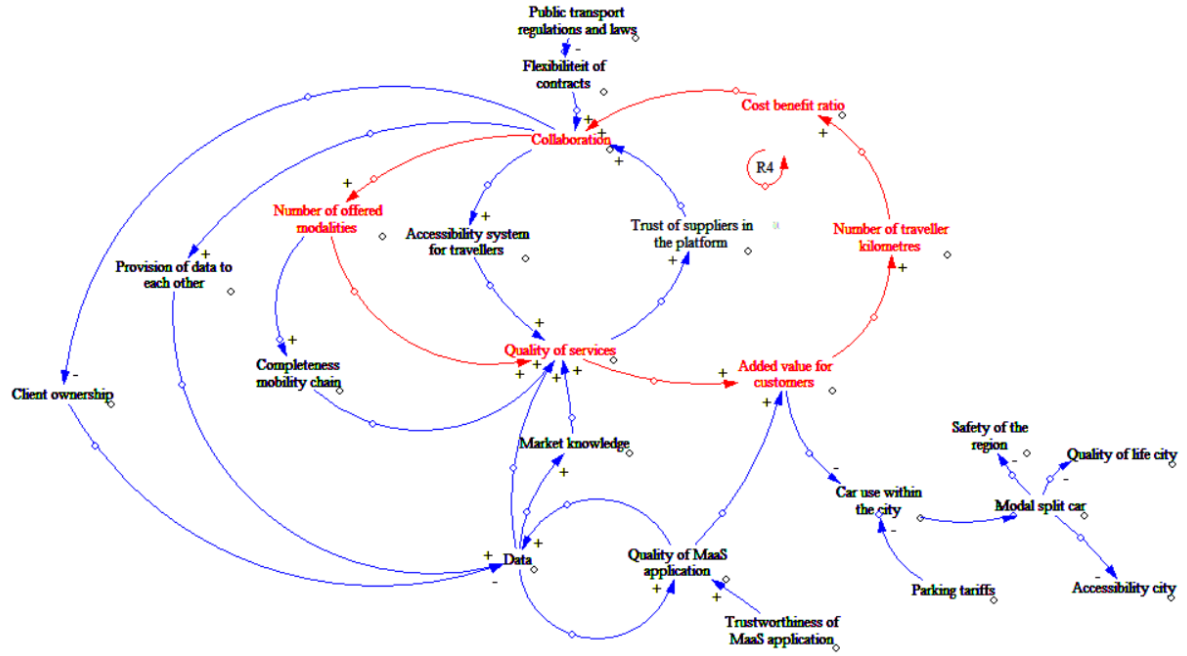
R2 = Collaboration → Accessibility system for travellers → Quality of services → Added value for customers → Number of traveller kilometres → Cost benefit ratio → Collaboration



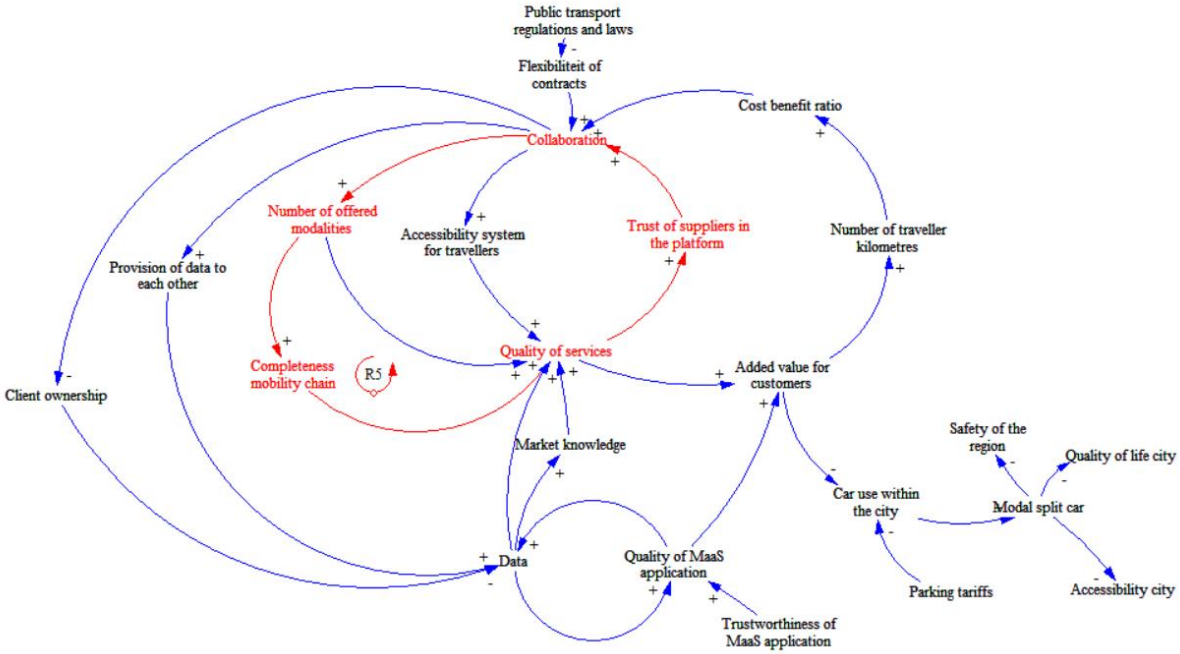
R3 = Collaboration → Number of offered modalities → Quality of services → Trust of suppliers in the platform → Collaboration



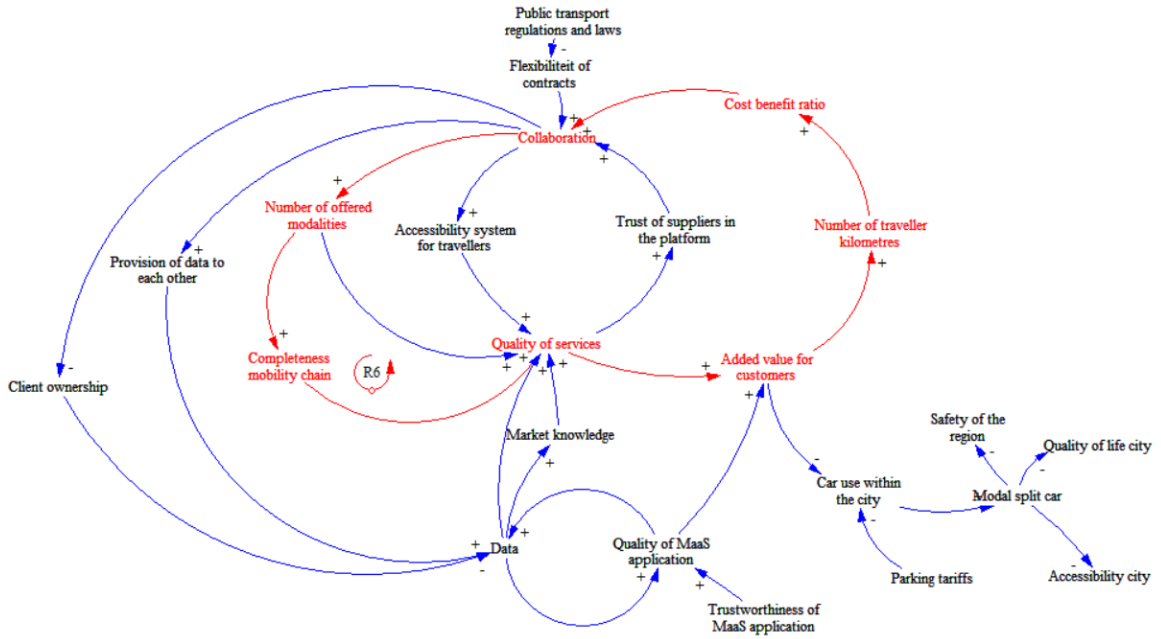
R4 = Collaboration → Number of offered modalities → Quality of services → Added value for customers → Number of traveller kilometres → Cost benefit ratio → Collaboration



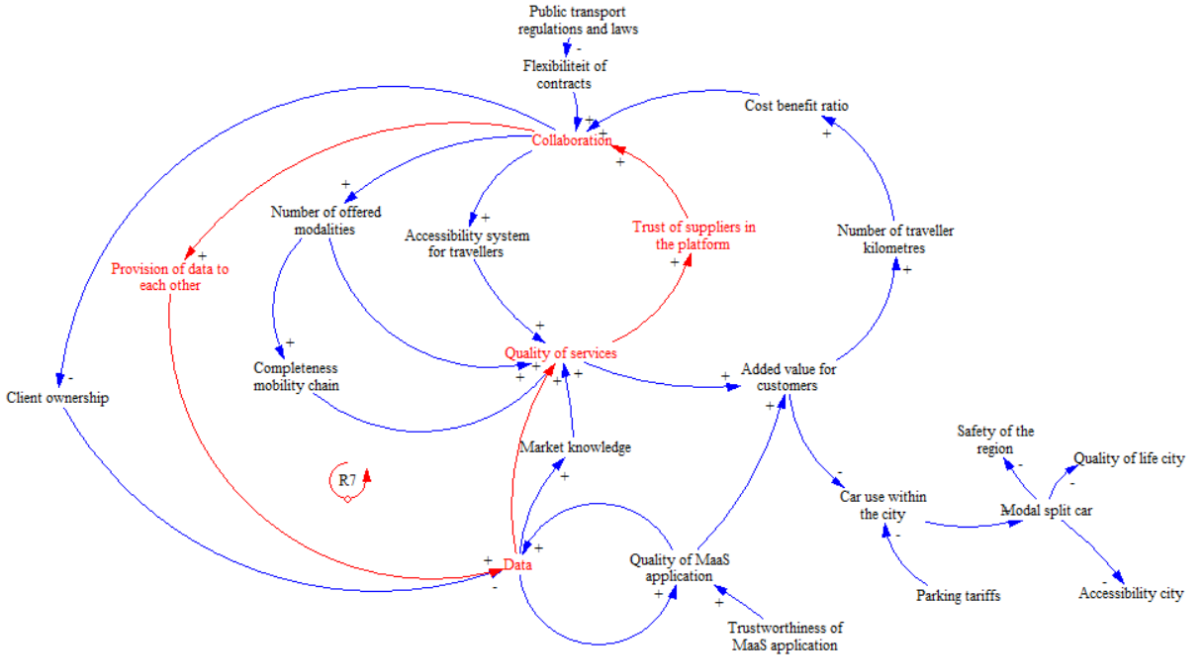
R5 = Collaboration → Number of offered modalities → Completeness mobility chain → Quality of services → Trust of suppliers in the platform → Collaboration



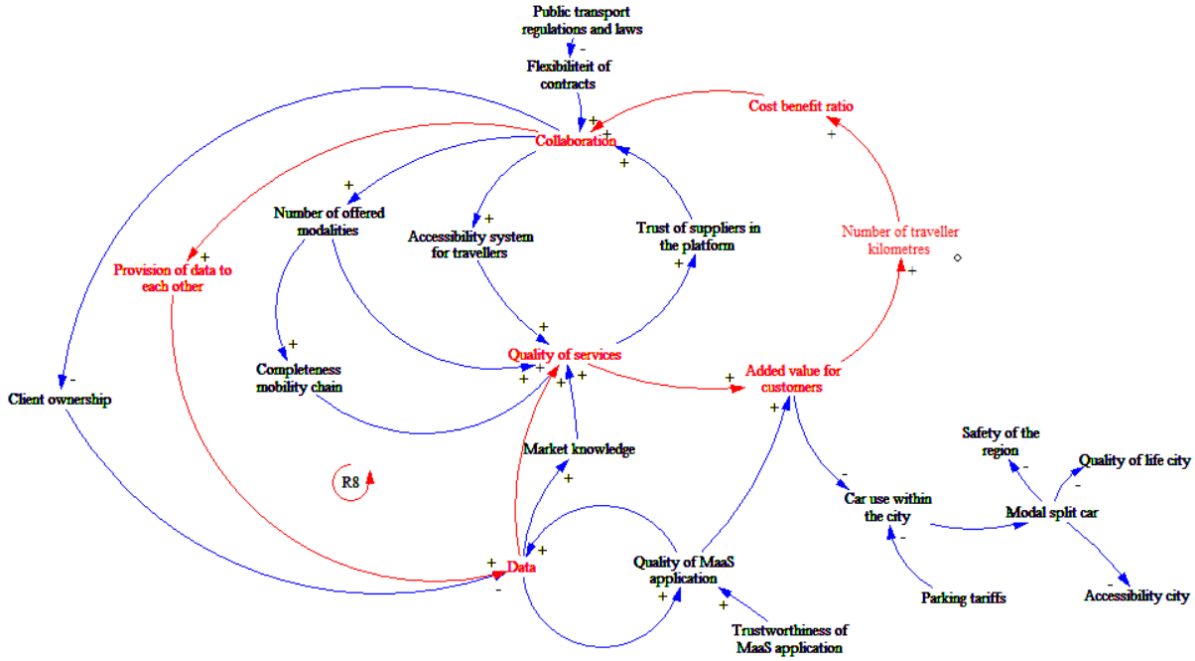
R6 = Collaboration → Number of offered modalities → Completeness mobility chain → Quality of services → Added value for customers → Number of traveller kilometres → Cost benefit ratio → Collaboration



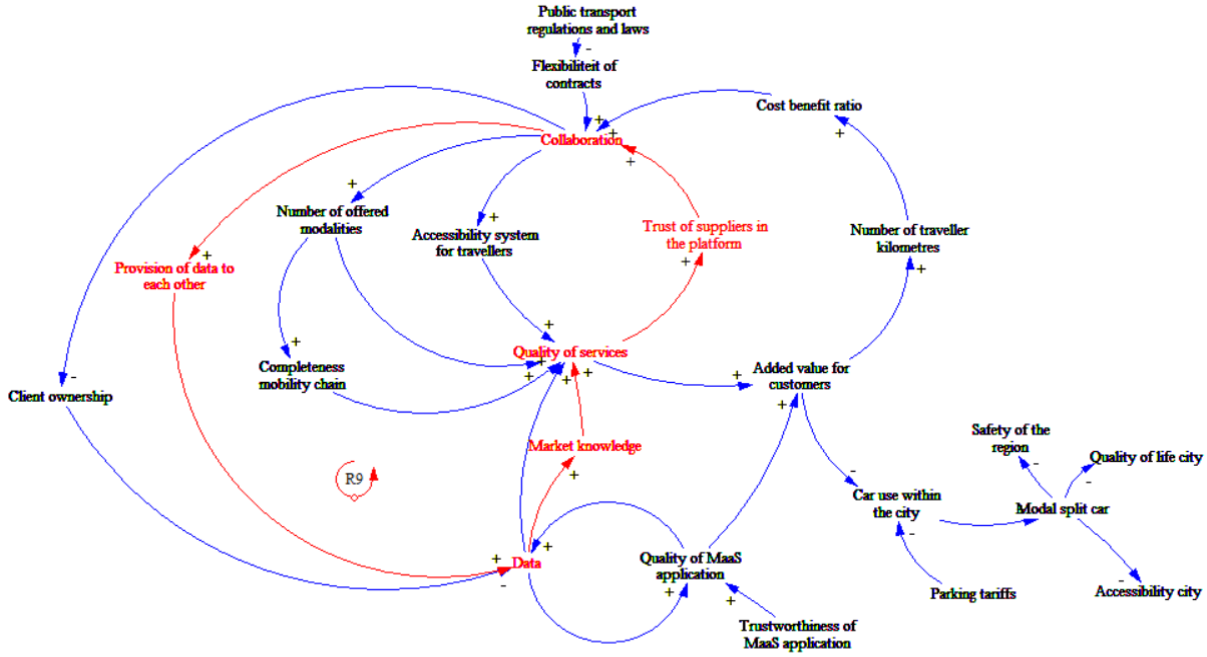
R7 = Collaboration → Provision of data to each other → Data → Quality of services → Trust of suppliers in the platform → Collaboration



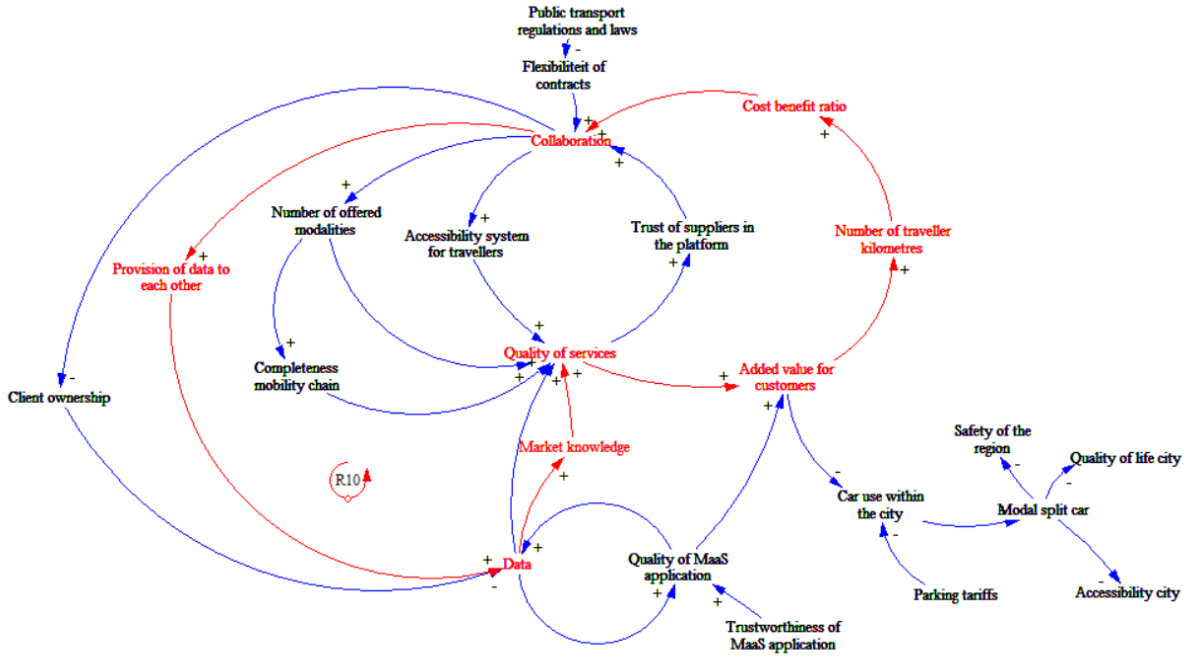
R8 = Collaboration → Provision of data to each other → Data → Quality of services → Added value for customers → Number of traveller kilometres → Cost benefit ratio → Collaboration



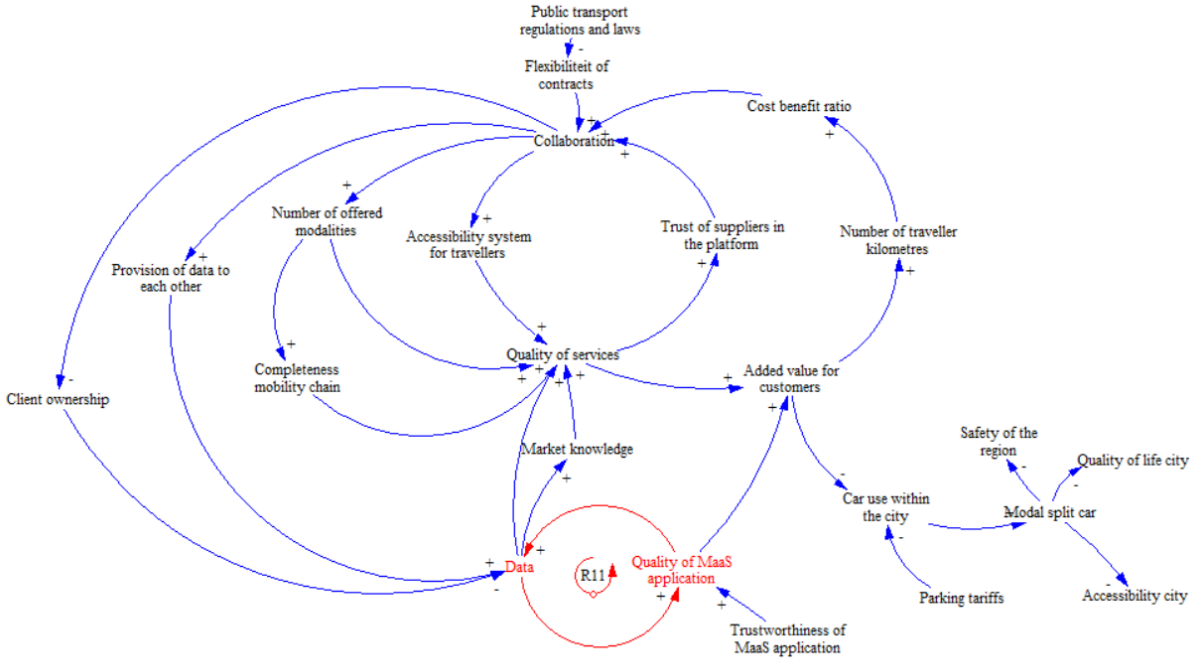
R9 = Collaboration → Provision of data to each other → Data → Market knowledge → Quality of services → Trust of suppliers in the platform → Collaboration



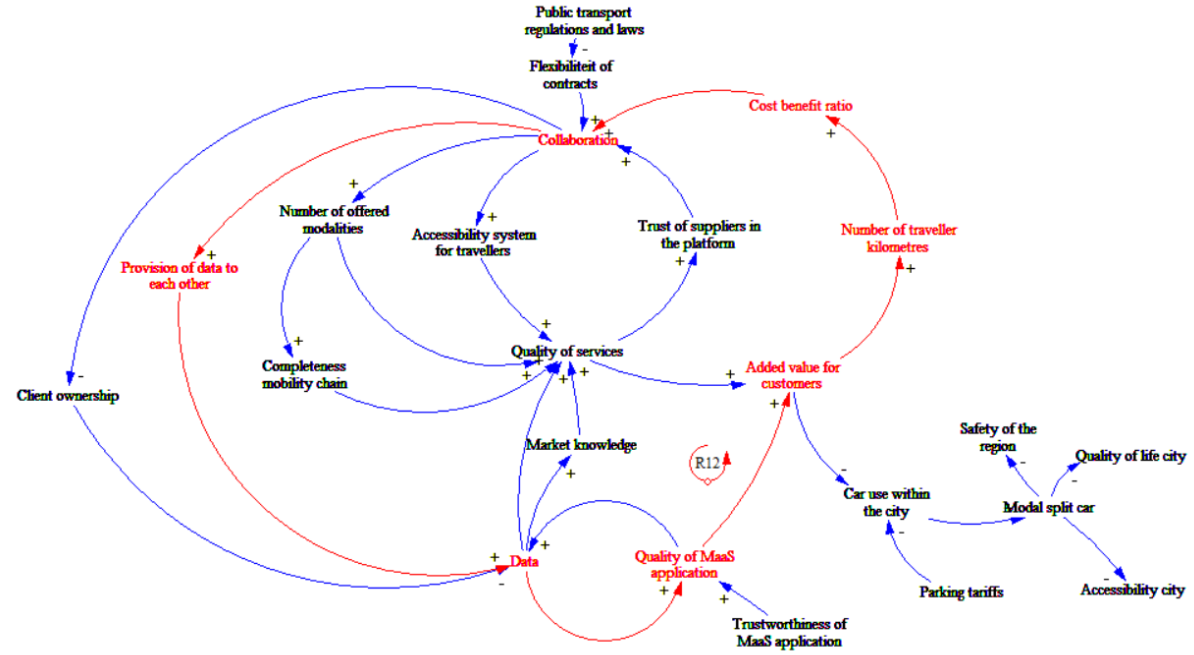
R10 = Collaboration → Provision of data to each other → Data → Market knowledge → Quality of services → Added value for customers → Number of traveller kilometres → Cost benefit ratio → Collaboration



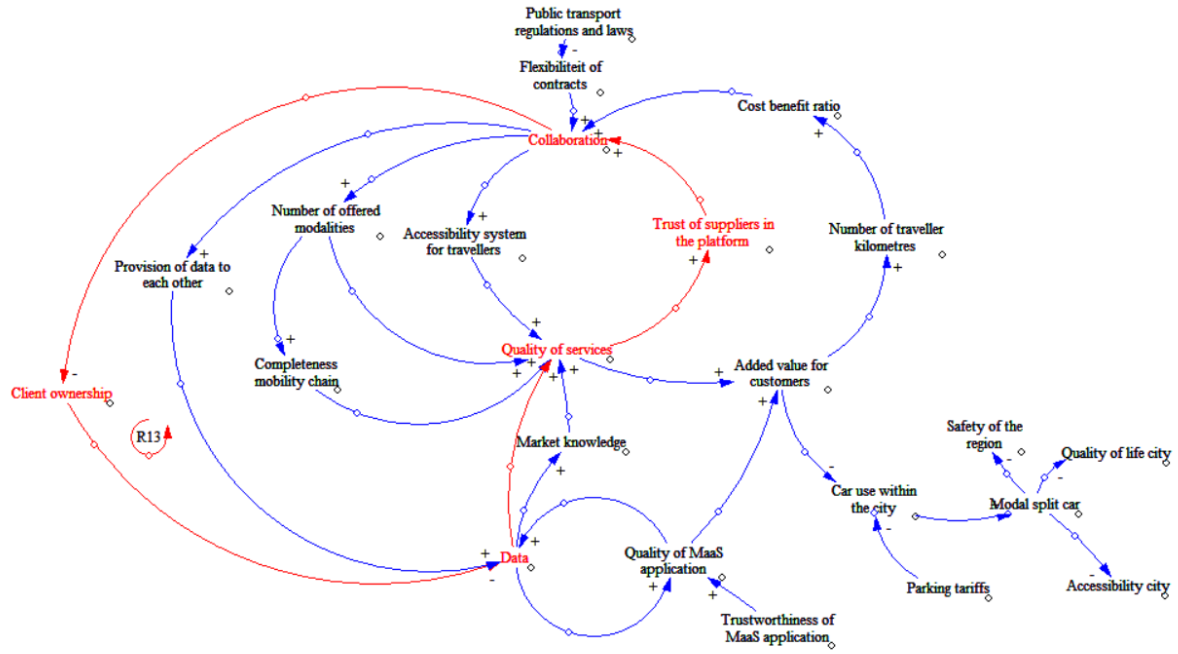
R11 = Data → Quality of MaaS application → Data



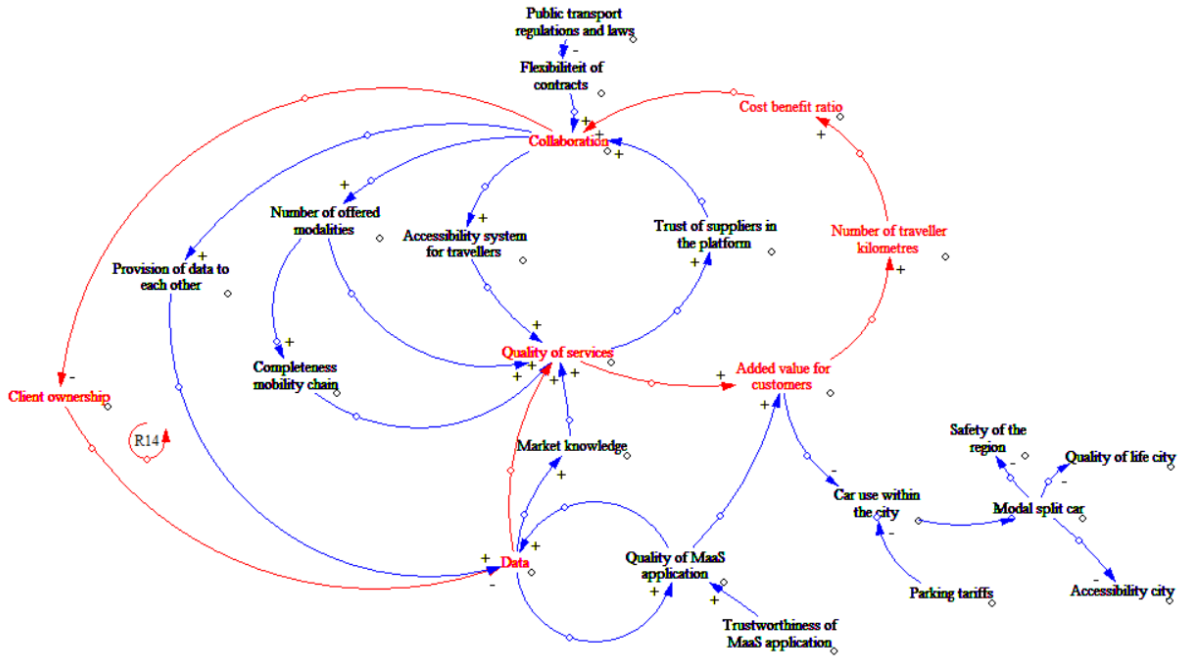
R12 = Collaboration → Provision of data to each other → Data → Quality of MaaS application → Added value for customers → Number of traveller kilometres → Cost benefit ratio → Collaboration



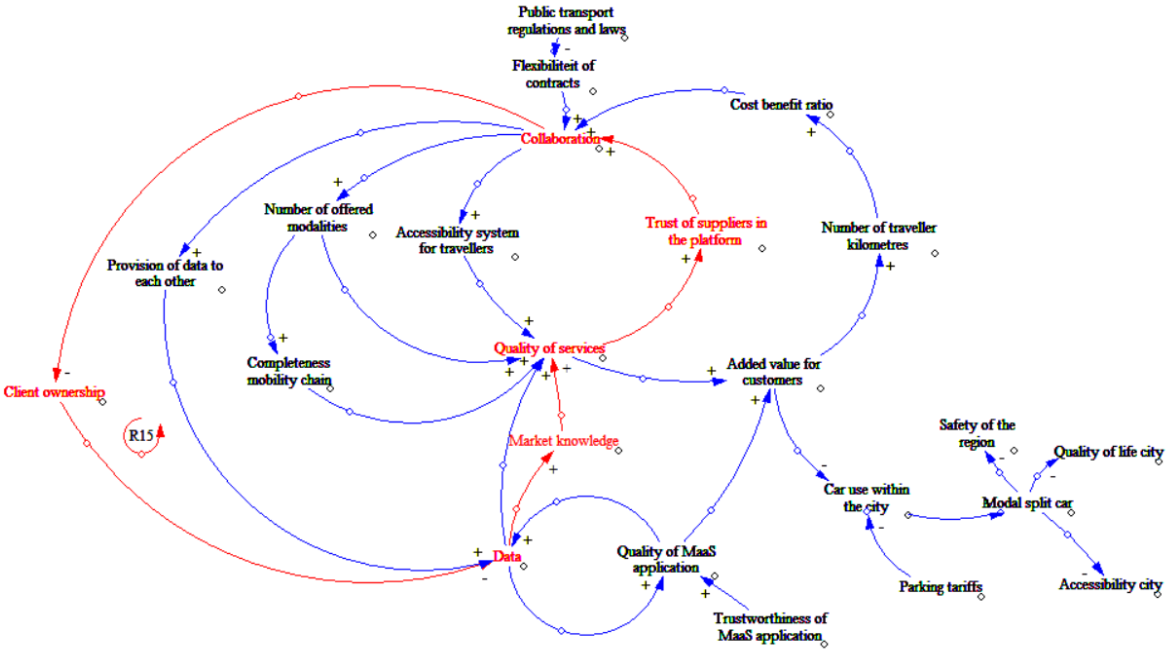
R13: Collaboration → Client Ownership → Data → Quality of services → trust of suppliers in the platform → Collaboration



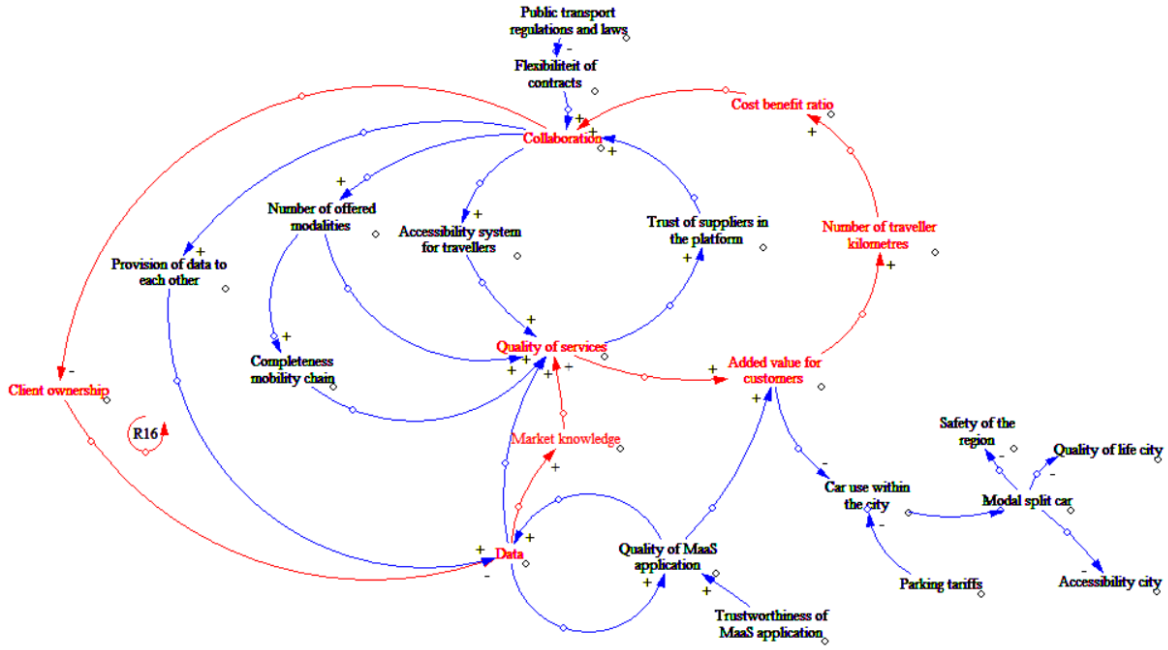
R14: Collaboration → Client Ownership → Data → Quality of services → Added value for customers → Number of traveller kilometres → Cost benefit ratio → Collaboration



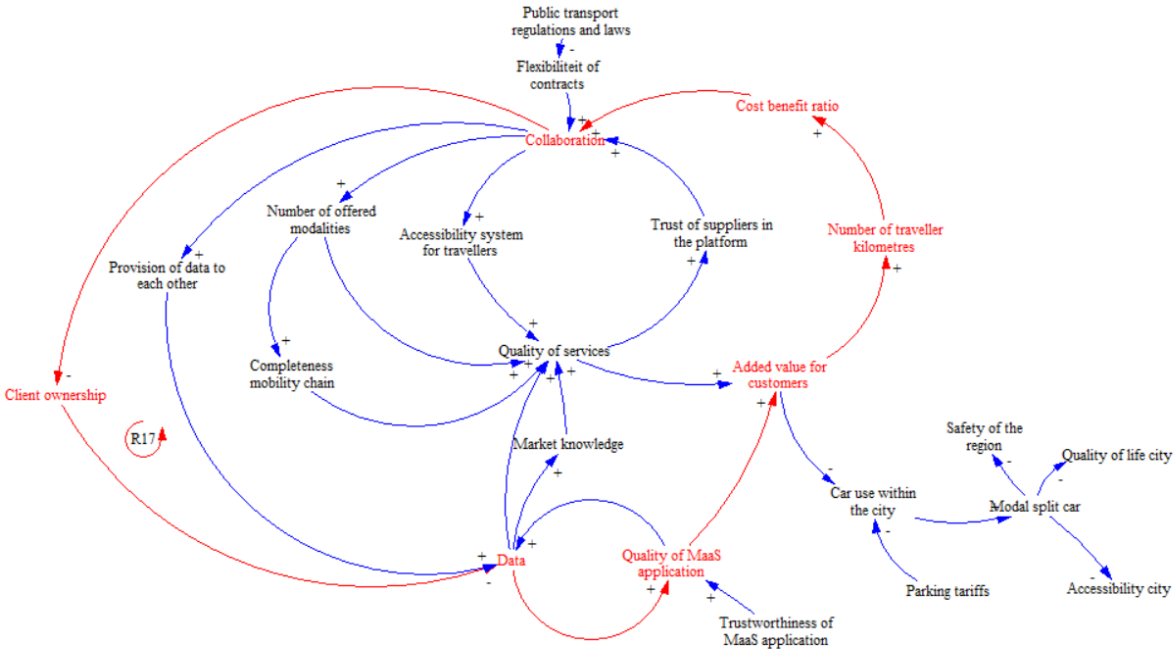
R15: Collaboration → Client Ownership → Data → Market knowledge → Quality of services → trust of suppliers in the platform → Collaboration



R16: Collaboration → Client Ownership → Data → Market knowledge → Quality of services → Added value for customers → Number of traveller kilometres → Cost benefit ratio → Collaboration



R17: Collaboration → Client Ownership → Data → Quality of MaaS application → Added value for customers → Number of traveller kilometres → Cost benefit ratio → Collaboration


Public transport regulations and laws
Flexibiliteit of contracts
Collaboration
Cost benefit ratio
Number of offered modalities
Accessibility system for travellers
Trust of suppliers in the platform
Number of traveller kilometres
Provision of data to each other
Completeness mobility chain
Quality of services
Added value for customers
Client ownership
R17
Market knowledge
Safety of the region
Quality of life city
Car use within the city
Modal split car
Data
Quality of MaaS application
Parking tariffs
Accessibility city
Trustworthiness of MaaS application