MSc Thesis

Stranded sustainable mobility initiatives

Lessons learned from cases in Amsterdam

Written by

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ABSTRACT

Cities inhabit the most people per unit of land surface, and all these people have the need and desire to move around. On top of that, vast amounts of goods are transported into and within these cities. The extensive transportation of people and goods causes a negative influence on the environment and a transition to sustainable mobility is therefore required.

Many niche-level sustainable mobility initiatives are started with the goal to support this transition. However, several of these initiatives get stranded in their process of being implemented in the mobility regime. Numerous studies have established on which aspects of mobility the most can be achieved regarding sustainability, but there is limited research performed into the inhibiting factors for sustainable mobility initiatives. This study aims at identifying the factors that negatively affect the potential influence of sustainable mobility initiatives on a regime-level transition to sustainable mobility in the Amsterdam Metropolitan Region, as well as identifying the inhibiting factors that are the probable cause of the stranding of these initiatives. In this context, niche initiatives are defined as actors (or groups of actors) aiming to implement a small-scale innovation or service, intended for a specific purpose, into the mobility regime. The regime in this research is the current market field and operation of mobility in Amsterdam.

Case studies of initiatives implemented in Amsterdam and interviews with persons connected to these cases were performed to discover inhibiting factors. The interviews were semi-structured by six categories of aspects based on academic literature. The results showed recurring patterns of the need for financial, governmental and societal support by the initiatives. These results indicate that the three dominant aspects of support required by these initiatives are: sufficient financial capacity to develop and sustain the initiative with its required complementary technologies and infrastructure, governmental support and institutional embedding and societal support caused by sustainability awareness.

On this basis, future initiative starters must inform and prepare themselves for these aspects to support the implementation of their initiative and governmental parties must participate in supporting these initiatives in order to support the sustainable mobility transition.

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1. INTRODUCTION

Transitions are happening in the field of mobility, methods for both public and cargo transport are increasingly powered by renewable energy sources to reduce the negative environmental impact of mobility. Mobility forms one of the largest contributors of emitted Greenhouse Gasses (GHG) (Moberg et al., 2018). Transitions are therefore required in the current mobility field to support its level of sustainability. Sustainable mobility is in this research defined as all types of mobility including cargo and public transport, which have a limited environmental impact compared to the same movements of mobility powered by fossil fuels. There are currently numerous research projects, innovations, public-private partnerships (Lienin et al., 2005), legislative incentives (Vergragt and Brown, 2007) and other efforts implemented that aim to make mobility more sustainable. The findings of this research can support the achievement of ambitions for sustainable mobility in Amsterdam as well as in other comparable cities.

1.1. PURPOSE OF THIS RESEARCH

The city of Amsterdam uses a model named 'Stadsdonut Amsterdam' to guide its policy makers to increased sustainability in the city in times of global environmental change. This model or 'compass' is based on the 'Doughnut economy' model by Raworth (2017) and is illustrated in Figure 1. The goal of a flourishing city which is socially righteous and ecologically safe, is accomplished by reaching goals for the social fundament. This fundament consists of the city's achievements in terms of independency, connectivity, health and action competence (Gemeente Amsterdam, n.d.-e).

The 'Stadsdonut Amsterdam' is the illustration of a policy goal for sustainability on the regime-level, for the whole city. The topic of this research, mobility in the city, belongs to the upper right 'connectivity' part of the doughnut.

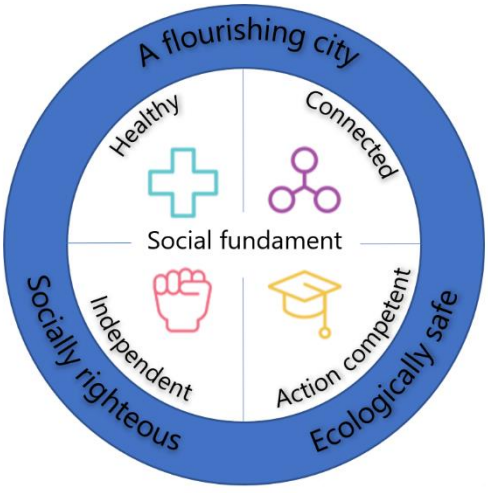

Figure 1. 'Stadsdonut Amsterdam' based on Raworth's 'Doughnut Economy' adopted from Gemeente Amsterdam (n.d.-e).

As part of the 'Stadsdonut' model, the municipality of Amsterdam has launched a zero-emission mobility plan called 'Actieplan Schone Lucht Amsterdam'. This plan aims to realise sustainable mobility by the year 2030, where all mobility modalities emit zero emissions and therefore reduce air pollution. (Municipality of Amsterdam, 2019).

Initiatives for upgraded or new modalities and infrastructures can support the accomplishment of this goal. However, despite the high expectations of these initiatives to be beneficial for this goal, some of them get stranded in the process of being implemented and used. In this context, initiatives in this study are defined as ideas that may lead to the development of an innovation in the form of a new or redesigned product, service, method or partnership (Talke et al., 2006)[1]. With the terms 'stranded initiatives' are considered projects which do not reach implementation or, once implemented, struggle to continue and expand despite the initial positive prospects. This halted process can be caused by singular or multiple factors. The sustainable mobility concept translates to the characteristics of the initiative which are focussed on providing sustainability alternatives to current unsustainable mobility modalities, and thus on changing environmentally harmful customs and methods.

This research focusses on initiatives that are aiming towards sustainable mobility in a metropolitan context. The current body of knowledge considering sustainable mobility (e.g. Goodman, 2013; Banister, 2008), drivers and barriers in the field of mobility (e.g. Geels, 2012; Farla et al., 2010), environmental supply chain management (e.g. Walker et al., 2008; Giunipero et al., 2012), and policy influences on sustainable mobility (e.g. Bardal et al., 2020; Canitez, 2020; Litman & Burwell, 2006) is vast. Also, the challenge of sustainable mobility and transport within metropolitan cities or regions is investigated by multiple scholars (e.g. Næss et al, 2011; Rajesh et al., 2019). However, the factors influencing sustainable mobility initiatives planned to be implemented in the metropolitan context are less well-known. With metropoles growing larger in size and number around the world as well as the growing need for (sustainable) mobility, more knowledge on this topic is important and relevant.

Niche-level initiatives for the development of sustainable mobility can influence the transitions happening on the regime level. Unfortunately, the reasons why particular initiatives strand are often not known due to scarcely available documentation regarding these initiatives. This research therefore aims to fill the knowledge gap of the unknown factors influencing these initiatives in this context. These factors can be drivers, positive incentives for the success of initiatives, or barriers which cause obstacles in the process to success. Knowledge of these factors is valuable for future initiative starters which are then informed in advance and able to devise measures to mitigate the effects of the inhibiting factors, or to be ready to adapt to the effects of them. Secondly, the knowledge of potential incentive factors can help one to make sure that these are taken to the advantage of the initiative.

[1] An innovation is realised when an organization has transformed an idea into a product, service or process in order to advance, compete and differentiate themselves successfully in their marketplace (Baregheh et al., 2009).

1.2. RESEARCH OBJECTIVE

The objective of this research is twofold. First, this thesis identifies specific types of initiatives within this context and develops a conceptual framework that includes influencing factors originating from academic literature divided on different scales.

The second part of the research objective is the performing of empirical research by investigating case studies. The findings of this research can be compared to the designed conceptual framework. Possible patterns within the cases can then be shown. The established framework is then used to define a set of recommendations which can help initiative starters and other parties in the process of developing an innovation from an initial idea, by providing the knowledge about the drivers and barriers for initiatives in this specific context. This way the obstructing factors can be overcome more effectively, and the chances of the initiative being implemented on the regime-level influence get increased.

1.3. RESEARCH QUESTION & SUB-QUESTIONS

The research question by which this research is driven is:

"Which factors negatively affect the potential for sustainable urban mobility niche initiatives to influence regime-level transitions, resulting in the stranding of these initiatives?"

The answer on this main research question will be supported by the answers on the sub-questions. The sub-questions for this research are:

1. *"What are key factors explaining the success or failure of sustainable mobility innovations in the academic literature?"*
2. *"What patterns or recurring inhibiting factors can be recognised in cases of stranded mobility initiatives in Amsterdam?"*
3. *"What lessons can be learned from the case study results regarding the influence on the regime-level transitions?"*

The key influencing factors for the success or failure of sustainable mobility innovations found in the academic literature are used in the answering of the first research question and the development of a body of knowledge that supports the case studies. Five cases of sustainable mobility niche initiatives in Amsterdam are then investigated in order to find the answer on the second research question. Finally, the influence of the niche initiatives on the mobility regime is discussed after the completion of the case studies and the analysis of the related findings. This discussion leads to the answer on the third research question.

1.4. STRUCTURE OF THESIS REPORT

To answer these research questions, the remainder of this thesis report is structured as follows. Chapter 2 concerns the analytical framework of the performed research. This consists of the theoretical framework, discussing the applied theoretical concepts, and the conceptual framework which concerns the specific indicators that are investigated in the case studies.

Chapter 3 describes the case study research method, the selection and characteristics of the cases in the case studies, and the analysis of the cases based on the conceptual framework.

Chapter 4 is the first of the 'empirical' chapters, it discusses the analysis of the indicators allocated to, and found on the niche-scale. This mostly regards aspects found directly related to or within the initiative or its actors. The other empirical chapter, Chapter 5, describes the aspects related to the regime in which the initiatives were or aimed to be implemented.

Chapter 6 elaborates on the findings from the cases. The inhibiting factors are discussed as well as the niche initiatives' influence on the regime. Furthermore, it discusses the theoretical concepts of the analytical framework in relation to this research and its results. Chapter 7 concludes this research, answers the research questions, and discusses the limitations of the performed research. At last, several recommendations are provided for future initiative starters and policy makers, as well as recommendations for further research.

2. TOWARDS AN ANALYTICAL FRAMEWORK TO STUDY STRANDED SUSTAINABLE MOBILITY INITIATIVES

This thesis explores inhibiting aspects in the process of sustainable mobility initiatives. The body of academic knowledge regarding the success factors for (sustainable) mobility initiatives is vast. These factors supporting the initiatives have been described by several scholars. The type of factors causing hinder or stranding of these initiatives could be these success factors, but with an inverted scale. However, there can be additional factors which are currently unknown which can come forward as a result of the case study. In order to work with the concepts as they are endorsed for this research, a more elaborate description is required.

The analytical framework of this thesis is derived as follows. First, the known factors combined in the theoretical framework are described and then operationalised. In this research it is considered that in theory, when all these supporting factors are sought for and embodied in the initiative's process, the initiative will be able to be implemented. All these factors, recognizable by indicators, are investigated in the case studies. If there are factors 'missing' in the process of an initiative these could be the cause of the stranding of that initiative. Second, when all factors described in the theoretical framework are found in the empirical research of the cases, it could mean that there are other, unknown factors that have caused the stranding of the initiatives. The analytical framework by which this research is guided thus consists of the known academic base, formed in the theoretical framework, and the conceptual framework containing the (categories of) factors which are investigated in the case study.

2.1. THEORETICAL FRAMEWORK

This section elaborates on the literature regarding this research topic and on the research framework which consists of the methods that will be used to perform this investigation. The literature regarding this topic is built upon three main concepts/theories: the multi-level perspective (MLP), Strategic Niche Management (SNM) and Supply Chain Management (SCM). These concepts/theories are related to the topic and are further explained in the following paragraphs.

2.1.1. MULTI-LEVEL PERSPECTIVE

The MLP consists of three main levels: Landscape, Regime, and Niche-level as illustrated in Figure 2. Geels (2002) explains that the established stability of socio-technical (ST) configurations results from the linkages between heterogeneous elements, which are in turn the result of activities of social groups which (re)produce them. The concept of *technological regimes* comprises the co-ordination and alignment of activities of these groups. This co-ordination in the socio-technical regimes is guided by rules. The earlier mentioned stability of these configuration is dynamic, but innovation in the ST regime and thus in the ST configurations is incremental.

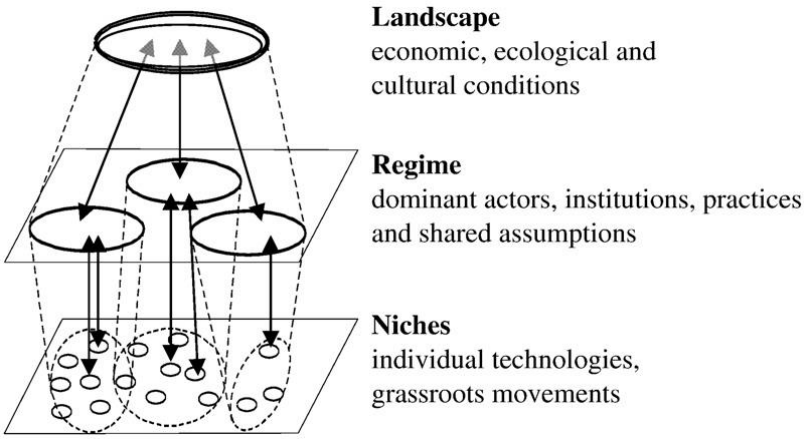

Figure 2. The multi-level perspective (copied from Nykvist & Whitmarsh, 2008).

Technological trajectories' result from technological regimes because the community of engineers searches in the same direction for possibilities for innovation. These technological trajectories are found in a 'socio-technical landscape' which consists of a set of deep structural trends. The socio-technical landscape comprises of broad factors as environmental problems, economic growth or political and cultural matters.

The ST-landscape is harder to change than the incremental change within the ST-regime, landscape change occurs therefore at a slower rate. Geels indicates that radical innovations are generated in niches and on the niche level. However, it is important to point out that innovations do not always start at the novelty side but can also result from incentives caused by changes in the regime and landscape levels. Changes in the ST-landscape can put pressure on existing regimes which provides opportunities for innovations to flourish, but the radical innovations at the niche level will not always 'reach' the ST-regime level.

The niche concept in the MLP not only looks at niches organised around a specific technology as is discussed by Nykvist & Whitmarsh (2008). This is also the case in other types of 'socio-technical transitions' such as 'niche accumulation', 'technical add-on' or 'hybridisation'. The scholars claim that niche activities in policy instruments, new functionalities and innovative ways of using existing technologies are also of importance for creating impact in a regime and thus the ST-transition.

This research mainly focuses on the niche and regime levels. Niche initiatives have the highest probability to cause changes on the regime level due to their radical nature. The aim of this research is to find the reasons why particular initiatives do not succeed to be implemented and cause effects on the regime level, the type named by Geels (2002) as a 'failed innovation'.

2.1.2. STRATEGIC NICHE MANAGEMENT

As stated earlier, this research aims to get insight on the reasons why particular ones strand. To create impact on the regime level, change is needed at different levels. Kemp et al. (2000) describe in their work: change is required on organizational, technological, infrastructural and wider social and institutional levels, and this provides a great barrier (or barriers). The scholars describe a way to overcome this barrier which they call 'Strategic Niche Management'. This concept focusses on the method of implementing often small-scale niche technologies into

the market in circumstances that are beneficial for these niche technologies. As Kemp et al. (2000) state:

> "SNM aims at taking the new technologies to the marketplace to try and use them in selected settings - niches - by real users". (p. 167)

Niches with specific circumstances are advantageous for technologies to be implemented, these circumstances can be specific local problems or recourses that require, or are beneficial for, the technology or initiative). Schot & Geels (2008) explain that:

> "the technological niches take place in protected spaces that allow nurturing and experimentation with the co-evolution of technology, user practices, and regulatory structures." (p. 538)

Experiences in these specific niches can be used for expansion and improvement of the technology or initiatives which eventually can have regime-level impact.

Kemp et al. (2000) indicate a method to overcome the barriers for moving towards sustainable mobility, "escaping the gridlock" as it is called in their work. This gridlock consists of dominant practices, vested interests and beliefs. An important aspect of SNM for realising this 'escape', is that SNM is not only a learning strategy via real users, it is also aimed at generating support by providing a platform for interaction for private and public decision makers. As Schot & Geels state: "SNM scholars argue that sustainable development requires interrelated social and technical change". To accomplish this change, several aspects of SNM are specified. The next sections elaborate on these aspects.

INTERNAL NICHE PROCESSES

First, there are internal niche processes. Raven et al. (2010) explain that there are indicated three main internal niche processes in an innovation journey. The level of interaction between these processes determines the success or stranding of an initiative. These internal niche processes are: the process of voicing and shaping of expectations, the process of building social networks, and a good learning process.

The 'voicing and shaping of expectations' process is successful when the expectations of participants converge into a shared vision, the expectations are increasingly based on tangible results of transition experiments, and the developed vision promises large increases on social and environmental dimensions.

The process of building social networks is successful, when there is a broad network including actors of varying science, policy, technology and social domains, as well as varying actors from in and outside the regime. Alignment in this network must be facilitated through regular interactions between the actors.

The learning process is successful when it is broad and reflexive. A broad process focusses on alignment between technical and social aspects and not only on techno-economic optimisation. Reflexivity of the learning process is found the questioning of underlaying assumptions like social values and changing the course of the innovation if this is necessary to match these assumptions (Raven et al., 2010).

Hoogma et al. (2002) indicate several aspects considering the learning process within technical niches. These aspects concern the technical development and infrastructure, the development of a user context, learning about the societal and environmental impact, the production and maintenance network, and the government policy and regulatory framework consisting of institutional structures and legislation. The scholars address two orders of learning. The first order contains e.g. the improving of design aspects of the niche, and what policies could help the adoption of the niche innovation. The second order is required for a niche innovation to result in regime-level change. Second order learning involves the questioning and exploring all aspects of the innovation instead of just testing them. Furthermore, they explain the importance of the quality of institutional embedding of the niche. This institutional embedding contains three aspects, bringing together complementary technologies and required infrastructures, producing widely shared, credible, and specific expectations, and enlisting a broad array of actors aligned in support of the new regime (a network of producers, users, and third parties like government agencies).

EXTERNAL FACTORS

Besides these internal niche processes are the external factors (e.g. on the regime level) which have influence on the chances of initiatives to become implemented. Witkamp et al. (2011) state that opportunities in a regime are connected to the stability of this regime. A less stable regime leads to more opportunities for niche development. This instability can be caused by ST-landscape developments which put pressure on the regime. This pressure can then lead to opportunities for niche innovations. Raven (2005) indicates three ways in which regime instability can increase niche size, i.e. niche creation or development. It can "create local opportunities for experiments, because niche actors develop expectations and visions linked to regime instability" (p.260); regime actors may become interested in the niche because they expect the niche to be a promising option for the future; and "in cases of very high instability, regime actors may adopt the niche as a problem solver."

KNOWN FORMS OF BARRIERS

Opportunities formed by regime instability and an established high level of interaction between the internal niche processes help an initiative to successful implementation. However, there are several aspects influencing the potential for sustainable niche innovations. Hoogma et al. (2002) indicate the barriers for niche technologies in sustainable transport. These barriers are related to technological, governmental, cultural/psychological, economical, infrastructural, and societal or environmental aspects.

First, for the technological aspect, it can be an inhibiting factor that new technologies often do not fit well into existing transporting system and require complementary technologies which can be in short supply or expensive. Second, governmental factors regard the communication of the need for specific new technologies. Also, policies are often not specific enough in the statements that guide developers, planners and investors to sustainable development or innovations. Hence, manufacturers remain certain about market developments, and are reluctant for risky investments in alternative technologies. Furthermore, existing regulations can form a barrier in the development of new technologies. The flexibility of legislation is often insufficient so the innovation cannot be implemented in the market/regime. This inflexibility can be caused by actors opposed of the innovation.

Third, cultural and psychological barriers are found in the unfamiliarity of the innovation, which often leads to scepticism because the new technology is criticised based on characteristics of the present dominant technology. Fourth, economic barriers are related to preferences and familiarisation of the users, risk aversion and willingness to pay for something unproven. Innovations have not yet proved their value, expectations are unsure. The innovation must be applied in practice first to be able to show the value of it. It also may not specifically meet the demands of customers. Changes in these demands can be needed to be able to introduce the innovation. Even when these first two barriers are overcome, consumers can still be reluctant to accept lesser performance in return for lower environmental impact compared to the present and proven alternatives. Also, the price of new innovations/technologies can be expensive compared to present alternatives. This is often caused by the small scale of manufacturing the new technology.

The fifth category of barriers contains the infrastructural barriers and regard the supply and production of the innovation. The development of an innovation from prototype to mass product is lengthy, cumbersome, and risky. Lack of incentive for development and implementation into the market of an innovation, can be caused by uncertainty about the interest of future in the innovation, or by lack of external factors e.g. legislation that presses manufacturers to act as well. The last and sixth category concerns societal and environmental barriers. The development of new innovations can solve certain problems but address new ones as well. Research is required to tackle these new problems, but the new problems can cause a negative image and affect the performance of the innovation.

2.1.3. SUPPLY CHAIN MANAGEMENT

This section will elaborate on the Supply Chain Management to complement the previous explained SNM approach and its focus on the diffusion and scaling of niche innovations into regime-level markets. But it is for this research of great importance to also look at the process before this upscaling process. Before a niche can be scaled to larger proportions, it must have a solid foundation on which can be build further upon. This foundation can be reviewed by using the SCM approach.

Although SCM is mainly focussed on the process of delivering products, or services from e.g. manufacturers to customers, the concept of investigating all parts involved in such a process is used this research. Mentzer et al., (2001) define a supply chain as:

> "a set of three or more entities (organizations or individuals) directly involved in the upstream and downstream flows of products, services, finances, and/or information from a source to a customer" (p. 4)

and supply chain management as:

> "the systemic, strategic coordination of the traditional business functions and the tactics across these business functions within a particular company and across businesses within the supply chain, for the purposes of improving the long-term performance of the individual companies and the supply chain as a whole." (p. 18)

Relationships between the different actors and agreements as the mutual sharing of risks and information are important for the success of SCM. In this research the focus lies on initiatives on niche level that potentially could affect transitions on the regime level. Cases of sustainable mobility initiatives often also concern supply chain innovations (once they are implemented and put into operation). The cases include different supply chain actors, which have influence on the chances of the initiative to have effect on the regime-level transition(s). This influence can either be of negative nature where the factor is considered a barrier or inhibiting factor, or of positive nature, in which the factor is a driver for the initiative. The following section elaborates on the elements of the SCM concept and which aspects/indicators can be used in the case study of this research. Because the focus of this research lies on sustainable mobility initiatives emphasises the next section on the sustainability aspect in SCM.

FACILITATORS OF SUSTAINABLE SUPPLY CHAIN MANAGEMENT (SSCM)

Crum et al. (2011) have defined four main facilitators in (sustainable) supply chain management (SSCM). These are: strategy, risk management, transparency, and organizational culture. Figure 3 visualises these facilitators and their overlaps.

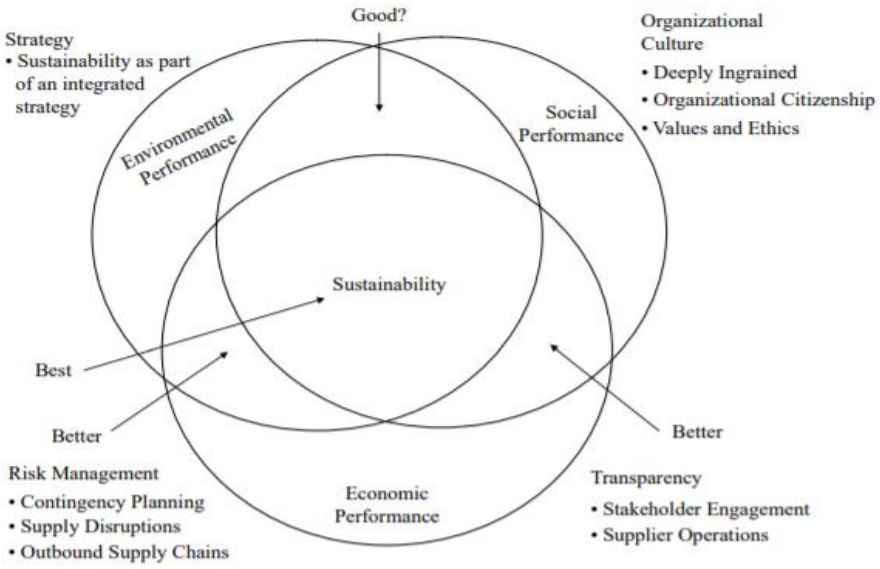

Figure 3. Visualisation of Sustainable Supply Chain Management, copied from: Carter & Rogers, (2008).

The strategy facet consists of the holistically and purposefully identifying of individual SSCM initiatives which support the overall (sustainability) strategy of the organization. Risk management also includes the contingency planning for both up- and downstream of the supply chain. The organizational culture is deeply ingrained and encompasses organizational citizenship. It includes high ethical standards and expectations along with a respect for society and the natural environment; Transparency regards the proactively engaging and communicating with key stakeholders. Furthermore, having traceability and visibility of up- and downstream supply chain operations.

SUSTAINABILITY DIMENSIONS OF SSCM

Within the SSCM are three sustainability dimensions identified: Economic performance, Social performance and Environmental performance as illustrated in Figure 3. Varsei et al. (2014)

defined performance measures for all three dimensions. Economic performance is measured by supply chain costs, environmental performance by emissions, water and energy usage, and waste generation and the social performance by work practices, human rights, society and product responsibility.

To be able to measure these performances, several drivers and enablers are required. The drivers concern stakeholders, institutional pressures and proactive measures. Enablers are the presence of resources, the supply chain configuration and capabilities. Varsei et al. (2014) state that "Organisations are compelled to satisfy the interests of their primary stakeholders to ensure viability of their business operations" (p. 247). Institutional pressure on a macro level can influence businesses and whole supply chains to adopt more socially and environmentally responsible practices. According to the scholars, the success of a supply chain depends on the systematic integration of business processes and collaborative performance of supply chain entities. To enhance the implementation of sustainability practices in a supply chain, an effective information exchange is required. As for resources within the supply chain, there is need for effective utilisation and sharing of resources and capabilities between supply chain entities to enhance the implementation of sustainable practices across the supply chain.

2.1.4. COMBINED PERSPECTIVE

The MLP, SNM and SCM approaches are all certain viewpoints to the subject of this research. All cover different aspects but have overlapping or relating elements. The following section elaborates on these aspects and on the combined perspective that guides this research.

Figure 4 illustrates the perspective in a schematic way. It needs to be read from the bottom up to the top. A radical niche initiative in sustainable mobility is expected to often take place at the level of a supply chain. A niche initiative requires the four facilitators for (S)SCM (strategy, risk management, transparency, and organizational culture). This relates to the first layer indicated as the 'Niche scale' layer. At this layer, the collaboration of primary actors and stakeholders consists of parties with social and technical backgrounds, complemented by the initiative owner. In this collaboration they share trust, risk, knowledge and resources, to reach the needed level of economic, social and environmental performance for this initiative. However, these performance levels alone will not per definition enable the initiative to have effect on the regime-level transitions.

Hence, layer two in the visualisation concerning 'Regime scale'. The SNM concept revolves around the indicators and aspects of the beneficial circumstances for the radical niche initiative so that it can be implemented in a 'protected environment' in the market. These circumstances consist of a high level of interaction between the internal niche processes, institutional embedding for the radical niche initiative, and possible forms of regime instability. When the initiative is supported by actors and is implemented in beneficial circumstances, the radical niche initiative will have increased potential to influence regime level transitions.

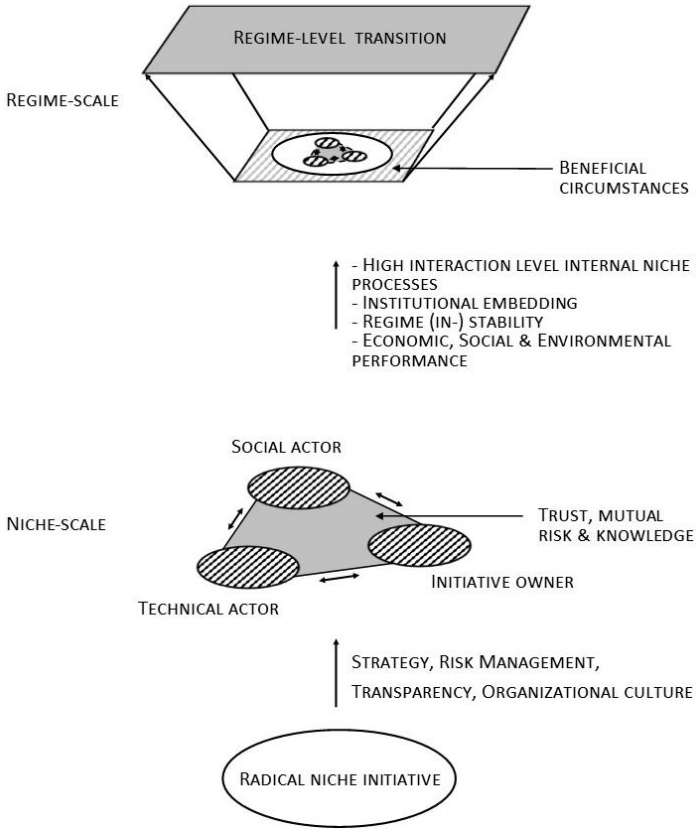

Figure 4. Theoretical concepts visualised, SCM & SNM can support radical niche innovations in a regime-level transition.

The composition of the factors according to the SCM and SNM approaches will reduce the chance of initiatives to get stranded. Therefore, a study on the factors affecting the potential for niche initiatives in sustainable mobility to have effect on regime-level transitions, and possible cause the stranding of radical niche initiatives, requires both an SCM perspective and SNM perspective.

The combined perspective on this subject is investigated in this research by executing case studies. This study of multiple cases reveals whether the factors described above are recognized, and if the cases show similar patterns or factors in causing the stranding of sustainable mobility initiatives.

2.2. CONCEPTUAL FRAMEWORK

The combined perspective of this research displays the scales coherently with the three theoretical concepts. These scales are thus the 'Niche' scale and 'Regime' scale. The theoretical concepts all address the same reality but use different 'lenses' to look at that reality. The indication of scales in this research is therefore only executed to provide a clear structure for this research, there are no demarcations between the concepts, and neither are these mutually exclusive.

The analysis of the issues found in the case studies is focussed on the 'Niche' scale and the aspects required by the initiatives to have influence on the 'Regime' scale. The first represents

the internal and external processes of the initiative regarding the actors connected to it. The second indicates the market in which the initiative is, or is planned to be, implemented. To further investigate the cases, parameters and indicators found in the academic literature of the concepts are required for developing the structure of performing the case study. In this section, factors and indicators retrieved from current academic literature and studies regarding both SNM and SCM concepts are operationalised into a conceptual framework in which distinctive

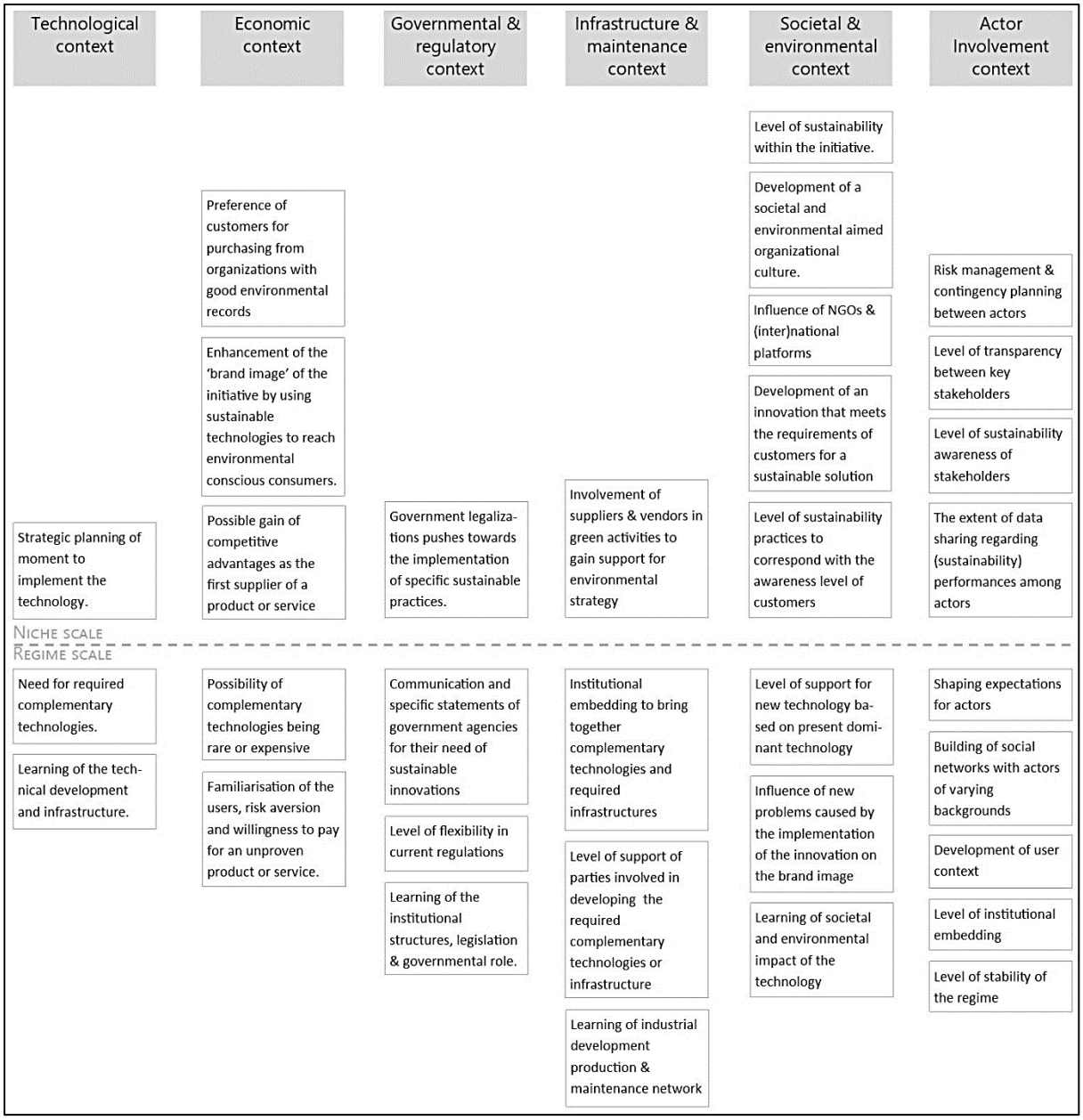

Figure 5. The conceptual framework consisting of factors on the niche and regime scales divided in six contexts.

and overlapping aspects of the concepts are combined. This conceptual framework is illustrated in Figure 5.

There have been found several main categories for the concepts SNM and SCM by which the indicators can be grouped. Scholars have discussed both concepts extensively. Multiple studies have provided lists of critical success factors, key indicators and parameters. However, some of these lists are applied to very specific a case subject or context. Luthra et al (2015) performed

an analysis on the interactions of critical success factors for SSCM implementation from an Indian perspective, some of these critical success factors have not been implemented in the conceptual framework due to their focus on changing an already operational organization into a more sustainable variant. The initiatives in the scope of this research are not like this type of organization. These initiatives often start with a new, not earlier designed product/service. However, the authors did list many generally applicable critical success factors, and these are used to develop the conceptual framework. Caniëls & Romijn (2006) followed the overview of critical factors for SNM of Kemp et al. in 1998 in their research into SNM as an operational tool for sustainable innovation. These are adopted in the development of the conceptual framework. For this research there have been defined six main contexts. These contexts are distinguishable in the two concepts. All contexts have a subdivision of specific indicators originating from the theoretical concepts.

2.2.1. TECHNOLOGICAL CONTEXT

All factors that relate to the technological part of the initiative are located in this context. The first indicator is: the planning of the moment to implement the initiatives' technology product or service into the current market (Luthra et al., 2015). The second indicator is the need for and scale of required complementary technologies (Caniëls & Romijn, 2006). Finally, the last technological indicator defined in this framework is the learning of the technological aspects like the link between design, infrastructure and the user preferences (Raven et al. 2010).

2.2.2. ECONOMIC CONTEXT

Five indicators related to the economic aspect of an initiative are included in the conceptual framework. Luthra et al. (2015) indicate three indicators which are linked to the image of the initiative as a provider of a new product or service. The first indicator explains the possible advantage of companies or organizations that are environmentally conscious in their methods. This advantage is formed by the preference of customers to buy from a party with good environmental records. The second economic related indicator regards the 'brand image' of the initiative. Environmentally minded customers can be attracted with sustainable technologies. These sustainable product or services can generate a better perception of the customer for the company or organization behind that product or service (Luthra et al., 2015). The third indicator involves the advantage which an initiative can reap at being the first supplier of a product or service. Caniëls & Romijn (2006) also define two additional economic related indicators. The first concerns the possibly required complementary technologies which are rare or expensive, or both. If the initiative cannot be implemented in the current market on its own, and therefore requires other technologies or infrastructures, this can cause severe expenses. The second indicator relates to the willingness of customers to buy a product or pay for a service that is unknown and is not yet proven to meet all demands and preferences of its customers.

2.2.3. GOVERNMENTAL & REGULATORY CONTEXT

Concerning legislations and regulations there are several indicators defined within both concepts. There is an overlap between the SCM indicator of government legalizations and an understanding of sustainability importance that supports an initiative (Luthra et al., 2015), and

the inhibiting SNM factor that governments often do not communicate specific needs for sustainable alternatives for present technologies (Caniëls & Romijn, 2006). If they did, this would be a beneficial incentive for the sustainable mobility initiative. Furthermore, the scholars indicate that the level of flexibility in current legislation is important for the process of an initiative. If a new technology requires no modifications of current policies, this will be a positive incentive for the initiative to be implemented in the market. However, the possibility also exists that government regulations are too strict for new technologies to enter the market. Governmental parties can be reluctant to embrace new initiatives as well, and choose for the safer, proven current technologies, although these are less, or not at all, sustainable. Additionally, the learning process of the institutional structure, legislation and government role is important when implementing new technologies in the market. Especially in case of implementing new innovations that require adaptations in current regulations.

2.2.4. INFRASTRUCTURE & MAINTENANCE CONTEXT

For the context of infrastructure and maintenance needed by the initiatives' product or service to be able to succeed at implementation, four indicators are acknowledged. First, there is the involvement in, and understanding of the sustainability strategy by the possible vendors or suppliers in the supply chain (Luthra et al.,2015). This of course is only in effect if there are vendors or suppliers in the supply chain, or both. If these third parties are in support of the sustainability strategy, this will benefit the initiative to reach its (sustainability) goals. Furthermore, Caniëls & Romijn (2006) explain that the second indicator, concerns the need for institutional embedding. This embedding can bring together the earlier mentioned complementary technologies and infrastructures if necessary. The third indicator involves the level of support of parties required for production or development of the (complementary) technology. There is a possibility that these parties wield hesitative behaviour regarding the investing in the initiative. This hesitation can find its source in the uncertainty about the success of the unproven product or service and therefore the future customer base. At last, the fourth indicator concerns the importance of learning about the industrial development, production, and maintenance network to improve the further upscaling of the initiative.

2.2.5. SOCIETAL & ENVIRONMENTAL CONTEXT

The most indicators are found for the societal and environmental context. Both concepts include multiple indicators. Luthra et al (2015) defined five indicators and for Caniëls & Romijn (2006) three. The first indicator is composed from several critical success factors described by the scholars. They point out that the quality and sharing of information within the supply chain is a key success factor. Also, the upgrading of technologies in the production process can be cost-effective and environmentally beneficial, as well as the use of information technology (IT). This can optimize the usage of required resources to support the business and improves communication and collaboration within the supply chain. All these critical success factors contribute to the level of sustainability within the supply chain. If a high sustainability level is achieved, this can scale up from the supply chain of a single initiative, to a market wide, regime-level.

The second indicator concerns the development of an organizational culture involving ethical standards and expectations regarding society and environmental. This links to the third

indicator which regards the influence of non-governmental organizations (NGOs) and international platforms. These can publicly support or reject an initiatives' product or service. It is therefore beneficial to gain positive attention of these parties. The fourth indicator pertains the process of designing and manufacturing a product or service that meets the customer demands for the most sustainable solution. This can lead to encouragement from, and satisfaction of customers, which in turn will benefit the success of the initiative. Furthermore, the fifth indicator regards the environmental, ecological and ethical awareness of the (future) customer base for the initiative, this does not only apply to the initiatives' product or service but also to the implementation of sustainable supply chain practices.

Caniëls & Romijn (2006) address the first indicator to be the level of support, or lack of support for the initiative. Possible scepticism of e.g. customers, government parties for the new product or service can exist. This scepticism is often based on the comparison of the new technology with the known already existing one. The other indicators describe the possibility of new problems that accompany the development of the initiatives' product or service, these (possible environmental related) problems can cause a negative image of the initiative. It is therefore of importance to learn about the environmental and societal impact of the implementation of the technology into the market, which is the third indicator for this context.

2.2.6. ACTOR INVOLVEMENT CONTEXT

The sixth context relates to all actor involvement indicators. These are all indicators referring to aspects of a supply chain, or between an initiative and the market it is implemented in. Four of the indicators described by Luthra et al. (2015) are used in the conceptual framework. The first indicator is the risk management between parties in the initiative. As described in the theoretical framework, is it crucial that actors within a supply chain agree to the sharing of risks. Connected to this sharing is the development of a contingency planning if there are unexpected problems that threaten the implementation of the initiative. The second indicator is the need for proactive engagement and communication between key actors to generate transparency throughout the supply chain. Third, the indicator of training and raising the level of awareness under supply chain members in environmental related subjects as pollution prevention. The initiative can take advantage of the improved environmental and operational performances. Furthermore, the fourth indicator concerns the sharing of information and data about the (environmental) impact of the initiative among stakeholders is crucial for the performance and efficiency of a supply chain.

Caniëls & Romijn (2006) elaborate on several indicators for the actor involvement context as well. The first is the shaping of specific expectations concerning the possibilities and impact of the initiative for the actors. Second, the need for developing social networks with actors of varying backgrounds, to reach the required support from businesses, government agencies, scientists and customers. The third indicator related to the customers is the development of a user context. This user context defines user characteristics, preferences, demands et cetera. When this context is developed, the initiative can capitalize on this and take it to its advantage. The fourth indicator concerning the institutional embedding of the initiative is related to (social) networks as well. Institutional embedding for the initiatives' product or service can create credible expectations for future customers. It also enlists actors in support of the

initiative, which are needed in the social network(s). A positive incentive for initiatives is indicated with the fifth indicator, this regards the instability of the regime which the initiative aims to influence. If this regime is instable, actors are inclined faster to open up to the initiatives' product or service.

2.3. SUB-CONCLUSION CHAPTER 2

his chapter has provided the key factors explaining the success or failure of sustainable mobility innovations found in the academic literature. To enable an initiative to influence a regime-level transition, there must be a high level of interaction between the internal niche processes, a solid institutional embedding of the niche initiative, and (in)stability of the regime, following the SCM and SNM concepts. To scale the initiative up to reach regime level influence, attention must be given to the six contexts and the corresponding indicators. These are the: technological, economical, governmental, infrastructural, societal and environmental, and actor involvement contexts. If the majority, or all indicators are attended to, the initiative is expected to have a higher chance of success. The analytical framework connects the theories of SCM, SNM and MLP with the main research question of this study. The indicators found in the SCM and SNP theories are researched in the case studies described in Chapter 3, the MLP concept is reflected on in the discussion in Chapter 6.

3. RESEARCH FRAMEWORK

This chapter explains the research methods that are required for the investigation of the topic, acquiring the necessary data and analysing this data, and to formulate the answer on the research question.

The performed desk research has investigated the current body of knowledge regarding the topic of this research. With this knowledge, the conceptual framework is developed. It contains indicators adopted from academic literature, concerning the theoretical concepts described in chapter 2.1. and applied on the specific subject and context of this research. The concepts are thus be operationalised to empirical aspects that can be recognized in the cases during the case study research.

3.1. CASE STUDY RESEARCH

Case study research is required to find evidence to support the stated conceptual framework. Case studies have a specific type of design, this type of design is conditional upon the unit(s) of analysis (defining the specific aspect(s) being investigated), the context of case(s), and the number of cases on which empirical research is performed. This design of the case study of this research is an embedded (multiple units of analysis) multiple cases design. Figure 6 illustrates this type of design in the lower right corner.

Multiple cases are researched so that possible patterns can be recognized, and the results of the investigation are structured by the analytical framework compared between the cases. The cases are various regarding the designed concept of the initiative, circumstances in which the initiative is launched, and the actors involved in the process of the initiative. The context of the cases in the case studies comprises mobility in metropolitan areas but knows different characteristics of transport which all belong to mobility in general. The units of analysis are the chain/network of actors and the environment in which the initiative is implemented.

The cases are first selected based on criteria which are listed on the next page. An in-depth research is then performed by comparing the data retrieved of these case studies to the conceptual framework. The three categories aspects in the research are thus concerning the actors that were involved in the development-process of the initiatives, the specific circumstances in which the niche initiatives have ‘entered’ the regime and the possibilities for continuation and upscaling of the initiatives, to be able to support the transition(s) on the regime level.

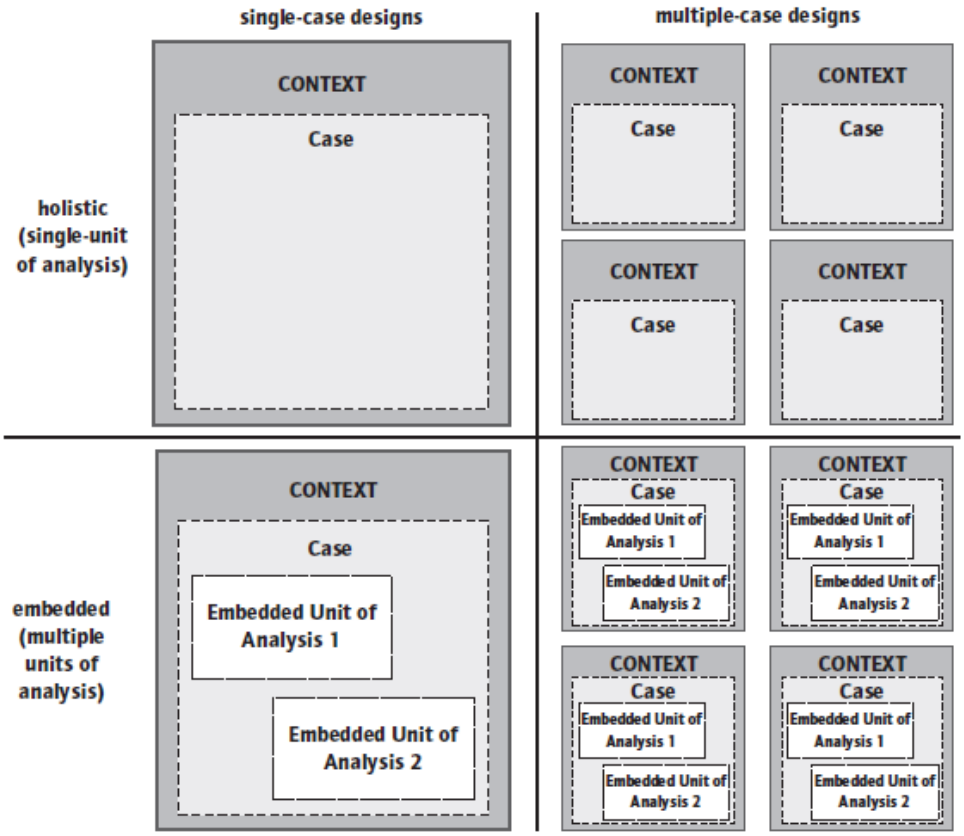

Figure 6. Types of case studies. Copied from Yin (2009).

The cases are selected by criteria which indicate the scope of this research. The following criteria are in place:

- only sustainable mobility initiatives, as described in the introduction are investigated,
- only land- and water-based mobility initiatives, aviation mobility is excluded from this research,
- only initiatives that took place in Amsterdam are used as cases in the case studies,
- only initiatives of which a prototype or pilot is designed or developed,
- only initiatives on which at least three actors are involved (preferably from varying societal backgrounds e.g. political, social, or entrepreneurial actors).

The number of retrievable publications of cases concerning stranded initiatives proved to be low. The selection process of cases that complied with the discussed criteria resulted in five cases of sustainable mobility niche initiatives. Online research provided the most available details for these cases.

3.2. CASE DESCRIPTIONS

The empirical part of this research exists of case studies. This section describes the characteristics of the cases. These characteristics are considerably different; therefore, a brief description of the cases is provided. There is a movement in the transport/logistical sector of Amsterdam to zero emission propulsion. Fossil fuels become less desired and are increasingly replaced by more sustainable alternatives due to the rise of awareness regarding climate change and the related policies trying to diminish or even eliminate this change. The

municipality of Amsterdam has put in place the policy that all mobility in the cities 'built up' area must be emission free by 2030 (Municipality of Amsterdam, 2019a). So, in this case, the city wants to innovate in their logistics and there is a pressure on the mobility system that demands a rapid change in the use of sustainable energy sources. The cases of this research all comply with the criteria for cases in this research as described in section 3.1. The characteristics of the cases used in this research are shown in Table 1, more elaborate descriptions are provided in the following sections.

Table 1. Overview of cases.

Name	Mobility category	Modality	Sustainability Description	Prototype/pilot	Actors
Nemo H2	Public transport	Water	Hydrogen vessel	Operational vessel	Entrepreneur, government, businesses
Vracht door de Gracht	Cargo transport	Water	Battery powered electric vessel	Operational vessel	5 companies, municipality, consumers
City Cargo	Cargo transport	Rail	Electric tram	Pilot period with prototype	Entrepreneur, municipality, consumers
City Pods	Public transport	Road	Electric autonomous shuttle vans	Pilots	Business, municipality/government, passengers
Tuk Tuk Company	Public transport	Road	(electric) Tuk Tuk tricycles	Operational vehicles	Entrepreneurs, municipality, passengers

3.2.1. CASE NEMO H2

There are all types of vehicles, vessels and other types of mobility which are currently available that are powered by electricity, often stored in battery packs. However, the demand of electrical energy to charge all these vehicles is putting pressure on the electrical grid of the city (Marano et al., 2013; Pfab, & Haexe, 2017). This pressure is expected to increase even more when all the mobility in Amsterdam would rely on a charging infrastructure connected to the electricity grid. Hence the necessity to search for viable alternatives to complement the battery powered electric technologies. A viable alternative is proven to be the use of the energy carrier hydrogen. (Sustainably produced) electricity can be used to produce hydrogen, which can be stored and then, in combination with a fuel cell, be transformed to electricity again. An example of the developments in this field is the hydrogen powered tour boat: the Nemo H2. This vessel with the design of a typical canal tour boat was published in multiple news articles (Agentschap NL, 2011. Chapter 5) and praised on its clean and innovative way of propulsion. The use of this type of propulsion could reduce emissions emitted by the tour boat sector (consisting of around 150 large tour boats of which 70% still run on diesel) which is currently responsible for the emission of 4% of particulate matter and 7% of nitrogen emissions in the whole city (Gemeente Amsterdam, 2019b). However, the boat was developed and launched in 2009 but never used in the waterways of the city (Het Parool, 2013). The main parties involved in the 'Fuel cell boat' consortium were Alewijnse Marine systems, involved in the electrotechnical systems for the vessel, Linde Gas Benelux for the production, storage and distribution of hydrogen gas, shipping company Lovers providing canal trips, Marine Service Noord for the design and production of mechanical systems in ships, and at last Integral for coordination,

project management, communications, knowledge transfer and relation management (Fuel cell boat, n.d.).

3.2.2. CASE VRACHT DOOR DE GRACHT (VDDG)

Water-based transport can be a beneficiary supplement to the current substantially land-based transport in the city of Amsterdam. Most of the transport of cargo currently happening in Amsterdam is land-based. This contributes to problems concerning accessibility, deterioration of roads, quay walls and bridges, air quality and the emission of carbon-dioxide. (TNO, 2020). Therefore, other methods for transport of cargo are required to reduce the contribution to these problems. One solution can be found in the transport over water considering the vast amount of water ways in the city of Amsterdam. Using vessels to transport goods in combination with the realisation of transfer locations in and outside the city can result in a severe reduction in the number of required transport movements by trucks as is proved by TNO with the project Amsterdam Vaart! 2019 (TNO, 2020). Transport over water can thus be beneficial in several ways for the city of Amsterdam. The case of 'Vracht door de Gracht' is beneficial in an additional way. The vessel 'City Supplier' of this initiative is propelled by a battery powered electric motor. Therefore, no emissions are produced when operating this vessel in the inner city.

The cargo vessel 'City Supplier' is developed by former consortium Mokum Mariteam which is currently incorporated by Rutte Groep (Mokum Mariteam, n.d.). The vessel is equipped with a cargo crane and is specifically designed to navigate through the narrow canals. The initiative initially focussed on transporting supplies to, and waste from different locations in the city centre, but currently that focus is steered towards waste transportation completely. Sustainable transportation of cargo via the waterways of Amsterdam could help reduce the congestion of city streets and benefit the reduction of emissions caused by the transport of cargo in case combustion engines would be used for the same task. Although the initiative exists for multiple years, there is not enough revenue and coverage of deployment of the boat to expand the business with a second vessel of similar type.

3.2.3. CASE CITY CARGO

The initiative City Cargo revolves around the use of trams for the transport and distribution of goods. Generally, trams are used as a form of public transport, while trains as another type of transport by rail, are known and proven for both types of transport. The initiative City Cargo therefore aimed at using trams as a form of cargo transport. This transport by rail could reduce the number of mobility movements of trucks or vans to distribute goods throughout the city of Amsterdam. The urban characteristics of the city were beneficial for the initiative because an extensive tram rail network, with a considerable amount of support tracks, was already present. The plan was that trams would be loaded just outside the city border at a collection and distribution centre. The trams would enter the city's tram rail network via a short connecting rail line and distribute goods throughout the city and unload at the required transition stations where, if necessary, the cargo containers would be loaded on electric vans to reach the final destination. The city of Amsterdam would be partially relieved of freight mobility entering and moving around causing traffic congestion and emitting GHGs because the electric powered trams were more sustainable compared to the use of fossil fuel powered lorries and vans. The

idea was received with great expectations and commendations (Het Parool, 2008; Trouw, 2007). Sustainability was becoming an important focal point in urban transport and this initiative could contribute to reach sustainability goals. Although a pilot project was executed to test the functionality and safety of the trams, the initiative has never reached full implementation in the city of Amsterdam.

3.2.4. CASE CITYPODS

Constant developments and transitions are noticeable in the field of mobility. One of these transitions is that of developing and implementing autonomous vehicles to compete, or rather supplement other present mobility modalities and their infrastructures. As a result of an enquiry of the 'Bond Nederlandse Architecten', to develop plans for an improved park and ride station in the residential area in 'Amsterdam Nieuw West', there was an idea for 'The Hub' where autonomous vehicles would be implemented. These are called CityPods. The CityPods are shuttle vans which can carry up to 20 passengers. The CityPods would be a similar type of shuttle as the third generation ParkShuttle van as described by Boersma et al. (2018). 'The Hub' would function as a transfer location between mobility modalities (OVMagazine, 2016; Zelfrijdend Vervoer, 2016; Architectenweb, 2016). These transfers will be oriented in traffic flows into the city from regional or national infrastructures as highways or railways, or out of the city whereby passengers can travel to 'The Hub' by several modalities and travel further by public transport, including the CityPods. This would reduce the use of private owned vehicles and increase the use of shared and public transport. The companies involved were UNStudio for the architectural part of the project, Goudappel Coffeng for the mobility investigation aspect and 2getthere for developing the autonomous shuttles.

This specific plan is never implemented further in Amsterdam, but comparable cases are found in Amsterdam and other cities. Examples for Amsterdam are the initiative to use autonomous shuttles to transport physically and mentally disabled children from their home to their day-care location in IJburg (Het Parool, 2017; AT5, 2019), and the use of an autonomous shuttle on the car-restricted 'Marineterrein' for shuttling visitors (Marineterrein.nl, n.d.). Outside Amsterdam, in e.g. Capelle aan de IJssel are autonomous vehicles implemented as a structural traffic solution instead of a pilot project (Goudappel Coffeng, 2020). Due to the potential of these initiatives for Amsterdam or the Amsterdam Metropolitan Region (AMR), it is kept as a case in this research as the technique is proven and there is the ambition to implement autonomous vehicles in Amsterdam or the AMR.

3.2.5. CASE TUK TUK COMPANY (TTC)

Although this initiative did not start as a sustainable mobility modality because the first vehicles were not powered by a sustainable energy source, it is still a case in this case study. The reason for this is that the vehicles were changed in a later stadium to sustainable versions due to corporate social and environmental responsibility, as well as demands of clients. The Tuk-tuk's were initially implemented as a taxi service for distances that were too short and therefore unattractive for regular taxis (Het Parool, 2007). This market was not provided with a mobility modality until the Tuk-tuk's were deployed. The Tuk-tuks were therefore a supplement to the public transport and mobility scene of Amsterdam. The initiative originated in Zandvoort, expanded to Den Haag and then became implemented in Amsterdam. The service was never

fully implemented in the city despite the allocation of a waiting stand for the (electric) Tuk-tuks near Amsterdam Central Station. There were successes booked with collaborative pilot projects for the municipal public transport company GVB (AT5, 2010) and the Dutch national railway organization 'Nederlandse Spoorwegen' (NS) (Trouw, 2008). However, the use of the Tuk-tuk's as taxi's was later changed to hosting events, marketing purposes and tourism.

3.3. RESEARCH METHODS

The conceptual framework as explained in Chapter 2.2 is used in the data collection when conducting the interviews in the case studies of this research, as well as in the analysis of the results of these studies. The data collection consists of online research into the characteristics of the initiatives and circumstances in which the initiatives tried to implement their service into the mobility regime. Online sources provided information in the form of publications related to the process of the initiatives, news articles discussing achieved successes and met setbacks or challenges, as well as websites of governmental parties, the initiatives themselves and various mobility-sector-related parties. Besides the use of online information sources regarding the specific initiatives in the cases, data is collected concerning ambitions and regulations of the governmental parties regarding sustainable mobility in general.

The data collected with the online research method is supplemented with data collected by conducting interviews. These interviews are conducted with initiative starters or with actors related to the initiatives. Furthermore, an interview is conducted with an expert in city logistics and mobility for a more general view on sustainable mobility initiatives. The interviews are conducted via a semi-structured method. An item-list with the subjects used in the interviews is located in Appendix 2. The item list contains aspects related to the indicators of all six contexts in the conceptual framework. Questions related to these aspects were asked in the interviews, the list is used for all the conducted interviews.

3.4. ANALYSIS OF THE DATA

The six contexts of the conceptual framework are used in the analysis of the results as well, the five cases as described in the first section of this chapter are reviewed on both the niche and regime scale by all the contexts. The indicators of the conceptual framework are not strictly separated, on the contrary, there often are overlaps and linkages between indicators of the 'Niche' or 'Regime' scale. Aspects found in the cases, which are in accordance with indicators of the conceptual framework are discussed in the subsequent empirical chapters, but only if these aspects are found evident in the case studies. A checkmark is then displayed, per case for that indicator, in the overview tables. This does not by definition mean that an indicator is not in some way related to the case, it just cannot be made evident with the collected data. The findings resulting from the case studies are used to substantiate or even supplement the factors already known from the online research. This knowledge is merged in the discussion and conclusion chapters and used to answer the research question. Furthermore, the results of the research are used to state recommendations for other (future) initiatives within the context of this research as well as recommendations for further research on this topic.

4. FACTORS OF INFLUENCE FOR INITIATIVES ON THE NICHE SCALE

This chapter elaborates on the researched indicators that apply to the in chapter 2 described 'Niche-scale'. Evidence is not found for all indicators in all cases, hence the need of specification which indicators are found and in what way these are identified in the cases. This distinction if indicators are found in the cases or not is illustrated in the overview Table 8 located at the end of the chapter. This chapter is divided in six sections corresponding to the six contexts. Each section describes the results of the case study analysis into the indicators of the conceptual framework which are found in the five cases.

4.1. TECHNOLOGICAL CONTEXT

Table 2. Niche scale indicator for the technological context.

	Nemo H2	VDDG	City Cargo	CityPods	TTC
Technological context					
Strategic planning of moment to implement the technology.	☑		☑		☑

The technological context comprises the aspects regarding technology that is used in the initiative. The initiative can encompass the marketing of a product to create revenue, as well as the possibility of using technology to provide a service. The cases in this research all fall under the last category. The Nemo H2 ferry required hydrogen propulsion technology to provide this service. The same situation is found in the case VDDG. This initiative required an electric vessel that was able to transport a certain defined volume of cargo for the initiative to be viable. This volume and weight of cargo had to be transported by an electric battery powered motor. The City Cargo initiative depended on the tramrail network of Amsterdam but required retrofitted trams and electric carts to be able to carry out their distribution service in the city. The level of technology required for Case City Pods is high as well. This initiative provides a public transport service by using autonomous shuttle vans. These vans itself had to be developed, but the current available technology requires supplementary technologies on the routes on which the vans are implemented. This aspect will be further explained in chapter 6 because this problem takes place on the regime level. The initiative of case TTC, which provided a special category of taxi service for short distances, was no exception and required efforts to get the three wheeled vehicles certified and on the roads of Amsterdam.

Moving on to the only indicator for the technological context of this scale and shown in Table 2; the strategic planning of the moment for the implementation of the technology. Three cases are identified in which this indicator is found. These are the cases Nemo H2, City Cargo and TTC. Two elements are found linked to this indicator in the case Nemo H2. The first was the availability of a certain future client. Before the initiative started, there was no plan for building a vessel that was powered by hydrogen in combination with a fuel cell. However, the initiative starters came from a chemistry background, and were orientating on the possibility to use hydrogen as a source of energy. The company of the initiative starters was located on the

premises of the oil and gas company Shell. Shell was moving to another location, which was not easily accessible by public transport at the time. Shell therefore asked the initiative starters to develop a vessel that could navigate over the IJ and function as a ferry service for their personnel. A contract for three years was signed and therefore an initial business case was realised. The second element was the requirement for the vessel to be able to navigate on the IJ itself. This was beneficial for the initiative starters, the vessel had to function as a ferry on rougher and more dangerous water compared to the quieter canals. It also had to be powerful enough to quickly avoid approaching large cargo vessels. Battery powered vessels would not meet this requirement which supported the business case of the initiative even more. It therefore was strategic and substantiated move of the initiative starters to start with the design and development process of the vessel at that time, with the aim of using it mainly as a ferry for Shell (H. Sie, Integral B.V.., personal communication, July 3, 2020).

The initiative starter of 'City Cargo' also strategically chose to implement the technology and business plan in Amsterdam. Three aspects played a role in this choice. The initiative starter was inspired by a project in Dresden, Germany where freight trams were used to transport goods between a logistical centre and a car factory (Eltis, 2015). Amsterdam has an extensive tramrail network, with additional emergency support tracks. These tracks were not or scarcely used by the conventional public transport trams. It was therefore a strategic choice for the initiative to focus on this city.

The second aspect concerned the construction of the major metro connection between the north part of Amsterdam and the southern part, the 'Noord-Zuidlijn', also indicated as metro line 52 (GVB, n.d.). The number of conventional tram movements on tramrail network was expected to decrease severely when the construction of this metro line would be completed due to lower numbers of passengers that would use the tram because of the availability of the faster metro connection. This would create 'space' on the network for the cargo trams to operate in. The third strategical aspect that was considered was the condition of the infrastructure of the tram rail network. There were two parties involved in that infrastructure, the company owning and managing the land on which all infrastructure was placed, and the company in charge of maintaining all additional infrastructure besides the rails itself e.g. lights or switches. These two companies worked well together and used fairly new equipment. The condition of the existing infrastructure and maintenance network was therefore a supporting aspect to strategically start the initiative in Amsterdam (P. Hendriks, City Cargo, personal communication, July 15, 2020).

The third case where strategic implementation was found concerns the 'Tuk Tuk Company' initiative. This initiative was started with a very clear strategy. Tuk Tuk Company was the first company or organization to use the three-wheeled vehicles as a form of public transport. The vehicles would generate revenue in three ways. The initiative starters would remain the administrator of the company. The first source of revenue was generated by taking on franchise takers that drove the vehicles to provide the taxi service to the clients in the inner-city of Amsterdam. The second source was generated by letting marketing agencies pay to publish advertisements on the vehicles, and third source of income was the paid telephone number which customers had to ring when they wanted to book a ride. That was the first part of the

strategy that this initiative maintained. The second was, by initially starting as a pilot project at the beach in Zandvoort near the larger city Den Haag. This pilot was performed to see if customers were interested in travelling with a Tuk-tuk in the first place, and secondly which level of revenue could be generated. When the pilot turned out to be successful, the initiative expanded to Den Haag first, and later to Amsterdam. All this time, the initial strategy was maintained (M. Beversluis, Tuk Tuk Company, personal communication, July 22, 2020).

Thus, three initiatives were strategically launched in Amsterdam. The infrastructure of this city was the decisive factor for the cases Nemo H2 and City Cargo, as for case TTC this was the size and potential customer base, which was proven to be sufficient after executing the pilot. In all three cases is the indicator seen as a 'driver' for the (momentary) success of the initiatives. In Nemo H2 this was the prospect a steady revenue. For City Cargo the absence of competition and good spatial circumstances, and for TTC the proof of success via the pilot in combination with additionally the possibility to be the first party to implement the service in Amsterdam on which is elaborated more in the next section. Cases VDDG and Citypods were different. In the case VDDG there was no need for strategic planning because the initiative was the solution for a specific problem in Amsterdam for a select group of actors (W. Post, Mokum Mariteam, personal communication, July 16, 2020). In projects with CityPods was the strategic planning of implementing the technology not yet the order of business.

4.2. ECONOMIC CONTEXT

Table 3. Niche scale indicators for the economical context.

	Nemo H2	VDDG	City Cargo	CityPods	TTC
Economic context					
Preference of customers for purchasing from organizations with good environmental records.		☑			☑
Enhancement of the 'brand image' of the initiative by using sustainable technologies to reach environmental conscious consumers.		☑	☑	☑	
Possible gain of competitive advantages as the first supplier of a product or service.	☑	☑			☑

The economic context comprises the elements regarding e.g. finances, subsidies, merit models and the ways of generating revenue. On the 'Niche' scale are multiple indicators defined for this context, these indicators are shown in Table 3. The indicators in this context are: the possible preference of customers for purchasing from organizations with good environmental records, the possible enhancement of the 'brand image' of the initiative by using sustainable technologies to reach environmental conscious consumers, and the possible gain of competitive advantages as the first supplier of a product or service. These indicators are described more elaborately in Chapter 2. This section follows the sequence of indicators as these are illustrated in Table 3.

The preference of customers or clients for an initiative with good environmental records, the first indicator for this context, is shown in case VDDG by the requests of a couple fundamental clients that only want to use sustainable transportation of their cargo. Furthermore, there were a few construction sites, that were only approved by the municipality of Amsterdam if the transportation of building material was performed via waterways, by which the initiative could benefit (W. Post, Mokum Mariteam, personal communication, July 16, 2020). The second case in which this indicator is identified in the TTC case. It is recognized in the pilot project that was done for the GVB in Amsterdam. TTC was approached for their services, but the vehicles must be powered by electricity (M. Beversluis, Tuk Tuk Company, personal communication, July 22, 2020). Hence, TTC developed and purchased the first electric vehicles in their fleet to meet the demands of this client.

The enhancement of the brand image of an initiative, the second indicator, is found in the VDDG case, the City Cargo case, as well as in the CityPods case. The VDDG initiative could publicize itself as a sustainable company due to the sustainable way of propulsion of the vessel. The provided service was therefore depicted as a more pleasant way of transport in the inner city of Amsterdam in contrast to the conventional transport with combustion engines that emits substances which contribute to air pollution (VVAB, 2012). The City Cargo initiative received much attention regarding the sustainability aspect of the initiative, and received multiple sustainability awards (Logistiek.nl, 2007; Logistiek.nl, 2008). "The twelve trams that were planned to be used in the initial phase of the implementation were all scheduled to be loaded at full capacity" (P. Hendriks, City Cargo, personal communication, July 15, 2020). So, although the indicator was found in the initiative, it did nevertheless not help the initiative with attracting more consumers due to the stranding of the initiative before it was implemented. In the CityPods projects with autonomous shuttle vans, the indicator is found in the situation that transport concession administrators often demand of the public transport operators that a certain level of sustainability is implemented in a public transport concession (A. Scheltes, Goudappel Coffeng, personal communication, July 2, 2020). Depending on the requirements and the specific traffic issue that must be solved, can be chosen for autonomous shuttle vans or other types of sustainable public transport like conventional electric busses (D. Mica, 2getthere, personal communication, July 24, 2020).

The possible gain that initiatives can reap by being the first supplier of a product or service is visible in three cases. This third indicator of the economic context on the niche scale is found in the cases Nemo H2, VDDG and TCC. This indicator translates in the case Nemo H2 to the fact that the initiative was the first party in Amsterdam that launched the phenomenon of a tour boat or ferry with hydrogen as an energy source. This meant that much attention was received by the initiative from government agencies and the press (Reuters, 2009), it was even nominated for KNVTS ship of the year maritime award (Schuttevaer.nl, 2011). An innovation subsidy for development of the vessel was granted by the ministry of economic affairs, via the nationwide agency 'Agentschap NL', currently 'Rijksdienst voor ondernemend Nederland' (Agentschap NL, 2011). This support could have brought the initiative in advantage regarding potential competition, if the initiative had been continued after completion of the pilot phase. In the case VDDG was the initiative owner Mokum Mariteam the first actor with a battery powered electric cargo vessel in the Amsterdam canals. As described for the first indicator of

this context where there a few clients that chose this initiative specifically for their sustainable services. However, the possible gain could have been larger if the parties that claimed to have a high standard for sustainability with whom the initiative had contact with for possible contracts (One World, 2015), would have accepted the higher price for sustainable transport.

The TTC initiative received the gain of competitive advantages in comparison to other taxi service providers, due to their specific target group and payment methods. The initiative provided a short-distance taxi service, which was not met by regular taxis due to the relatively low revenues which short distances generate. Additionally, the reputation of the regular taxi branch was not positive at the time of implementation of the TTC initiative. For example, passengers suspected that they were scammed by the taxi drivers by taking longer routes so the costs for the ride were higher. The initiative offered therefore an alternative method of transport. It was paid by zones, where every zone in the city had a fixed price. Passengers knew in advance, by means of the number of zones, what the price for the service would be (M. Beversluis, Tuk Tuk Company, personal communication, July 22, 2020). This caused a different and specific target group for the initiative.

There are a couple links found in this context. The gain of an initiative compared to its competition can be linked to the perception of the initiative by a consumer or client as is shown in the TTC case. The enhancement of the brand image by publicizing the initiative as a sustainable alternative to current less sustainable methods can potentially cause an increase in the number of sustainable minded consumers (City Cargo, VDDG). However, if the price of this sustainable alternative is extensively higher it can become a barrier for the clients to make use of the sustainable service (VDDG).

4.3. GOVERNMENTAL CONTEXT

Table 4. Niche scale indicator for the governmental context.

	Nemo H2	VDDG	City Cargo	CityPods	TTC
Governmental & regulatory context					
Government legalizations pushes towards the implementation of specific sustainable practices.	☑			☑	☑

The single indicator identified for the governmental context is the pressure of legalizations that pushes sustainable practices to be implemented as is shown in Table 4. There are two cases in which such a situation is found. The first is the case Nemo H2 where this indicator is visible by the issuing of permits for tour boats in the Amsterdam waterways. Before the start of the initiative, the municipality had issued 182 permits for tour boats in the city of Amsterdam. But these were generally polluting diesel-powered tour boats, and the municipality strived for better air quality in the city. The development that followed was the issuing of one to a maximum of ten extra permits, accompanied with the condition that the vessels should not have an emitting type of propulsion (H. Sie, Integral B.V.., personal communication, July 3, 2020).

The situation in the CityPods case is significantly different. To realise pilots or real traffic issue solutions with autonomous cars, it is necessary to get permission to drive with vehicles on public roads while these vehicles are not certified et cetera. Hence the implementation of an alteration of the Dutch traffic act 'Wegenverkeerswet 1994' which enabled the experimentation with autonomous vehicles (Overheid.nl, 2018). This change in legislation facilitated initiatives concerning autonomous driving. However, there remains often a form of tension between the road authority, the municipality and the authority for vehicle inspections 'RDW', which is responsible for certifying the safety of the vehicle. All these actors must agree on providing permission for the initiative to test and experiment on public road (A. Scheltes, Goudappel Coffeng, personal communication, July 2, 2020).

These situations in these cases are examples of legislative actions being taken to facilitate innovative initiatives. But there are more ways in which a governmental actor can act (W. Ploos van Amstel, expert city logistics, personal communication, July 14, 2020). A governmental party can take several types of governmental action:

- by regulating/enforcing by which e.g. certain heavy trucks cannot enter the city centre anymore,
- by facilitating by which it becomes easier to e.g. reach a hub on the border of the city centre easily, from where goods can be distributed throughout the city,
- by stimulating, which is executed with subsidies,
- by coordinating where e.g. electric types of transport get priority against other traffic via bus lanes or at last,
- by experimenting. Experimentation is effective because if experiments are successful, it can be prescribed on the business community which has no arguments against using that technology.

Regarding the provision of subsidies are a couple of cases identified as well. In both the Nemo H2 case and the TTC case are subsidies provided by the innovation agency Agentschap NL/Senternovum (Agentschap NL, 2011; M. Beversluis, Tuk Tuk Company, personal communication, July 22, 2020). In addition to that subsidy for TTC, received the initiative a subsidy for innovation from the European Union as well to stimulate close-knit public transport. Furthermore, there was also a subsidy from the municipality of Amsterdam for the development of electrical Tuk-tuks. No governmental support was found in the case of VDDG, it was all initiated and financed by the initiative starters. The City Cargo initiative was supported by a subsidy but did not receive any financial support from the municipality of Amsterdam (P. Hendriks, City Cargo, personal communication, July 15, 2020).

So, governmental legalizations did in some cases support the initiatives. In the cases of the CityPods, Nemo H2 and TTC this was partially performed on a national level by subsidies via the innovation and entrepreneurial agency Agentschap NL. The support on local scale comprised a subsidy provided by the municipality of Amsterdam in the TTC case and additional permits for sustainable tour boats in the Nemo H2 case. Notable is the choice for supporting by providing subsidies for new sustainable innovations. While this financial support is often required to bear the costs of development, subsidies are not considered the most lasting support an initiative can receive. It can cause less pressure to search for revenue sources like

potential clients because the subsidy covers the initial costs (W. Post, Mokum Mariteam, personal communication, July 16, 2020; W. Ploos van Amstel, expert city logistics, personal communication, July 14, 2020). Other guiding legislative methods like 'coordinating', which can be recognized in the Nemo H2 case are plausible even so, or even more important to support a new niche innovation.

4.4. INFRASTRUCTURE & MAINTENANCE CONTEXT

The indicator for this context is the 'involvement of suppliers & vendors in green activities to gain support for environmental strategy'.

Table 5. Niche scale indicator for the infrastructural context.

	Nemo H2	VDDG	City Cargo	CityPods	TTC
Infrastructure & maintenance context					
Involvement of suppliers & vendors in green activities to gain support for environmental strategy		☑	☑		

Aspects for this indicator are identified in the cases VDDG and City Cargo as is indicated in Table 5. In the VDDG case this translates to the parties that started the initiative. Three tour boat companies, a transport company and waste treatment company came together and searched for a solution to transport goods over water. These actors were convinced that this would be a sustainable solution which would reduce nuisance on the busy city roads caused by conventional transport methods. However, when approaching potential customers which claimed to take sustainable operation of their business seriously, the repeating barrier was the higher costs of this way of transport (OneWorld, 2015). Apparently, this higher price did not cause such a problem for the future clients of the City Cargo trams. The sustainable cargo trams were positively received by numerous potential clients and the first twelve trams were booked for full capacity (P. Hendriks, City Cargo, personal communication, July 15, 2020; Logistiek.nl, 2008b). This can potentially be linked with the volumes and type of cargo that must be transported to the clients of the different initiatives.

This indicator is not found in the other three cases. The guiding question asked in the interviews was: "What position did suppliers or other actors involved, take regarding the sustainable aspects of the initiative?". None of the interviewees of these cases have provided insight over this aspect. There is a possible reason for the commercially oriented initiatives Nemo H2, VDDG and City Cargo why there are very limited results for this indicator found in the cases. When sustainability objectives are defined within organizations or supply chains it proves that the contribution to sustainability of the initiatives that provide transport services is only marginal compared to the whole life cycle analysis of products (W. Ploos van Amstel, expert city logistics, personal communication, July 14, 2020). Considering the general aim of suppliers and vendors which is the purchasing and selling of products, the barrier might be that transport must be low-cost and results for their sustainability goals are easier obtained in the production or recycling of the products.

4.5. SOCIETAL & ENVIRONMENTAL CONTEXT

Table 6. Niche scale indicators for the societal & environmental context.

	Nemo H2	VDDG	City Cargo	CityPods	TTC
Societal & environmental context					
Increasing level of sustainability within the initiative.					☑
Development of a societal and environmental aimed organizational culture.					☑
Influence of NGOs & (inter)national platforms	☑				
Development of an innovation that meets the requirements of customers for a sustainable solution			☑	☑	☑
Level of sustainability practices to correspond with the awareness level of customers					

Multiple indicators are identified in the societal & environmental context, these are shown in Table 6. The first indicator regarding the level of sustainability performance within the initiative is only found in the TTC Case. This includes sustainability aspects as the sharing and quality of information between actors, existing techniques that get upgraded in the development process or the usage of smart intelligence technology e.g. hardware, software or networks. The TTC initiative started out with vehicles that had a four-stroke 550 cubic centimetres Daihatsu combustion engine. But eventually the initiative partially changed their fleet of vehicles to battery powered electric versions. In the other cases there was certainly sharing of information, although none of the interviewees mentioned specific situations of sharing information regarding environmental or societal aspects. There were no aspects for upgrading of techniques for specifically used to increase the environmental characteristics of the initiatives, or the usage of smart intelligence technology to increase performances of the initiatives found in the cases. This is not by definition remarkable if looked at the characteristics of the initiatives. Most of the initiatives were already using sustainable methods from the start such as hydrogen and electrical propulsion. Although these methods are more sustainable compared to conventional methods, the generation of hydrogen or electricity remains a sustainability issue.

The next three indicators in this context are also found in one or more of the cases. The indicator for the development of a societal and environmental aimed organizational culture is also recognized in the case TTC. This initiative started as an initiative that did not portray itself for the high level of sustainability. After implementation of the emitting vehicles and the results of this implementation were known, it became clear for the initiative owners that change regarding sustainability was necessary. The initiative wanted to be a societal responsible business and be part of the business community that performs 'Maatschappelijk verantwoord ondernemen (MVO)' in the Netherlands. MVO means that companies take the effects of their operation on humans, the environment and society into account (Rijksoverheid.nl, n.d.). Therefore, the organizational structure of the initiative was split up in two parts. TTC ended up hosting events (instead of the taxi service) and Tuk Tuk Factory (TTF) was launched for the development of electrical Tuk-tuk vehicles (M. Beversluis, Tuk Tuk Company, personal

communication, July 22, 2020). In the other cases are no specific considerations found for improvement of elements in the organizations to reduce potential negative effects of their operations on society or the environment.

Moving on to the third indicator of this context, the influence of non-governmental organizations (NGOs) or (inter)national platforms. There are several related issues found in the cases. Recurring is the support that NGOs can provide in lobbying activities, large NGOs have paid employees for these activities (W. Ploos van Amstel, expert city logistics, personal communication, July 14, 2020). In the case of Nemo H2 were NGOs beneficial for lobbying to receive necessary permits although specifics were not provided. (H. Sie, Integral B.V.., personal communication, July 3, 2020).

The fourth indicator about the development of an innovation that meets the requirements of customers for a sustainable solution is first identified in the case City Cargo. An example of the cargo freight tram initiative for this indicator was the supply of a large supermarket in the middle of Amsterdam. This supermarket could be supplied in 40 movements of the cargo tram in comparison with 16 vehicle movements where large LZV trucks were used. Although the number of movements was higher, the nuisance for road users was severely less. For the trucks to be able to supply the supermarket, shop employees had to stop and manage traffic, so the truck had enough space to turn into the loading dock. The conventional transport method therefore created more nuisance for citizens then the initiative would do. This characteristic of the initiative is beneficial for the citizens of Amsterdam because it takes away hindrance of their daily behaviour.

In contrast to consumers or people involved in noticing (or just not noticing and therefore enjoying) the benefits innovation which the initiative brings, is the use of electric transport compared with conventional, emitting forms of transport that use fossil fuels. Research of Goudappel Coffeng into passenger experiences of busses has shown that 90% of the passengers is not even aware that a bus is powered by electricity or by a combustion engine. The requirements of consumers for the sustainability aspect of public transport seem therefore very limited (A. Scheltes, Goudappel Coffeng, personal communication, July 2, 2020). The reduction of nuisance caused by public transport is beneficial for people outside the vehicle. Less noise and no emissions cause a better living environment (Öhrström et al., 2006; Welsch, 2006). However, it thus seems that this is not a demand of high priority for users of public transport. The last case in which this indicator is found is the case TTC. For a project issued by the public transport agency of Amsterdam, the GVB, the initiative used electric powered Tuk-tuks because this was a specific requirement of the client. The electrical Tuk-tuks were used as a shuttle service between major nightlife plazas. The sustainability aspect of these vehicles was therefore, again, not focussed on the end-users of the taxi-service, but on the living environment in which the vehicles operated.

The development of an innovation specifically designed to meet the requirements of customers is hardly found in this research. Even in the case of TTC, where the innovation specifically was designed for the client of TTC, and not for the end-user of the shuttle-service. The requirements of society for a sustainable solution seem to be hardly noticeable. The choice for companies or organizations to choose for a sustainable solution can vary. It possibly is because the company

wants to be a societal responsible business, or because it is issued by a governmental partner that specific regulations are obeyed. An example of the latter is the obliged use of zero-emission forms of transport, often trucks, to deliver heavy building materials in the city centre of Amsterdam. Companies comply with these regulations to be able to continue their business (W. Ploos van Amstel, expert city logistics, personal communication, July 14, 2020). This correlates with the last indicator of this context, the level of sustainability practices of the initiative to correspond with the awareness level of customers. This indicator is not found in any of the cases of this research. Initiatives that have a sustainable appearance are often published in the press and receive awards but the link with the awareness level of customers, specifically end-users, is not established in this research with these cases.

4.6. ACTOR INVOLVEMENT CONTEXT

Table 7. Niche scale indicators for the actor involvement context.

	Nemo H2	VDDG	City Cargo	CityPods	TTC
Actor involvement context					
Risk management & contingency planning between actors	☑			☑	☑
Level of transparency between key stakeholders	☑	☑		☑	☑
Level of sustainability awareness of stakeholders					
The extent of data sharing regarding (sustainability) performances among actors					

The involvement of actors is of great importance, as is substantiated in section 2.2.6. The indicators for this involvement are researched in the case studies. These indicators are shown in Table 7: Risk management & contingency planning between actors, the level of transparency between key stakeholders of an initiative, the level of sustainability awareness of the stakeholders, and the extent of data sharing regarding (sustainability) performances among actors involved in the initiative. The presence or development of a risk management & contingency planning proved to be conceived as an unrealistic element by several interviewees. In the cases of Nemo H2 and VDDG there were only made juridical or organizational agreements regarding payments and responsibilities. Payment milestones and service-level agreements are in place in CityPods cases, as well as which stakeholder carries which risks (D. Mica, 2getthere, personal communication, July 24, 2020). No risk or contingency plans were identified in the cases City Cargo and TTC.

In the case of the Nemo H2 initiative there was no ambition to have a risk or contingency plan. There was a business structure where all 5 initial stakeholders had an equal share, which regulated that eventual profits would be shared in a fair way. Additionally, there were contracts in which payment agreements for the amount of invested time and energy of each stakeholder were described (H. Sie, Integral B.V., personal communication, July 3, 2020). The second case in which a business structure with multiple actors is recognized is the VDDG case. This initiative started with five partners that reached each other via their professional networks. Two actors were land-based, a transport company and a waste processing company. These actors

cooperated with three water-based tour boat companies. These five partners founded the company 'Mokum Mariteam'. The actors were supplementary to each other regarding the development of workload and revenue due to the difference in their originating businesses. However, after implementation and multiple years of operation, the revenue stream of the initiative became thinner due to the financial crisis at the time. The initial key actors discussed the viability of the initiative, and possible ways to generate more income out of their own work field. This was not an option for the three tour boat companies and these actors therefore decided to step out of the partnership. The two land-based actors carried on with the initiative but eventually decided to sell the company due to the unfair distribution of costs and yields. The initiative was still operating at a loss at that time. The decision was then made to sell the company to the current owner Rutte Groep (W. Post, Mokum Mariteam, personal communication, July 16, 2020).

The aspects related to the risk management indicator were therefore often limited to the development of an organizational and juridical agreement in the form of a 'B.V.' which is a type of company where the ownership of the company is divided in shares (KVK, n.d.). There were no back-up plans ready for in the event that revenue goals were not reached anymore.

The City Cargo initiative was a B.V. as well (Graydongo, n.d.), but also did not have a risk management or contingency plan. The different element in this case was the absence of private sector actors. All confidence was placed in the energy company Nuon which was owned by the city of Amsterdam. This company was the sole investment source of the initiative. An operating company was founded with Nuon, which was called Professionals for You, and City Cargo was the first party of this company. However, when Nuon left the operating company because the city of Amsterdam wanted to sell Nuon, nothing could be done for the City Cargo initiative regarding the investments because Nuon had to be dissolved before the sell could be persevered. As a result, Professionals for You was dissolves just as quick as it was founded (P. Hendriks, City Cargo, personal communication, July 15, 2020).

The indicator was also not found in the case TTC, this initiative was also a B.V. type of business and founded by the two initiative starters. The initiative was in the initial stage designed as a franchise organization where the initiative starters had the managing position and the franchisers had to pay a franchise fee. Together with the marketing contracts, and the paid telephone number for bookings, this composed the merit model of this initiative, there were no other key stakeholders. So, other than the contracts with franchise takers and marketing agencies, there was no need for a risk or contingency plan. The executed pilot was performed with private money which also led to an additional loan of a bank which funded the extra required finances (M. Beversluis, Tuk Tuk Company, personal communication, July 22, 2020).

A relation between risk management and the security of revenue is expected to be in place in the cases. The majority of initiatives in the cases were structured in a company form B.V. with payment agreements and judicial contracts but a remarkable aspect is the difference between initiatives VDDG and TTC that have secure revenue models and initiatives that are not equipped with a solid revenue plan. The cases Nemo H2 and City Cargo depended heavily on one source of income. In the case of Nemo H2 this was a subsidy (besides the equal investments of all shareholders) and in the case of City Cargo this was the presence of one investing party. It

would therefore be expected that there is a contingency plan in case that one source of income falls away, but this was not the case.

Handling of risks is correlated with the level of transparency between key stakeholders. This second indicator for the actor involvement context on the niche scale indicates the way in which stakeholders engage with each other. A proactive engagement and communication between the key actors or stakeholders, helps the initiative to succeed as is described in 2.2.6. The communication consisted in all cases of periodical meetings between (key) stakeholders. In the case Nemo H2 this resulted in the end of the initiative after the pilot project period, because "the investment of time and thus money became no longer worthwhile for certain key stakeholders" (H. Sie. , Integral B.V., personal communication, July 3, 2020). The VDDG initiative is another example where several meetings were held during the design phase of the vessel. But when the existing situation in which the initiative was implemented changed over time as is discussed previously, the communication between stakeholders alone could not keep the partnership intact. For the City Cargo case is only known that the communication to actors was a top-down method of management. All actors involved with the initiative were paid by the owners of City Cargo Amsterdam B.V. (P. Hendriks, City Cargo, personal communication, July 15, 2020).

In CityPods projects there was always a very high level of communication and proactive engagement between stakeholders. This supports the acceptance of the new and unfamiliar technologies by actors outside the initiative(s) (A. Scheltes, Goudappel Coffeng, personal communication, July 2, 2020; D. Mica, 2getthere, personal communication, July 24, 2020). Pilot projects or real traffic issue solutions can then easier be implemented in the existing infrastructure. The TTC initiative knew a proactive communication method to keep pressure on the municipality of Amsterdam to achieve certain things like permits. This method was developed by keeping a good relationship with the press. This caused the citizens of Amsterdam to receive the initiative as sympathetic. This had in turn effect on the local politics, which therefore cooperated more easily with the initiative. The analysis of this indicator in the cases did not turn out substantiated examples of clear transparency between key stakeholders. If periodic meetings are held which was found in several of the cases, and actors are equal shareholders in profits, risks and responsibilities, this probably leads to enough transparency for the stakeholders to continue with the initiative. However, if these shares of key actors then shift to an unbalance it can result in a discontinuation of the original organizational structure of the initiative. This is seen in the cases Nemo H2 and VDDG.

The last two indicators of this context are in none of the cases identified. The data collection did not deliver more insight in the level of sustainability awareness, nor for the level of data sharing regarding the performances in the initiatives as a whole supply chain or as a single link. The higher the level of data sharing, the more it should benefit the collaboration of the actors of the initiative. Additionally, a high level of sustainability awareness between stakeholders should benefit the level of sustainability of the initiative and its sustainability performance. But there is no evidence found in the cases that lead to a lack of access to data or unawareness of actors. These indicators are therefore unlikely been of major influence in the cases of this research. The reason for this can probably be found in the size of the initiatives of these cases.

The initiatives were all limited in size with only one or a small number of vehicles, there were no large supply chains involved. Most of the activities within the initiative were executed by the same actors.

4.7. SUB-CONCLUSION CHAPTER 4

A few remarkable aspects came to light in the research to the niche scale indicators. All cases are researched by the same method with the same items as subjects. There are however quite significant differences between the number of indicators found in the cases, but this is further discussed in the discussion. This sub-conclusion will elaborate on the indicators and the associated contexts on the niche-scale.

Remarkable is the finding that niche-scale indicators for the technological, economical, and governmental contexts are found applied in several cases. Where this is not the case in the societal and environmental context. Another remarkable finding is the clear difference found in the actor involvement context between the first two and last two indicators. While the first two indicators are found applicable in several cases, the last two indicators are not found at all in the cases. These niche-scale indicators are not found applicable in the cases: the 'Level of sustainability practices to correspond with the awareness level of customers', the 'Level of sustainability awareness of stakeholders' and 'The extent of data sharing regarding (sustainability) performances among actors'. One or more unfound indicators of a context evidently brings down the score of the context.

A recurring element in the cases is the costs of the service that the initiative provides, for the users of that service. A large customer base is positive for the generation of revenue for the initiative, but a high cost of the service provided by the initiative negatively effects the size of this customer base.

The level of sustainability of the initiative is desired high by all actors: the initiative actor, the actors in the supply chain or users of the initiative, as well as by governmental actors. A high level of sustainability can be supported by the governmental actor, but it nevertheless often results in higher costs compared to unsustainable alternatives. End-users therefore are potentially less motivated to choose for the sustainable option. It therefore seems that when a governmental actor wants to support the implementation of sustainable niche initiatives, it must financially support the initiative so that the costs for the end users can be kept lower or similar to the unsustainable alternatives. Or that unsustainable alternatives must be forced to change to sustainable activities by legislative actions. These actions can be taken by e.g. only providing permits to sustainable operating companies.

Table 8 contains all the contexts and the corresponding indicators. Scores in the form of plusses and minuses are designated to the contexts in comparison to each other. The score '++' refers to the context with the indicators that were found the most applicable in the cases, and '- -' to the context containing the indicators that were found the least applicable.

Table 8. Overview of indicators that apply to the cases on the 'Niche' scale.

	Nemo H2	VDDG	City Cargo	CityPods	TTC	Context score
Technological context						
Strategic planning of moment to implement the technology.	☑		☑		☑	++
Economic context						
Preference of customers for purchasing from organizations with good environmental records.		☑			☑	+
Enhancement of the 'brand image' of the initiative by using sustainable technologies to reach environmental conscious consumers.		☑	☑	☑		
Possible gain of competitive advantages as the first supplier of a product or service.	☑	☑			☑	
Governmental & regulatory context						
Government legalizations pushes towards the implementation of specific sustainable practices.	☑			☑	☑	++
Infrastructure & maintenance context						
Involvement of suppliers & vendors in green activities to gain support for environmental strategy		☑	☑			+/-
Societal & environmental context						
Increasing level of sustainability within the initiative.					☑	- -
Development of a societal and environmental aimed organizational culture.					☑	
Influence of NGOs & (inter)national platforms	☑					
Development of an innovation that meets the requirements of customers for a sustainable solution			☑	☑	☑	
Level of sustainability practices to correspond with the awareness level of customers						
Actor involvement context						
Risk management & contingency planning between actors	☑			☑	☑	-
Level of transparency between key stakeholders	☑	☑		☑	☑	
Level of sustainability awareness of stakeholders						
The extent of data sharing regarding (sustainability) performances among actors						

5. REGIME SCALE CIRCUMSTANCES FOR NICHE INITIATIVES

This chapter elaborates on the aspects found in the mobility regime that are beneficial or detrimental for the niche initiatives. In order to define the main inhibiting factors for sustainable mobility niche initiatives, aiming to influence regime level transitions.

These aspects are divided with specific indicators related to the six contexts, adopted from the conceptual framework. Each context is discussed in a section of this chapter, similar to the previous chapter.

5.1. TECHNOLOGICAL CONTEXT

Table 9. Regime-scale indicators for the technological context.

	Nemo H2	VDDG	City Cargo	City Pods	TTC
Technological context					
Need for required complementary technologies	☑	☑	☑	☑	☑
Learning processes & adaptations in relation to the technical development and infrastructure	☑	☑		☑	☑

The technological context in relation to the mobility regime, concerns all technology related issues which originate outside the niche initiatives own control. The indicators for this context on the regime-scale are shown in Table 9. All initiatives researched in the cases required complementary technologies located within this regime. As partially described in the previous chapter, all initiatives were in some way in need of infrastructure or technologies other than that provided by the initiative itself. The indicator for this context is therefore discussed with reference to aspects from all five cases.

The Nemo H2 vessel was powered by compressed hydrogen and required a filling station. However, the complete infrastructure for transporting and refuelling hydrogen did not exist in Amsterdam. The plan was to realise a filling station on the terrain of the company Shell. The reason was that the infrastructure for hydrogen refuelling was already partly present in the form of a compressor and the hydrogen itself (Agentschap NL, 2011). The design of the filling station was finished (Het Parool. (June 4, 2013). However, the filling station was never realised due to long development and testing phases after which Shell was no longer interested in the ferry service. The vessel had to be refuelled using compressed hydrogen which was transported in high pressure cylinders. A location for a refuelling station in the city itself proved to be a difficult debate with the municipality of Amsterdam due to safety concerns and the required space close to the water (H. Sie, Integral B.V., personal communication, July 3, 2020).

The vessel 'City Supplier' of the VDDG initiative in theory did not require other technologies beside the boat and the crane to be operational. The boat and crane were designed and developed by Saan, one of the initiative starters. However, it was designed to be able to transport a certain number of 'eco-cassettes' which were earlier developed by Icova, one of the other initiative starters. These 'eco-cassettes' were used to transport waste from pick up points

at the locations of clients to the waste collection and processing location. The crane on the front of the boat had to be powerful enough to reach onto the quay wall and lift the loaded cassettes on the deck. The bow of the ship therefore had to be designed so that it was stable under these activities. These requirements took a few years to come up with a sufficient design and the boat was then built and put into operation. When implemented, the initiative discovered the need for docking locations in the city on each 'rak', which is the length of quay wall between two bridges (W. Post, Mokum Mariteam, personal communication, July 16, 2020). However, this is further discussed in the Infrastructure & maintenance context in section 5.4.

The required supplementary innovations in the City Cargo case are numerous: an extra tram track through a water defence dike, collection and distribution centres at the city border, transfer stations at ten locations in the city and at last the development of several battery powered electric 'last mile' delivery vans that would transport the goods from the transfer stations to the client addresses. The freight trams were designed for the transportation of goods instead of public transport purposes. The initiative required such a vast amount of complementary technologies, that the costs to cover all these technologies became a severe barrier.

In CityPods projects it could vary what the aim of projects was. For certain pilot projects it was necessary to indicate a specific route or track to be used for the project. Safety precautions had then to be implemented on these indicated tracks to ensure the safety of other road users (Goudappel Coffeng, 2020). The autonomous shuttles were already developed, tested and proven to be functional, depending on the adaptations of the area in which the shuttles would be implemented. Level 4 is currently the highest achievable level of automation. The next level, level 5, would be automated driving regardless of the surroundings in which a vehicle is placed. But this level is still not reached (A. Scheltes, Goudappel Coffeng, personal communication, July 2, 2020; D. Mica, 2getthere, personal communication, July 24, 2020). When these autonomous vehicles are planned to be used to solve a real traffic issue instead of a pilot project they require a route where necessary adaptations are implemented at complicated locations with crossings of different modalities of mobility. The costs of these adaptations are generally considerably higher compared to these of a pilot project.

The TTC case required complementary technology in the form of waiting locations in the city to wait for customers to make use of their taxi-service. This remained the main issue throughout the whole period of the taxi-service operation (M. Beversluis, Tuk Tuk Company, personal communication, July 22, 2020). Additionally, there was the need for charging infrastructure for the electrical Tuk-tuks. But this was linked to the development of the waiting locations at key locations in the city.

Related to this indicator for the need of complementary technologies is the other indicator for this context on the regime scale: the learning process and adaptations by the initiative actors in relation to the technical development and infrastructural aspects. Experiences in the implementation process of the initiative into the regime, can result in the need for changes. These changes can concern the design of the innovation as well as the service of the initiative. This indicator is also found in the data as applicable the majority of the cases, except the City Cargo case.

As earlier discussed, the required hydrogen refuelling infrastructure was the main infrastructural problem for the Nemo H2 initiative. The company Shell with whom the first contract was signed stated that the filling station could be developed on its terrain, but when it came down to the details concerning the design and the location of the filling station, the actors could not reach an agreement. This became a structural problem due to the so called "chicken-and-egg situation" (H. Sie , Integral B.V., personal communication, July 3, 2020) between the vessel and its required refuelling station, where both parts needed the other part. Negotiations and discussions were held, but actors were not motivated to develop a hydrogen infrastructure. There was no demand for it besides the Nemo H2 Vessel which at the time was still under construction and would later be operating solo. The willingness of key actors to invest time and money in the initiative decreased partially because this infrastructure remained an obstacle to be overcome. As a result, the expansion of the initiative stranded. A lesson learned in this case was therefore to invest more time and thus money in a future project that requires a similar intertwined collaboration with its infrastructure (H. Sie, Integral B.V., personal communication, July 3, 2020).

The initiative actors of the VDDG case found out that the design of the current vessel is functional but can be improved. The shape of the bow is in the current design developed to absorb the force of the crane when lifting cargo off and on to the boat. However, this current shape causes the vessel to be slow in rougher water like the river 'IJ'. The lesson learned is to change the shape of the bow or develop a more powerful way of electrical propulsion for the vessel. But this is a lesson learned from the use of their own technology instead of that of complementary technologies. The previous mentioned docking locations on each 'rak' are believed to be necessary to enable transport of cargo over water. However, this is not the only required element; to shift the volume of cargo from land-based to water-based, transfer stations at the border of the emission-zone around the city centre are required. The speed of transport via water is slower compared to transport on land, to reach acceptable delivery periods goods must be loaded on and of the vessels at strategic locations in or around the city. Although the municipality has high ambitions for zero-emission mobility, the required infrastructure desired by the initiative is still a hope for the future, because the municipality still has not taken action to realise the infrastructure required for the wanted level of sustainability (W. Post, Mokum Mariteam, personal communication, July 16, 2020). The lesson learned for this initiative remains therefore that the ambitions of a governmental actor regarding regime-scale infrastructure and mobility are not ensured to be adhered.

This situation is also found in CityPods projects where numerous pilot projects with autonomous vehicles are launched, finished and reflected on, without further steps taken. These projects do require considerable investments, time and effort of the actors involved. A lesson learned is that there is very limited sharing of knowledge and experience of the performed pilots, which results in the situation that (mainly governmental) actors are launching their own projects. However, these projects generally end up with the same results that other pilots already retrieved. It therefore can be seen as a nonoptimal use of funds and resources (D. Mica, 2getthere, personal communication, July 24, 2020).

The learning process regarding the necessary complementary technologies for the TTC initiative concerned a combination of infrastructure and legislation aspects. The first non-electrical Tuk-tuks had to be imported from Thailand. This was a problem because the vehicles did not have a European approval. Therefore, the process became quite complex and expensive. The vehicles had to be imported in the United Kingdom (UK), certified under the 'Specific Vehicle Approval Test' which was an exception in legislation for kit-builders that built their own three-wheeled vehicles. After the approval of the Tuk-tuks in the UK they had to be imported in the Netherlands. Because the vehicles were imported from a European union member state, could the Dutch national agency for vehicle safety RDW do nothing more than demand small modifications to the vehicle and certify the Tuk-tuks for the use on Dutch roads (M. Beversluis, Tuk Tuk Company, personal communication, July 22, 2020). However, when the Tuk-tuks were legal to be driven on the roads, the locations to stop and pick up passengers were the problem. Regular taxi drivers received the Tuk-tuk drivers as unfair competition (the Tuk-tuk drivers did not require a taxi-licence) and therefore protested against the use of the regular taxi stands by the Tuk-tuk drivers. As discussed before in the previous chapter this infrastructural issue became the main problem for the initiative as a taxi-service.

The data regarding the City Cargo initiative does not reveal any lessons learned regarding the technology required by the initiative. The pilot project used existing infrastructure and (retrofitted) trams. The planned transfer stations and collection centres including the extra tram track were not yet developed at the time the initiative stranded.

5.2. ECONOMIC CONTEXT

Table 10. Regime-scale indicators for the economical context.

	Nemo H2	VDDG	City Cargo	City Pods	TTC
Economic context					
Complementary technologies being rare or expensive	☑		☑	☑	
Familiarisation of the users, risk aversion and willingness to pay for an unproven product or service				☑	☑

This section elaborates on the indicators concerning the availability and price of the discussed complementary technologies and infrastructure, as well as the familiarisation of the end-users to the initiative. Table 10 shows the application of indicators in the cases for this context. Furthermore, the possible aversion of the initiative's innovation by the end-users due to risks or unwillingness to pay for something unproven is also discussed.

The previous section described the infrastructural obstacle for the case Nemo H2. The required hydrogen refuelling infrastructure did only partially exist and missed the most important part: the filling station. The rareness of hydrogen as a fuel (in combination with a fuel cell to use the energy) became the main issue to overcome. After 9-10 years instead of the initially planned 3 years of developing the vessel, a solution was still not found (H. Sie, Integral B.V., personal communication, July 3, 2020). The second case in which the characteristics of the

complementary technologies were a large issue, specifically the costs of these technologies was the City Cargo initiative. Although large investments were done, the required bank guarantee that the municipality of Amsterdam asked for the development of the ten transfer stations in the city could not be provided. Therefore, these transfer stations were never developed, and the initiative could not function without these stations. Another initiative for which the complementary infrastructure and technologies are expensive is the CityPods initiative. To adapt the in the previous section mentioned defined tracks or routes in such a way that the autonomous vehicles can be implemented requires severe investments (D. Mica, 2getthere, personal communication, July 24, 2020). The investments are probably of such significance that the initiative(s) themselves will probably never be able to recoup them. Other sources of financial support are then needed. The two cases VDDG and TTC did not receive a checkmark for this indicator because the required technologies or infrastructures in these cases were not too rare or expensive for the implementation of the initial phase of the initiatives.

The second indicator for the regime-scale economic context is only found in the cases where a pilot project is performed. A pilot project is a good way to let the future end-users get familiar with a new technology or innovation (W. Ploos van Amstel, expert city logistics, personal communication, July 14, 2020). Pilot projects have been used in the cases of the CityPods initiative and TTC initiative to gain knowledge and experience, but simultaneously let the people be able to experience the initiatives' innovations. The TTC initiative followed a clear strategy for implementing their service. A pilot project in Zandvoort was performed and proved the service to be desirable by customers. Consequently, the service was implemented on a larger scale in the cities Den Haag and Amsterdam. The CityPods initiative knows multiple projects which were launched as pilot projects, as described in section 5.1. These pilot projects are also used to gain experience and knowledge about the innovation, but the reception of the innovation by its possible future users as well. The latter is of great importance regarding the further expansion of the use of autonomous vehicles in the future. All key actors including the end-users must become involved in the development process of the innovation, to support the reception and benefit the implementation of the innovation (A. Scheltes, Goudappel Coffeng, personal communication, July 2, 2020). The other cases did not reveal specific situations of aspects related to risk aversion or unwillingness to pay for an unproven service. The VDDG initiative did encounter difficulties regarding the expansion of their customer base as is described in the previous chapter, but this was linked to the price of the service and not to reluctance of end-users for the functionality of the service due to e.g. its innovative characteristics.

5.3. GOVERNMENTAL & REGULATORY CONTEXT

Table 11. Regime-scale indicators for the governmental context.

	Nemo H2	VDDG	City Cargo	City Pods	TTC
Governmental & regulatory context					
Communication and specific statements of government agencies for their need of sustainable innovations		☑	☑	☑	☑
Level of flexibility in current regulations				☑	
Learning process of, and adaptations to, aspects regarding institutional structures, legislation & governmental role.	☑		☑		☑

On the regime scale are three indicators found for the governmental and regulatory context, this is shown in Table 11. These indicators regard the characteristics of the governmental institutions, communication and role towards niche initiatives and the regime itself.

The first indicator is the communication and the level of specification of governmental agencies for their need of sustainable innovations. This means the specific way that governmental actors use to reach initiatives with the goal to let them engage in increasing the level of sustainability in the regime. The main governmental factor is in all these cases the municipality of Amsterdam. This municipality publicises their ambitions extensively (Gemeente Amsterdam, n.d.-b) and has a specific plan of action Gemeente Amsterdam. (2019a). However, in the data collection it became clear that these ambitions were not worked out as far as to the level on how to reach these ambitions. The VDDG initiative did not receive specific desires of the municipality for sustainability at the time of implementation, the initiative was launched by five private actors with their own am for the initiative. After several years changed the goals of the municipality more and more focused towards sustainability. The impasse is found in the way these goals are communicated. It comes across initiative actors as that the goals are mentioned by the municipality, and that this communication alone is believed to be enough to set initiatives in motion to reach these goals and ambitions. This is not the case as is witnessed by the VDDG initiative. Specific guidebooks or a contact point were not provided, and initiatives had to figure out themselves which person to contact to receive required support or knowledge (W. Post, Mokum Mariteam, personal communication, July 16, 2020). Clearly defined legislation is very important in reaching major ambitions, it creates a level playing field. This means that all actors involved in the regime must comply with the same legislation. Sustainable initiative starters run the risk of dealing with unfair competition regarding performances and costs, compared to conventional unsustainable operating actors when this legislation is not present. (W. Ploos van Amstel, expert city logistics, personal communication, July 14, 2020).

There were initiatives that did receive specific requests of the municipality. One of these was the TTC initiative. The municipality requested the initiative to implement the Tuk-tuks as a taxi service in Amsterdam Zuid-Oost to provide an alternative way of public transport for the illegal taxis that were operating in that area. Another request received by the initiative from the

municipal public transport company GVB was to develop an electrical Tuk-tuk, this request came paired with a subsidy to fund the expenses of this innovation project. The communication and partnership with the municipality was received as positive by the initiative, although the Tuk-tuk stand to wait for customers remained an unresolved issue (M. Beversluis, Tuk Tuk Company, personal communication, July 22, 2020). The second initiative which received legislative support was the City Cargo case. The initiative received the permit to exploit the freight tram service for 5 years, and the use of the tram infrastructure for 10 years. No other companies were in these periods allowed to provide a similar service in Amsterdam and use the tram tracks. The municipality therefore agreed on a legislative perspective with the initiative (P. Hendriks, City Cargo, personal communication, July 15, 2020).

The third case in which the municipality supported the initiative owners was the plan to implement autonomous vans in the residential district 'IJburg' for the transportation of mentally and physical restricted children. A feasibility study was performed with the financial support of the municipality that wanted to support the parents of the children who were the initiative starters, to find out if it was possible to implement the innovation at that location (A. Scheltes, Goudappel Coffeng, personal communication, July 2, 2020). The shuttles are never made operational due to the long periods of time that were calculated to load and unload the wheelchairs. The initiative would therefore require three vans to reduce these periods, which resulted in excessive costs in which the municipality could not assist or provide (Het Parool, June 16, 2017). The only case that did not provide indications for this indicator was the case of the Nemo H2 initiative.

The second indicator of this context is the level of flexibility in current regulations and the resulting influence of it on the initiatives of the cases. This indicator was in the CityPods case found in the safety aspect of the innovation, safety is deemed as a very important factor by the initiative actors, but often the conclusion gets drawn that the innovation is not safe based on the results of pilot projects. The initiative actors argue to be able to prove that safety. The execution of pilot projects is believed to be a positive factor for the generation of visibility of the innovation, but simultaneously is a hazard because of the possibility that wrong conclusions are drawn by the results of a pilot project (D. Mica, 2getthere, personal communication, July 24, 2020). Remarkable is that the indicator for the level of flexibility of regulations is only found in one case. In this case the level of flexibility is low, while the other initiatives did not experience situations of inflexibility that can be pointed out.

Moving on to the third indicator, the learning of the institutional structures, legislation & governmental role. This indicator is found in multiple cases: the Nemo H2, City Cargo and TTC cases. In the first, there were specific aspects of the structure of governmental actors that were a barrier in the development process of the innovation. Different departments are located within the governmental structure and these departments consist of individuals with their own tasks and responsibilities. Examples are: the port authority Port of Amsterdam which is concerned with the river IJ, another department that is concerned with the inner waterways and canals, and yet another that deals with emission issues. This led to the situation that an initiative actor had to attend numerous departments to arrange affairs, where every department had different perspectives and opinions (H. Sie, Integral B.V., personal

communication, July 3, 2020). This links to the situation appointed at the first indicator for the VDDG case. No single point of contact was available for these initiatives. A comparable situation is found in the City Cargo case. The initiative actors encountered similar issues of disunity within the governmental actor. Not all the representatives of the city districts were proponent of the freight tram concept. The representatives of the city districts 'Centrum' and 'Nieuw-west' were against the plans because of the route through the city centre which would potentially cause nuisance. Another lesson learned was the periodic characteristics of agreements made by political actors. "After the term of office of the municipal council is completed and a different council is formed via the elections, the new council is partly able to reverse the agreements made with the previous council members" (P. Hendriks, City Cargo, personal communication, July 15, 2020). This obstacle had to be overcome, but then the decisive issue of financial shortages caused the negotiations and discussions to end prematurely.

The TTC initiative learned a different lesson in governmental difficulties. This again revolves around the long-lasting negotiations regarding a taxi-stand for the Tuk-tuks. Although the municipality provided permits for the Tuk-tuks per registration number of the vehicle, per year, the allocation of a waiting area or 'taxi stand' for the Tuk-tuks remained an issue. It was prohibited for the Tuk-tuks to wait for the Tuk-tuks in almost every area apart from loading and unloading areas (Het Parool. September 12, 2008). The problem however with these locations was that it was prohibited to park longer periods of time. Eventually after numerous discussions and negotiations there was one Tuk-tuk taxi stand developed, but it was quite far from the Central Station. "The lack of taxi stands caused difficulties for the initiative to generate enough revenue and was the reason why the concept failed" (M. Beversluis, Tuk Tuk Company, personal communication, July 22, 2020).

5.4. INFRASTRUCTURE & MAINTENANCE CONTEXT

Table 12. Regime-scale indicators for the infrastructural context.

	Nemo H2	VDDG	City Cargo	City Pods	TTC
Infrastructure & maintenance context					
Institutional capacity to bring together complementary technologies and required infrastructures		☑	☑		☑
Level of support of parties involved in developing the required complementary technologies or infrastructure	☑				
Learning process of, and adaptations to, aspects related to industrial development, production & maintenance network	☑				☑

Three indicators are defined in this context on the regime scale and visualised in Table 12. The first is the institutional embedding that can bring together complementary technologies and required infrastructures. The second is the level of support provided by the parties involved in developing the required complementary technology or infrastructure. The first indicator is in

several of the cases related to the indicators of the governmental context. This is one of the relations or overlaps as discussed in section 2.2. But because this section regards the aspects of the infrastructures required by the initiatives, the indicator is allocated in this context. Evidence is found for this indicator in three of the five cases except the Nemo H2 and CityPods cases.

Starting with the VDDG case, the level of support for bringing the innovation together with the required infrastructure was very low. As discussed before, the transportation of goods over water is beneficial for the city in terms of reduction of congestion and reducing damage on quay walls and bridges due to lower numbers of transport movements over land. However, this transportation method requires additional infrastructure in the form of transfer stations to load and unload from land to water and vice versa, plus the availability to dock at each 'rak'[2] in the inner city. Both these requirements ask for assistance of governmental actions. However, due to the political nature of the governmental actor, quick actions cannot be made, and other problems as the housing shortage must be attended to too. The latter caused the municipality to sell public real estate for the development of houses instead of using that real estate to develop the required infrastructure for sustainable transport.

The other issue of the lack of docking locations is found in the delicate political position that responsible governmental actors are located in. To realise these docking locations at the quay wall it is most probably that on many locations the current use of the available space by residents and citizens must change. This current use is the parking of cars and bicycles on the quay walls, and the mooring of private owned boats alongside the quay walls. If these parking spaces or the mooring of private boats become prohibited in allocated locations to make space for the use of loading and unloading in a city where parking spaces are rare, this can become an issue of political debate with citizens voting according to the results of that debate (W. Post, Mokum Mariteam, personal communication, July 16, 2020). This governmental behaviour therefore can be seen as contradictory to the pronounced ambitions for sustainability of that same governmental actor, the municipality of Amsterdam. Similar issues of required infrastructural additions for the initiatives that did not receive support in the form of institutional embedding were found in the City Cargo case with the development of the transfer stations, and the TTC case with the allocation of the taxi stands for the Tuk-tuks.

The second indicator concerns the level of support that parties related to the infrastructure of the initiative have for the development of the required complementary technologies or infrastructure. This indicator is only recognized in the Nemo H2 case. In this case there was unwillingness amongst the stakeholders involved in the hydrogen refuelling infrastructure. Initially there was the promising involvement of the company Shell which claimed to be willing to have a hydrogen filling station on their terrain, but another location had to be found after the contract of the initiative with Shell expired and Shell did not longer desire an own ferry service for their personnel. Linde Gas, as one of the actors involved in the initiative searched for another location in the city but this did not result in a suitable alternative to the Shell location due to failed negotiations with the municipality concerning the concerns for the safety of a hydrogen refuelling station and the required space adjoining a canal or other water way

[2] Nautical term for the length of the canal between two bridges

(H. Sie, Integral B.V., personal communication, July 3, 2020). This is also the lesson learned on infrastructural development for this initiative linking to the third indicator of this context. The other case which indicated aspects for the third indicator is the TTC initiative. This initiative was simultaneously providing the taxi-service and innovating electrical Tuk-tuks. Although the electrical Tuk-tuks had been placed on the European market, the company in Thailand involved in the production of the vehicles went out of business when the certification for the vehicles expired due to the vehicles falling short of the requirements. The initiatives ancillary company Tuk Tuk Factory therefore continued with the development of electrical Tuk-tuks with the company Spijkstaal with the help of the TU Delft university (M. Beversluis, Tuk Tuk Company, personal communication, July 22, 2020).

5.5. SOCIETAL & ENVIRONMENTAL CONTEXT

Table 13. Regime-scale indicators for the societal and environmental context.

	Nemo H2	VDDG	City Cargo	City Pods	TTC
Societal & environmental context					
Level of support for new technology based on present dominant technology			☑	☑	
Influence of new problems caused by the implementation of the innovation on the brand image	☑				☑
Learning process of, and adaptations to aspects regarding the societal and environmental impact of the technology.					

The indicators for this context are visualised in Table 13, all indicators concern societal or environmental aspects on the regime scale. The level of support for the new technology, based on the dominant conventional technology is the first indicator for this context on this scale. As described in Chapter 2, it is possible that a new initiative with a new type of technology or innovation gets judged by the known and proven characteristics and performances of the current available technologies. In the cases Nemo H2, VDDG and TTC this could not be found in the data. The implementation of the VDDG initiative went quietly, and publications in the press were issued by the initiative itself (W. Post, Mokum Mariteam, personal communication, July 16, 2020). Aspects linked to the indicator were found in the other two cases, it was e.g. very clearly noticeable in the City Cargo initiative. The initiative was obliged to install cameras during the pilot project of three months around the trams so the public transport company could investigate the tram's safety regarding other road users, while public transport trams were operational on many of the same tracks. (P. Hendriks, City Cargo, personal communication, July 15, 2020). The CityPods initiative receives scepticism regarding the safety of the vehicles as well but this is already described in section 5.3.

The second indicator concerns a whole different subject within the societal and environmental context. The development and implementation of an innovation or technology could cause disturbance in parts of society due to issues that are unfamiliar or that society does not know to deal with. Other issues can occur when an (sustainable) initiative causes other sustainability

problems. The latter is not found evident in the data collected in this research. Aspects related to the first are found in the cases Nemo H2 and TTC. In the Nemo H2 case this relates to the safety of the hydrogen refuelling station which after the debacle on the shell terrain was aimed to be located somewhere else in the city. In the TTC case this was related to the more social aspect that the TTC service was received as unfair competition by the taxi branch in Amsterdam because Tuk-tuk drivers did not require a permit to carry out the taxi-service. This was discussed within the municipality, but due to the specific target group that the initiative provided to (and the regular taxis did not), could the initiative continue providing their service to the users in Amsterdam (M. Beversluis, TukTuk Company, personal communication, July 22, 2020). For the last indicator concerning the learning of the societal and environmental impact of the technology, were no situations found that made this indicator evident in the cases.

5.6. ACTOR INVOLVEMENT CONTEXT

Table 14. Regime-scale indicators for the actor involvement context.

	Nemo H2	VDDG	City Cargo	City Pods	TTC
Actor involvement context					
Shaping expectations for actors	☑			☑	
Building of social networks with actors of varying backgrounds	☑			☑	☑
Development of user context	☑				☑
Level of institutional embedding					
Level of stability of the regime				☑	☑

The last context to be discussed on the regime scale is the actor involvement context. This context contains five indicators which are illustrated in Table 14. The shaping of expectations for actors is the first indicator. The case Nemo H2 is applied to this indicator because of the phases which the initiative maintained. The first phase was a pilot project to prove that a tour boat could be propelled with hydrogen in combination with a fuel cell. The second phase would be the expansion and wider scale exploitation of multiple hydrogen powered vessels. But due to the earlier mentioned long development and testing methods, the first phase period was much longer than anticipated and the actors did not have the same stakes in continuing the initiative as when they were at the start of the initiative (H. Sie, Integral B.V., personal communication, July 3, 2020). The second case applicable for this indicator is the CityPods initiative. The initiative involves all actors from the start in pilot projects or the implementation of a solution for a traffic issue, including certifying agencies and end-users. This enables the speed of the process of the initiative. Involving these actors makes the expectations clear from the start as well. This also creates a higher feasibility to succeed with the project (A. Scheltes, Goudappel Coffeng, personal communication, July 2, 2020).

The second indicator concerns the building of a social network around the initiative. This network ideally has actors of various societal backgrounds. This will provide a broad body of knowledge and perspectives. Three cases are applied. In case of the Nemo H2 initiative it is

found in the variety of stakeholders within the consortium and the connections with governmental actors and the client with future end-users. The second case is again the CityPods initiative for the reason described in the previous paragraph. Many stakeholders within a consortium or business structure such as a B.V. are involved as well as actors outside such a business structure, like governmental and societal actors which are involved in an early possible stadium of the project. The last case is the TTC case. This initiative on its own was commercially oriented, but it did keep close contact with the municipality as the governmental actor as well as with the local press and therefore the end-users of the service. While this second indicator concerns the building of a network of actors around the initiative starter, the third indicator relates to the development of a user context. In the cases of this research there is often a division in that 'user' of the initiative. Often there is a larger party as the client, like a big company as Shell in the case of the Nemo H2 initiative or a governmental actor in case of the City Pods initiative. However, this client is in those cases not the end-user of the service. The end-users were planned to be the personnel of Shell in the Nemo H2 case and the citizens and other passengers of the locations in which the CityPods are implemented. The indicator shows for the first case in the requirements for the capabilities of the vessel. Personnel had to be transported, so the vessel had to be built for the use of transporting people, and the designed route required the vessel to be able to cross the river IJ to bring these people to their destination. In the CityPods case the indicator was shown in the involvement of the future passengers in process of implementation. Information is provided about the characteristics of the relatively new technology, the risks, and the precautions taken to shield of these risks (A. Scheltes, Goudappel Coffeng, personal communication, July 2, 2020). The fourth indicator is not proven to be correlated with the cases of this research. No signs of the potential of institutional embedding that could create credible expectations for the end-users or the enlisting of new actors in support of the technology or initiative were found.

The last indicator of this context is found applied to two cases in contrast to the penultimate indicator. The level of stability of the regime in which an initiative is planned to be implemented can be either beneficial or counteracting for the new technology to receive support by the regime actors. In the cases of the CityPods and TTC the regime is and was instable which opened op possibilities for the initiatives. In the TTC case this was noticed in the earlier mentioned targeting of a specific group of customers that did not get provided for by the regular taxi services. Another aspect was the first-mover benefit, the initiative was the first actor to provide this service which worked out due to the first mentioned aspect. The CityPods initiative profited of other aspects of the regime. The shuttle vans are often seen and implemented as additions to current conventional methods of public transport like busses. Public transport concessions know busy and quieter routes, which corresponds with the level of revenue generated on these routes. The quieter routes on which less passengers are transported, are more expensive compared to the routes with high numbers of passengers because the largest operational cost of e.g. a bus, is the driver's salary. From a societal perspective the decision is made to keep the public transport route in place, despite the unprofitable financial situation. Opportunities are found for the implementations of autonomous shuttles on these lines because a driver is naturally not required for these shuttles. Another aspect is the flexibility of the engagement of the shuttle vans on public transport

routes. The autonomous shuttles can be operated on a regular schedule or on call basis where passengers book a van on their preferred time. However, the realisation of this method of public transport on these less used routes requires severe investments, and actors must be able and willing to dedicate these investments to this initiative.

5.7. SUB-CONCLUSION CHAPTER 5

The innovations and services of the initiatives in all cases required complementary technologies or infrastructure. In some of the cases this caused the stranding of the initiatives (City Cargo & TTC). Other inhibiting factors were found in all cases as well in some form of lack of societal or governmental support, or even the experience of opposition for the initiatives' services or innovations. Second is the absence of applicable indicators in particular in the VDDG and City Cargo cases. This is mainly found in the last three contexts that regard the infrastructural, societal, environmental and actor related aspects. This is potentially related to the starting point of the initiatives. Both started as commercial businesses which tried to compete with a sustainable technology against the conventional, proven competition in the mobility branch without the support of the future customer base or other (societal) actors from the start.

A few remarkable elements are found in the application of the indicators within the cases. The first, is the similarity with the niche-scale indicators of Chapter 4. The indicators of the societal and environmental contexts are for the regime-scale also found as least applicable, as is shown in Table 15. However, although certain indicators are not found in the cases does this not necessary mean that this is detrimental for the initiatives themselves. The checkmark for the indicators is not applied to the cases if evidence for the specific indicators is not found. This only generates a lower score of the context, for the extent of application in the scope of this research. E.g. if there are no new societal or environmental problems caused by the implementation of the innovation that affect the brand image, this is in fact positive for the initiative, but does result in the absence of a checkmark for this indicator.

The next chapter includes the discussion of the main found correlations in this research, discusses the findings of the case studies and links the theoretical concepts to the findings of the case studies.

Table 15. Overview of indicators that apply to the cases on the 'Regime' scale.

	Nemo H2	VDDG	City Cargo	City Pods	TTC	Overall score
Technological context						
Need for required complementary technologies	☑	☑	☑	☑	☑	++
Learning processes & adaptations in relation to the technical development and infrastructure	☑	☑		☑	☑	
Economic context						
Complementary technologies being rare or expensive	☑		☑	☑		+

Familiarisation of the users, risk aversion and willingness to pay for an unproven product or service				☑	☑	
Governmental & regulatory context						
Communication and specific statements of government agencies for their need of sustainable innovations		☑	☑	☑	☑	+
Level of flexibility in current regulations				☑		
Learning process of, and adaptations to, aspects regarding institutional structures, legislation & governmental role.	☑		☑		☑	
Infrastructure & maintenance context						
Institutional capacity to bring together complementary technologies and required infrastructures		☑	☑		☑	+/-
Level of support of parties involved in developing the required complementary technologies or infrastructure	☑					
Learning process of, and adaptations to, aspects related to industrial development, production & maintenance network	☑				☑	
Societal & environmental context						
Level of support for new technology based on present dominant technology			☑	☑		- -
Influence of new problems caused by the implementation of the innovation on the brand image	☑				☑	
Learning process of, and adaptations to aspects regarding the societal and environmental impact of the technology.						
Actor involvement context						
Shaping expectations for actors	☑			☑		-
Building of social networks with actors of varying backgrounds	☑			☑	☑	
Development of user context	☑				☑	
Level of institutional embedding						
Level of stability of the regime				☑	☑	

6. DISCUSSION

The discussion chapter consists of three sections. The first two sections discuss the findings related to the inhibiting factors found in the cases, and which lessons are learned from these cases regarding the influence on the mobility regime. Subsequently, the third section elaborates on the similarities between the findings in the cases and the theoretical concepts used in this research.

6.1. PATTERNS AND RECURRING INHIBITING FACTORS IN THE CASES

Several patterns of recurring inhibiting factors are found which are related to the business case of the initiatives, the actor involvement within the initiatives, the required infrastructure(s) for the initiative, the governmental actions related to the initiatives and the sustainability awareness of society. Three business-case-related factors are found in the cases on the niche scale.

First, the presence of a viable business case plays a major role in the choice for implementing an innovation in a specific place. In this research, the business case concerns the presence of clients and the prospect of generating profits. This is found in the cases Nemo H2, VDDG and TTC. The initiative must find ways of generating enough financial support when a viable business case is not available. However, this proved to be a challenge for some niche initiatives. The initiatives in the cases Nemo H2, City Cargo and CityPods did not, or no longer, have a business case nor multiple sources of financial support.

The second business-case-related inhibiting factor is about relation between the generation of revenue and the sustainable appearance of the initiative. A sustainable mobility initiative can use its sustainable characteristics to be more appealing to end-users. However, the sustainable alternative for the conventional (less sustainable) options is often more expensive. This can lead to reluctance of end-users to choose for the sustainable initiative. This is an inhibiting situation for the initiative: a higher revenue must be reached to bring the price down, but this higher revenue can only be reached if more actors use the service.

The third business-case-related inhibiting factor concerns the (lack of) presence of a secure revenue model compiled of multiple sources of income, in combination with a risk and contingency plan for the actors of the initiative. A few of the initiatives relied on a single source of financial support. This was e.g. a single (temporarily) contracted client in the case of Nemo H2, or a single investment party such as in the City Cargo case. In order to reduce the dependency on one source of income and thus decrease the level of risk for financial problems, would it be preferable to arrange multiple sources of support. However, it would be expected to have a contingency plan in case this would not be achievable. This plan would consist of possible subsequent actions to be taken by the initiative actors in the situation that the single source of financial support disappears. The problem encountered in the cases is that actors do not have or want such a plan because the dominating opinion is that to implement an innovation, the initiative actors just have to begin and see along the process what challenges

are met. The lack of financial security between and for the initiative actors, with the corresponding risks, is therefore defined as an inhibiting factor for niche initiatives.

Connected to this factor is an actor-involvement-related factor identified in the lack, or low level of variety in the societal role of involved actors (e.g. firms, users, policy actors or scientists). This can result in an insufficient supporting societal base for the initiative. Moreover, the shaping of expectations of key stakeholders involved is of importance in a project with a fixed duration as well as one without a defined time period. Unclear intentions of all stakeholders concerning subsequent steps after a fixed pilot period can result in a discontinuation of the initiative after a pilot phase. Unclear expectations for an initiative without a fixed process period can result in the resignation of stakeholders when e.g. profits are disappointing. Thus, either the lack of variety in backgrounds of the initiatives' actors, or unclearly defined mutual expectations are inhibiting factors for a niche initiative in the process of expanding into the regime.

Besides the business-case-related factors and actor-involvement-related factors, revolves the third theme around the inhibiting factors related to the required infrastructure(s) and the generation of investment funds to develop the required complementary infrastructural add-ons.

Additional to the lack of a viable business case, is the infrastructure-related factor that concerns the lack of beneficial characteristics of the current infrastructure at the location of implementation. Beneficial infrastructural characteristics were determined as a strategic advantage in the cases of Nemo H2, VDDG and City Cargo to implement these innovations at those locations. These beneficial characteristics can originate in the physical urban infrastructure, as well as in the availability to exercise the initiatives activities. Initiatives that could not benefit from the presence of beneficial infrastructures, encountered difficulties at the regime-scale when trying to solve these infrastructural problems. This was e.g. found in the 'City Pods' case in IJburg where the existing infrastructure had to be altered for the successful operation and implementation of the initiative's service. However, financial funds were not sufficient to execute this alteration and the project was never started at that location.

This lack of funds for necessary infrastructure is found as an inhibiting infrastructure-related factor on the regime scale. The generation of enough funds appeared to be a fundamental inhibiting factor in some of the cases. Large investments for infrastructural 'add-ons' in the city could often not be provided by the initiatives themselves. Investors were reluctant to investing in the development of infrastructural elements, due to regulations such as leaseholds and the governmental ownership of the integrated urban traffic and mobility system and urban properties in the city of Amsterdam (Gemeente Amsterdam, n.d.-c). As a result, investors had no collateral in case the initiative was not successful. The financial support for needed infrastructural add-ons in the city of Amsterdam is therefore seen as an inhibiting factor. This is often the reason why pilot projects are chosen for instead. Clients which are often governmental parties therefore regularly opt for gathering experience and knowledge with pilot projects because of the relatively low costs. Hence the numerous 'City Pods' pilot projects with autonomous shuttles, and the very limited number of projects where business cases with real urban traffic issues are tackled. Although these type of pilot projects are in fact a good

method to let end-users get familiar with a technology or service, it often does not result in an implemented and viable initiative in the real urban mobility regime. Initiatives can get stranded after completion of the pilot project period when no agreements for continuation after the pilot period were established.

The fourth obstructing theme concerns government-related factors. The first inhibiting factor found related to this theme, is the lack of variety in methods of support that governmental actors choose to use. In multiple cases this occurred by stimulating governmental action with the provision of subsidies to the initiatives. However, there are multiple other methods which can be used to support sustainability niche initiatives in a regime. Regulating and coordinating as a governmental action is only seen in the Nemo H2 case where permits for tour boats were only provided if the vessels did not emit emissions. The governmental attitude of unilateral support for sustainable niche actors can therefore be considered as an inhibiting factor for niche initiatives in the mobility regime in Amsterdam. In comparison, a combination of methods like stimulating governmental action combined with facilitating, regulating governmental action in infrastructural aspects, provides potentially better support for future niche-scale initiatives in competing with their unsustainable competition.

Another significant inhibiting government-related factor is found in the cases in the communication of the main governmental actor, the municipality of Amsterdam. Ambitions regarding sustainable mobility are publicized by the municipality. However, clear legislation or the support in the form of structured contact points or help desks is scarcely present. The link between the regime-scale ambitions and niche-scale initiatives is weak and thus seen as an inhibiting factor for the initiatives within the scope of this research. A second factor related to the governmental actors involved in the initiatives, is the lack of support and flexibility in regulations. Regulations proved to cause difficulties for certain initiatives to implement their service in the current mobility. An example is the prohibition for Tuk-tuk drivers to use the taxi stands for regular taxi's as waiting location. The reason was that the Tuk-tuk drivers did not have a taxi licence, although they did provide a similar service compared to drivers of regular taxis.

The last government-related inhibiting factor besides the sometimes-obstructing attitude regarding the support of initiatives, is the prioritising of ambitions by the governmental actor. This prioritisation is not always focused on reaching the ambitions mentioned in the previous paragraph. Changes in the current infrastructure must be made to succeed in the ambitions for sustainable mobility. Sustainable niche initiatives which want to provide sustainable transport over water, rails or roads need specific infrastructural components as is discussed above. However, the development of these infrastructural changes would be disadvantageous for other uses of the available public space such as housing developments, availability of parking spaces or changes in the living environment regarding noise pollution. These kinds of changes can resonate in political discussions which are influenced by the composition of the governmental actor. This political tug-of-war concerning priorities can therefore be seen as an inhibiting regime-scale factor.

A fifth theme is the sustainability awareness and expectations of clients and end-users. In multiple cases is found that the sustainability aspect of the initiatives did not receive as much

appraisal as one would expect. Clients often were governmental parties or commercial parties with strict ties to society e.g. public transport concession holders, engaged in improving the sustainability of their operations, but the end users e.g. passengers of public transport, are generally not aware whether or not the mobility modality is sustainable. This lack of awareness can be seen as an inhibiting factor for the societal support for a sustainable innovation. It could also be the probable cause why the related niche-scale indicators of the conceptual framework, were so limitedly found in the cases.

To summarize, the inhibiting factors recognized for the initiatives in the cases are structured in Table 16 for both scales.

Table 16. The inhibiting indicators found in the cases on the niche and regime scales.

Niche scale	Regime scale
The lack of viable business case with contracted clients and/or suitable location	Dependence on expensive complementary technologies and infrastructure
Higher operating costs for sustainable services compared to unsustainable alternatives	
The lack of supporting governmental action	The lack of communication, regulation and organizational structure of the governmental actor
The lack of societal sustainability awareness	The lack of political priority for the development of complementary infrastructures required by the sustainable initiatives
The lack of clear expectations and financial security within initiative	The lack of regime actor variety involved in the initiative and lack of mutual defined expectations

The impact of the inhibiting factors found in the cases can in many instances be reduced or avoided by ensuring aspects in three dominant categories; stable financial resources, governmental support and societal awareness and support. Figure 7 illustrates these three categories and their connection with the integration of the initiative in the regime.

The stability of financial resources can originate in the presence of a viable business case, multiple streams of revenue generation and the availability of subsidies provided by governmental actors. A stable financial situation of the initiatives reassures involved actors that the financial aspect will most likely not be the challenge for successful implementation of the initiative in the regime. A lack of stability in the financial support for the initiative can on the one hand result in unaffordable required complementary technologies or infrastructures. This was found in the City Cargo case where tram rails and transfer locations had to be developed but turned out to be unaffordable for the initiative. On the other hand, it can result in high asking prices for the service provided which make the initiative uncompetitive with other potentially less sustainable alternatives. This was found in the VDDG case which therefore had

to rely upon the revenue generated by one of the initiative starters, outside jobs were hardly available.

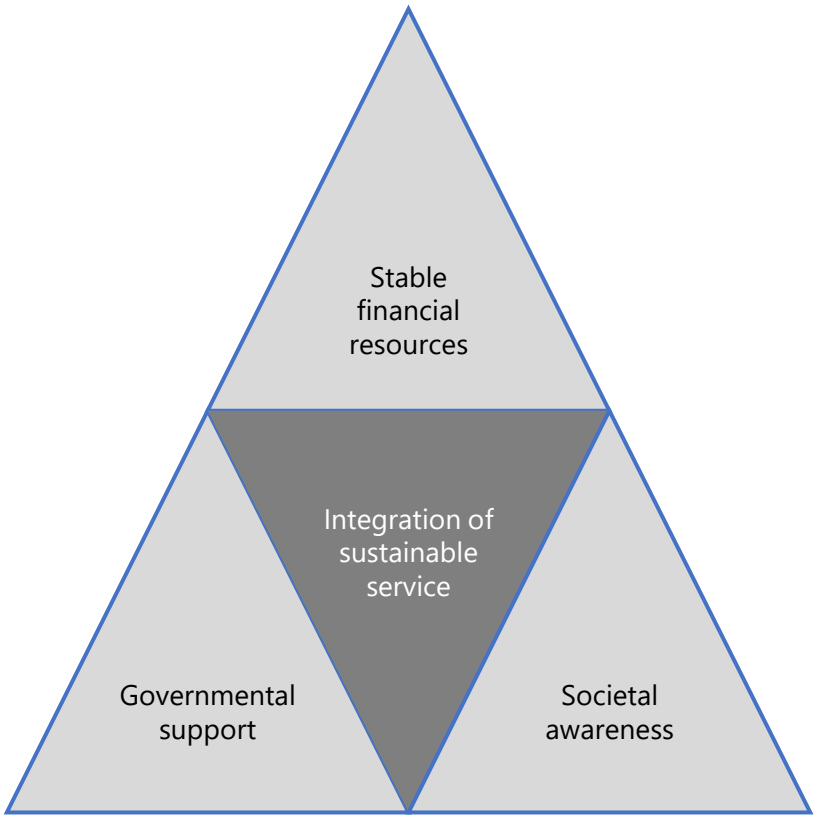

Figure 7. The most dominant aspects to reduce the impact of inhibiting factors on the integration of a sustainable service.

Governmental support is often required as well for a successful implementation in society, and integration of niche-level initiatives in society. Governmental actors can support niche scale initiatives in multiple ways. The main components are: the making of alterations in current legislation or the development of more flexible legislation, facilitating in the development of necessary infrastructure to prepare the city on sustainable mobility, and regulating unsustainable competitors of the initiatives. Alterations in legislation or the flexibility of it, can e.g. enable initiatives to use existing infrastructures which reduces the required funds to implement the initiative in the regime. Facilitating initiatives with the development of necessary infrastructural add-ons mitigates the implementation of sustainable niche initiatives due to reduced costs and better accessibility of users or clients in the city.

The initiatives required these two types of governmental support but in several cases this was not provided. The initiatives in the cases 'Nemo H2', 'VDDG' and 'TTC' required legislative and facilitative support required for the development of critical infrastructural add-ons like a hydrogen filling station, loading locations or a TukTuk waiting location. These add-ons were critical for the continuation or expansion of the operation of the initiatives.

At last, the third beneficial governmental action is the (disadvantageous) regulating of unsustainable operations by competitors of the initiatives which creates a 'level playing field'. It compels these competitors to change their operations into sustainable variants. This makes the niche initiative no longer the only provider of the sustainable but often more expensive

service. Moreover, governmental regulations can push clients or end-users to use the service of the sustainable initiative. Both of these outcomes in the end partially support a regime-level transition towards sustainability.

The aim of a societal awareness campaign includes the development of a change in the attitude of society regarding sustainable mobility. The realisation of this change includes two aspects. First, raised awareness for sustainable mobility by actions of governmental actors, NGOs, or other societal actors will push clients and companies towards the usage of sustainable mobility modalities. As was found in the 'CityPods' case, research performed by one of the actors indicated that passengers of electric busses were not aware of the sustainable characteristics of the vehicle. Second, related to the first aspect, is that the raised awareness among citizens can create political support for sustainable mobility. If e.g. passengers are aware of the benefits of sustainable variants of mobility in relation to their living environment, it could influence their choice of voting for political parties within the governmental actor. This can influence the political debates regarding the priority of using public space for developing necessary infrastructures, over other societal needs. This would help e.g. the initiative 'VDDG' with its need for the development of accessible loading docks at the cities canals.

6.2. Influence of niche initiatives on regime-level transitions

The nine inhibiting factors found in the cases led to the indication of three required dominant categories of aspects as is discussed in the previous section. These aspects can support the initiative to be implemented in the current mobility regime. However, influences on the current regime are required to change that regime into a sustainable variant of itself. Hence, the focus of this section lies on the lessons learned from the case study results regarding the influence of the niche initiatives on the regime-level transition(s) to sustainable mobility.

This transition is required to change the current mobility system into a sustainable variant that suffices in the ambitions of the municipality of Amsterdam as discussed in the introductory chapter. These ambitions concern a zero-emission production by the mobility modalities in the city. In this research two regimes can be identified. First, the urban mobility regime on which the focus of this thesis lies, and secondly the sustainability regime for the whole city which is illustrated and guided by the 'Stadsdonut' model. Mobility is part of this model as is discussed in Chapter 1 and can therefore be seen as a smaller regime within a larger regime.

The achievement of the regime-level zero-emission-mobility goal, as stated by the 'Actieplan Schone lucht' of the municipality of Amsterdam, requires a transition to alternative sustainable methods for current mobility modalities, or sustainable variants of the current used modalities. This research is built upon the three theoretical concepts as discussed in Chapter 2. Raven et al. (2010) elaborate on the importance of the coupling of developments at the niche, regime and landscape levels:

> "Transitions only occur when the regime is sufficiently 'open', 'stable' or 'adaptive' to accept radical innovations; when there is sufficient pressure from the landscape for socio-technical change; and when radical innovations have been developed in niches that can be used to exploit the opportunities for change." (P. 63).

However, the authors also state that although this development of radical niche innovations is necessary, it is not sufficient to trigger transitions. The cases in this research all involved radical niche initiatives and required an open, stable or adaptive regime. However, this was often not the case. An important lesson learned from this research is that the academic knowledge of the requirements for a regime to be sufficient open, stable and adaptive to enable a transition, is proven in the cases 'Nemo H2', 'City Cargo' and 'TTC' where the mobility regime of Amsterdam proved to be the opposite of these characteristics. In these cases, the regime was found to be too rigid and undynamic to tolerate the radical niche initiatives and their required infrastructures. Hence, the Amsterdam mobility regime still corresponds to the characteristics of a typical regime described by academic scholars. A side-note has to be stated that several of these cases were started and ended multiple years ago. However, other initiatives in the cases still did encounter inhibiting factors at the time of this research.

Furthermore, to set a successful transition in motion, the 'landscape' must apply pressure on the regime. Extensive evidence of the pressure originating from the landscape-level is not found in the cases, but this was also out of the scope of this research. Landscape-level pressure for reaching a high level of sustainability can be found in e.g. global or continental climate agreements like the Paris Agreement (European Commission, n.d.-a) or European Green Deal (European Commission, n.d.-b).

The initiatives were encountering multiple inhibiting factors as is discussed in section 6.1. Not only on the niche-level but on the regime-level as well. A regime is often not supportive of niche initiatives trying to alter the regime's characteristics. Raven et al. (2010) indicate that "regimes tend to be stabilised and resist to any fundamental change" (p.59). The scholars describe that this resistance occurs at three dimensions. First, the very rigid institutional structures which prevent the breakthrough of innovations; Second, actors and networks represented by incumbent organisational capitol and institutionalised power which makes them 'blind' for alternative innovations. And third, by current technological artefacts, production technologies and infrastructures which give hardness to the regime. These technologies are again often represented by large vested interests of the incumbent actors.

The recurring aspect in the governmental strategy and action plan is the lack of attention given to possible new radical innovations. The creation of beneficial circumstances for niche-level initiatives is not mentioned. The central thread revolves around known technology like electrical vehicles and upgrading the accessibility of public transport. The possible reason for this choice of correspondence is to keep the level of credibility received by society as high as possible. Niche initiatives are unknown, unproven and yet to be implemented and are therefore possibly not high on the list of political priorities to communicate with the Amsterdam society.

A second lesson learned regarding the influence of the initiatives on a transition on the regime-level is the dependency of the initiative on the regime. The sustainable niche initiatives in the cases of this research all were examples of sustainable mobility. These examples provided society a preview of which urban sustainable mobility modalities are available to use. The services provided or intended by initiatives had promising sustainability and mobility characteristics and several sustainability awards were awarded to e.g. the 'Nemo H2' and 'City Cargo' initiatives, for their innovative way of transport. However, the case studies showed that

the initiatives were not able to further influence the mobility regime, than with the publishing of promising characteristics and by raising awareness for their innovations via the press and in the mobility branch.

The third lesson is that the municipality of Amsterdam does put energy in changing the existing regime(s) with its 'Stadsdonut Amsterdam' model, and the action plan 'Actieplan Schone lucht' which is published in 2019. The strategy of this plan to change the mobility regime is described as a combination of 'push' with regulating governmental action, and 'pull' with stimulating and facilitating action. Additionally, the strategy of 'communication' is implemented due to rapid developments in battery characteristics and action radius (of electric-powered vehicles). It claims that experience teaches that this method works to realise the transition to zero emission mobility (p13. Gemeente Amsterdam, 2019a). Although this experience is not found in the cases, it does correspond with the three required dominant aspects of support described in the previous section that support niche initiatives with their implementation in the regime.

6.3. Reflection on the cases and theoretical concepts

This research was guided by three theoretical concepts, the Multi-level Perspective (MLP), Strategic Niche Management (SNM) and Supply Chain Management (SCM). This section discusses the level of similarity between the characteristics of these concepts and the findings of this research.

The overarching theoretical concept for this research is the MLP, it defines the linkages between the niche, regime and landscape levels. The MLP concerns a broad focus area and is not focussed on a single aspect like an individual niche initiative. It regards the whole interaction between all levels that are part of a transition. The dominant aspect to be noted is therefore that the MLP primarily structured the investigation and the theoretical base of knowledge on which this research is built. The research of this research did not result in concrete findings regarding the landscape level which is also discussed in the previous section. As Raven et al. (2010) indicate, the landscape is "a metaphor for the background setting and background developments for regimes and niches" (p.62). Thus, in-depth research for one of the three levels of the MLP is not performed but the theoretical concept did structure the research with the other two levels.

Therefore, this research mainly focused on the niche and regime levels, the objective of this research was to find the reasons why niche initiatives did not succeed in being implemented or having influence on the regime level. The SNM concept concerns the implementation and use of niche innovations in selected settings in a marketplace (Kemp et al., 2000). In this research, the marketplace is seen as the mobility regime of Amsterdam. Multiple indicators were found in the SNM literature and adopted in this research. These indicators were divided in six contexts and used in the conceptual framework as is shown in Chapter 2. However, several of these indicators were hardly found in the results of the case studies. Especially the indicators belonging to the societal & environmental context, and the actor involvement context. The question is whether these were the correct indicators to use in this research, or if the initiative actors of the cases were not focussed on these contexts despite their sustainable characteristics. The indicators 'Learning process of, and adaptations to aspects regarding the

societal and environmental impact of the technology' and the 'Level of institutional embedding' were not found in any of the cases. The reason for the first indicator could be that the initiatives were not (yet) engaged in finding out what their societal and environmental impact was. For the latter indicator could the potential reason be that the initiatives were too radical to receive institutional embedding and that as a result they lacked the support of societal actors in favour of the initiative. This was found in the 'TTC' case, the initiative actor claimed that the initiative could be seen as a "lice in the fur of the municipality of Amsterdam" (M. Beversluis, Tuk Tuk Company, personal communication, July 22, 2020), and that they achieved governmental action in favour of their initiative by keeping a close relation with the local press.

The SCM concept is the third theoretical concept belonging to the combined perspective and indicators of SCM were also used in the conceptual framework. Aspects of SCM were identified in the initiatives because of their provision of services to clients or users. According to Mentzer et al., (2001), SCM aims at "improving the long-term performance of the individual companies and the supply chain as a whole" (p.18). The 'individual companies' and 'supply chain' are in this research translated to the 'initiatives' and 'regime' respectively. The investigation of most of the indicators found in SCM academic literature, resulted in numerous results clarifying the inhibiting factors for the initiatives. However, there were also SCM indicators not found to be applicable in the cases. These indicators also belonged to the 'societal & environmental context' and 'actor involvement context'. These indicators were the 'Level of sustainability practices to correspond with the awareness level of customers', the 'Level of sustainability awareness of stakeholders' and 'the extent of data sharing regarding (sustainability) performances among actors'.

Evidence for the first two mentioned indicators is limitedly found in the cases. On the one hand, the initiatives were primarily trying to get their service viable and able to compete with their competition. For example, in the Nemo H2 case was the sustainable method of propulsion of the vessel purely used because of the requirements of the business case which was present at the time. Market research for the preference of users for sustainable transport was not performed because the dominant opinion was to just start with trying to make the innovation operational. On the other hand, the reason could also be that the stakeholders of initiatives were no 'social entrepreneurs' with specific aims to support sustainability with their innovation or service. The actors were just trying to generate profits and make their service viable, the sustainable characteristics helped them with e.g. the reception of subsidies to develop their innovation further. These indicators result from the SCM literature but are found unsuitable for researching this type of initiatives. The indicators originate from sustainable supply chain management (SSCM) which, besides analysing new starting companies, also investigates existing companies that make their current operations more sustainable as well. The abovementioned indicators are believed to be better suitable for this latter goal instead of analysing new niche initiatives as is performed in this research. However, the findings of future research on this topic could be different for these indicators if sustainable awareness is created in society. This potentially influences the perspective of customers as well as that of involved actors on the sustainability of the initiatives.

7. CONCLUSION

By analysing the efforts of sustainable urban mobility niche initiatives on the sustainability transition in the Amsterdam mobility regime, this thesis has shown how financial, governmental and societal support is required to enable this type of initiative to succeed. The lack of these categories of support is shown by the dominant negatively influencing aspects found in the cases of this research.

The aim of this research was twofold. It identified specific types of initiatives within the context by developing a conceptual framework including the influencing factors and the scale of their influence as well. Secondly, it applied this conceptual framework to cases of sustainable mobility initiatives. The findings of this research were compared to the initial conceptual framework and recurring patterns and factors were shown. Below, the main research question *"Which factors negatively affect the potential for sustainable urban mobility niche initiatives to influence regime-level transitions, resulting in the stranding of these initiatives?"* is answered after the discussion of the findings for the three sub questions. Thereafter, the limitations and generalization of this research are discussed, and recommendations are provided. These recommendations concern further research and also contain an advice aimed at future entrepreneurs trying to start an initiative that fits within the scope of this research.

7.1. ANSWERING OF THE RESEARCH QUESTIONS

Academic literature is researched to answer the first sub-research question: "What are key factors explaining the success or failure of sustainable mobility innovations in the academic literature?". This resulted in the conceptual framework for this research. This conceptual framework is built upon two theoretical concepts: (sustainable) supply chain management (SSCM) and strategic niche management (SNM). The known facilitators and barriers of SSCM are combined with these of SNM in a combined perspective. To transform this perspective into tangible aspects to research in the cases, indicators from other scholars discussing these concepts are adopted and divided into six contexts: the technical, economical, governmental, infrastructural, societal and environmental and actor involvement context. The applicability of these indicators is researched in five cases: the Nemo H2 case, the Vracht door de Gracht case, the City Cargo case, the City Pods case and the Tuk Tuk Company case by conducting interviews.

The second sub-research question concerned the inhibiting factors for niche scale initiatives: "What patterns or recurring inhibiting factors can be recognised in cases of stranded mobility initiatives in Amsterdam?". Inhibiting factors were found on both the niche and regime levels, nine inhibiting factors were found as the most applicable in the cases. These factors concern the lack of: a viable business case and/or location, supporting governmental action and communication by the governmental actor, societal sustainability awareness, clear expectations and financial security within the initiative, political priority for the development of complementary infrastructures required by the sustainable initiatives, as well as the lack variety in the societal background of involved actors in the initiative and the lack of mutual defined expectations. In addition, the dependence on expensive complementary technologies or

infrastructure and the higher operating costs, which result in higher costs for end-users of the sustainable services compared to these of unsustainable alternatives, were found as recurring inhibiting factors.

The answer on the third sub-research question: "What lessons can be learned from the case study results regarding the influence on the regime-level transitions?" consists of three lessons learned from the case studies in this research. The first important lesson regarding the influence of the initiatives on a transition on the regime-level is the dependency of the initiative on that regime. The case studies showed that the initiatives were not able to further influence the mobility regime than with the publishing of the initiatives' promising characteristics and by raising awareness for their innovations via the press and in the mobility sector. The second lesson is that the academic knowledge concerning the requirements for a regime to be sufficiently open, stable and adaptive to enable a transition by radical niche initiatives is proven in e.g. the cases Nemo H2, City Cargo and TTC where opposing characteristics of the mobility regime of Amsterdam were found which potentially caused the stranding of these initiatives. A third lesson is the recurring aspect concerning the lack of attention given to possible new radical innovations in the governmental strategy, although the municipality of Amsterdam has developed a plan to achieve a transition to sustainability in the existing regime(s) with its 'Stadsdonut Amsterdam' model and the action plan 'Actieplan Schone lucht' Only the use of existing technologies is mentioned in the action plan, the creation of beneficial circumstances for niche-level initiatives is not mentioned.

All things considered; it is now possible to answer the main research question. Three dominant categories of required support for the initiatives are defined to reduce the inhibiting impact of the nine most recurring inhibiting factors found in the cases. These categories of support are: financial support, governmental support and societal awareness for sustainable mobility. These three categories are required for the implementation and adaptation of the sustainable mobility initiatives by society on the regime level. The adoption of the innovation or service could then enable the initiatives to gradually expand and compete with unsustainable alternatives and support a sustainable mobility transition.

First, financial support can reduce the inhibiting factors related to insufficient financial capacity to develop and sustain the initiative with its required complementary technologies and infrastructure. Sufficient funds for the development and operative costs enable the initiative to compete with competitors in the mobility sector, keep actors satisfied and involved in the initiative, and supports further expansion of the initiative. This expansion of the sustainable initiative in the regime could positively influence the sustainability transition in the mobility regime. Second, governmental support can help an initiative in multiple governmental actions like regulating, facilitating or stimulating action. These actions can benefit the initiative and inhibit the unsustainable competition. However, governmental support in the form of infrastructural and economical facilitating lacked in the cases as well as the shortcoming of political support for the development of infrastructure needed by sustainability initiatives. Finally, there is a need for societal awareness regarding sustainable transport. The pressure on policy makers will be harder to establish if this awareness is not created, and initiatives can get stranded as a result of this as well.

7.2. LIMITATIONS AND GENERALISATION

Three dominant limitations were found in this research. First, the cases of this research know a large variety in characteristics. Although the cases were selected with criteria, there still remained considerable variety in the characteristics of the cases. This caused the discussion of various aspects, specific for a case which were not found in any of the other cases. Similarities and linkages regarding the characteristics of the cases were not often found because of this diversity between the cases. These similarities or linkages could potentially have provided further insight in the specific characteristics or circumstances of the initiatives. However, this research did provide an overview of the inhibiting factors in the cases of this context and in their circumstances, supported with a body of supplementary and corresponding information.

Second, the case studies did provide insight in the extent of applicability of the indicators in the cases. This made the determination of the most inhibiting factors in the cases possible. However, a determination of the severity of the inhabiting character of the factors was not investigated. A hierarchy between the inhibiting factors could therefore not be accomplished. This could possibly support both initiative starters and policy makers in distributing their resources to oppose the impact of the inhibiting factors in current or future cases. Nonetheless, the effort is made in indicating how often the indicators were found in the cases.

Finally, the conducted interviews in the data collection phase turned out to be all with parties that were commercially involved in the initiatives of the cases; with the only exception of a city logistics expert which was not related to any of the cases. Effort is made to conduct interviews with governmental parties as well, but unwillingness or communication of these parties turned out to be hindrances and interviews never took place. However, the single category of background and perspective of the interviewees resulted in a clear review of the results of the interviews and prevented confusion in the data collection. This facilitated the data analysis and drawing of conclusions. Potential biases could be the lack of self-criticism of the interviewees by e.g. accusing other factors or actors as the inhibiting issues, while possibly their own efforts were the cause of the stranding of the initiative(s).

These three limitations concern the choices made and difficulties that were encountered during this investigation. These can be solved in further research on this topic. However, a more general limitation of this research concerns the context on which this research was focussed. Five cases originating in Amsterdam are investigated and this research has provided insight in the obstructions which promising niche initiatives encountered. However, the context can be set to a much larger scale. The city of Amsterdam has implemented its own policy goal to accomplish sustainable mobility in 2030, while the climate agreement for the whole Netherlands aims at the year 2050 (Klimaatberaad, n.d.). Thus, the municipality of Amsterdam is progressive regarding the achievement of sustainable mobility in its city. An additional important matter is to investigate the efforts made for sustainable mobility in other urban areas. The reason for this need is the potentially different strategy of governmental actors in other urban areas for the achievement of sustainable mobility. This research did not prove that its findings would have been the same when cases in another urban area would have been used. Additionally, the aspect of commuting mobility which happens between cities is not

investigated. Both the investigation of cases in other cities, selected by the same case criteria, and the inclusion of the commuting aspect can potentially provide more general additional insight in the inhibiting factors that negatively influence the achievement of sustainable mobility in an urban area.

7.3. RECOMMENDATIONS

In the discussion of this thesis it has become clear that several aspects are required for sustainable mobility initiatives to be able to influence a regime level transition. Financial resources, governmental support and societal awareness and thus support, are required for the integration and success of niche level initiatives in their process of becoming competitive with present actors of the regime. The recommendation for new actors planning on implementing a sustainable mobility initiative in the metropolitan region of Amsterdam is to secure financial funds. This could be done by inter alia: finding a location with infrastructural benefits which reduces expenses, establishing a customer base with the specific need for the initiatives' service or product, safeguarding the affordability and development of necessary infrastructures and searching for multiple sources of income. Furthermore, it is recommended to develop close connections and agreed upon support from a governmental party or parties involved in the initiative, which outlast political periods of office in order to prevent earlier made agreements from getting cancelled by successors of political actors.

Regarding the performed research in this thesis, two aspects are recommended. First, to further explore this topic by investigating similar cases in this context on more actor perspectives than only the entrepreneurial or commercial side. This will potentially provide additional perspectives on the inhibiting factors that negatively influence niche initiatives' potential on influencing the mobility regime and take away the potential bias in this research regarding the accusations against other not-interviewed actors stated by the interviewees.

The second recommendation regards investigating which factors are the most relevant for which kind of initiatives. This research has shown initial evidence that e.g. actor involvement issues were quite prominent in three of the five cases but did not seem to come up in the VDDG and City Cargo cases. Further research can potentially identify contextual or contingency factors that drive this outcome.

The third recommendation is to investigate the interaction between policy goals and the governmental action regarding sustainable mobility in and between urban areas. This knowledge is of importance to get insight in the accomplishments of governmental actors to reach the nationwide ambition to develop sustainable mobility by the year 2050.

In conclusion, this thesis provides insight in the obstructions that promising niche initiatives encounter in their attempts to aid in supporting the sustainability transition in the mobility regime. The results of this research can potentially help future initiative actors with the implementation of their innovation, as well as inspire policy makers to incorporate and support promising niche innovations in the current regime.

8. REFERENCES

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9. APPENDICES

APPENDIX 1: List of interviewees in cases of performed case studies.

APPENDIX 2: Item list used in interviews

APPENDIX 1: LIST OF INTERVIEWEES IN PERFORMED CASE STUDIES.

Interview case Nemo H2.

H. Sie, Integral B.V., personal communication, July 3, 2020

Interview case 'Vracht door de gracht'.

W. Post, Mokum Mariteam, personal communication, July 16, 2020

Interview case City Cargo.

P. Hendriks, City Cargo, personal communication, July 15, 2020

Interviews case Park shuttles/CityPods

A. Scheltes, Goudappel Coffeng, personal communication, July 2, 2020

D. Mica, 2getthere, personal communication, July 24, 2020

Interview case Tuk Tuk Company

M. Beversluis, Tuk Tuk Company, personal communication, July 22, 2020

Interview with city logistics and mobility expert.

W. Ploos van Amstel, expert city logistics, personal communication, July 14, 2020

APPENDIX 2: ITEM LIST OF INTERVIEWS

List of items used as a structure to perform the interviews with actors related to the cases. The list is divided following the six contexts used in this research.

TECHNOLOGICAL

- strategic actions for implementation of innovation/service
- the extent of the need for complementary technologies
- learning process/adaptations in technical development of innovation/infrastructure

ECONOMICAL

- the extent of research into preferences of future clients for sustainable alternatives of current services
- the extent of increase in positive reception of sustainable options by the implementation of the initiative
- the extent of benefit for the initiative compared to the competition created by the being the first actor to provide the innovation/service
- extent of rareness and affordability of complementary technologies
- potential difficulties for landing investors created by unfamiliarity of initiative

GOVERNMENTAL

- the extent of the understanding for the importance of the initiative supported by regulations
- method of publicizing sustainability ambitions by the municipality
- the level of support or opposition and flexibility for the initiative found in legislation and regulations
- learning process and adaptations in dealing with legislation and regulations or governmental attitude

INFRASTRUCTURE AND MAINTENANCE

- Perception of sustainable aspects of the initiative by suppliers or other actors involved / level of support for environmental strategy
- the level of institutional embedding which can improve the connection between the initiative and required infrastructures or technologies
- willingness of third-party actors like producers or suppliers for production of the innovation

- evaluated experiences and adaptations regarding the design and development process of the infrastructures and maintenance

SOCIETAL AND ENVIRONMENTAL

- sustainability aspects that improve the sustainable performance of the initiative (upgrades techniques in development process, use of intelligent technology or the quality and distribution of information between stakeholders)

- level of focus in organizational structure on societal and environmental aspects

- involvement of non-governmental organizations (NGOs)

- consideration of the expectations or demands of future end-users regarding sustainability in the development process

- level of demands from society for more sustainable options of conventional mobility

- level of scepticism for the initiative based on the knowledge of predominant technologies

- occurring of new societal or environmental problems in the development process of the innovation

- learning process and adaptations to societal and environmental events

ACTOR INVOLVEMENT

- level of risk management, presence of a contingency plan for the initiative

- communication between stakeholders in the process

- methods for raising awareness for sustainability performance within process

- level of information sharing regarding the sustainability impact of the initiative with actors or stakeholders involved in the initiative

- methods of shaping expectations for actors

- method of building a social network around the initiative

- level of developing a user context with user characteristics and preferences

- level of positive influence by institutional embedding for the credibility of the initiative and therefore indirect for delivering actors supporting the initiative