Move People, Not Cars

A case study how cycling can contribute to sustainable development
in Metro Manila

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Cover page source: private collection of writer. The picture is taken in Iloilo City during the ThinkBike workshop with the Dutch Cycling Embassy, the Embassy of the Kingdom of the Netherlands in the Philippines and local stakeholders.

Abstract

The United Nations translated the Mondial need for sustainable development to combat climate change into the Sustainable Development Goals. These are a blueprint to achieve a better and sustainable future for all. This thesis is focused on the increase of the use of bicycles to achieve the SDGs. Cycling has many benefits for health, the environment, the livability of cities, gender equality and much more. The benefits of bike commuting for achieving the SDGs are analyzed according to hardware, software and orgware components of cycling. Metro Manila is the most congested city in Asia and is therefore the main case in this study. However, the results can be beneficial for other Asian cities as well.

Keywords: Cycling, Sustainable Development Goals, Metro Manila, Climate Change

Preface

In front of you lies my thesis 'Move People, Not Cars'. I have written this thesis to complete the master Human Geography with a specialization in Conflicts, Territories and Identities at the Radboud University in Nijmegen. During my internship at the Embassy of the Netherlands in the Philippines, I have developed a great interest in sustainable mobility. At the embassy, we have worked on several cycle-related events which sparked my interest for the relation between cycling and sustainability. The process of writing this thesis has been very interesting and has taught me so much.

For my internship at the embassy, I have lived in the Philippines for seven months. It has been a pleasure to get to know how friendly, helpful and funny Filipinos are. I would like to thank all the interview participants for providing me with all your knowledge and insights. This study would not have been possible without all of your help. I am especially thankful to Myles Delfin for introducing me to so many BikeScouts, and to Aldrin Pelicano who followed the embassy team to Iloilo City and also for introducing me to many cycle advocates. Thereby, I would like to thank Kevin Punzalan, my supervisor at the embassy. Kevin was always ready to discuss ideas, motivate me and provide me with feedback.

Furthermore, I would like to thank my thesis supervisor Henk van Houtum for always believing in this thesis. After each conversation we have had about cycling, I became more enthusiastic than I already was. Thereby, many thanks to Edward Douma from the Dutch Cycling Embassy who has supported this study from day one and who has given me tons of information. This project would also not have been possible without my colleagues Karina van Hoek and Jordana Hiltrop. Thank you for all your help and kindness – professionally and personally. Finally, I want to thank my boyfriend Koen for moving across the world with me.

Salamat po!

Margot Daris
Nijmegen, June 2020

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List of Abbreviations

ADB   Asian Development Bank

DCE   Dutch Cycling Embassy

ECF   European Cyclists Federation

EDSA   Epifanio de los Santos Avenue

MMDA   Metropolitan Manila Development Agency

SDGs   Sustainable Development Goals

UN   United Nations

1. Introduction

The human population is growing, a trend which is especially visible in urban areas. It is expected that an additional 2,5 billion people will live in cities by the year 2050 (United Nations Environment Program, 2019). To manage this rapid urbanization, to reduce poverty and to address equity and environmental issues, it is important for people to have access to services and opportunities (ibid.). Given the rapid growth of people living in cities, demand for efficient infrastructure increases simultaneously. The traditional means of infrastructure in the past decades have been focused on roads and highways for car-use (Pucher et al., 2007). However, these traditional ways of developing infrastructure are now outdated due to the high congestion levels that follow from it (European Cyclists' Federation, 2016). Walking and cycling are modes of transportation that enhance urban quality and facilitate social cohesion (ibid.). Walking and cycling are cheap and flexible ways of transportation and only require a small amount of space. These modes of transportation enable people to have access to education, healthcare, services and employment.

Next to providing a mode of transportation, walking and cycling contribute to sustainable development in several other ways. It contributes to good health and wellbeing, economic growth, and sustainable cities, among others. The United Nations developed the Sustainable Development Goals (SDGs) as a backdrop for a better and more sustainable future for all. On the 1ˢᵗ of January 2016, the SDGs officially came into force (United Nations, 2019). The SDGs are set to mobilize all people to end all forms of poverty, fight inequalities and tackle climate change. Every country is encouraged to take action to promote prosperity while protecting the climate and the planet at the same time (ibid.).

The increase of people living in cities is for 90% concentrated in Asia and Africa (United Nations Environment Program, 2019). Also, much of the transportation related carbon dioxide-emissions are expected to come from Asia and Africa (Massink et al., 2011). Therefore, it is crucial to prepare cities in these continents for these developments. To manage the transportation of millions of people on a daily basis, the world has to look at sustainable ways of transport, such as walking and cycling. Cycling as a way of transportation is contributing to the SDGs worldwide. The European Cyclists' Federation (2016) emphasizes that it is essential for humanity and for the planet to make transportation more sustainable. Equal participation in society can be ensured through increased mobility for all.

For this thesis, I have chosen Metro Manila, the capital of the Philippines, as the case to focus on. On October 29, 2019, GMA News published an article which states that Metro Manila is the worst city in the world to drive in for two years in a row (Julia Mari Ornedo, 2019). It takes Philippine car-users five minutes to drive a one-kilometer stretch of road due to the city's traffic problems. The capital of the Philippines is expanding, and more Filipino's move to the city for opportunities. This trend causes that Metro Manila is one of the mega cities where the urgency of a new mode of transport is highly visible and needed.

1.1 Research Objective and Research Questions

This thesis is a problem-oriented, theory-led empirical research project. Thereby, the thesis contributes to the current scientific theoretical debates and to the societal problems that are reflected in the SDGs. I will position myself in these debates and contribute to the literature about the sustainable effects of cycling on both the environment and humankind. Therefore, this research aims to specify how cycling policy in Metro Manila can contribute sustainable development and a livable city in the future.

According to GMA News (2019), Manila is the worst city to drive a car in the whole world. Filipino's who live and work in Manila can spend up to eight hours a day stuck in traffic because of their commute. GMA News estimates that 405.000 vehicles use the city's most important access road, the Epifanio de los Santos Avenue (EDSA), every day to get into the city and leave the city after work. This traffic situation makes the capital of the Philippines highly unlivable with its traffic jams, noise and pollution. The current situation needs change, especially given the population growth and thereby the increase of motorized vehicle-use.

In order to implement cycling as a way of transportation it needs to be taken seriously. The decision to commute by bicycle depends on factors such as image, weather, safety and distance (Pucher and Buehler, 2008; Aldred and Jungnickel, 2014; Willis, Manaugh and El-Geneidy, 2015). Moreover, this decision is influenced by government policies regarding cycling (Pucher and Buehler, 2008). According to the Dutch Cycling Embassy (DCE) (2020), transportation policies should aim at a mix of means of transportation of which the bicycle is an integral part. When cycling is incorporated in government policy, it can contribute to the livability of cities, safety on the roads, economic gains, a better health and several other positive developments. This means that when cycling is being implemented as a way of transportation, it can contribute to achieving the SDGs and sustainable development in general. Therefore, the research question of this thesis is:

How can cycling contribute to sustainable development in Metro Manila?

In order to answer the research question, I have formulated three sub-questions. The three sub-questions are based on the distinction by the Dutch Cycling Embassy. According to the DCE (2020), cycling policy should be focused on three components: hardware, software and orgware. The hardware involves the development of proper infrastructure, safe cycle paths or connectivity between several bike routes. The software focusses on how to attract people to use cycling as a way of transport through campaigns and equal traffic laws. The orgware is focused on the capacity building of the different institutional actors. This is needed to strengthen the cycling strategy on a broader basis (ibid.; Van Gent, 2020). These three components of cycling policy need to be addressed in order to create a successful cycling environment and therefore contributing to achieving the SDGs. Through the SDGs, hardware,

software and orgware contribute to create sustainable development in Metro Manila. Therfore, the three sub-questions are formulated as follow:

I. *How can cycling hardware contribute to achieving the Sustainable Development Goals in Metro Manila?*

II. *How can cycling software contribute to achieving the Sustainable Development Goals in Metro Manila?*

III. *How can cycling orgware contribute to achieving the Sustainable Development Goals in Metro Manila?*

1.2 Scientific Relevance

In the 1950s, scientists have demonstrated that carbon dioxide is warming the earth (NASA, 2019). The increasing amount of carbon dioxide in the air is affecting the earth to warm up. According to NASA, the current trend of climate change is extremely likely to be the result of human activity. Data from the past 800.000 years shows that the level of carbon dioxide on earth has been increasing and decreasing over time, causing several ice-ages and warmer periods. However, the current increase of carbon dioxide in the air is occurring ten times faster than the average rate of an ice-age-recovery warming.

The effects of climate change are multifold, among which global temperature rise, the warming up of oceans, shrinking ice sheets, decreased snow cover, sea level rise, extreme weather conditions and ocean acidification (ibid.). The United Nations (2020) translated the urgency to act upon climate change into the Sustainable Development Goals. The UN aims to reach the SDG's by the year 2030 which means that all people in all countries have to take action. Some actions may seem small but still have an impact when more people are mobilized. Organizations such as the Dutch Cycling Embassy and the European Cycling Federation claim that cycling contributes to at least eleven of the seventeen SDGs.

The aim of this thesis is to emphasize how cycling as a way of transportation can contribute to the achievement of the SDGs in Metro Manila. When more people use a bicycle to commute instead of a car, this will lead to a reduction of carbon dioxide emissions (ECF, 2018; Bakker et al., 2018; Massink et al., 2011). This means that the air and soil will be less polluted due to car fuels and gasses and the quality of water will be better due to less polluted ground water. Thereby, bike lanes use less space than car infrastructure. This means that the soil is less sealed which also has environmental benefits (ECF, 2018). In addition to all climate improvements, cycling also contributes to personal health situations (ECF, 2019). Cycling prevents cardio-vascular diseases, diabetes, some forms of cancer and osteoporosis. Moreover, according to the ECF, cycling prevents 18110 premature deaths per year in the European Union.

Recently there has been more awareness of the sustainable aspects of cycling as a way of transportation (Pucher and Buehler, 2017). Most of the academic research on cycling, the international conferences, the internet websites that provide information and the social media attention are from the last decade. Next to more available information, there is also an increase in bike use in Europe, North America and South America. However, the increase of information about cycling and a larger bike use share is not (yet) involving Asian mega cities such as in the Philippines (Bakker et al., 2018).

One of the problems in cities with an underdeveloped cycle climate is that cyclists often have to commute alongside heavy motorized vehicles (MacNaughton et al., 2014). Cyclists are directly exposed to the air pollution from these vehicles which makes the commute unpleasant. Another pitfall of cycling is the perceived image it represents (Aldred and Jungnickel, 2014; Willis, Manaugh and El-Geneidy, 2015). In many Southeast Asian countries cycling is associated with poverty (Bakker et al., 2018). This perceived image can prevent people from using bicycles. These and other problems contribute to the fact that cycling is not a generally accepted mode of transport in Southeast Asia. The lack of information about cycling in this region shows the research gap which has the capacity to bring about an important contribution to the shift to sustainable urban transport in Asia.

This thesis focusses on Metro Manila, a city that is in the need of a new environmental-friendly way of transportation. To come to a comprehensive overview of the way cycling can contribute to achieving the SDGs in Manila, I focus on three components of cycling. The hardware, software and orgware of cycling focus on infrastructure, mindsets and organization respectively (Dutch Cycling Embassy, 2020; Van Gent, 2020). The contribution of this thesis to the academic debate and practical environmental developments is to come up with a study that shows all the positive contributions of cycling to the sustainable development in Metro Manila.

1.3 Societal Relevance

The Netherlands is often seen as the perfect example of bicycle use and bicycle policy (Harms et al., 2016; Pucher and Buehler, 2008). However, in the 1970s, the Netherlands had big issues with traffic safety and the rise of traffic fatalities because of the gradual increase in car use and car ownership. Thereby, there were issues concerning the environment, accessibility and livability in the country (Harms et al., 2016). These concerns, especially the rise in traffic fatalities, caused a public outrage and demonstrations (Dutch Cycling Embassy, 2020). As a result of the public pressure, Dutch urban planning policies gradually became more considered with cycling. The bicycle regained its importance as mode transportation and traffic safety became less of an issue. This brief history of the origins of the Dutch cycling culture shows that the creation of a cycling culture is even possible in countries that are predominantly car-centered. One of the goals of the DCE is to show other countries, provinces and cities that they do not have to reinvent the wheel regarding cycling policy and implantation. The example of

the Netherlands shows that it is possible to create a cycling culture and this knowledge is applicable to other countries as well.

As mentioned above, the amount of people living in cities is increasing. Therefore, it is crucial to anticipate at this trend in order to keep cities livable. Cycling contributes to this objective in at least six ways. First, riding a bicycle instead of driving a car improves the quality of public spaces and creates more livable cities (Dutch Cycling Embassy, 2018). When there are less cars on the road, car parks can be turned into bike lanes, playgrounds or green areas to improve the local environment. Second, cycling gives people the opportunity to get access to education, public spaces or a job which encourages social participation (ibid.). This also goes for the elderly who can remain socially active through cycling.

Third, cycling contributes to a good health. It reduces the risk of diabetes, some forms of cancer, cardiovascular diseases and depression (United Nations Environment Program, 2019). Cycling on a regular basis is a convenient way of exercise which boosts physical fitness and it prevents obesity. Thereby, more cyclists also lead to fewer casualties in traffic. Cities with cycling policies experience fewer casualties among cyclists, fewer accidents and fewer traffic deaths (ibid.). Fourth, according to the United Nations Environment Program (2019) and the Dutch Cycling Embassy (2019), people who walk or cycle to work tend to be more satisfied, less stressed, more relaxed and experience greater freedom compared to people who drive their car to work. Therefore, cycling contributes to a greater psychological health and well-being. In turn, businesses in areas with high levels of cycling perform better than business in car-oriented areas (ibid.).

Fifth, cycling is a cheap way of transportation, it is cheaper to buy and maintain a bicycle than a car (Dutch Cycling Embassy, 2018). The annual costs of a bike are approximately €300, whereas the annual costs of driving a car is approximately €8500. This also makes a bicycle more inclusive and equitable than a car. Sixth, cycling to a destination rather than taking a car contributes to a better environment (ibid., European Cyclists' Federation, 2016). The use of a bicycle creates minimal carbon dioxide emissions which improves air quality (Bakker et al., 2018). This reduces air pollution which in turn is better for people's health. Thereby, bicycles are a silent way of transport which reduces the overall traffic noise. All in all, cycling provides people with the means for a comfortable city life.

1.4 Research Outline

After this chapter, this study entails four more chapters. In chapter 2, the theoretical framework is established. Climate change and climate change mitigation are described. Thereby, the Sustainable Development Goals are interpreted from the perspective of cycling. Thereafter, I describe the hardware, software and orgware of cycling, based on the distinction made by the Dutch Cycling Embassy. The case of Metro Manila is highlighted and finally the conceptual model is illustrated. In chapter 3, the research methods are discussed. I start with describing the qualitative research approach. Then, the case

selection is described and how Metro Manila relates to other metropoles in developing Asia. Subsequently, the interview techniques and participants are described. Finally, the research methods are described.

Chapter 4 starts with describing the connection between cycling hardware and sustainability by showing pictures that illustrate the current state of the infrastructure in Metro Manila. Thereafter, the responses from the interviewees about cycling hardware topics are explained. This is followed by their responses regarding cycling software and cycling orgware. Finally, the connection between hardware, software and orgware and the SDGs is made. In the final chapter, the conclusion, implications for cycling, the discussion and suggestions for further research are provided. I will also highlight some of the consequences of the Covid-19 pandemic for cycling worldwide.

2. Theoretical Framework

The most relevant concepts and theoretical debates for this thesis are discussed in this chapter. The first part discusses climate change, climate change mitigation and why we need cycling to achieve the Sustainable Development Goals. The second part discusses cycling as a way of transportation, where I make the distinction between hardware, software and orgware. In the third part, congested cities and especially Metro Manila are discussed. The final part describes the conceptual structure of this study.

2.1   Climate Change

The current trend of climate change is extremely likely to be the result of human activity (NASA, 2020). The fact that carbon dioxide is warming the earth was already demonstrated in the 1950s. Ever since, climate change poses a bad picture that keeps getting worse (VijayaVenkataRaman, et al. 2012). The effects of human activity on climate change started around 1850 during the Industrial Revolution. People started to produce significant quantities of greenhouse gas emissions which led to what we now know as climate change. The most pressing consequences of climate change in the current era are sea-level rise, global temperature rise, the warming of the oceans, shrinking ice sheets, declining Arctic sea ice, glacial retreat and ocean acidification (ibid.). The first part of this section of the thesis elaborates on the belief that through climate change mitigation, people try to slow down or reverse the effects of climate change. The second part explains how the UN developed the SDGs to create a better and sustainable future for all.

2.1.1   Climate Change Mitigation

The effect of climate change will be felt all over the world but especially in lower income countries (Ravindranath and Sathaye, 2002; Yumul et al., 2011). In lower income countries, more people will die because of to the consequences of climate change. People who live in a lower income country are more vulnerable to setbacks because they have lesser capacity to adapt to new situations. Thereby, the relative effects on investments and the economy will be worse in those parts of the world. Because of this disproportionate distribution of climate change effects, it is crucial that lower income countries understand their vulnerability to climate change damages (ibid.). Moreover, lower income countries need to implement policies to be prepared for the changing climate. The policies should include both mitigation and adaption strategies (ibid.).

In order to slow down or reverse the effects of climate change, the world should develop in a sustainable way. Sustainable development includes an extensive and overall approach to economic, social, cultural, political and environmental process (Sathaye et al., 2007). A shift towards sustainable

development is needed to make this sort of progress the norm. This requires that non-climate policies and actions should also take climate change mitigation into account. Merely referring to climate change is not enough, it should be an integral part of the policy (ibid.).

The Philippines is both a lower income country and an island state which makes it even more vulnerable to climate change (Yumul et al., 2011). Island sates are exposed to the sea-level which is expected to keep rising due to climate change. The location of the Philippines on the Pacific Ring of Fire makes the country prone to natural disasters such as earth quakes, typhoons, landslides and volcanic eruptions. Hence, the country has a lot of experience in disaster risk management which is now integrated into climate change adaptation (ibid.).

2.1.2   Sustainable Development Goals

The UN has translated the Mondial need for sustainable development to combat climate change into the SDGs. These are a blueprint to achieve a better and sustainable future for all (United Nations, 2020). The SDG's address the challenges people face in the global setting we live in. The goals are interconnected and affect all people over the whole world. The aim of the UN is to achieve the SDG's by 2030, which is why it is important that people all over the world act now. Even though the goals are set to tackle the world's biggest challenges, everyone can contribute to reaching them. Actions that may seem small can have a great impact on the overall agenda.

This thesis is focused on the increase of the use of bicycles to achieve the SDGs. The increased use of bicycles might seem as a small action. However, the behavioral change of cycling has many benefits for health, the environment, livability of cities and gender equality. According to the European Cyclists Federation (2016), cycling is directly linked to eleven of the seventeen SDG's. In this thesis I focus on the eleven SDGs, based on research by the ECF to explain how cycling can contribute to the sustainable development in Metro Manila. The coming paragraphs elaborate on the SDG's[1] that cycling contributes to.

The first goal that cycling can help to contribute to is 'end poverty in all its forms everywhere'. Cycling gives a cheap and affordable way of transportation for people who would otherwise have no access to education, jobs, markets and community activities (ECF, 2016). Enlarged access gives people a chance to improve on their economic situation. Most surveys that are conducted to count transport are only focused on motorized vehicles (Njenga and Davis, 2003). Non-motorized transport such as pedestrians and cyclists are not counted. Because there is no accurate number of active mobility transport, it seems like there is no need to develop efficient infrastructure for this kind of transport. However, there is a need to create a connected active mobility network to provide access for everyone

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[1] Note that the sequence of numbers of the SDGs in this thesis differ from the sequence used by the United Nations. This thesis uses a different sequence for clarity purposes.

to villages and cities. This is crucial for the generation of household incomes and for children to have access to school (ibid.). For example, in Malawi, many children have to walk for two hours to get to school or they live too far away to even go (Oxfam, 2018). Oxfam started a project to provide these children with bikes to allow them to get an education and beat poverty.

The connected active mobility networks also help to achieve the second goal to 'end hunger, achieve food security and improved nutrition and promote sustainable agriculture'. Cycling gives food producers secure and equal access to land, resources, financial services and markets (ECF, 2016). Thereby, cycling gives people better access to food markets which increases nutrition options. The transportation of the food itself is also more sustainable when it is transported by bikes. Traditionally, transportation of goods is done by motorized vehicles to increase economic efficiency (Njenga and Davis, 2003). However, there is no connection between motorized transport of goods and the needs of people that do not have access to this type of transport or to food markets. Transportation is an integral part of the accessibility of food and nutrition (ibid.). Thus, for those who do not have access to food because of transportation limitations, bicycles may provide a solution.

The third goal is to 'ensure healthy lives and promote well-being for all at all ages'. Cycling improves a healthy life style and it is a non-air polluting way of transportation. Moreover, cycling can be done at (almost) all ages. Millions of people die or have serious health issues because of physical inactivity (Racioppi et al., 2005). Thereby, inactivity can also lead to several types of cancer, diabetes and heart diseases (ibid.). Whereas active lifestyles increase life expectancy, stress tolerance and independence at old ages. Walking or cycling to work allow people to have regular physical activity. The mental aspect of well-being is also increased by active mobility (Van Houtum, 2019). According to St.-Louis et al. (2014), commuters who walk and cycle are happier and more satisfied than those who drive a car or use public transport. Thus, an active commute can increase health, well-being and quality of life.

The fourth Sustainable Development Goal to which cycling contributes is to 'achieve gender equality and empower all women and girls'. Through cycling, women and girls can get better access to water, schools, markets and jobs that would otherwise not be accessible to them (ECF, 2016). This way, cycling gives women and girls equal opportunities as men and boys. Globally, men are 6,7% more likely to cycle than women (Fleming, 2020). In the United States, the gap is even higher with 17,4% more men cycling than women. Prati (2018) conducted a research about cycling women in the European Union. She found that women cycle more in countries that score high on the Gender Equality Index. Her findings suggest that women are under-represented in cycling because of the traditional task division between genders such as childcare and household responsibilities. The care of children or carrying goods for the household may make it difficult to bike. Thus, in countries where this traditional task division is equally distributed between men and women, gender equality and female cycling reinforce each other to provide equal access.

The fifth cycling-related goal is to 'ensure access to affordable reliable, sustainable and modern energy for all'. Cycling contributes to energy efficiency in the transport sector as it only uses renewable human power to move people and goods (ECF, 2016). The transport sector is the largest end-use consumer of energy in the world (Mrkajic et al., 2015). The most problematic aspect of the transport sector is urban transport which has consequences for the climate, social livability and the local environment in cities. Therefore, transportation has an important impact on the quality of life in urban areas (ibid.). Because cycling only uses renewable human power and does not emit any CO2 gasses, it is a sustainable alternative to parts of the urban transport sector. Naturally, the use of motorized transport for the supply of supermarkets and the like cannot be replaced by bicycles. However, parcel services and small cargo deliveries can easily be done by cyclists.

The sixth goal is to 'promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all'. The cycling industry provides products and services for sustainable transport as well as for sustainable tourism (ECF, 2016). Thereby, the cycling sector creates more jobs than other transportation sectors, such as aircraft and cars (ibid.). In 2014, 650.000 people were employed in the cycling sector in the European Union (ECF, 2014). This includes jobs in the bicycle industry, bicycle retail, bicycle infrastructure and bicycle tourism sector. Nonetheless, there is almost a universal worldwide trend that favors the use of motorized vehicles over the use of non-motorized vehicles because it is seen as a symbol of a modern transport system and economic growth (Pucher et al., 2007). In an overwhelming majority of countries, walking and cycling are seen as outdated, slow, inefficient and inconsistent with a modern transport system. However, in the long term, the use of motorized vehicles causes congestion, air pollution, traffic dangers and deteriorates mobility for the poor. According to Hymel (2009), traffic congestion limits employment growth and therefore economic growth. In large cities, this effect is more substantial than in smaller cities. Thus, in order to create long term sustainable economic growth, it is important to focus on active mobility.

The seventh SDG to which cycling contributes is 'build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation'. Among the responsibilities of local governments is to improve the infrastructure, improve the connectivity, provide convenient transportation options and to create attractive urban spaces (Hull and O'Holleran, 2014). When more people are cycling, it becomes easier and more legitimate for governments to build proper infrastructure for economic development and human well-being (ECF, 2016). Proper infrastructure is crucial for the safety of cyclists; therefore, government policy should treat car users, public transport users, cyclists and pedestrians equal (Hull and O'Holleran, 2014).

The eighth SDG aims to 'make cities and human settlements inclusive, safe, resilient and sustainable'. Cycling contributes to the sustainability, inclusivity, safety and health in cities, and is thereby non-polluting (ECF, 2016; Buehler and Pucher, 2011). The more people use cycling, walking or public transportation to commute, the more sustainable the transport system will be. Governments can stimulate people to use active mobility and public transport by regulations and federal taxes (ibid.).

Taxes make the use of motorized vehicles more expensive which discourages people to use it. Simultaneously, this encourages people to produce and purchase less-polluting vehicles such as bikes. For a successful policy, it is important that governments provide funding and subsidies for public transport and active mobility at the same time as implementing taxes (ibid.).

The ninth SDG is to 'ensure sustainable consumption and production patterns'. Using cycling as a way of transport can be sustainably beneficial for people, goods, productions and deliveries (ECF, 2016). As mentioned above by the fifth SDG, cycling is a sustainable alternative to parts of the urban transport sector because it only uses renewable human power (Mrkajic et al., 2014). In many urban areas, 50% of all deliveries can be done by bicycle (ECF, 2016). Small packages that are delivered by bicycle decreases CO_2 emissions, traffic congestion and pollution.

The tenth goal is to 'take urgent action to combat climate change and its impacts'. Cycling gives all people direct possibilities to fight climate change and to commute in a non-polluting way (ECF, 2016). Through individual bike commuting, cyclists are part of a collective community sometimes even without realizing it (Wilhoit and Kisselburgh, 2015). The collective action by cyclists has a positive impact on societies, traffic situations and the environment. This goes together with the final cycling-related goal: 'strengthen the means of implementation and revitalize the global partnership for sustainable development'. Cycling advocates support the global partnership for sustainable development. The community promotes cycling worldwide as a sustainable way of transportation, both in developed and developing countries.

2.2   Cycling as a Way of Transportation

There are several factors that can play a role in determining whether or not people decide to commute per bike or to use another way of transportation. History, culture, topography and climate are important but are not the only components (Pucher and Buehler, 2008). These factors can generally be classified into three categories: hardware, software and orgware (Dutch Cycling Embassy, 2020; Harms et al., 2016). The key characteristics of hardware are a safe and connected network, integrated transport and end-of-trip facilities. For the software these are education, communication and road safety. The most important factors of the orgware are strategy and policy, funding and accountability (Van Gent, 2020).

The conceptual framework behind hardware, software and orgware is that the success of a cycling environment depends on multiple factors (Harms et al., 2016). Even though the build environment and cycling infrastructure are very influential in the decision to use a bike for transportation, by itself it is not sufficient to encourage cycling (Willis, Manaugh and El-Geneidy, 2015). Thus, a good cycling policy outcome needs a combination of material measures such as infrastructure (hardware), immaterial measures such as education and information (software) and institutional conditions (orgware) (Harms et al., 2016). The three -wares are the basic requirements that

have to be met in order to create a successful cycling environment and cycling culture. In this part of the thesis I will elaborate on these three categories.

2.2.1 Hardware

The hardware are the physical elements of the built environment such as bike lanes, bike parking spaces and the number of bikes (Van Gent, 2020). However, hardware is not just infrastructure in itself, it is also about a safe and connected network, integrated transport and end-of-trip facilities. The cycling hardware in an area makes cycling more attractive and indirectly convinces people to use an active form of transportation (Harms et al., 2016).

Trips on bicycles are mostly done on dedicated bike lanes. Therefore, dedicated bike lanes are the backbone of cycling infrastructure (Schoner and Levinson, 2014). This backbone is needed in order to create an efficient cycling network. Thus, the efficiency of a bike lane is closely connected to the connectivity it provides. Bike lanes that are very well connected are automatically more efficient. On the other hand, bike lanes that are poorly connected discourage cycling. Cycle connectivity is not only important in terms of bike lanes and destinations, public transport nods should also be integrated.

Distance is an important factor for determining whether someone is willing to cycle commute and with what frequency they are willing to cycle commute (Wuerzer and Mason, 2015; Willis, Manaugh and El-Geneidy, 2015; Heinen, Maat and van Wee, 2013; Mullan, 2012). When people perceive the cycling route networks in their area as convenient, they are more likely to cycle. Thereby, people who know the cycle routes between their origin and their destination are also more likely to cycle commute. Commuters who perceive the cycling network in their area as inefficient due to detours, disconnected bike lanes or bike lanes that stop on the other side of the intersection, will not consider cycling for transport.

The reach of bicycle use can be increased when it is considered in association with other modes of transport (Dutch Cycling Embassy, 2018). When the distance to commute from A to B is considered to be too far to cycle, the commute can be split up in two parts. The first part can be covered on a bike, while the second part is covered by public transport or vice versa. Therefore, it is important to create an easy transition from the bicycle into public transportation. Safe and secure bike parking at the public transportation junctions is crucial for this concept. To stimulate covering part of the commute by bicycle, city governments may implement public bike sharing stations (Bieliński et al., 2019). Once public bike sharing stations are available at many public transport junctions, it is a good option to use a bike for the last mile(s) to a workplace.

A measure to enhance the connectivity of bike lanes and thereby shortening the distance for cyclists is by the use of lightly travelled residential areas. Via these routes a short-cut connection is usually created. There are usually no separate bike lanes in these streets but there are other regulations

to ensure the safety of cyclists. Most of the streets in residential neighborhoods have traffic calming regulations. This means that motorized vehicles are not allowed to go past a speed limit of 30 kilometers per hour. Other strategies to slow down motorized traffic are speed bumps, one-way streets, narrow sections in roads, extra curves and zigzag routes (Pucher and Buehler, 2008).

In the Netherlands, the bike network doubled in only an eighteen-year time span. There was over 9000 km of bike network in 1978 and it expanded to almost 19000 km in 1996 (Pucher and Buehler, 2008). A well-connected bike network contributes to the attractiveness of cycling. In the Netherlands, as well as in Denmark and Germany, bike networks consist of bike lanes next to the main road and off-street short-cut connections which are not accessible for cars (ibid.). This enables cyclists to take the most direct and the safest possible routes to their destinations. The comprehensive bike networks in these three countries enable cyclists to cycle anywhere almost completely on separate bike lanes next to main roads or on lightly travelled off-street bike lanes.

End-of-trip facilities are also an important aspect of cycling hardware. The most obvious end of trip facility is bike parking. Once a cyclist arrives at a destination, there needs to be proper and safe bike parking. Cyclists who have to park their bike in an unsafe area with a likelihood of the bike getting stolen, are not stimulated to bike more often to that destination. In the Netherlands, Denmark and Germany, local governments and public transport units provide these facilities. Thereby, private developers and building owners are required to provide bike parking facilities within or around their buildings (Pucher and Buehler, 2008).

In densely build up areas it may be hard to provide safe and secure bike parking areas due to a lack of space. However, there are several creative ways to solve this issue. The largest bike parking in the world recently opened in Utrecht (ibid.). This facility provides parking spaces for 12500 bikes and is located next to the biggest train station in the Netherlands. This bike parking is in the middle of the city center, so it is built underground where there is enough space. Another creative Dutch example is the bike parking space next to the train station in Amsterdam. Due to a lack of space, there are bike parking boats next to the train station.

Other end of trip facility are showers, changing rooms and storage space for bike gear. Cycling in moderate temperatures merely affects a person's physical appearance. However, cycling in tropical climates may cause a person to arrive unpresentable at a destination (Nankervis, 1999). In most countries, it is not culturally accepted to appear sweaty and exhausted at a workplace. To stimulate people to cycle to their work anyway, it is crucial to provide them with showers, changing rooms and preferably also storage space for their bike gear (Lee and Pojani, 2019).

2.2.2 Software

The software of biking is focused on mental and virtual elements, which is the human side of mobility (Dutch Cycling Embassy, 2020). The tree key characteristics of cycling software are education, communication and road safety (Van Gent, 2020; Harms, 2016). The software tries to implement behavioral and cultural change, makes drivers more aware of cyclists and puts the perspective of traffic and urban design on human movement.

2.2.2.1 Perceived Images

In order for people to see cycling as a "normal" mode of transportation, a socio-technical transition needs to take place (Bakker et al., 2018; Civitas, 2020). In some countries this cultural shift will be more difficult than in other countries. In lower income countries, cycling is still often seen as a 'poor way of transport' whereas cars are a symbol of wealth. Countries such as the Netherlands and Denmark traditionally use bicycles for every day commute (Da Silva Bandeira et al, 2017). The use of bicycles is highly accepted in these countries. However, in many other countries this is not the case. This can be explained by socio-cultural, educational and infrastructural aspects (ibid.). The acceptance of bicycle use not only differs between countries but also within countries. The perceived image of cycling shapes cycling practices within communities (Aldred and Jungnickel, 2014; Willis, Manaugh and El-Geneidy, 2015). In a community where cycling is seen as a choice or as normal, it is an accepted form of transport. However, in communities where cycling is seen as a lack of choice, it suggests that the cyclist is poor or from the working class. Concerns about appearance are negatively correlated with cycling (Willis, Manaugh and El-Geneidy, 2015).

In one of the cities in the United Kingdom that Aldred and Jungnickel (2014) studied, cycling is associated with the local problems of the city. Adults who cycle to work are seen as struggling and having a low income, just as the city itself. Da Silva Bandeira et al. (2017) analyzed cycling practices in Brazil and concluded that less educated workers are more likely to cycling to work than those with high education. Thereby, those with low incomes are also more likely to use bicycles to commute and for leisure than those with high incomes. The authors suggest that those with a higher education level tent to have a higher income and are thus better able to buy motorized vehicles. Both these papers demonstrate that cycling is seen as a 'poor way of transportation'. This image is problematic for the encouragement of commute cycling. What strengthens this image is that some companies prefer their employees to come to work by car (Willis, Manaugh and El-Geneidy, 2015). This way, companies reinforce the image that motorized vehicles are the best way of commuting.

2.2.2.2 Weather Conditions

Weather conditions are part of cycling software because they influence human perceptions. As a cyclist you are highly exposed to weather conditions compared to motorized vehicular transportation (Helbich, Böcker and Dijst, 2014). Therefore, the use of bicycles can be constrained by the weather. The most obvious weather conditions that restrict cycling are rain, heavy wind and extreme temperatures (ibid.; Nankervis, 1999; Mattson and Godavarthy, 2017; Lee and Pojani, 2019). Below, these three weather conditions are discussed and what this means for the cycling environment in Metro Manila.

Helbich, Böcker and Dijst (2014) found that temperature has a supportive effect on the choice to cycle commute in Rotterdam. Thus, a pleasant temperature supports people to cycle to their destination rather than using motorized vehicles. However, the relation between cycling and temperature is not linear but quadric. When the temperature gets too high, it negatively influences the willingness to cycle because it makes people feel uncomfortable (Mattson and Godavarthy, 2017). This tip off point may be different for people in different climate settings as those who are acclimatized to a tropical temperature are better able to coop with it (Lee and Pojani, 2019). The different tip off point can partly be explained because the temperature in tropical climates is mostly the same all year. Therefore, people do not enjoy spending time outdoors in warm weather (ibid.). In countries such as the Philippines, the ideal cycling temperature is somewhere between 17 and 33 degrees Celsius. This might pose a problem as the temperature in Metro Manila rarely drops below 30 degrees Celsius at day time.

Perspiration and wind have a negative effect on cycling (Mattson and Godavarthy, 2017; El-Assi et al., 2017). Both weather conditions cause uncomfortable commutes and prohibit people from biking. In general, people have to look representable in their work space which gets complicated by cycling in heavy wind and rain. The problem with rainfall is not only that commuters get wet, it also has some safety consequences. Heavy rains can cause roads to become slippery or flooded, motorized vehicle drivers have more difficulty to spot cyclists and some cyclists hold umbrellas while riding limiting their view and control over the bike (Lee and Pojani, 2019).

Metro Manila has a tropical climate with a dry and a wet season (Philippine Cities, 2020). During the dry season, there is rarely perspiration and the sun shines practically every day. Heavy rainfalls mark the wet season, but this does not mean that it is raining constantly. The heaviest rain falls are usually restricted to an hour a day. Therefore, it is possible for commuters to plan their cycle commute in accordance with the rainfall. The combination of the high amount of sun hours in Metro Manila and the countless tall buildings in the city create another complication. All tall buildings together create 'urban canyons'. These urban canyons are areas between tall buildings that heat more quickly than surrounding lower density or natural areas (Helbich, Böcker and Dijst, 2014). This is because of the multiple reflections of solar radiation and the absorption of heat in building surfaces during day time. At night, these urban canyons cool off less than natural areas because of the limited sky view and the solar energy storage in building surfaces. On the other hand, tall buildings might provide shelter from

wind and precipitation in densely built-up areas. However, tall buildings may direct strong winds that are caught at higher altitudes downwards and potentially creates drafts and gusts at street level (ibid.).

2.2.2.3 Education

In Southeast Asia, both policymakers and people associate cycling with poverty (Bakker et al., 2018). They see the motorcycle as a modern substitution of a bike. One way to overcome this image of 'cycling is for the poor' is through education. Children in the Netherlands have bicycle education from an early age (Van Gent, 2020). The bicycle education is both theoretical and practical in order to teach them the traffic rules and how to implement those rules. Children at an early age learn about road safety awareness which contributes to the understanding that cycling is a form of urban mobility for people of all ages and abilities. Cycle education stimulates children from a young age to perceive cycling as a mode of transportation (ibid.; Harms et al. 2016).

Cycle training for adults can be a practice that normalizes cycling (Aldred and Jungnickel, 2014) both for cycling adults and for driving adults (Harms et al., 2016). Cycle training for adults can have an influence on both road safety and on societal perceptions towards cycling (ibid.). Road safety is enhanced because motorized vehicle drivers become more aware of cyclists' rights, the responsibilities they have while driving a motorized vehicle and the accountability of their actions towards cyclists. Thereby, societal perceptions may change positively which leads to an increase of bike commuting. Stimulation to cycle through adult education is also possible in the work place. Employers can influence their employees to cycle by giving a higher mileage allowance for employees who cycle to work or set up a cycle lease plan for e-bikes (Civitas, 2020).

2.2.2.4 Communication and Promotion

Communication and promotion are also part of cycling software and may increase cycling rates. Research has shown that the combination of changing residences or jobs and individualized marketing campaigns may trigger behavioral change towards cycle commuting (Harms et al., 2016). Marketing campaigns are most effective in neighborhoods where there is already an efficient active mobility infrastructure such as bike lanes and sidewalks. Bike promotion events also stimulate people to cycle more often. These events may include a temporarily closure of streets for motorized traffic to make these streets more alive and livable (Sarmiento et al., 2010).

A more modern way of communication about cycling is through mass media and social media. Some European cities have set up marketing campaigns to influence the perception of cycling (Harms et al., 2016). Munich has organized a photo contest and Copenhagen tries to sell cycling as a lifestyle. However, communication to promote cycling does not necessarily have to originate form government

agencies. Active mobility influencers may post videos on YouTube, pictures on Instagram or stories on Facebook about their commutes. This is an easily approachable measure to stimulate people to use more active mobility.

2.2.2.5 Safety

The perceived traffic danger and a lack of cycle safety are important reasons that retain people from cycling (Pucher and Buehler, 2008; Mullan, 2012). In contexts where the meanings, competences and materials needed to cycle are difficult, less people consider using a bike for transport (Aldred and Jungnickel, 2014). For example, if bike commuters need to share the road with heavy traffic, if there is badly maintained infrastructure or if there are many dangerous intersections people are not encouraged to cycle for transportation. Especially women and elderly are sensitive for the perception of traffic danger (Pucher and Buehler, 2008).

Dedicated bike lanes are also important to perceive cycling as being a safe mode of transportation (Pucher and Buehler, 2017). Interestingly, the perceived safety is more important for people to cycle than the actual safety statistics (Dutch Cycling Embassy, 2018). Even if the chances of an accident are statistically low, people will not consider cycling if the physical environment looks dangerous. To increase the perception of safety, intersections can be transformed by adding separate traffic lights for cyclists, thereby reducing the chance of conflict with motorized vehicles.

The safety of cycling is concerned with accidents. There are two types of accidents: single-vehicle and multiple-vehicle accidents (Civitas, 2020). Single vehicle accidents happen when a cyclist slips and falls due to a curve, gravel on the road or bad weather conditions. When a cyclist gets hits by another vehicle, it is called a multiple vehicle accident. Most of those happen at an intersection in cities that are densely built up. The risk of death for a cyclist that is hit by a motorized vehicle increases significantly with every additional kilometer per hour that the motorized vehicle is driving (ibid.). The safety at intersections can be increased by adding separate traffic lights for cyclists, thereby reducing the chance of conflict with motorized vehicles (Dutch Cycling Embassy, 2020).

In countries where cycling is an established way of commuting like the Netherlands, Denmark and Germany, cycling is also much safer than in countries where it is less established (Pucher and Buehler, 2008). The UK and US can be categorized as less established cycling countries. Fatality and injury rates are much higher for cyclists in these two countries than in countries with an established cycling culture. In the Netherlands, Denmark and Germany the number of cycling fatalities has declined by 70% since the 1970s (ibid.). One of the conclusions that policy makers take from this is that more cycling leads to safer cycling. More cyclists on a bike lane makes them more visible to motorized vehicle drivers. This argument is true over time and across cities and countries.

In order to prevent multiple-vehicle accidents, it is important for vehicle users that they know how to drive safely around cyclists (Willis, Manaugh and El-Geneidy, 2015; Winters et al., 2011). In countries where cycling is established, motorists know how to share the road with cyclists and they know that they have to pay extra attention to the possible presence of cyclists. However, this remains a problem for motorists in countries where cycling is less or not established. To address this issue and to provide more safety for cyclists, many bike lanes in the Netherlands are separated from the main road. This creates a physical boundary to enhance the safety of cyclists. In residential streets, it is not necessary to have separate bike lanes because there are less motorized vehicles on those roads (Pucher and Buehler, 2008). Residential streets are usually connected which creates a traffic calmed area. To enlarge the sense of safety for cyclists in the residential areas, there are diverse measures such as raised intersections, speed bumps and artificial dead-end streets.

Another approach to make cycling safer in case of a collision is to make the use of helmets obligatory (ibid.). Most European countries do not require helmets because it decreases the amount of cycling (Civitas, 2020). Dutch experts also argue that the obligatory use of helmets discourages people to cycle more often. Wearing a helmet is less convenient, less comfortable and less fashionable. Also, helmets do not prevent accidents, but only have an effect on the seriousness of the injury. Thereby, wearing a helmet can encourage the cyclists to ride more riskier because the cyclists have a false sense of safety. Motorized vehicle drivers might also look at cyclists as less vulnerable when they wear a helmet, making the drivers less considerate. The Netherlands is the safest country in the world to cycle and only 1% of the adults and only 3 to 5% of the children wear helmets (Pucher and Buehler, 2008).

2.4.3   Orgware

The orgware of cycling are the organizational and institutional elements (Harms et al., 2016). The most effective way of the implementation of cycling policy is to start with a solid local government with knowledge about cycling (Civitas, 2020). Cycling is not a goal in itself but a mean to reach other goals and can therefore be linked to several other policy areas of the local governments such as the reduction of carbon emissions. This means that many parties need to be aligned such as administrations, governments, planners, engineers, communities, organizations, individual people and many more (Van Gent, 2020). When all these stake holders work together, it is possible to design and create a proper cycling transport environment.

2.4.3.1 Policies

Government policies regarding cycling are multi-faceted: transport policies, land-use policies, urban development policies, housing policies, environmental policies, taxation policies and parking policies

(Pucher and Buehler, 2008). The top three cycle countries are the Netherlands, Denmark and Germany. What these three countries have in common is that they have an official National Bicycling Master Plan (ibid.). The ultimate goal of these plans is to raise cycling levels for daily commutes and at the same time improve cycle safety. The plans also include approaches to achieve this, for example better designs of lanes, paths and intersections; better bike parking facilities; coordination with public transport; and cycling safety and promotion campaigns.

Since the 1970, local governments in the Netherlands have been planning, constructing and funding bicycle necessities. The local governments in the Netherlands make specific plans for the particular conditions and needs for the municipality. Thereby, the local governments provide cycle training. During primary school, all Dutch children have to do an official cycling exam in their neighborhood to show that they are aware of traffic regulations and that they are able to arrive at a destination independently.

Higher government levels, such as the provinces or the state, provide additional policy guidance, coordination and funding. These levels are also responsible for cycling necessities in the rural areas and to provide connections between municipalities. In general, the aim of cycling policy is to raise awareness of the cyclists on the road relative to motorized vehicle users (Pucher and Buehler, 2008). Motorists are obligated to anticipate on potentially dangerous situations for cyclists. As mentioned above, the perceived safety of cycling is very important. In the Netherlands, this perception is strengthened by laws to further increase the safety of cyclists (Dutch Cycling Embassy, 2018). In case of a collision between a cyclist and a car, the car driver is liable by default. The idea behind this law is that car drivers have a bigger size and more power on the road, therefore they should be considerate of more vulnerable road users.

The Dutch central government has spent an average of €60 million per year on cycling projects between 1990 and 2006 (Pucher and Buehler, 2008). This includes €25 million each year specifically for bike parking at train stations to improve the connection between cycling and public transport. Thereby, the central government also gives €1.8 billion per year to the provinces specially to spend on transport projects, including cycling facilities. Another policy by the national government to promote cycle commute are tax benefits for employers if their employees cycle to work. In return, the employees can buy a bicycle tax-free up to a value of €749 every three years (Heinen, Maat and van Wee, 2013).

The EU is also involved in cycling policy by contributing funding for bike route connections between countries and for regions where the cycling network is underdeveloped (Pucher and Buehler, 2008). Thereby, the EU facilitates cycle research and best practice information among EU countries.

Thus, the orgware is focused on finding ways of financing, make long term plans, organize the planning apparatus and to implement cycling into urban planning. If cycling can be made as comfortable or more comfortable than riding a motorized vehicle, human behavior positively changes towards cycling. There are numerous examples of small strategy and policy changes that encourage cycling (Van Gent, 2020). In Copenhagen, the city government installed 'bike footrest' which are inexpensive railings

so that cyclists have a place to lean while waiting for the traffic light. In Edinburgh, they opened the historic city center for pedestrians and cyclists on the first Sunday of each month while prohibiting motorized vehicles to enter. A more rigorous measure to encourage cycling is to create traffic-calmed areas. The aim of these areas is to make drivers more aware of cyclists and to put more emphasize on human movement (Puchler and Buehler, 2017). Traffic calmed streets have a speed limit of 30 km/h or less, have fewer traffic lanes, more curves, speed bumps, raised intersections and crosswalks, and dead ends for cars. This policy implementation promotes cycling as it creates convenient cycling environments. The Netherlands developed the concept of traffic calming and it is now also implemented in Germany, Switzerland and Austria as well.

To organize and align the orgware in a city with many stakeholders can be difficult. Bogota is a good example of a city where this went well (Woodcock et al., 2007). This city implemented policies that restrict car use, such as car-free days and major parking restrictions. At the same time, the government invested in active-transport infrastructure. This led to an increase in cycling as well as an improvement of air quality, accessibility and quality of life. The case of Bogota shows that if all stakeholders work together to implement cycling as a way of transport, it can make a huge difference for the livability of a city.

What we can learn from the above-mentioned examples is that a successful cycling policy can only be achieved when there is sufficient knowledge about cycling and when multiple stake holders are involved. When municipalities work together with other organizations and connect cycling policies to other priorities in that municipality, it is possible to generate recognition and funding (Civitas, 2020). A first step to start this process is to come up with pilot projects. This generates data, knowledge and support from citizens and can eventually lead to the expansion of the project area to the whole municipality.

2.4.3.2 Pollution

Generally, cycling is seen as an environmentally sustainable and healthy activity (Cupples and Ridley, 2008). Therefore, cycling is promoted by governments and lobby agencies as an effective way to ease urban congestion and pollution to create healthier environments and individuals. However, cyclists are exposed to traffic-related air pollution during their commutes because they often cycle alongside motorized vehicles (MacNaughton et al., 2014). The two main components of traffic-related air pollution are black carbon and nitrogen dioxide, both of these elements have been causally associated with increased mortality (ibid.).

According to Tainio et al. (2016) and Prati (2018), the benefits of physical activity outweigh the risks of being exposed to pollution. Even in areas with extremely high concentrations of pollution, cycling for 1 hour and 15 minutes or walking for 10 hours and 30 minutes per day will not cause harm

to people's health (Tainio et al., 2016). These areas with an extremely high pollution level are only causing harm to people with unusually high levels of active travel such as bike messengers. In those cases, the benefits of physical activity do not outweigh the benefits of physical activity.

2.3   City Congestion

The human population is growing, and this is especially visible in urban areas (United Nations Environment Program, 2019). This trend is clearly present in developing Asia where the number of urban inhabitants increased from 375 million in 1970, to 1.84 billion in 2017 (Asian Development Bank, 2019). According to the Asian Development Bank (ADB) (2019), it is expected that the urbanization rate in Asia will rise from 46% in 2017 to 64% in 2050. In order to deal with this rapid growth, Asian cities need a holistic approach that entails an efficient public transport system, land-use plans and affordable housing. Part of land-use plans are infrastructure, environmental sustainability and flexibility to respond to the market. At the same time, these cities should not only focus on improving itself but also work together as a system. Interconnected cities are able to provide the flows of goods, services and people to and from other cities as well as rural areas. Therefore, an efficient urban system with well-connected infrastructure is crucial.

However, the current situation in Asia tells us that an efficient infrastructure is difficult to develop. In 2019, the ADB published the results of their calculations about congestion in Asian cities with more than five million inhabitants. The researchers calculated the time needed to travel in peak-hours relative to the time needed to travel during free-flowing traffic. This gave them the ratio of driving duration during peak hours to the off-peak hours between two locations in each direction. The congestion number per city is the average congestion ratio across all location pairs in the city. Figure 1 shows the results of this research.

With distance, Metro Manila is the most congested city of all Asian cities with more than five million inhabitants. The ADB studied 278 cities with an average number of 1.24 congestion. This means that on average people need 24% more time to commute during peak hours than during off-peak hours. The ADB concluded that congestion problems are more severe in cities in middle-income countries such as the Philippines. Figure 1 shows that Metro Manila has an average congestion number of 1.51. In other words, it takes Filipino's in the capital city 51% more time to commute during peak hours than during off-peak hours.

In September 2019, GMA News published an article which ranked Metro Manila as the worst city in the world to drive a car in. This is based on data from Waze which is a commonly used route planner application for mobile phones all over the world. According to this data, Filipino's need five minutes to drive one kilometer due to traffic congestion. The EDSA is the
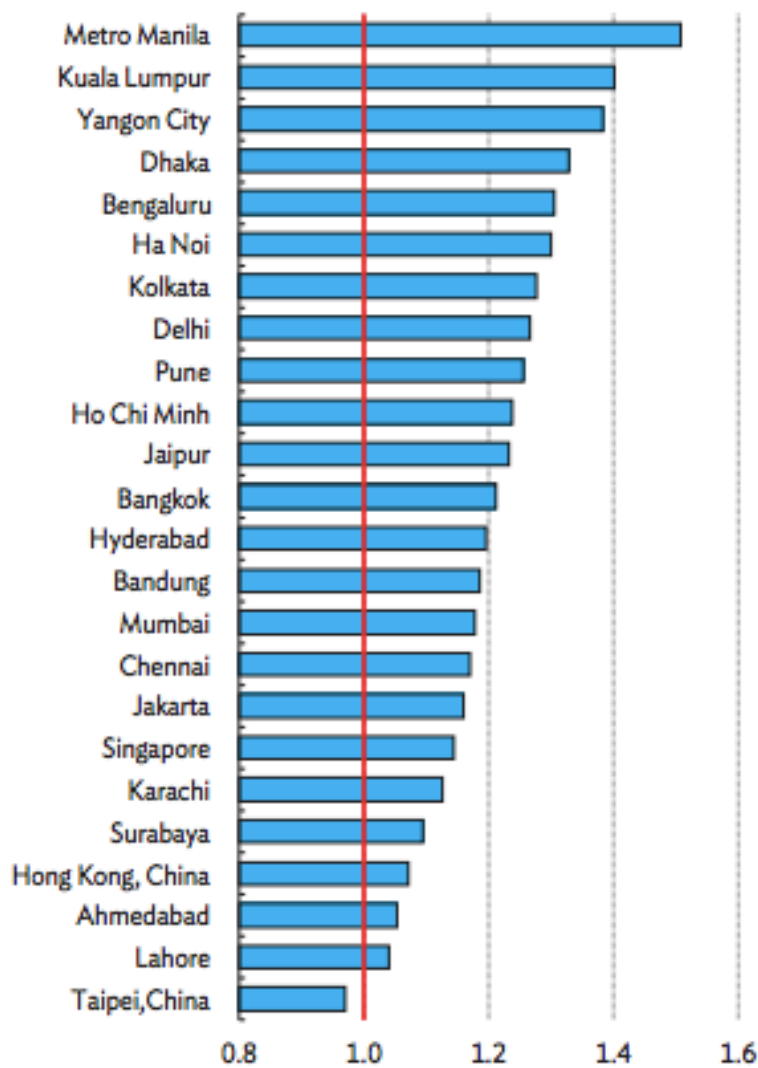
Figure 1: Relative Congestion in Asian Cities with more than 5 million inhabitants

Source: Asian Development Bank, 2019

main road that people use to go to their work. Currently, 405.000 motorized vehicles use the EDSA on a daily basis. GMA News published another article in January 2020 stating that Metro Manila has the second worst traffic congestion out of 417 cities, based on data from TomTom. The data shows that traffic congestion in Metro Manila is 71%. This means that it takes Filipinos 71% more time to arrive at their destination than when there is no congestion. A 30-minute trip by car in the morning should be added with 29 minutes. In the evening a 30-minute trip by car should be added with 38 minutes.

Metro Manila, also known as the National Capitol Region, is the capitol of the Philippines. The city is located on Luzon which is the biggest island of the country. The country consists of 7107 island and the total land area is 300.000 square meters (Philippine Cities, 2020). Metro Manila consists of seventeen cities, each with their own local government and mayor. Figure 2 shows the different cities and the location on the map. According to the last consensus in the Philippines in 2015, almost 13 million people live in Metro Manila which makes it one of the most populous cities in the world

(Philippine Statistics Authority, 2016). Metro Manila is the cultural, political, educational and economic center of the Philippines.

The Metro Manila Development Authority (MMDA) is the agency that is responsible for the metropole's planning, monitoring and coordination between districts and it provides metro-wide services (Bakket et al., 2018). Since the metropole consists of seventeen cities, each of these cities has its own government unit with its own traffic management office. Every traffic management office has their own staff, programs and budgets. This makes it a complicated matter for the central MMDA to have an overarching policy for the whole of Metro Manila. What makes it even more complicated is that there is also a separate agency that organizes all infrastructure related to roads. This is the responsibility of the Department of Public Works and Highways (ibid.).

Bicycles have never been promoted in Metro Manila or other parts of the Philippines (Bakket et al., 2018). Therefore, cycling has never been mainstreamed for Filipino's. In the 1990s cycling was even prohibited on major roads due to safety and

Figure 2: The Seventeen Cities of Metro Manila

Source: Philippine Cities, 2020

congestion issues. Since 2000, approximately 23% of households in Metro Manila own bicycles. Bakker et al. (2018) estimate that 35% of all trips in the metropole are within a 15-minute walk or bicycle trip. However, the majority of these trips are made by public transport or private cars. Only 2% of all trips in Metro Manila are made by bicycles.

In the last few years, there have been some attempts to improve the cycling climate in the Philippines in the political realm. Proposed bills include the designation of bike lanes, proper bike parking, the establishment of a Local Bikeway Office and transportation demand management (Bakker et al., 2018). For a bill to pass in the Philippines, it needs to be approved by both the Congress and the Senate. Currently, none of the bike-promoting bills has passed which shows that the majority of policy makers do not give much priority to cycle policy.

In the absence of political perseverance, nongovernmental organizations stood up to improve the cycling culture in Metro Manila. The Firefly Brigade is an NGO based in Quezon City in the north of Metro Manila. They promote cycling as an environmentally sustainable form of transport to make our cities better places to live in (Firefly Birgade Philippines, 2020). The Firefly Brigade emphasizes

that cycling helps to improve the environment. Another NGO in Metro Manila that promotes the use of bicycles are the Bike Scouts. Their purpose is twofold: first, they help victims of (natural) disasters who are cut off from the world by providing them means of communication; and second, they promote the use of bicycles as a sustainable way of transport (Bike Scouts, 2020). There are several other cycle organizations active in Metro Manila that strive for a more bicycle-friendly city. Most of these groupings gather and connect through Facebook. During my time in the Philippines, I learned that Filipino's see Facebook as a legitimate form of information gathering and a highly valuable social platform. Therefore, most organizations communicate through Facebook rather than via a website.

2.4 Conceptual Structure

Figure 2 shows the conceptual structure that is based on the academic literature and the conceptual distinction that is adopted from the DCE that are described above. The conceptual structure of this study has three levels: 1) sustainable development in Metro Manila; 2) sustainable development goals; and 3) cycling dimensions. Level 1 symbolizes sustainable development in Metro Manila and cities that deal with the same congestion issues and have the same background. The eleven goals that are presented in level 2 are the eleven goals that cycling contributes to according to the ECF (2016). Level 3 displays the dimensions in which the aspects of cycling can be divided according to the DCE (2020). The conceptual structure also shows that there is a gap between level 2 and level 3. It is not clear how the hardware, software and orgware contribute to the achievement of the SDGs. This gap in the literature is where this thesis is positioned. By studying this gap, I want to contribute to the existing academic literature about the sustainable effect of cycling on both the environment and humankind.
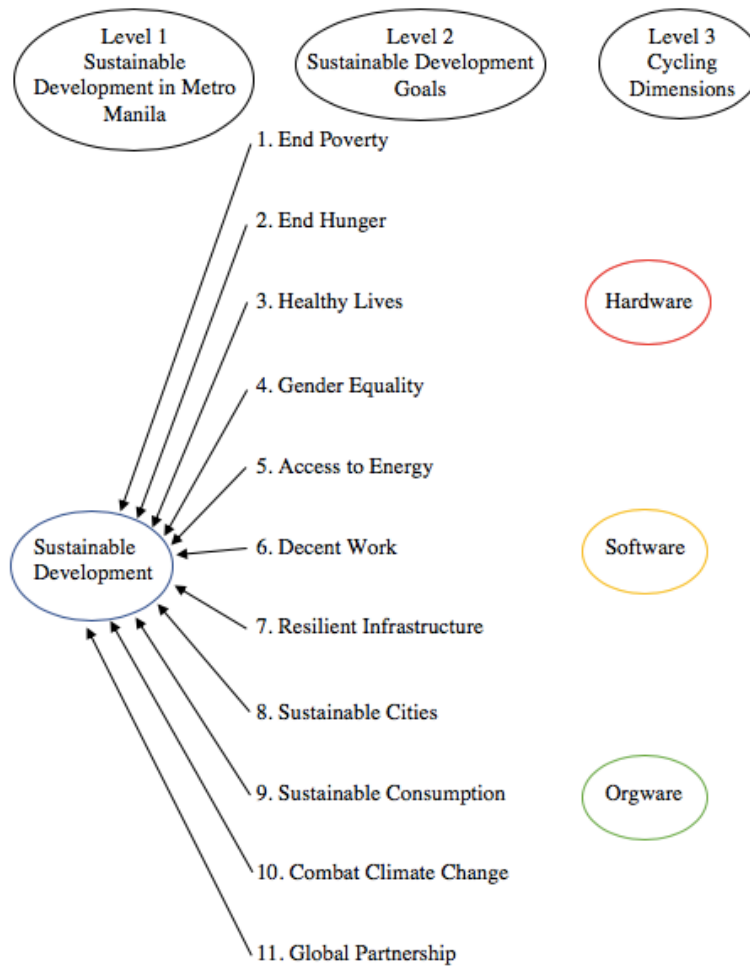
Figure 3: Conceptual Structure

Chapter 3: Data and Methods

Chapter 3 discusses the data and methods that are used in this thesis. First, the research approach is outlined. Second, the case selection and internal and external validity are exemplified. Third, the data approach is explained and divided into three categories. Finally, the research methods are explained.

3.1   Research Approach

The aim of this thesis is to expand our knowledge about the relationship between cycling and sustainable development. I have chosen to use a qualitative research method because this type of research is about exploring relations and issues. On the other hand, quantitative research is about testing hypotheses and finding patterns (Ranshuysen, 2012). A qualitative research method fits flawlessly with the objective of this thesis because it contributes to a relatively new field of sustainability literature. Thereby, quantitative research is about engaging with the world and is constructed around empirical issues (Mason, 2002). The puzzle in this thesis is processual as it is especially focused on how things change, interact and influence each other. The dynamics and nuances of cycling and all its facets are studied in a processual manner to map how it can contribute to worldwide sustainable development. The theoretical approach in which this thesis is positioned is culturalism. Culturalism is about perspectives, narratives, experiences and how this relates to others (ibid.). In addition, the epistemological approach in this thesis is interpretivism which emphasizes the sense people make of their own lives and experiences.

Most qualitative research uses existing literature, research and theory as a background and is complemented with researchers' own data to connect it to existing debates (Mason, 2002). In Chapter 2, I have described existing literature about cycling and (its connection with) sustainable development. Chapter 4 presents my own research results that are conducted during interviews and a focus group. The goal of this research design is to contribute to existing literature about the sustainable effect of cycling while at the same time providing a comprehensive overview of all cycling aspects that should be considered in this regard. Thereby, this relationship with all its aspects is empirically applied to a single case.

The research method that is used in this thesis is a case study. A case study is a contextual, in-depth study of a single case at a single point in time or over some period of time (Gerring, 2007; Creswell et al., 2007). The data collection of a case study is detailed and involves several sources of information such as existing literature, rapports, documents and interviews. Within case study literature there is still debate about the generalizability of case studies. Scholars such as Gerring (2007) argue that case studies attempt to be representative for a broader set of cases. However, the case does not have to be perfectly representative for the population of cases. On the other hand, Creswell et al. (2007) argue that qualitative researchers should be reluctant when it comes to generalizing cases because each context and each case differs. In the social sciences, it is very rare that there is unit homogeneity across the case population.

Even though Metro Manila is a metropole with millions of inhabitants, the capitol of a developing country, geographically in Southeast Asia and has a tropical climate, the city is not identical to Bangkok, a city which shares all of these characteristics.

Therefore, for this thesis, I have chosen to use a single case study because cycling in relation to sustainable development is considered in a novel way. Case study research is suitable for researches about topics that are not yet present in the literature or looked at in a completely different way (Gerring, 2007). This study compiles the comprehensive network of all aspects of cycling and how this together can lead to sustainable development while applying this to an empirical case. Most of the existing literature is focused on a single or a few reasons why people decide to bike commute as their way of transportation. Some of these researches explicitly mention the sustainability aspect (Cupples and Ridley, 2008; Pucher and Buehler, 2008), however, those are not empirically applied to cases.

Conducting interviews is a frequently used data gathering method for case studies (Yin, 2003; Creswell et al, 2007; Mason, 2017). In this research, semi-structured interviews are used to gather data as well as my own observations and documents from the MMDA and the Philippine Statistics Authority. In semi-structured interviews, the questions are open-ended to create space for interviewees to elaborate on their opinions and experiences (Galletta, 2013). However, the questions are carefully tied to the research topic throughout the whole interview. The data for this thesis is gathered in late 2019 and early 2020 through interviews and a focus group. Interviewees are asked about their personal views of cycling at the time of the interview and their visions of the future cycling climate.

3.2   Case Selection

The case that is selected for this thesis is Metro Manila, the capitol of the Philippines. As I have shown in figure 1, Metro Manila is the most congested city in Asia (ADB, 2019). However, Metro Manila is not a self-contained case. Many cities in Asia are dealing with congestion problems and the pollution that comes with it. Therefore, it is important to mention that even though this research is focused on Metro Manila, to a certain extent the recommendations and findings can also be applied to other cities in Asia that deal with traffic congestion. Characteristics that these cities share are the millions of inhabitants, a tropical climate, located in a developing country and in the need of a renewed transport system. Several countries in Southeast Asia are rapidly developing which creates a larger economy. The problem of a larger economy is that more people have to commute to their work each day which causes traffic issues (ibid.). Many concerns in Metro Manila are also visible in other cities in the Philippines such as Cebu City and Davao and in cities abroad like Bangkok and Jakarta.

Nevertheless, there are four reasons why Metro Manila is extremely suitable for research about the connection between cycling and sustainable development in a city. First, the natural existing cycling circumstances are favorable. Metro Manila is a relatively flat city with few hills which makes cycling

suitable for people of all experience levels. Additionally, the Philippines has a tropical climate with temperatures between 25 and 30 degrees Celsius. These are pleasant cycling temperatures, especially in the mornings when it tends to be a bit cooler. Even though Metro Manila is located next to the South Chinese Sea, the city is protected by the Manila Bay. Thus, cyclists do not have to endure harsh sea winds.

The second reason why Metro Manila is a suitable case for this case study is that there are several existing cycling activist groups. There are around forty Facebook pages and groups based in Metro Manila that are completely dedicated to cycling (Bakker et al., 2018). Most of these pages and groups are for recreational cycling but this shows that cycling is something that the people in Metro Manila consider. Seven of the forty pages are dedicated to cycling advocacy (ibid.). These organizations report on their activities, highlight issues and spread ideas for better cycling circumstances. Exactly those groupings form the backbone of a potentially flourishing cycling climate. People already gather to cycle commute in unfavorable conditions which is promising for the number of bikers that will be in Metro Manila if the conditions are better.

The third reason is that the biggest conglomerate in the Philippines, Ayala Land, is already investing in biking infrastructures in their newly developing neighborhoods. In the Philippines, most infrastructure and buildings are built by conglomerates. Because of this, the conglomerates have a lot of power in the Philippines because they can decide what to build and where to build it while making millions in the process. Ayala Land recognizes the traffic problems in Metro Manila, therefore they invested in constructing biking infrastructure in a newly developed part of the central business district in the city. This bears hope for future investments in cycling infrastructures in the rest of the city.

The fourth reason why Metro Manila is a suitable case for this study is that the embassy of the Netherlands in the Philippines is promoting several projects related to cycling in the Philippines. From August 2019 to January 2020, I was an intern at the embassy in Manila. This gave me unique opportunities to talk to many stake holders and to be involved in cycling projects from the embassy. Cycling is one of the public diplomacy tools that the Embassy of the Netherlands in the Philippines uses to promote sustainability in the Philippines. In October 2019, the Embassy organized a two-week long event dedicated to cycling. This included trainings at the Asian Development Bank, presentations at the Road and Traffic Congress, meetings with Ayala, a meeting with the oldest heritage site of Metro Manila, a visit to Iloilo City and courtesy calls with the Mayor of Iloilo City and the governor of Iloilo province. For these events, the Dutch Cycling Embassy flew to Metro Manila to support the embassy and to spread their cycling knowledge.

It is important to consider the internal and external validity when selecting a case for a case study. External validity is about the possibility to generalize the findings of the case study over a broader population of cases (Gerring, 2007). Case studies often have problems with external validity because it includes only a single case of few cases. Metro Manila is representable for other large cities in the Philippines, such as Cebu City, because these cities have the same traffic and sustainability related

issues. These cities also share similar natural circumstances that are favorable for a cycling climate. Thereby, the same conglomerates that are active in Metro Manila are also active in other large cities in the Philippines. It is more difficult to generalize the findings of this case study to cities outside of the Philippines. However, there are important lessons that can be taken from this case study to improve the cycling climate in other cities worldwide that also deal with traffic congestion issues. The internal validity of case studies is usually high (Gerring, 2007). This is because the veracity of a causal relationship is established through thorough in-depth research. Because this study very thoroughly researches Metro Manila, it is likely that the results match with the reality of the situation in the city.

3.3   Data Approach

According to Yin (2003), there are six sources of evidence in case study research: documentation, archival records, interviews, direct observations, participant-observations and physical artifacts. These sources are complementary which makes that a good case study uses more than one source. Documentations and archival records are stable and can be reviewed repeatedly. These are objective as they are not created for the purpose of the case study and have a broad time and events coverage. A downside of these two types of evidence sources is that it might be difficult to retrieve the information for example due to privacy reasons. Thereby, the author of the source may be (deliberately) biased. Interviews are targeted because they are conducted with the purpose of the case study. They are insightful and provide perceived causal interferences. However, if the questions of the interview are poorly constructed, the interviewer shows a bias. The participant can also be biased or could give inaccurate answers if they do not recall events correctly. A final problem with interviews is that the participant gives answers that the interviewer wants to hear. Direct observations show the reality and the contexts of the event. However, it is time-consuming, selective and costly. Many hours are needed for human observations and the events may proceed differently because it is being observed. Participant-observations have the same up- and downsides as direct observations but are also subjected to participant biases. Finally, physical artifacts are insightful into cultural features and technical operations. Yet, those are also selective and not always available.

For this study, I initially chose to conduct interviews and to use all the gathered information to answer my research question. However, while I was discussing this study with my supervisor at the embassy and later with my supervisor at the university, I chose to incorporate more data sources than merely interview data. Because I was living in Metro Manila, I had the opportunity to make direct observations of the traffic situation. Observations are crucial as a source of evidence for this thesis as it shows the readers the actual traffic situation in Metro Manila. The direct observations show the urgency of this research and make it approachable for readers who have never been to the metropole. I have

taken all pictures myself while I walked to the embassy every morning or on my way back home. Below, at paragraph 3.3.3, I elaborate on the direct observations.

Next to direct observations, I also chose to incorporate documentations into this study. The main reason to do this is because it allows me to gather information about government policies regarding the infrastructure and sustainable development. Several interview respondents referred me to the MMDA to gather information about city planning. Thereby, through the website of the MMDA, I found the Philippines Statistics Authority. This organization is responsible for the documentation about the focus of the SDGs in the Philippines and the progress the country has made so far regarding reaching those goals. In paragraph 3.3.2, I will further explain the use of documentations in this thesis.

The direct observations and documentations are complemented with interview data. According to Yin (2003), the interview is one of the most important sources of evidence. Interview data is also a great way of gathering data for case studies (Mason, 2002). The interviewees were very eager to share their knowledge and experiences with me. They provided me with a lot of information and new ideas that I had not thought of myself. I met the first interviewees through my network at the embassy. After several interviews, a snowball effect emerged. Interviewees referred me to other cycle advocates and experts. This resulted in a diverse and highly capable group of interview participants. The next paragraph 3.3.1 provides more information about the interview participants.

My internship at the embassy and the possibility to live in Metro Manila provided me with a lot of chances and knowledge that I would not have been able to gather in the Netherlands. First of all, I would not have met all the interview participants if I would have conducted this research from the Netherlands. Second, I would not have been able to do all the direct observations. And third, while speaking to all the interview participants, they provided me with the background knowledge that I needed to analyze the documentations. These three sources of evidence form the data triangulation of this study. In chapter 4, the results are discussed along the distinction of hardware, software and orgware. The basis of this chapter are the direct observations to provide the reader with an accurate illustration of the traffic situation right now. Hereafter, the interview data forms the core of the results chapter and provides a lot of information. The policy aspect of orgware is complemented with information from the documents from the MMDA and the Philippines Statistics Authority. The triangulation of these data sources provides a comprehensive picture of how cycling leads to sustainable development in Metro Manila.

3.3.1 Interviews

This section elaborates on the interviews and the focus group that were conducted for this case study. Interviews that are conducted for case studies usually have open-ended questions (Yin, 2003; Creswell et al, 2007; Mason, 2017). This enables the interviewer to ask about facts, opinions and suggestions.

Because of the open-ended nature of my questions, some participants suggested other experts or advocates that I could interview for this case study. Next to the open-ended question interviews, there are two other types of interviews: the focused interview and the survey (Yin, 2003). The purpose of a focused interview is to corroborate certain facts that the interviewer deems to be yet established. This type of interview is not suitable for my case study because I wanted the participants to elaborate on their opinions, views and suggested improvements. Surveys are conducted to create quantitative data which makes it unfit for this case study.

In total, I have interviewed twenty-two persons for this study. There is a distinction within the group of people that have been interviewed. The first group consists of people that are cycling advocates, within this group there are five interviewees. They mostly voluntarily commit themselves to the task of making Metro Manila a more bicycle-friendly city. The people who joined the focus group were also all cycling advocates. During this group interview, eleven interviewees were present. The second group of people are cycling experts. The experts concluded in this study are employed by organizations that work towards a better cycling environment in Metro Manila. I have interviewed six experts from different backgrounds.

The participants of the interviews and focus group have been carefully selected. The aim is to compile a group of participants with different knowledge, experience and expertise. Yet, this case study is not about cycling for recreation. Therefore, all interviewees need to have affiliation with biking to commute or biking as part of sustainable development. All cycle advocates and some of the cycle experts are Filipino. Most Filipino's have great English communication skills but in order for me to carefully reflect on all their answers, I have recorded all interviews. Some participants referred to specific parts and streets in Metro Manila that I previously was not aware of. For these references, my colleagues from the embassy helped me with the transcript and locating those areas on the map.

3.3.1.1 Cycle Advocates

The first group of interviewees are cycle advocates in Metro Manila. The first interview is with Aldrin Pelicano of the organization Manila Moves. The aim of Manila Moves is to promote walking and cycling as a commute. Aldrin posts recommendations about biking in the city on his Facebook page to inspire and help people to start biking and to improve the biking experience. Aldrin visits the embassy often to discuss the embassy's public diplomacy strategy regarding cycling and how we can help each other. He also flew to Iloilo City with the embassy team and the Dutch Cycling Embassy to give advice about their cycling network.

The second interview is with Aris Santos who cycles to his work every day. This is a commute of 21 kilometers back and forth. The third and fourth interviewees are Yummy Santos and Rj Jali Jali. They are a married couple and are struggling with the traffic situation in Metro Manila. From their home

it is 21 kilometers to their work which they try to cycle at least once a week. The traffic situation in Metro Manila makes it very difficult for them to maintain a personal life but they do not feel fit nor confident enough to cycle commute more often. I met Aris, Yummy and Rj via a colleague who works at the Danish embassy in Manila. The Dutch embassy had a meeting with the Danish embassy about cycling policies and while we were discussing this, I informed them about my research. The colleague from the Danish embassy told me he could introduce me to some of his friends who deal with cycle commuting.

The fifth interviewee is Karen Sison who is part of the organization Cycling Matters that pushes for positive change through reporting about cycling news, produces accessible content for education and celebrated Filipino cycling culture. They want to inform people about cycling because, according to them, there is not enough media coverage about cycling in the mainstream media. The stakeholders in the transportation system need more education about cycling. By sharing their knowledge, Cycling Matters hopes to share their bike knowledge with them for smarter, safer and more sustainable cycling. I found Cycling Matters on Facebook and decided to send them a message. Karen responded and was able to come by the embassy for an interview.

3.3.1.2 Cycle Experts

The second group of interviewees are cycle experts. The first interviewee of this group is Kevin Punzalan. He is a policy officer at the Embassy of the Netherlands in the Philippines. His work is focused on renewable energy, waste management and cycling policy. Kevin has worked on several projects to promote cycling and Dutch cycling experience in the Philippines. These projects include meetings with the administration of the historical site Intramuros to make it a more bicycle-friendly area, curtesy calls with several mayors and governors and the organization of multiple screenings of the documentary 'Why We Cycle' in Filipino cinemas to promote the Dutch cycling culture. During my internship at the Embassy, Kevin was my supervisor and we worked together closely.

The second expert is Gilbert Berba, an urban planner who works for Ayala Land. Ayala Land is the biggest conglomerate in the Philippines. This makes the company responsible for a large share of the buildings and infrastructure in Metro Manila and many other parts of the Philippines. While the DCE was in Manila, we have had a meeting with Ayala Land after they expressed interest in Dutch cycling culture. Gilbert is very interested in cycle infrastructure and his work gradually focusses on implementing this in their new development projects.

The third and fourth interviewees work for the Institute for Climate and Sustainable Cities, which is based in Metro Manila. Golda Hilario is a program developer and Paula Valencia is a transition analyst. The ICSC is a climate and energy policy group based in the Philippines advancing climate-resilient and low-carbon development. Currently they are working on mobility to create sustainable

cities. Therefore, they are interested in active modes of transport. For this objective they formed an urban development team to explore opportunities. The ICSC notes that there are a lot of initiatives around active modes of transportation but there is no connectivity. To get a more comprehensive picture of biking in Manila, they started to count bikers. Once they know how many people bike, they can make a case for the local governments. For this project, the ICSC teamed up with the University of Applied Sciences in Twente. At the time of the interview, there were two Dutch students doing an internship at the ICSC. The two students, Kevin Heerema and Rosan Verbaak were also present during the interview. The embassy team has worked together with the ICSC more often on issues about sustainability. The interview and the meeting prior were a good opportunity to reconvince and share knowledge.

The fifth expert is Edward Douma, who is a project manager for the Dutch Cycling Embassy. The DCE is a public-private network for bicycle inclusive mobility. They represent the best of Dutch cycling: knowledge, experience and experts. Together with their partner companies, the DCE flies all around the world to share their knowledge. In October 2019, Edward visited Metro Manila to give lectures and trainings at the Road and Traffic Congress, the Asian Development Bank and Ayala Land. Thereby, he participated in several meetings to promote Dutch cycling expertise. During his visit to the Philippines, Edward flew to Iloilo City together with a team from the embassy to host a ThinkBike workshop. The purpose of these workshops is to bring stakeholders together who might have a different vision and, in the end, align those visions and come to a comprehensive strategy. During the ThinkBike workshop in Iloilo, there were representatives from cycle activist groups, government agencies and business groups. In the end we came up with a proposal which we presented to the mayor of Iloilo City and the governor of Iloilo Province.

The final expert is Lior Steinberg. Lior is an urban planner and co-founder of Humankind, an agency for urban change. His goal is to help cities to look beyond functionality and to plan urban spaces that make people smile. Therefore, his work aims to create people-oriented cities with an emphasis on local and innovative interventions. Humankind is one of the partner companies of the DCE and in that capacity Lior visited Metro Manila together with Edward. Lior has a unique way of urban planning and is has been involved in the strategy to make Iloilo City more bicycle-friendly long after our visit.

3.3.1.3 Focus Group

The focus group that was brought together for this thesis is with members of the Bike Scouts. The Bike Scouts have a twofold mission. First, they are a volunteer bicycle messenger service that works to gather information from disaster areas about survivors and their immediate needs. This information is delivered to agencies that provide help and to the families of the survivors. Their objective is to connect those who are isolated by natural and man-made disasters to the people who care about them. As these disaster areas are often not accessible by planes or motorized vehicles, they do everything on their bikes. Second,

the Bike Scouts promote bicycles as a sustainable form of transportation and recreation. They ride their bikes to create the energy and sense of community that inspires people to participate in social good. They also have cargo bikes full of books for people who do not have access to libraries. The Bike Scouts have an extensive network of around 15.000 members. They work together with several government units (like Pasig), they have a partnership with Decathlon, produce their own podcasts, the Greenways Project, and several other projects.

When I was interning at the Embassy of the Netherlands in Manila, the Danish embassy introduced Myles Delfin to us. The Danish Embassy had been working with the Bike Scouts for several years but due to budget cuts, their cooperation came to an end. However, the team from the Danish embassy still believed in the cause of the Bike Scouts. Therefore, they introduced Myles to the Dutch team in hope that we could continue this relation. The first meeting was successful, and the mission of the Bike Scouts needlessly fit into the public diplomacy strategy of the Dutch embassy. For the second meeting Myles brought along ten other Bike Scouts to brainstorm about a joint sustainability event. After this meeting, all the Bike Scouts participated in a focus group to provide me with information about their experiences with cycling in Metro Manila.

I have classified the Bike Scouts as cycling advocates. This paragraph introduces the bike scouts that were present during the focus group and elaborates on why their input is valuable for this thesis. Myles Delfin is the founder of the organization and is in regular contact with the Embassy of the Netherlands in the Philippines to work together on cycling related projects. Keisha Mayuga started the bike sharing project at the University of the Philippines while she was still a student. She is still involved in this project and works as an environmental planner. Thereby, Keisha wants to make cycling more approachable for women. Ricky Medina is a media director and has his own radio show about health issues. Jen Espinosa is his text writer. Mary Ann Vingino is a former government employee which gives her unique insights about how to successfully come in contact with the government apparatus. Georwyn Victor is a video and content creator about cycling. He has his own YouTube channel with 60.000 subscribers where he posts videos about cycling in and around Metro Manila. Jeremy Remoquilo and Jay-Vee Galicia make videos for the Bike Scouts. These videos are both the promote the cause of the organization but also to document all the situations in which they are involved. Joshua Ambayec is the website developer for the Bike Scouts and is involved in the creation of an application for the organization. Mia Bunao is a highly respected cycling advocate in Metro Manila. She used to work for the government but in 2002 she created a platform to promote cycling. Her platform is called 'Explore your City on a Bicycle' which aims to create a community where everyone can share their biking experiences in Metro Manila. Edgar de Jesus is a technical consultant for the Philippine Center for Environmental Protection and Sustainable Development Inc. He combines his professional work in the sustainability sector with his private interests to make cycling a better experience in Metro Manila.

3.3.2 Documentations

Documentation as a source of evidence can take several forms like letters, memoranda, minutes, administrative documents, newspapers and so on (Yin, 2003). There is always a risk that documentations have a certain bias, therefore, they should not be seen as literal reports about events. Documentations are a useful source of evidence when it is combined with other sources. Nowadays, a lot of information can be found online in databases. Governments, companies and NGO's post their yearly reports and plans for the future on their websites. These reports contain a lot of information, but it is important to remember that those reports have not been written for the purpose of this study. Those reports were written for a specific purpose and a specific audience and thus it can be biased.

The MMDA is the overarching organization for transportation in the seventeen cities in Metro Manila. The organization publishes their approved budgets and targets online annually. These documents from the years 2018, 2019 and 2020 are analyzed to gather information about the intent and prospects of the MMDA to invest in cycling infrastructure. Thereby, the Philippines Statistics Authority made a list of the specific parts of the SDGs that the Philippines pays attention to (Philippines Statistics Authority, 2020). The agency also reports on the progress of the SDGs in the Philippines. These documents provide information for this case study regarding the role of the government in achieving sustainable development. However, it is important to keep in mind that these reports are likely to be biased towards government goals. The database is open for public and can be accessed online.

3.3.3 Direct Observations

In August 2019, I arrived at Metro Manila for my internship at the Embassy of the Netherlands in the Philippines. The embassy is located in Makati, the central business district of Metro Manila. This is also where I have lived for seven months. Actually living in the city enabled me to do direct observations of the cycling environment in Metro Manila. The observations are useful to provide additional information of the traffic situation in the city. The pictures allow readers to see the current traffic congestion that cycling commuters deal with.

According to Yin (2003), direct observations can be formal and more casual. Formal direct observations are usually structured and have a strict study protocol. Casual direct observations on the other hand can be made during a field visit and are less structured. My direct observations are casual and I took the pictures myself. The pictures are taken during my morning and afternoon commute. Every morning during rush hour I walked to the embassy. Usually I finished work at 5pm which enabled me to walk home before the evening peak-hours. The difference between walking through Makati at 5pm and 6pm was tremendous and significantly increased my commute.

Because my commute was in the Makati district, all pictures are taken there. On days when my work day ended in a different district, I had to commute by car because it is not allowed to walk next to

highways. These car rides occasionally took me three to four hours to arrive back at the embassy or at my home even though it was just a 5 to 10 kilometers ride. When you are in a car during rush hour in Metro Manila, all you can see is cars around you. Thereby, the sun goes down rather quickly in the Philippines. Therefore, my commutes from different districts did not allow me to take pictures of commuting situations involving active mobility.

3.4   Research Methods

According to Guest et al. (2012), there are two types of qualitative research in the social sciences: explanatory and confirmatory. Most qualitative research is explanatory and asks questions such as 'How does X relate to Y?', whereas confirmatory research hypothesizes about how 'X relates to Z and leads to Y'. Explanatory research usually gathers data especially for the purpose of the research, while confirmatory research uses existing data. The aim of this thesis is to tackle an empirical problem with academic theories as a basis and complemented with the generated data. This thesis is explanatory and allows me to thoroughly read the data, look for key words, trends, themes and ideas that help me to outline the analysis in the next chapter (ibid.).

As mentioned above, the interview data is the most important source of evidence in this thesis. Yin (2003) argues that in general, this is the most important source of evidence for qualitative research. According to him, here are three ways to read interview data, namely: literally, interpretively and reflexively. A literally reading of the interview data is useful when the researcher is interested in the literal version of what is there in the world (Mason, 2017). The researcher looks at the literal form, content, structure and style that the interviewee used. However, some would suggest that a pure literal reading is not possible because everyone is biased to some extent by their own social context. An interpretive reading of interview data goes beyond the literally reading. This form allows the researcher to involve him/herself in the constructing or documenting of the version he/she thinks that the data mean or represent (ibid.). The researcher reads through and beyond the data to see what the interviewees' interpretations and understandings are, how they make sense of social phenomena. A reflexive reading of the data locates the researcher as part of the data that he/she has generated (ibid.). The researcher has an integral role or perspective in the interpretation and generation of the data.

The interview data in this thesis is read interpretively. If I read my data literally, meanings and interpretations of answers will get lost in the analysis. Thereby, all the participants are biased in the sense that they are in favor of a better cycling environment in Metro Manila. A reflexive reading of the interview data is not suitable for this case study because I do not locate myself as being part of the data. Therefore, I have chosen to read my data interpretively to allow myself to interpret the interviewees but at the same time have an aloof attitude. After reading the data thoroughly, I will analyze the data thematically. Thematic analyses complement an interpretively reading of the data because both require

the involvement and interpretation of the researcher. The researcher focusses on identifying and describing the implicit and explicit themes within the data (Guest et al., 2012). The identified themes are categorized and analyzed in the next chapter.

Chapter 4: Analysis

In this chapter, the research questions that are formulated in Chapter 1 are analyzed. The analyses are on the academic literature described in Chapter 2 and on the interview data, documents and observations that are described in Chapter 3. First, I focus on the hardware of the cycling environment in Metro Manila and to which SDGs this contributes. The second part of this chapter focusses on the software and how this contributes to reaching the SDGs. The third part does the same but for the orgware of the cycling environment. The final part combines these analyses and elaborates how cycling as a whole can contribute to sustainable development.

4.1 Hardware and Sustainability

This part of the thesis focusses on the hardware of cycling and how this relates to the SDGs in Metro Manila. I start with describing the current infrastructure in the metropole which is illustrated with my own pictures and observations. Thereafter, the visual infrastructure improvements that are suggested by the interviewees are described. This is followed by their thoughts about connectivity, distance and congestion. Finally, I describe the concept of bike sharing and the necessities for end-of-trip facilities.

4.1.1 Current Infrastructure

The current infrastructure in Metro Manila is not ideal for non-motorized vehicles. The pictures below illustrate an everyday traffic situation in business district Makati. Picture 1 and 2 below show the crossing of Kalayaan Avenue and Makati Avenue. During the morning and afternoon rush hours, these streets are completely crowded with cars, jeepneys, motor cycles, pedestrians and some cyclists. Picture 1 and 2 show that there are cyclists brave enough to face the rush hours of the middle of the business district of Metro Manila. Filipino's do not make use of traffic lights during rush hours because nobody adheres to those. Instead, traffic enforcers stand in the middle of the crossings to direct the flow of traffic. What is also clearly visible in these pictures is that there are no bike lanes at all. What I observed is that the cyclists bike their way through all the motorized vehicles that stand still waiting for the green light to the front of the traffic jam, which is shown in picture 2. This provides the cyclists several things. First of all, by cycling in front of the motorized vehicles, the cyclists are safer because they do not have to cross lanes with motorized vehicle drivers. This decreases the chance of collision. Second, the cyclists breathe in cleaner air than when they are stuck behind a motorized vehicle with polluting emissions. Third, it is also more practical for the cyclists to be in the front of the traffic jam, so they have a better visual of the traffic situation. Being the first to cross the intersection, the cyclists have a free road ahead of them where do not have to zigzag between cars until the next intersection.

Picture 1: Intersection Kalayaan Avenue and Makati Avenue

Source: Observations of writer

Picture 2: Intersection Kalayaan Avenue and Makati Avenue

Source: Observations of writer

In picture 3 you can see a man on an e-scooter on Makati Avenue, a few meters before the intersection. These e-scooters can go up to 25 km per hour and are rising in popularity in Metro Manila. There are many benefits to an e-scooter that make it attractive for commuters in the metropole. It does not take up much storage space which makes it easy to bring to your workplace or even to your office or cubicle. An e-scooter is also cheaper than a motorcycle and you do not have to pay for gasoline. Thereby, even though e-scooters theoretically cannot go faster than motorized vehicles, during rush hours the e-scooters can zigzag through all traffic jammed vehicles which reduces travel time. However, because the roads in Metro Manila are maintained quite poorly, this poses a risk for e-scooters. Holes in the pavement are not rare and can lead to catastrophic accidents for e-scooter-users. Thus, the lack of bike lanes poses a problem for e-scooters as well.

Picture 3: E-scooter on Makati Avenue

Source: Observations of writer

Picture 4 shows an overcrowded jeepney during the morning rush hour. My colleagues at the embassy told me that during World War II, the Americans brought jeeps to the Philippines that were modified to seat eight to ten people. After the war, the Americans left hundreds of jeeps behind and the Filipinos modified those into public transport busses. Filipinos started to call these public transport vehicles jeepneys and they are now seen as a national symbol of the Philippines. Every jeepney driver has his/her own uniquely designed jeepney, usually with bright colors and quotes referring to biblical texts.

During rush hours, most jeepneys are overcrowded with people going to their workplace or returning back home. All jeepneys drive their own routes and stop whenever someone shouts 'para', the Tagalog word for stop, which leads to several problems for ongoing traffic. Firstly, because every jeepney rides its own route, the only way to know this route is by looking at the carton board sign which states in which direction the jeepneys goes and by experience. There is no system for the number of jeepneys that ride the same route and there is no set time schedule. Many commuters are thus dependent on a highly unreliable public transport system to go to their work. Second, because jeepneys stop whenever someone shouts 'para', they are the cause of many traffic jams. When jeepneys drive on the left side of a three-lane road and they have to stop to let someone off the jeepney, other vehicles need to slow down or dodge in order to let the jeepney pass. This is the cause of many traffic jams throughout the day. Third, because there are no set 'jeepney-stops', there are also no set places where someone can enter the jeepney. This results in that people have to wave to jeepneys on the side of the road to let them know that they want to enter. However, there are no special jeepney-lanes where people can safely enter and exit the jeepney. This is a cause of traffic jams as well and it poses dangerous situations for the people who enter and get off the jeepney. A fourth problem with jeepneys is that the drivers drive very recklessly. Jeepney rides cost only P9, which is €0,16, this means that jeepney drivers do not earn a lot of money. Therefore, they want to pick up as many commuters as possible. In order to do this, they drive very fast, stop wherever and whenever and switch lanes whenever it suits them. This leads to very unsafe traffic situations. Next to problems with ongoing traffic, jeepneys have a large carbon footprint. Most of these vehicles originate from the Second World War and are very polluting. Because jeepneys are so old, drivers do not maintain them. The maintenance of jeepneys is more expensive than the purchase of a new one. This causes that the jeepneys produce a lot of polluting emissions.

Picture 4 also shows that the jeepney in the back is completely full. The man in the blue shirt has to stand in the back of the vehicle. When rush hours are at its peak, up to five (wo)men stand at the back of the jeepney and inside is also packed with commuters. Especially the situation for people who stand at the back of the jeepney is very unsafe. They can fall of the jeepney and end up in the middle of busy traffic or burn themselves on the exhaust pipe. In case of a collision, they are likely to be crushed between the jeepney and the vehicle behind it. One of the interviewees, Aldrin Pelicano, told me about hitchhiking at the back of a jeepney. When he was working in Manila, he had to travel 4 kilometers from his home in Ortigas to his work place. However, because most people live out of Metro Manila, by the

time a public transport vehicle would reach his city, all seats would be taken. Before he started bike commuting, this left him with no other option than to hitchhike, even though he was aware of the dangers.

Picture 4: Overcrowded Jeepney

Source: Observations of writer

Picture 5 shows the 'side walk' alongside Makati Avenue, a very busy access road into the business district of Metro Manila. The side of the road where people walk, functions both as a side walk for pedestrians and as a parking space for cars. Picture 6 shows the intersection of Makati Avenue and Kalayaan Avenue, just like picture 1 and 2 but from the other side of the intersection. There is no enforced pedestrian crossing, therefore, pedestrians are walking in the middle of a busy street with cars and jeepneys coming from every direction. Picture 7 shows the same intersection, but without much vehicular traffic. Here, you can see that there is a pedestrian crossing, but the traffic rules are not enforced. The pedestrians are walking while they have a red light in picture 6. In the middle of the intersection at picture 6 and 7, there is a small traffic island for pedestrians who are crossing the street. However, this cannot be optimally used because there are men selling peanuts, corn or other produces in the middle of the island which takes up a lot of space.

These three pictures illustrate that the infrastructure in Makati is not designed for pedestrians and is very car-centered. Pedestrians do not have the necessary space to safely walk alongside Makati Avenue. Therefore, they are forced to walk on the road which might lead to traffic jams, collisions and other unsafe situations. Moreover, when there are no traffic enforcers present, pedestrians cross the street whenever they see fit. This illustrates that not only motorized vehicle drivers do not adhere to the traffic rules, because pedestrians do not adhere to those either.

Picture 5: 'Side walk' alongside Makati Avenue

Source: Observations of writer

Picture 6: Intersection Makati Avenue and Kalayaan Avenue

Source: Observations of writer

Picture 7: Pedestrian crossing

Source: Observations of writer

Picture 8 is taken only a few hundred meters from the intersection of Makati Avenue and Kalayaan Avenue; however, it shows a completely different environment. Picture 8 illustrates a side walk alongside Paseo de Roxas and is separated from the road with a low fence, bushes and trees. The trees are important because they provide shade and protection from the sun. The sidewalk is broad enough for people to cross each other without bumping into another person. Moreover, the sidewalk is well maintained without any holes in the ground or wandering garbage.

Picture 8 shows that there are very big differences in the infrastructure in Metro Manila, even within the same district. Thereby, this picture shows that urban developers are aware of a favorable pedestrian environment such as alongside Paseo de Roxas. But even alongside Paseo de Roxas, there are no bike lanes that cyclists and e-scooters can make use of. There are also no bike parking spaces where cyclists can safely park their bikes. Even though Paseo de Roxas shows great potential, there are still improvements to be done to make the street hospitable for cyclists.

Picture 8: Side walk Paseo de Roxas

Source: Observations of writer

4.1.2 Infrastructure Improvements

In this part of the thesis, I will elaborate on the experiences, ideas and comments of the respondents regarding the cycling infrastructure in Metro Manila. Thereby, the connectivity, distance and congestion are also discussed. Thereafter, the concept of bike sharing is discussed as well as end-of-trip facilities. However, first, it is important to make a clear what a bike lane is. According to the European Commission (n.d.) a bike lane is a legally reserved space for cyclists on the road and it has to be visually separated from traffic. Because cycle lanes only have to be visually separated from traffic and not necessarily physically, it is a fast, flexible and cheap solution on existing roads.

4.1.2.1 Visual Infrastructure

When asking the interview respondents what they think of the status of the cycle infrastructure in Metro Manila, most of them answered similarly: "Well, the infrastructure is just not there! There is a big difference between a not really good status and just not there" *(Gilbert Berba, December 17, 2019)*. The respondents were all united in their answers that there is no proper cycle infrastructure. Golda Hilario explained that "They created bike lanes, but the pavement is not fit for bikes. There are holes and trees in the middle of the bike lanes" (Golda Hilario, December 9, 2019). Rj Jali Jali shared this experience and commented that "[…main roads are] mostly paved but since we pass through a lot of side roads, they tend to be a bit unfinished and quire rough. Especially when it starts to rain, there can be a lot of gravel and loose rocks on the roads. That can be quite challenging" (Rj Jali Jali, December 4, 2019).

The infrastructure that is needed to cycle is just not there in Metro Manila. There is no space nor regulation for cyclists to use the roads. This problem originates from a lack of distinction in the classification of roads. Kevin Punzalan explained this:

> *"In the Philippines, there is a lack of distinction between major roads which are used to get from one district to another, and roads within a district which you describe as 50 km/h, and then the roads in residential streets which are used to access individual homes. The problem is that Manila did not follow a formal plan. So, often you see roads that are supposed to be major roads but with very densely packed establishments or homes along it. Because there are so many people, by default, there will be cars parked outside and lots of people on the street. So, even if that road was designed for fast traffic, cars have to slow down. It is no different from the actual purely residential streets where cars also have to slow down. There is a bigger problem there, it is about zoning and urban planning that has to be addressed if we want to properly segregate streets for particular urban traffic. Unfortunately, that is a topic I have seen no Filipino urban planner ever talk about." (Kevin Punzalan, January 9, 2020).*

Kevin's observation that there needs to be a distinction between the functionalities of roads is supported by findings of the European Commission (n.d.). Within built-up areas, there are two basic types of roads: low-speed and medium-speed. On low-speed roads, where cars drive less than 30 km/h, traffic can be mixed. However, on medium-speed roads where cars are allowed to drive up to 50 km/h, visually separated bike lanes are necessary. Outside built-up areas, there are also high-speed roads where bike lanes should be physically separated from the main road to ensure the cyclists' safety.

The bike lanes that are present in Metro Manila are still very car-centered and are not integrated in a bicycle network. Thereby, most bike lanes just stop at a certain point and cyclists are forced to cycle on the main road. In other areas such as BGC, the bike lanes are part of the side walk which regularly leads to conflicts between pedestrians and cyclists. Several interview participants mentioned that solely painting a line on the road to visually indicate a bike lane, is not sufficient in the Philippines. When people start to use bike lanes for different purposes, it poses a problem for cyclists. "There are areas where there are cycling lanes, but nobody is using it and then it becomes a place where people put their stalls and sell stuff" (Golda Hilario, December 9, 2019).

Thereby, there have been some attempts of the government creating bike lanes along busy access roads, such as the EDSA. According to Gilbert Berba: "The MMDA did create a dedicated bike lane but it […] just totally disappeared. Even the infrastructure was left behind. What used to be a bike lane, is more like a gimmick. It was tested and then just dropped. There was no real support for it." (Gilbert Berba, December 17, 2019). This experiment along the EDSA shows that cycle lane experiments involve more than merely painting a bike lane on the road. The infrastructure has to be maintained and traffic rules have to be enforced. According to Edward Douma, it would be interesting to test cycle infrastructure on side streets:

> *"If you look at side streets, those are relatively also packed with cars. I recall one time when we wanted to get to a restaurant and even all the side streets were loaded with cars. If you manage to create safe cycling conditions in those smaller side streets, there is no need to heavily invest in big bridges or cycle lanes. If you can limit the number of cars entering those streets and use those streets to create space on the streets to play, to walk, to cycle or to use any other kind of transport except for cars, I think it would be relatively doable and you only need to focus on specific intersections or main corridors and highways. […] So, if you manage to focus on those 30 km/h areas in the Philippines, there is no need for a separate infrastructure." (Edward Douma, April 28, 2020).*

Experiments like these on side streets are very accessible and cheap while it can lead to numerous opportunities for people to reclaim the streets.

Many of the cycle advocates that were interviewed said that there are more cyclists in Metro Manila than people notice. This is because they are not consolidated as a group, take up less space and

are not stuck in traffic. A lot of construction workers commute by bike. Metro Manila is rapidly developing and there are a lot of buildings being constructed. Therefore, there are many construction workers who cycle very early in the morning causing that others do not notice them. Thereby, most interview participants believed that more people will start bike commuting when there is proper and dedicated infrastructure. Lior Steinberg commented that:

> "In the end of the day, people are egoistic in the positive sense. Every morning they will make the right decision. You wake up and you think: 'Shall I get to work in a traffic jam and spend a lot of money? Or I go by bike, save a lot of money and get there in the same amount of time?' In Manila you are probably faster on a bike." (Lior Steinberg, May 5, 2020).

4.1.2.2 Connectivity, Distance and Congestion

According to several interview participants, the biggest problem with the connectivity in Metro Manila is the North-South division. There is sort of an invisible wall between the two parts of the city that withholds people to travel. Kevin Punzalan explained this:

> "That invisible wall is basically created by road networks which are exclusive. For example, Makati is kind of in the middle. If you were to travel south, you have no choice but to take an express way, which is only for cars. That is already a barrier for people who want to cycle or use another form of transportation. Second is costs, those express ways are not free. If you combine the costs and the limitations and the actual traffic congestion… it limits people. For example [for] me to go from where I live in the south to Makati takes me on average 90 minutes each way. If I were to travel to the north, it would take me at least 2 hours. That is not a small amount of time in a day." (Kevin Punzalan, January 9, 2020).

Because there is no connected cycle infrastructure, people do not see how near places are to each other in Metro Manila. In terms of actual distance between the districts, a lot is doable by bike. Even though Metro Manila is a big city, you can reach a lot by using active mobility. Karen Sison mentioned that "You realize that once you get on a bike, […] how close everything is supposed to be. It is such a big problem because people are always away from family and friends." (Karen Sison, December 11, 2020). Within 5 kilometers, there is a lot around you in a big city as Metro Manila that is easily accessible by bike.

As mentioned in the theoretical framework, congestion is a huge problem in Metro Manila. The congestion is caused by the volume of cars. Because there are so many cars, usually people cannot drive faster than 10 or 20 kilometers per hour. In the above citation, Kevin explained that his travel time to the embassy is 90 minutes by car each way. However, the distance between his home and the embassy is only 15 kilometers which would take him only 30 minutes by car without traffic. Rj Jali Jali estimates that an extra

3 to 5 kilometers adds an hour to your travel time during rush hour. This made him realize that everything within 14 kilometers is much faster to bike than to drive by car.

4.1.3   Bike Sharing

Bike sharing is a much-discussed topic to solve the issue of the 'last mile' (El-Assi et al., 2017; Bieliński et al, 2019). Shared bikes stimulate people to cycle the last mile to a work place. The last mile can be from a public transport station or from a parking garage to the actual destination. According to Kevin Punzalan, a shared bike-system enlarges the connectivity and reachability of places both for public transport users and for private car drivers. If you can rent a bike once you get off the bus or train, it would save time but still does not cost a lot of money. For car users, renting a bike would save them a lot of time because they are not stuck in traffic in their car. If there are big parking lots with shared bike stations outside of the city, people can park their car there and skip traffic in the city center on a rental bike. Because there are less cars coming into the city, the congestion will decrease. Thereby, a shared bike is very accessible because the costs are low and you don't have to buy a bike yourself.

However, a successful bike rental needs proper bikes. According to Aris Soriano and Karen Sison, there have been bike sharing-experiments in Pasig. Those only lasted for a few months because there were problems with the bikes. There was no one maintaining the bikes and therefore, many of the bikes were broken. Thereby, there was no system to trace the bikes. People could park it where ever they wanted and not return it to a bike sharing station.

Another problem that some of the participants foresaw is that Filipino's like to own things and would therefore not like to share a bike. Aldrin Pelicano argued that:

"Filipino's are not really on sharing things. Culturally, we love to own things. It is not really my own opinion. I got this from a bike shop manager. He told me that their experience in running a bike shop, they are really surprised that people love to customize their bike. […] Filipino's would buy the enter level bike and start replacing all the parts." (Aldrin Pelicano, November 26, 2019).

The private space is very strong in the Philippines. Therefore, it might take some time for Filipino's to adjust to a bike sharing system.

To implement a successful bike sharing-system, the MMDA should have a holistic approach that incorporates more than just bikes. It should be safe to cycle, there have to be proper bike parking areas and the bike sharing stations should be efficient. Thereby, according to Lior Steinberg, this system works best in cities that use a lot of public transport. In Metro Manila, many people use jeepneys. Once the jeepneys are incorporated in a modern public transport system, the shared bike stations can be at the

same location as the jeepney stations to enhance a smooth transition from the jeepney to a bike for the last mile. This holistic approach enables people to have more control over their time, have more mobility and flexibility and it is good for their health.

4.1.4   End of Trip Facilities

End-of-trip facilities are an important aspect for the choice whether or not to cycle commute. Naturally, people want to park their bike in a safe place where they do not have to be worried that their bike might get stolen. However, many building administrations in Metro Manila do not allow people to park their bike in the underground parking garage. These parking garages are meant for cars and thus they do not allow you to bring your bike inside. Georwyn Victor experienced this problem:

> "*I bought a folding bike, but our building administration didn't allow the folding bike inside the building, which is crazy. What happened is, I sold the folding bike and bought an older second-hand bike, so I could be more confident in parking the bike outside the building. […] I always have to think of where I can park my bike." (Georwyn Victor, December 9, 2020).*

If building administrations would modernize their parking policy, more people would be able to park their vehicle in the parking garage. One parking space for a car takes up the parking space for ten bicycles.

Rules regarding parking spaces around public establishments such as coffee shops are different in every city in Metro Manila. Myles Delfin mentioned that there is an increased amount of bicycle parking spaces around shopping malls, universities and offices. Aldrin Pelicano argued that some Starbucks branches now provide bike parking. He believes that this can benefit their business as the coffee shop becomes better reachable. However, in Quezon City, the situation is different. Karen Sison mentioned that there is an ordinance in Quezon City that all public buildings should have bike racks. Unfortunately, this ordinance is not implemented and even government offices do not have proper bike parking facilities.

Other crucial end-of-trip facilities are showers and changing rooms at the work place. Because the Philippines has a tropical climate, day temperatures usually reach 30 degrees Celsius or more. This makes people concerned about being sweaty and tired when they arrive at their destination. Not many buildings in Metro Manila provide showers and changing rooms. However, there are 'green building certifications' for buildings that do provide these facilities. Thereby, bike commuters usually bring a set of office clothes to change at their work place. Cycling advocates like Aldrin Pelicano and Georwyn Victor also create YouTube videos about the best way to pack your office clothes and how to bring these along during the cycle commute.

4.2 Software and Sustainability

The following part is focused on the connection between cycling software and sustainability. First, I describe the Filipino mindset regarding cycling and the complications. Second, the weather conditions also influence the decision whether or not to cycle. Third, education can help to change the Filipino mindset and to encourage people to cycle. Fourth, communication and promotion regarding cycle commuting is highlighted. The fifth part of cycling software is dedicated to safety. Finally, the last part is about the private sphere and how the current traffic situation limits social and economic lives of Filipino's.

4.2.1 Filipino Mindset

The Filipino transport system is very car centered. Likewise, Filipino mindsets are also very car centered which has a big social impact. Edward Douma mentioned that there is a certain attitude towards the status of cycling. This is because the less fortunate are the ones on a bike. Therefore, the moment people start earning more money, they are less likely to bike. Lior Steinberg also referred to this and mentioned that the car is seen as a status symbol, whereas a bicycle is for poor people. Thus, having a car in the Philippines means that you have economic success. This mindset that cycling is for the poor needs to change into the idea that cycling is a classless activity. Kevin Punzalan addressed that: "[…] class perceptions of activity and ways of getting things done can affect whether or not people accept you. There has to be an effort to show that cycling isn't something done out of desperation but as something that is good for everybody whether you're rich or poor, young or old." (Kevin Punzalan, January 9, 2020). Mia Buano also mentioned that biking is an equalizer, it creates a sense of community because it makes people more sociable and accessible. In order to move to a cycle-friendly city, the mindset should be that the bicycle is a modern way of moving around for everyone.

At the moment, cars are the superior mode of transport in Metro Manila. Yummy Santos feels that car drivers treat her like a no one when she is bike commuting. Rj Jali Jali agrees with her and mentioned that car drivers tend to think of cyclists as lesser beings. According to Myles Delfin, this is because there is a lack of consciousness about the space that people, vehicles and bicycles occupy on the road. Because there is no mutual understanding between road users, dangerous situations occur. Mia Buano also sees that there is anger among road users:

> *"Cycling in Manila is both lifesaving and life threatening. Life threatening because all the issues of road safety. […] It is an interaction with the community. I also look at it as lifesaving on so many levels. It frees you as a person, I think it makes you a better and happier person. When you ride your bike, you have the opportunity to be part of your community and create a sense of community. […] I have been bike commuting since 2001. I have seen how the roads have*

changed. Both infrastructure-wise and how the people use the roads. I think a lot of people are less kind. Maybe because of the stress on the road. When you ride your bike, you have the opportunity to become the force of good. Bikers are smiling all the time instead of being stuck in traffic." (Mia Buano, December 9, 2019).

According to Mia, cyclists are happier citizens because they are not stuck in traffic for hours every day. Lior Steinberg agrees with her and arguments that societies can completely change because of an increase in cycle commute:

"Society is becoming calmer because imagine being in a city like Manila, millions of people start their day with a fight. If you have a nice city where you can just slowly cycle and get to work in a chill way, the entire mentality of a country can change, just by changing one hour in the morning and one hour in the evening." (Lior Steinberg, May 5, 2020).

Commuters who are stuck in a traffic jam in their private car only see the cars around them or perhaps they would play with their phone. Whereas cyclists are more aware of their surroundings and therefore, they get to appreciate their city more.

Next to being more aware of their surroundings, cyclists get physical activity during their bike commute. In a densely populated urban area, the only physical activity you are able to get is if you have a gym membership. However, many Filipino's cannot afford a gym membership in terms of costs and lack of time. Karen Sison mentioned that one of the reasons why she started bike commuting is because she constantly felt tired and sluggish. Once she started biking, she had more energy, started to feel healthier and her endurance increased. Thereby, Aldrin Pelicano argued that cycling helps to clear your mind after a stressful day at work.

However, in order to profit from all these benefits, Filipino's need to accept that cycling is a way of commuting and not just a recreational activity. Golda Hilario argues that the first step to perceive cycling as a mean to commute is that it should not be perceived as a dangerous activity. It is only dangerous when road users do not respect each other. Keisha Mayuga mentioned that cycling should become a mainstream activity:

"It will take a while for a person to convince another person that cycling can get you from point A to B. I think that is what we are missing in the narrative of our culture of cycling is really to normalize it. To make it an option, not just an alternative but really an option to cycle. I guess the mainstreaming of it hasn't really gotten there." (Keisha Mayuga, December 9, 2019).

Once people realize that cycling can be a mainstream activity, they can experience that in many cases, cycling is much faster than driving a car. Biking is more than a leisure activity but can be used a commute from A to B.

4.2.2 Influence of the Weather

As I have mentioned earlier, the Philippines has a tropical climate. This means that day time temperatures can rise to about 37 degrees Celsius during the hottest months of the year. The weather is an easy excuse not to cycle and is used by many Filipino's. Aldrin Pelicano gets a lot of comments about this on his Facebook page 'Manila Moves'. People comment that it is too hot to cycle and that they do not want to arrive at their office sweaty and dirty. Aldrin argues that this idea is childish and easily solvable if you are prepared and allow time to fresh yourself up.

There are more ways to work around the issue of temperature. Aris Santos mentioned that cycling becomes more attractive when bike lanes are provided with shade. Trees next to the bike lane provide shade and increase the attractiveness of cities. Thereby, it is important to dress for the sunny weather, so you do not get burnt. Another solution to cope with the climate might be the use of electric bikes. E-bikes allow you to have less resistance and therefore you can pedal less and sweat less. Yummy Santos mentioned that there is already an increase in the use of e-scooters in Metro Manila.

4.2.3 Education Possibilities

The situation for bike commuters at the moment is that they have to anticipate to the behavior of motorized vehicle users. Yummy Santos and Rj Jali Jali explained to me that while they are cycling, they are constantly reading the cars and anticipate on their movements. They say that knowing how to drive a car, makes it is easier to anticipate on other car drivers. According to Mia Buano, schools teach the children basic safety rules on the roads, but they do not emphasize the actual practice. Thereby, Edward Douma explained that the testing system for drivers' licenses is very limited in the Philippines. Drivers do not get tested on their knowledge of how to deal with cyclists, how to behave in traffic or how to apply the right rules for cyclists and drivers. In other words, education about cycling is lacking in the Philippines.

To create more awareness about cycling among Filipinos, some respondents argued that schools should educate children about bike commuting. Cycling being taught at a young age, children grow up with the idea that cycling is mainstream and something you can do on a daily basis. Mia Buano argues that teaching children about cycling goes beyond merely bike commuting:

"In school they teach safety on roads, but they don't give emphasize on the actual practice anymore. […] It's not only a culture of biking, it's a culture of being kind. And reinforcing it in school, children tell their parents after school and then their parents also get pressured. As parents, they have to affirm their children about the right thing to do." (Mia Buano, December 9, 2019).

When children learn about cycling in school and experience how much fun it is, they can influence their friends and parents to cycle as well.

The Dutch Cycling Embassy facilitated a successful experiment about cycle education in New Zealand. The DCE worked together with schools, a private organization and municipalities to organize bike classes and to teach children how to cycle. Because there was no safe environment to learn how to cycle, they created a cycle track around the school. This provided the children a safe environment to get familiar with riding a bike. To make the experiment accessible to all children, the DCE arranged a container full of second-hand bicycles. In this way, children from families that do not have the financial means to buy a bicycle could still be part of the experiment. An experiment like this one could be very feasible in Metro Manila because it is a small-scale project. It can start at one or two schools and once it shows results, it can be implemented in other schools. Because there is a collaboration between schools, private organizations and municipalities, this project is not completely reliant on school funding.

Nonetheless, a crucial condition for schools to teach children about bike commuting is that the practice itself is safe. This means that there needs to be a proper infrastructure for cyclists. Thereby, cyclists should be respected as road users by motorized vehicle users. If bike commuting is not safe, it is unlikely that parents will allow their children to cycle to school or even in their neighborhoods.

4.2.4   Communication and Promotion

Communication and promotion tools are adopted by government agencies and cycling advocates to influence the perception of cycling (Harms et al., 2016). Many of the cycle advocates that are interviewed, mentioned that they help their friends or family to start bike commuting. It empowers and inspires people to see a friend being able to bike commute, this makes them believe that they are also able to do it. Thereby, cycling is more accessible for starters when they commute as a group. Mia Buano pointed out that there are monthly group bike rides to make other road users aware of cyclists. She wants to encourage the conversation about cycling to make it sexy and attractive again.

Yummy Santos hopes to spread awareness by posting about her commutes. She films about how she packs her office clothes and which route she and her husband take to get from their home to their offices. Georwyn Victor has a YouTube channel with 60.000 followers with which he tries to influence

a young audience to bike. He notices that over the last few years, there is more online content about cycling. By reaching out to the youth, Georwyn hopes that they become the future bike commuters. Social media is very influential in the Philippines; the country is even referred to as the 'Social Media Capital of the World' (The Asia Foundation, 2018). On average, Filipino's spend four hours per day on social media, especially on Facebook, and has therefore the highest social media use in the world. Rj Jali Jali mentioned this as well and he thinks that it is key to have a popular figure promote cycling on social media. Popular figures who promote cycling can influence millions of Filipinos on social media which can have a big impact to increase bike commuting.

Karen also notices this social media trend at her platform Cycling Matters. The goal of Cycling Matters is to inform people about cycling because there is not enough information available in the mainstream media. Karen and her peers create podcasts where they discuss different cycling matters and news about cycling. Myles Delfin and the BikeScouts also create podcasts to help mainstreaming cycling. He has been working for cycling magazines and he posts his photography on Instagram.

Myles believes that the combination of social media and an attractive environment is the perfect combination to convince people to start biking. Kevin Punzalan agrees with Myles that an attractive environment helps to engage people with cycling:

"I think it is better to use attraction in convincing people to use their bike: create an attractive environment so that it becomes something that people would like to do. Show the advantages instead of just telling people what to do. You can do this by improving pedestrian and cycling infrastructure. Making sure there are wide enough sidewalks, wide enough cycle paths, dedicated biking, making sure that commercial areas have shower facilities." (Kevin Punzalan, January 9, 2020).

Myles added that attractive environments are green spaces like parks with coffee shops or libraries. If people have a reason to go out and enjoy the environment, that would encourage them to use bikes. When Lior Steinberg and Edward Douma were in Metro Manila, they went to a bike festival in Intramuros. The streets were closed for motorized vehicles, so people could enjoy the historic part of Metro Manila. At the festival, the were stalls where you could buy local produce, people could rent bikes or e-scooters and there were performances by the local community. Lior argues this is the perfect way to show people how cool and useful bicycles can be.

Thereby, the practical part of bike commuting should also be communicated. Gold Hilario mentioned that it is important to know who the target group is that we want to start bike commuting. If it is the young professionals who work in big office buildings, we should create campaigns around their needs. They want to arrive at their work place or schools good and fresh looking. Therefore, communication and infrastructure should address that. Keisha Mayuga also mentioned that it is

important to know how many cyclists there are in Metro Manila. If the numbers are known, communication strategies can be created around that.

4.2.5   Bike Safety

I have asked all the interviewees whether they think it is safe to cycle in Metro Manila. Even though all cycle advocates bike commute regularly and all cycle experts have experienced it at least on time, they all agree that cycling is not safe in Metro Manila. Gilbert Berba answered: "You risk your life when biking on the streets. There is no respect for bikers. There has to be this discipline of proper sharing between vehicles and non-motorized vehicles." (Gilbert Berba, December 12, 2020). Golda Hilario mentioned that it is engrained in the Filipino culture that cycling is not safe. Many Filipinos grow up in cities where the sign is that there are houses and streets; streets and made for cars and not for cycling and walking. This example shows how much the Filipino mindset is aimed at motorized vehicles. The lack of a proper public transport system also causes struggles for cyclists. Jeepneys switch lanes without signaling, park in the middle of the road and drive very aggressive. Thereby, it is also not safe to ride a jeepney. Even the railway system is not safe because there are too many people using it. Yet, Filipinos still use those means of transport.

Kevin Punzalan argues that if we were to make cycling safer in Metro Manila, there has to be a conscious effort to penalize those who violate the traffic rules and those who cause accidents. According to Kevin, there is a disregard for pedestrians and cyclists. Thereby, there is a limitation in the law regarding reckless driving. Kevin explained that there is only one law that allows for a car driver to be penalized in case of an accident. This law does not make a distinction between a car hitting another car or a car hitting a person. There is even no distinction when this accident leads to fatalities. There should be a law created to protect pedestrians and cyclists from motorized vehicles. Car drivers have a greater responsibility and therefore they need to be more conscious and respect pedestrians, cyclists and their space on the roads.

Another aspect of bike safety is female discrimination. All women that I have interviewed were asked if they notice that their cycling experience is different because they are a woman. Jen Espinosa answered that when she is with a group of BikeScouts, she is usually the only woman in the group. However, she does feel like she is respected and accepted, and more women are involved than before. For women who cycle independently the situation is different. Both Keisha Mayuga and Karen Sison have been catcalled before. Other people shout at them that because they are ladies, they should be proper and should not cycle.

Mia Buano has been involved in a project to count bike commuters. She has counted cyclists four times from 4 to 7 p.m. During those four counts, there was only one woman in one count. Keisha counts female cyclists on her own initiative. Usually she sees one woman out of ten or fifteen cyclists.

These numbers show that there is a lot to improve upon to make women feel like they are free and safe to cycle.

4.2.6   Private Sphere

The following paragraphs describe the influences of the traffic situation in Metro Manila on the private sphere of Filipinos. This is classified according to social lives, working lives and the costs of transportation.

Because of the traffic situation, people living in Metro Manila experience limitations in their social lives. Those who live in the North are not able to go to a more southern city on a weekday since it would cost them too much time to travel. Paula Valencia said that she does not meet with friends who live in the south because it is difficult to go there. Public transportation is too overcrowded, taxi service Grab is too expensive and if she would drive by herself it would take too much time. What people have to consider is whether it is worth it to spend four or five hours in traffic to see their friends for one hour. Families also experience these problems. Parents who drive to their work every day and are stuck in traffic for three hours each way miss six hours in their children's life on a daily basis. Thereby, spending so much time in traffic makes people angry, tired and not very sociable.

On the other hand, cycling is a social activity. On a bike, you are able to chat with your friends, get exercise and go to your destination at the same time. Cycling brings people joy as they are able to appreciate their surroundings and they get to feel healthy. Karen Sison emphasizes this as she is also part of a cycling team. Many of the cycling advocates meet up regularly with their peers to cycle as a group and to teach biking to newcomers.

Next to limitations in people's social lives, there are also limitations to their working live. At the moment, employees are encouraged to work from home. When they go to the office, they arrive late because of traffic. According to Paula Valencia this is an accepted truth because not only employees are late but employers as well. The same thing happened to Georwyn Victor who left his job last year because the commuting experience got too bad. Lior Steinberg mentioned that there is a friction between the work that is done, and the work that could be done:

"Every minute spent in a traffic jam costs money. If you think that you have millions of people stuck in traffic every day. People are making work decisions according to traffic which means that there is a friction between the great work they could have and the work they took. Something that is very difficult to measure is transportation justice. What most people forget is that there are a lot of trips not done because of traffic. People who cannot visit family is a lost opportunity. If you look at a city like Manila, the gap between people is getting worse because poor people cannot afford to make trips and therefore there is no justice." (Lior Steinberg, May 5, 2020).

Lior mentions 'transportation justice' with which he means that it is unfair that many trips cannot happen because of the traffic situation. Poor people tend to be the victim of transportation justice and therefore, a larger gap between the poor and the rich emerges. In other words, there is a connection between how congested a city is and how much money is lost in the economy because of it.

Joshua Ambayec notices that the productivity at work is very low because people arrive at their work place exhausted from their commute. Kevin Punzalan mentioned this as well and gave an example about having meetings in Metro Manila. It is impossible to plan more than two meetings in one day in different districts in the city. It takes quite some time to travel from one meeting to the other which is a lot of unproductive time. This can be very frustrating because business men cannot use their time efficiently.

Next to inefficient and unproductive work days, the costs of commuting have a significant impact on the lives of many people in Metro Manila. In the Philippines, wages are quite low which means that Filipinos do not have much money for daily expenses. Several interviewees mentioned that they save money because they bike commute. Rj Jali Jali spends at least P500 (€8,93) per day if he brings his car to work for parking and gas. If he uses public transport for his commute, he spends P300 (€5,36) every day. Keisha Mayuga tracked all her commutes for a week to see how much the costs would be if she would have taken a Grab every time that she cycled. By cycling everywhere, she saved P3000 (€53,57).

Filipinos emphasize that they live in a third world country which makes it difficult for them to financially make ends meet. Once you have a bike, commuting does not cost anything. Thereby, according to Kevin Punzalan, many Filipinos have basic mechanical skills which makes it easy to maintain the bikes. Lior Steinberg pointed out that the quality of life also increases when people do not have to spend half of their income on a car or their commute.

4.3 Orgware and Sustainability

The following paragraphs discuss the orgware of cycling and sustainable development. First, necessities for policy are described as well as two policy measures. Second, government cooperation between the different cities of Metro Manila and the MMDA is outlined. Finally, the pollution as a result of motorized vehicles in Metro Manila is discussed.

4.3.1   Policy

For cycling to become mainstream, it is important that there are policies about cycling. Aldrin Pelicano mentioned that at the moment there is a rising number of private vehicles in Metro Manila. Because there are more private vehicles, there is no space on the road nor policy for bicycle users. According to

Myles Delfin, the lack of cycling policy is because there is no data about commute cycling in the Philippines. The available data is only focused on recreational cyclists. Thereby, bike routes are not shown on heat maps.

Because there is no particular cycling policy in the Philippines, people do not adhere to traffic rules about bike lanes. Myles Delfin gave an example:

"[In] Pasig there are protected bike lanes but then you see motors using those bike lanes. There is no enforcement happening. For me the enforcement is 50% of the problem, the other 50% is the people who violate the rules. (Myles Delfin, December 9, 2020).

Keisha Mayuga notices the same problem at the University of the Philippines which is the biggest university in Metro Manila located in Quezon City. They created a cycle network to move around campus, but students use the bike lanes as a sidewalk as well. Because there is no enforcement, you cannot get penalized for walking on the bike lane. Therefore, the rules of bike lanes as being a space on the road dedicated to cyclists are not strictly followed.

In order to implement cycling policy, it is important for traffic enforcers to know the rules and how to deal with cyclists as well. Generally, Filipinos do not adhere to traffic rules at all. Therefore, during rush hours, there are traffic enforcers at all the intersections to regulate the numerous vehicles. To guarantee safety for cyclists, the traffic enforcers should know where on the road cyclists should be and when they are allowed to cross the road. For example, they should know whether cyclists cross the intersection at the same time as cars or at the same time as pedestrians. There is some urgency with this because more people are starting to use e-scooters to commute in Metro Manila. The traffic enforcers may opt to treat the e-scooter users the same way as cyclists. Gilbert Berba experiments with these rules for cyclists in one of the real estates of Ayala Land. He argues that it is important for traffic enforcers to have education regarding cycle rules.

The MMDA is responsible for the traffic regulation in Metro Manila and to coordinate between the seventeen cities. The organization publishes documents about the allocation of their budgets and targets on their website. In 2018, the MMDA spent P1.027 million (€18,3 million) on 'safe and smooth flow of traffic in Metro Manila'. This money is spent on the ferry service, pedestrian footbridges, heavy traffic, traffic signals and others. However, there has not been money allocated to cycling infrastructure nor policy. In 2019, this changed and P62 million (€1,2 million) was reserved for bikeway development. Even though this is not a hefty budget for bikeways in such a big city, the MMDA showed that they know they should invest in cycling. Unfortunately, in 2020 there was no money allocated to bikeway development and a minimal budget for the 'maintenance of various transport facilities and infrastructures'.

In 2017, the Philippine Statistics Authority published a list of SDG indicators to monitor the progress the Philippines has made to achieve the goals. In this document, there is no mention of bicycles

to promote sustainability. The Philippine Statistics Authority only mentions that there should be a focus on passenger and freight volumes in transportation. In other words, they focus on how to move more people with motorized vehicles. Thereby, the Philippine Statistics Authority published an informational and promotional brochure about the SDGs and how they aim to achieve the SDGs. In this brochure there is also no mention of sustainable transport nor cycling.

Nevertheless, in many countries all over the world, we see cycling policies emerging to convince people to cycle and to make the cycling environment attractive. I have asked the interviewees about two of those policies and whether they think it would have an effect when it is implemented in Metro Manila. The first policy is limiting the speed limit in residential areas to 30 kilometer per hour. Aldrin Pelicano's response was that it is not possible for children to play on the streets anymore because too many vehicles drive too fast. If the government would find a way to regulate the speed limit, he thinks that it would encourage parents and children to play and live on the streets again.

What many respondents brought up was that the speed limit is not so much of an issue in Metro Manila, but the number of cars is the real problem. Lior Steinberg described it as follows:

"It is not only about the speed of cars but also the amount of cars. In the Netherlands there are a lot of streets where you can only drive 15 and it is pleasant to cycle there, you mix the traffic. But in Manila, it will not work with the amount of cars. It is very difficult to cycle in a traffic jam: the cars are close to each other, there is not much space, you feel the cars around you that are very hot. Thus, you have to work on the speed and on the number of cars. When there are too much cars per hour, you build separate infrastructure. It is very easy to look at Manila and say that traffic is very slow, so you can cycle. This is not the case." (Lior Steinberg, May 5, 2020).

Because there are so many cars on the road, they can barely drive faster than 20 or 10 kilometers per hour. Thus, according to the respondents, the speed limit is not the problem. The problem is that because of the number of cars, there is no space on the road to cycle.

The second policy measure that I have asked the respondents about is the implementation about car free days. Edward Douma told me that the DCE has been involved in these experiments before in Bogota and Rio de Janeiro. In those cities, they regularly close the roads for motorized vehicles in order for people to organize events and initiatives along the roads. People are selling homemade cookies, there are social activities and children are playing on the streets. Car free days allow people to claim the street and at the same time, they can have some economic value out of it. When Edward Douma and Lior Steinberg were in Metro Manila, there was a car free day festival in Intramuros which was a huge success.

Other interviewees mentioned that in Pasig, a city in the east of Metro Manila, closes some roads every Sunday. Golda Hilario sees that people are reclaiming the streets there. For her, that is how Metro

Manila should have been with cyclists, Zumba dancers and people selling food on the streets. Keisha Mayuga implemented car free Sundays at the University of the Philippines. She sees that if you let it happen, people will come, and it becomes a community. Kevin Punzalan lives in Alabang and there are car free Sundays there as well. He notices that it becomes quite crowded with cyclists there. Because this area is not fully built up yet, there are not many car drivers there.

In order to implement car free days, policy makers have to be strategic with the areas they chose to close. Keisha Mayuga mentioned that the MMDA once closed the EDSA but that didn't make sense because it is the main road in the metropole. Thereby, there are no opportunities to create a community on a highway. Gilbert Berba argues that car free days could work but then there has to be an alternative form of transportation. He thinks it is important to have a proper public transportation system to partly replace cars during those days.

4.3.2   Government Cooperation

In the theoretical framework, I emphasized that the most effective way of implementing cycling policy is to start with a solid local government with knowledge about cycling (Civitas, 2020). When municipalities work together with other organizations and connect cycling policies to other priorities in that municipality, it is possible to generate recognition and funding. However, this is quite a complicated matter in Metro Manila. Gilbert Berba explained to me:

> *"[…] In this country, the local governments are very empowered on their own. If they really want to, they can do it. They have to prioritize it. In terms of interconnecting this together, we have the MMDA. They have to tie it all together and go beyond boundaries." (Gilbert Berba, December 17, 2020).*

The seventeen cities of which Metro Manila is comprised of all have their own local government unit with its own mayor. The MMDA is supposed to regulate and supervise all the traffic in the metropole and to connect the different cities.

However, many of the interviewees said that there is no real cooperation between the MMDA and the local government units. Thereby, private property developers are also very influential in the Philippines and should thus also be included in holistic policy programs. Cooperation between these stakeholders is very important because bicycle networks should be planned holistically. A cycle network is not efficient when it stops at the end of a neighborhood, the whole city should be included. Golda Hilario mentioned that cycling is just not a priority for most of the local governments and thus, they do not allocate much of the budget to the improvement or expansion of cycling infrastructure.

Myles Delfin has been working together with a lot of local governments to advise them about cycle policy. He notices that the local governments are still below the foundation of understanding what they should do to improve the cycling network. Myles sees it as an opportunity of the cycle community to help them understand what they need and why. However, the political part of governing is part of the problem. Mayors are concerned with getting reelected and winning more votes. Therefore, they cannot overturn the whole infrastructure in their constituency from one day to the other because that would agitate many voters.

4.3.3   Pollution

The air quality in Metro Manila is strongly affected by pollution (Mongaby, 2020). Annually, the pollution leads to 4000 deaths in the capital region of the Philippines. The air quality is usually at its worst after New Year's Eve because of all the fireworks. In January 2020, the situation was even worse than in previous years because of the eruption of the Taal Volcano which is south of Metro Manila. Most public utility vehicles such as jeepneys are rather old which also causes more pollution. The poor air quality is not encouraging people to cycle more often.

According to Lior Steinberg, the only way to solve the pollution problem is to focus on public transport and cycling to reduce the pollution. The use of private cars will only make the problem worse. Many cycle advocates that were interviewed expressed their concerns about the effects of pollution on their health. Most of them bike while wearing a mask to prevent breathing in toxic air. Gold Hilario advices people to cycle early in the morning before most cars are on the road. At those times there is less traffic and fresher air which makes cycling more enjoyable.

4.4 Cycling and Sustainable Development

Above I have described the responses that the interview participants gave during the interviews. Together with my own observations and documents from the MMDA, this illustrates the current state of the cycling infrastructure in Metro Manila. In this part of the thesis, I will connect all this information to the SDGs and answer the sub questions that were formulated in the first chapter.

The first sub question is: '*How can cycling hardware contribute to achieving the Sustainable Development Goals in Metro Manila?*'. First, cycling hardware contributes to the first SDG: 'end poverty in all its forms everywhere'. As mentioned above, wages in the Philippines are quite low, therefore people do not have much money for their daily expenses. Proper cycle infrastructure allows them to go to their work without having to pay to get there, this increases job opportunities. A good example of how cycling decreases poverty is that many construction workers are bicycle commuters. Even though they get a low pay, they are still able to work without initial costs. The second SDG that hardware contributes to achieve is associated with the first: 'end hunger, achieve food security and

improved nutrition and promote sustainable agriculture'. In general, access to food in Metro Manila itself is not a problem because there are many supermarkets. However, fresh produces to improve nutrition are a problem because those are very expensive. It is imaginable that part of the costs is allocated to the transportation of the products. It takes a lot of time to transport fresh food from the villages north and south of Metro Manila into the city. Thus, if the city would be less congested, transportation would be more efficient, prices may decrease, and food accessibility improves.

The third goal that cycling contributes to achieving is the sixth SDG: 'promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all'. By resolving the transport system problems, the interview respondents believe that the Philippine economy will grow. The division between north and south has a huge impact on economic development as people are not able to work in different parts of the city, transport goods or have a meeting 10 kilometers away from their office. Golda Hilario told me that in the year 2000, P3.15 million (€56.250) is lost every day in Metro Manila because of traffic and that this number has probably increased by now. Thereby, employees are encouraged to work from home which may limit their professional development. Cycling also promotes sustained, inclusive and sustainable economic growth because it creates jobs in the industry sector, education and tourism.

Finally, cycling hardware contributes to a fourth goal, the seventh SDG: 'build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation'. Many interview respondents agreed that when there is more and resilient infrastructure, more people will start bike commuting. Once commuters notice that cycling has a lot of personal benefits, they will gradually shift to that mode of transport which will lead to less congested roads. However, cycle infrastructure is crucial for this trend to happen.

The second sub question is: '*How can cycling software contribute to achieving the Sustainable Development Goals in Metro Manila?*'. There are five SDGs that are contributed to by cycling software. The first one is number three: 'ensure healthy lives and promote well-being for all at all ages'. In general, bike commuting contributes to a healthy lifestyle because it provides daily physical activity. Knowledge about nutrition is very scarce in the Philippines, and thereby, rice and fast food is very cheap. During my morning commute which was a twenty-minute walk from my apartment to the embassy, I would pass by several fast food chains. There were always people going in and out as early as 8 a.m. to have a burger, fried chicken, fries and rice. The combination of a lack of physical activity and a lack of nutrition causes that many Filipino's are obese. By cycle commuting, Filipino's get the chance to have daily physical activity which will increase a healthy life style. Thereby, when more people are cycling instead of using a private motorized vehicle, there are less CO_2 emissions in the air which makes cycling itself a healthier activity. Aldrin Pelicano, one of the bike advocates that I talked to, mentioned that he started to get a bad cough because of the pollution. He now wears a special mask to prevent to inhalation of the polluted air. However, most of the cycle advocates, including Aldrin, mentioned that they feel healthier, more energetic and stronger because they cycle on a regular basis.

Cycling software also contributes to SDG four: 'achieve gender equality and empower all women and girls'. In order to illustrate how cycling software contributes to gender equality, I have asked all female interviewees about their experiences with being a female cyclist. Two women told me that they have been catcalled before while they were cycling. This shows that there are clues that female cycling is less accepted than male cycling. The women also told me that when they count how many cyclists they see and how many of those are female, those numbers are very low. Keisha Mayuga counts that usually one out of fifteen cyclists she passes are female. Whereas Mia Buano has been involved in official bike count and she has only seen one woman in four counts. The interview participants do not know what the reason is why there is such a big gap between male and female cyclists. It can be argued that this is because of bike safety. Bike commuters risk their life because the traffic situation is so dangerous for them. It can be argued that this gap exists because women and girls are more cautious and concerned with their own safety. However, when more girls and women start cycling, there will be more equality on the roads and it gives them more opportunities to visit places.

The third SDG that cycling software contributes to is the seventh: 'build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation'. As I mentioned before, better infrastructure will lead to more cyclists. However, the mindset of Filipino's has to change in order for a big cycling movement to emerge. The interviewees told me that there are problems with the perceived image of cycling. Filipino's think that only poor people cycle because they cannot afford a car. The car is a status symbol in the Philippines and class perceptions are very important for people to accept you and to work with you. A conscious effort should be made to change this image of cycling so that more people use the renewed infrastructure and a sense of community emerges. Thereby, when more people cycle, it becomes safer for cyclists. Their place on the roads is more accepted and respected when there is more use of bike lanes.

The fourth SDG that cycling software contributes to is: 'take urgent action to combat climate change and its impacts'. Bike commuting is a very accessible measure to take individually. Yummy Santos and Rj Jali Jali are a married couple that I talked to and they told me that they started bike commuting because they are afraid that their daughter will not be able to enjoy nature like they were able to. All other interviewees are aware of the carbon footprint of motorized vehicles and are proud to take climate action. Climate change due to pollution is very visible in a city like Metro Manila. The embassy is located on the twenty-sixth floor of a building in the middle of Makati which is in the center of Metro Manila. On sunny days when it had rained before, the view would reach very far, and I was able to see the sea and the mountains that are located 47 kilometers away. However, on days where it had not rained, and the pollution was not washed away, I could not even see the next building.

The fifth SDG that cycling software contributes to is: 'strengthen the means of implementation and revitalize the global partnership for sustainable development'. The cycling advocates that I interviewed are all part of bike commuting communities. Through their own communities they teach others how to bike, they commute in groups and they organize events. The BikeScouts are even

volunteer bike messengers when a natural disaster has hit the Philippines and people are cut off from the outside world. The cycle experts are also involved in the global partnership for sustainable development in their own way: through the embassy, private developing companies or as consultants. All interviewees understand the fact that we have to help each other and work together to create a global partnership for worldwide sustainable development and that cycling can be an important factor for sustainability.

The third sub question is: '*How can cycling orgware contribute to achieving the Sustainable Development Goals in Metro Manila?'*. Cycling orgware helps to achieve five SDGs. The first two are goal number five: 'ensure access to affordable reliable, sustainable and modern energy for all' and goal number nine: 'ensure sustainable consumption and production patterns'. The transport sector is the largest consumer of energy in the world (Mrkajic et al., 2014). Especially urban transport is problematic because it has a lot of impact on the livability in cities. Cycling is a form of modern transport because it uses renewable human energy. This idea is already adopted by some fast food chains in Metro Manila that use bikers to deliver food to customers. Government agencies should invest in active mobility both for commuting and for delivery services. Metro Manila is a big city, but it is also densely populated. Therefore, there is a lot available within a reach of five kilometers. These short distances are easily bike-able if the government provides the means for people to use affordable, reliable, sustainable and modern energy in the form of bicycles. Thereby, consumption and production patterns are more sustainable when the mode of transport is not motorized but active human energy. If government agencies provide people with the means to consume and produce sustainable by the use of bicycles, it becomes more easily approachable for people living in the city to contribute to conserve the environment.

As mentioned above, cycling hardware contributes to achieving goal six: 'promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all'. However, cycling orgware is also very important to reach this goal. Many of the interviewees believe that by resolving the traffic problems, the economy will grow. In order to resolve this, the local government units of the seventeen cities and the MMDA should work together to create a holistic plan for the entire metropole. A holistic bike network contributes to economic growth because it decreases city congestion. The congestion causes that car drivers arrive at their work angry as they started their day with a fight on the road. Therefore, they are tired, frustrated and low in energy. This is not conductive for an efficient and positive word day and will therefore not contribute to sustained, inclusive and sustainable economic growth.

Cycling orgware also contributes to goal seven: 'build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation'. It is the responsibility of the MMDA to coordinate with the seventeen cities of Metro Manila about a transportation system. When more people use cycling infrastructure, it becomes more legitimate for government agencies to invest in cycle infrastructure. This is because people see others using it instead of being a waste of space because nobody uses it. However, in the last three years, the MMDA has only once invested in a bikeway

network and this investment was quite minor. There is a lot to gain in Metro Manila when the government agencies cooperate and build resilient infrastructure to foster innovation and sustainability.

The final SDG that cycling orgware contributes to is number eight: 'make cities and human settlements inclusive, safe, resilient and sustainable'. Some of the respondents mentioned that by closing streets for motorized vehicles once a week, people claim the streets and a community emerges. Neighbors are selling homemade products on the street, children are playing, people are dancing and gather around for social activities. By restricting car use in a way that people can enjoy the streets and move around on bikes, cities become inclusive, safe, resilient and sustainable. It creates a positive and energetic atmosphere where people can enjoy each other's company. In order to implement this, government agencies should work together with local stake holders.

Chapter 5: Conclusion and Discussion

The aim of this study has been to contribute to the literature about the sustainable effects of cycling on both the environment and humankind. In Chapter 4, the results of the interviews, observations and documents are described. Thereby, I have answered the three sub questions of this study. This chapter provides an answer to the research question and the implications for cycling. Thereby, the research limitations and suggestions for further research are discussed. Finally, while writing this thesis, the whole world has been in the ban of the Covid-19 virus. The virus has had a huge impact on societies worldwide. Most of those effects are very negative. However, due to the virus, bike culture has a revival and many cities are investing in a renewed bicycle environment.

5.1   Research Question

The focus of this thesis has been to analyze sustainable development in Metro Manila and how it is influenced by cycling in recent years and the possibilities for the future. Cycling has many different aspects and to make a clear division in the maze of possibilities, I have adopted the distinction from the DCE. The DCE defines cycling hardware, software and orgware. The three sub questions were defined according to this distinction in chapter 1 and are answered in chapter 4. This paragraph provides an answer to the following research question:

How can cycling contribute to sustainable development in Metro Manila?

In order to answer the research question, I have interviewed cycle advocates and cycle experts, I have described my own observations and I have analyzed documents from the MMDA. The timeframe that was focused on is the present situation and the possibilities for the near future. During my internship I have lived and worked in Metro Manila which gave me unique insights in the transportation problems and possibilities in the metropole.

Both cycling and sustainable development are broad concepts. In order to make the concepts more approachable, cycling has been divided into hardware, software and orgware; sustainable development has been divided in the eleven sustainable development goals to which cycling has an impact according to the ECF (2016). First of all, cycling helps to reduce poverty and hunger because cycling hardware, such as infrastructure, provides people with means for transportation. This enlarges the area that people can reach without the use of motorized vehicles for which they do not have the financial means. On a bike, employees and customers can go to their work or to a market without having to pay for their transportation. The effect of cycling to reduce poverty and hunger is probably stronger in rural areas because jobs and produce are more available in urban areas. In some rural areas, bikes literally provide access to work or food.

Cycling software contributes to creating healthy life styles for people in Metro Manila, the Philippines and all over the world. Cycling makes you feel more energetic, happier, stronger and healthier. A healthy life style has a physical and a mental aspect. Daily physical activity is important for a healthy life style as it prevents people from serious illnesses such as cancer and diabetes. Thereby, daily bike commuting reduces obesity which is becoming a problem in the Philippines. For the mental aspect, it is arguable that bike commuting instead of being stuck in traffic every morning makes people happier, more energetic and more efficient human beings. Biking can clear your head after a long day at work, it allows you to shake off frustrations and enjoy your surroundings. Lior Steinberg has worked in many densely populated urban areas and he mentioned that once more people start bike commuting, they become happier and the whole society positively changes.

Gender equality increases through cycling software because it provides women and girls a mean to reach more places without the use of motorized vehicles. Cycling empowers women and girls to be independent and to pursue their goals. However, in Metro Manila there is a huge gap between male and female cyclists that should be addressed. The interviewees could not give a conclusive answer to why this gap exists. However, according to previous research by Prati (2018) this could be because of the traditional gender roles where women have to take care of the children and the household. Thereby, it can be suggested that this is because, in general, women are more concerned with their safety than men. Cycling is still a very dangerous activity in Metro Manila which could explain why women are more hesitant to bike commute.

Access to modern and sustainable energy is enlarged because of cycle orgware. Correspondingly, sustainable consumption and production patterns are also influenced by cycle orgware. Currently, motorized vehicles are mostly used for transportation in Metro Manila. However, transportation in urban areas is usually to cover very short distances. These trips can easily be covered by bike commuting or bike cargo. Several fast food chains in Metro Manila already use bikes to deliver their food to customers. This initiative shows that it is possible to do bike deliveries in a congested city and that there should be more capacity building to convince government agencies to enlarge this practice.

Sustainable economic growth is increased by both cycling hardware and orgware. The hardware is focused on the development of proper infrastructure, safe cycle paths and connectivity between bike routes. Once this is established, it is easier to move around in the city which leads to an increased amount of job opportunities. It will be easier to organize meetings, take a job in a different city or to transport goods. In other words, a less congested city is beneficial for economic growth. However, to create this, there has to be involvement of the local government units of the seventeen cities and the MMDA as an overarching organization. This is the orgware side of creating sustainable economic growth.

All three -wares have an influence on goal number seven that aims to create a resilient infrastructure. The hardware part is to build infrastructure and a bike network. The interview participants believe that once there is proper infrastructure, more Filipino's will perceive cycling as a viable option

to commute. The software is important for the creation of resilient infrastructure because the mindset of Filipino's has to change in order for more people to start bike commuting. The current perception of bikers is that they are poor and that they have low social status. This image has to change into the idea that bikers are healthy and use a modern way of transport. A resilient and attractive infrastructure will contribute to create a positive image around cycling. The orgware part is important for a resilient infrastructure because it is impossible to create this without the cooperation with and between local government units and the MMDA. There has to be a holistic plan for the entire city to create an efficient as possible bike network. Correspondingly, cycle orgware contributes to the creation of inclusive, safe, resilient and sustainable cities and human settlements. In order to create this, there should be policy that favors bicycles over motorized vehicles. A great start to implement this is to organize bike free days and to combine this with street festivals where people can reconnect with each other and the streets.

Thereby, cycle software contributes to taking action to combat climate change and its impacts. The UN emphasizes the fact that it is very important that everyone all over the world has to take action to combat climate change. Cycling is a perfect example of individual action which is easily approachable. Finally, cycling software also contributes to the creation of a global partnership for sustainable development. Cycling connects people and creates communities. Those communities are a symbol for taking matters in your own hands to combat climate change, deal with traffic problems and to create a better future for everyone.

5.2   Implications for Cycling

The starting point of this thesis has been that cycling contributes to sustainable development and to combat climate change. As mentioned in chapter 2, the consequences of climate change will be felt harder in lower income countries than in higher income countries (Ravindranath and Sathaye, 2003; Yumul et al., 2011). This is because people who live in lower income countries are more vulnerable to setbacks because they have lesser capacity to adapt to new situations. In order to slow down the effects of climate change, the whole world should develop in a sustainable way. Therefore, climate change should be an integral part of policy, even if it is a non-climate policy at first glance (Sathaye et al., 2007).

This study has illustrated how cycling contributes to sustainable development in Metro Manila. In my opinion, there are two important aspects of cycling that should be more broadly focused on, both empirically and academically. First, cycling policy should receive more emphasize in both academic and empirical debates. According to Pucher and Buehler (2008), the aim of cycling policy is to raise awareness of cyclists on the road in relation to motorized vehicle users. However, cycling policy is much more than that. There have to be long term plans, cycle networks, safety regulations, financial resources, promotional campaigns, events and much more. Once government agencies seriously create cycle

policy, it will have great empirical impacts. When maintained policies emerge, people will perceive cycling as a viable option because government organizations made it a legitimate form of transportation.

The second cycle aspect that should be more focused on is the creation of a cycling culture. According to Willis, Manaugh and El-Geneidy (2015), concerns about appearance are negatively correlated with cycling. The interview participants told me that in Metro Manila, the idea of cyclists is that they are poor, they have low social status or that they are unsuccessful. On the other hand, cars are seen as a symbol of wealth. Nonetheless, the interview participants also mentioned that we should 'make cycling sexy'. As a first step, people will find cycling more attractive when the bike lanes are proper and maintained. A nice cycle environment is separated from the road, for example by trees which at the same time provide shade. When the means of an attractive cycle culture are there, the culture and the network can be enlarged. Some interviewees told me that Filipino's like to customize their bikes to make the bikes very personal. These practices help to create a cycling culture in cities where this was not existent.

The case that was studied in this thesis is Metro Manila. However, the findings can be applied in a much broader sense than merely in the capital of the Philippines. I have tested how cycling can help to achieve the SDGs which is important for every country. As mentioned above, lower income countries will be disproportionally more affected by climate change. Therefore, it is crucial for people all over the world but especially for people living in those countries to start acting now. The bigger picture is that we have to create a more sustainable lifestyle in order to combat climate change. Cycling is a piece of the puzzle that gives individuals the opportunity to act now.

5.3   Research Limitations and Suggestions for Further Research

During the process of writing this thesis I have encountered several research limitations. Thereby, I have some suggestions for further research about cycling and sustainable development. The first research limitation that I encountered is that in qualitative research, there is always a bias of the interpreter. Because of my own background, believes and preferences, I had to be careful not to be too positive about cycle commuting. Even though I would love it if there would be a cycle culture in Metro Manila from tomorrow onwards, I know that this is a process that takes years to develop. Thereby, most of the interview participants are also very much in favor of a cycle culture so I had to formulate my interview questions in a way that they would not just give me the answer that I wanted to hear or that was the most desirable.

The second research limitation in this study is that I have not interviewed a government representative from the MMDA or from a local government unit. While I was still in Metro Manila, I have tried to contact these agencies, however I did not get a response. Kevin Punzalan, my supervisor from the embassy, told me that those organizations are very hierarchical and usually do not have time

for interviews of this sort. However, I have interviewed Gilbert Berba, an urban planner who works for Ayala Land and who works closely together with several local government units. He has provided me interesting insights into the way government units in Metro Manila work together with private developers.

Thirdly, this study has focused on a single case: Metro Manila. I have chosen to focus on one case because I have lived there, which gave me unique insights into the culture and environment. I believe that the results of this study are to a certain extent generalizable to other congested cities in developing countries. However, it would have been interesting to see the results if two cities were compared to each other. If Metro Manila is compared to another city, would the same results occur? Are there trends in sustainable mobility in developing countries? Is Metro Manila a more favorable city to implement cycling policy than other metropoles?

The fourth critical note of this study is that the focus was mostly on cycle mobility. However, there are other forms of sustainable mobility such as walking and roller skating or with the use of a scooter. I chose to restrict this study to biking because I wanted to conform to the studies of the DCE and the ECF. This limitation is also my first recommendation for further research. It would be interesting to focus on active mobility as a whole to see if there are more possibilities to attract people to use those ways of transport for their commute. One step further than active mobility is the use of e-bikes and e-scooters. Even though those devices are probably too expensive for most Filipino's, it would be a viable solution for the wealthier people living in Metro Manila.

The second recommendation for further research is to properly count how many cycle commuters are already present in Metro Manila. The interviewees repeatedly told me that there are more cyclists than you think but that people don't notice them because they are in a car. Once we know the number of cyclists, these figures can be presented to government agencies. This will show them the necessity of bike infrastructure and a comprehensive network to increase the efficiency for bike commuters. Thereby, work groups with both bike commuters and representatives from government agencies would be very useful for the design of new road networks. The DCE organizes these ThinkBike workshops to facilitate coordination between several stakeholders.

The third recommendation for further research is to delve deeper into the public transport system. The interviewees repeatedly mentioned that this has to change correspondingly with the process of a better cycle environment. Due to the disfunction of public transportation, many Filipino's are forced to use a private car or to commute for five or six hours per day by public utility vehicles. Once the public transportation system in Metro Manila is fixed, there will be an easier flow of traffic, less congestion, less time spend in traffic and more sustainable development. A less obvious measure to restrict car use that should be further researched is the use of carpooling systems. For example, people living in the same neighborhood in Quezon City who work in Makati could carpool instead of using their own car. Consequently, there are less cars going in and out of each city which improves the flow of traffic. It would be interesting to do further research about these possibilities.

The fourth recommendation for further research would be to experiment on the roads with pop-up bike lanes. The only way to know with certainty whether or not people will use cycle mobility is to experiment with it. Once car drivers who are stuck in a traffic jam see how much faster they arrive at their destination if they bike, it is the more utilitarian choice to start biking as well. These pop-up bike lanes should be tested in well thought out areas where it is safe and possible to bike without too much interference of motorized vehicles. At the moment, there are many of these pop-up initiatives all over the world due to the Corvid-19 crisis. The next paragraph elaborates on this.

The final recommendation for further research is to delve deeper into the underlying relations between hardware, software and orgware. I have followed this distinction from the DCE with the purpose of structuring the concept of cycling and to make the concept more approachable. Nonetheless, many aspects of the -wares overlap and correlate with another -ware. It would be interesting to make a more detailed distinction and description of these categories. Once a theoretical study of this sort is conducted, the -wares distinction will be easier applicable to other cities.

5.4   Covid-19 Pandemic

At the time of writing this thesis, the whole world is in the middle of the Covid-19 pandemic. Many countries are in lockdown in order to prevent the virus from spreading any further. Unfortunately, a lot of people who are infected with the virus are terribly ill and are even dying. Thereby, the pandemic and lockdown have a lot of economic and social consequences that everyone around the world has to deal with. I will not elaborate on the negative side effects of the Covid-19 virus but instead I want to highlight a positive consequence of the current situation. Governments and private companies worldwide are taking measures to reinvent and redistribute public spaces for the benefit of cyclists and pedestrians (Harms and Douma, 2020).

Many cities all over the world use the lockdown situation to reinvent their traffic situation (ibid.). The use of public transport is decreasing because it can be difficult to maintain the one-and-a-half-meter distance between you and the other passengers which is required to prevent the virus from spreading. Therefore, it is important that cities make room for cyclists and pedestrians to commute. Cycling and walking allow people to keep distance from other people and it is a relatively safe way of travelling. However, many cities lack the facilities to pleasantly walk or cycle as a way of commute. The current situation is ideal to transform the present infrastructure into a space where there is more room for active mobility or where there are more (temporary) cycle lanes.

Milan is probably the most progressive and ambitious city when it comes to the Covid-19 crisis and the implementation of active mobility measures. Milan is located in the Northern Italian region Lombardy which is one of the most polluting areas of Europe. During the lockdown, traffic congestion decreased with 30 to 75% and air pollution with it (Laker, 2020). The city government aims to keep

these levels low after the re-opening of the city and has therefore announced to transform 35 kilometers of road into cycle and walking streets during the summer of 2020. In the meantime, there are temporary cycle lanes, new and broader pavements, speed limits of 30 kilometers per hour and streets with priority for cyclists and pedestrians. In Brussels there are also initiatives by the government to improve the active mobility environment. Since the Covid-19 crisis, the city center of Brussels prohibits cars from driving faster than 20 kilometers per hour (Nederlands Dagblad, 2020). This gives more freedom to and safety for pedestrians and cyclists. Berlin has been experimenting with pop-up bike lanes to allow commuters to go to their work (Oltermann, 2020). After a week, the city council already concluded that the bike lanes were a success and expanded the bike network. Over 130 other German cities have requested pop-up bike lanes on their roads as well.

The Covid-19 lockdown in Metro Manila started on March 16, 2020. During the first weeks of the quarantine in the Philippines, there were no attempts to focus on cycling in order for Filipinos to commute. However, Jordana Hiltrop, a colleague from the embassy, told me that there are no jeepneys on the roads anymore because it is prohibited to use public transportation in Metro Manila. This means that it is less chaotic and busy on the streets. There are still safety concerns because car users are not used to having cyclists on the roads. However, there seems to be a trend that there are more bike commuters at the moment than before the lockdown. On June 13, 2020, the MMDA and the Department of Transportation even started building a protected bike lane along the EDSA (Mercurio, 2020). This is a great start to build a cycle infrastructure network in Metro Manila which will hopefully lead to better and safer cycling for everyone.

Literature

Aldred, R., Jungnickel, K. (2014). Why Culture Matters for Transport Policy: The Case of Cycling in the UK, *Journal of Transport Geography,* 34, 78-87.

Asian Development Bank (2019). Asian Development Outlook 2019, Update Fostering Growth and Inclusion in Asia's Cities. URL: https://www.adb.org/sites/default/files/publication/524596/ado2019-update.pdf. Last retrieved: 07-05-2020.

Bakker, S., Guillen, M., Nanthachatchavankul, P., Zuidgeest, M., Pardo, C., van Maarseveen, M. (2018). Hot or Not? The Role of Cycling in ASEAN Megacities: Case Studies of Bangkok and Manila, *International Journal of Sustainable Transportation*, 12(6), 416-431.

Buehler, R., & Pucher, J. (2011). Sustainable transport in Freiburg: lessons from Germany's environmental capital. *International Journal of Sustainable Transportation*, 5(1), 43-70.

Bieliński, T., Kwapisz, A., & Ważna, A. (2019). Bike-sharing systems in Poland. *Sustainability*, *11*(9), 2458.

Bike Scouts (2020). Welcome to the Bike Scouts Project. URL: https://bikescouts.org/about-us/. Last retrieved: 25-03-2020.

Creswell, J. W., Hanson, W. E., Clark Plano, V. L., & Morales, A. (2007). Qualitative Research Designs: Selection and Implementation. *The Counseling Psychologist*, *35*(2), 236-264.

Civitas (2020). Policy Note: Cycling in the City. URL: https://ec.europa.eu/transport/sites/transport/files/cycling-guidance/smart_choices_for_the_city_cycling_in_the_city_0.pdf. Last retrieved: 22-04-2020.

Cupples, J., Ridley, E. (2008). Towards a Heterogenous environmental responsibility: Sustainability and Cycling Fundamentalism, *Area*, 40(2), 254-264.

Dutch Cycling Embassy (2018). Dutch Cycling Vision. URL: https://www.dutchcycling.nl/images/downloads/Dutch_Cycling_Vision_EN.pdf. Last retrieved: 27-03-2020.

Dutch Cycling Embassy (2020). Cycling for Everyone. URL: https://www.dutchcycling.nl/. Last retrieved: 13-11-2019.

European Cyclists' Federation (2014). Cycling Works: Jobs and Job Creation in the Cycling Economy. URL: https://repository.difu.de/jspui/bitstream/difu/232402/1/DS1369.pdf. Last retrieved: 12-05-2020.

European Cyclists' Federation (2016). Cycling Delivers on the Global Goals. URL: https://ecf.com/sites/ecf.com/files/The%20Global%20Goals_internet.pdf. Last retrieved: 13-11-2019.

El-Assi, W., Mahmoud, M., Habib, K. (2017). Effects of Built Environment and Weather on Bike Sharing Demand: A Station Level Analysis of Commercial Bike Sharing in Toronto, *Transportation*, *44*(3), 589-613.

European Commission (n.d.). Cycle Lanes. URL: https://ec.europa.eu/energy/intelligent/projects/sites/iee-projects/files/projects/documents/presto_fact_sheet_cycle_lanes_en.pdf. Last retrieved: 19-05-2020.

European Cyclists' Federation (2018). The Benefits of Cycling. URL: https://ecf.com/resources/cycling-facts-and-figures. Last retrieved: 30-03-2020.

European Cyclists' Federation (2020). Discover the Benefits of Cycling. URL: https://ecf.com/. Last retrieved: 30-03-2020.

Fleming, S. (08-01-2020). From Books to Bikes: 4 Unexpected Gender Gaps. *World Economic Forum*.

Firefly Brigade Philippines (2020). Homepage Facebook. URL: https://www.facebook.com/fireflybrigade.org/. Last retrieved: 25-03-2020.

Galletta, A., Cross, W. (2013). Mastering the Semi-Structured Interview and Beyond: From Research Design to Analysis and Publication. New York: University Press.

Van Gent, A. (2020). Can cycling be the equal transport mode to cars? URL: https://www.aurecongroup.com/thinking/thinking-papers/cycling-cars-equal-transport-modes Last retrieved: 27-03-2020.

Gerring, J. (2007). Case Study Research, Principles and Practices. Cambridge: University Press.

Guest, G., MacQueen, K., Namey, E. (2012). Planning and Preparing the Analysis. *Applied Thematic Analysis*, 21-49.

Harms, L., Bertolini, L., & Brömmelstroet, M. T. (2016). Performance of Municipal Cycling Policies in Medium-Sized Cities in the Netherlands Since 2000. *Transport Reviews*, *36*(1), 134-162.

Harms, L., Douma, E. (2020). DCE-Memo: Overzicht van Covid-19 Maatregelen: Herontwerp en Herindeling Stedelijke Infrastructuur in Relatie tot de Fiets. Memo for the Dutch Ministery of Infrastructure and Water.

Helbrich, M., Böcker, L., M. Dijst (2014). Geographic Heterogeneity in Cycling Under Various Weather Conditions: Evidence from Greater Rotterdam, *Journal of Transport Geography*, 38, 38-47.

Heinen, E., Maat, K., van Wee, B. (2013). The Effect of Work-Related Factors on the Bicycle Commute Mode Choice in the Netherlands, *Transportation*, *40*(1), 23-43.

Houtum, van, T. (2019). Waarom We Fietsen, *Profielwerkstuk*.

Hull, A., & O'Holleran, C. (2014). Bicycle Infrastructure: Can Good Design Encourage Cycling?. *Urban, Planning and Transport Research*, *2*(1), 369-406.

Hymel, K. (2009). Does Traffic Congestion Reduce Employment Growth?. *Journal of Urban Economics*, *65*(2), 127-135.

Laker, L. (21-04-2020). Milan Announces Ambitious Scheme to Reduce Car Use After Lockdown. *The Guardian*.

Lee, Q., & Pojani, D. (2019). Making Cycling Irresistible in Tropical Climates? Views From Singapore, *Policy Design and Practice*, *2*(4), 359-369.

MacNaughton, P., Melly, S., Vallarino, J., Adamkiewicz, G., Spengler, J. D. (2014). Impact of Bicycle Route Type on Exposure to Traffic-Related Air Pollution, *Science of the Total Environment*, *490*, 37-43.

Mason, J. (2002). Linking Qualitative and Quantitative Data Analysis. In: *Analyzing Qualitative Data* (pp. 103-124). Routledge.

Mason, J. (2017). *Qualitative researching*. Sage.

Massink, R., Zuidgeest, M., Rijnsburger, J., Sarmiento, O., Van Maarseveen, M. (2011). The Climate Value of Cycling, *Natural Resources Forum*, 35, 100-111.

Mattson, J., Godavarthy, R. (2017). Bike Share in Fargo, North Dakota: Keys to Success and Factors Affecting Ridership. *Sustainable Cities and Society*, *34*, 174-182.

Mercurio, R. (13-06-2020). Construction of EDSA Bike Lanes Starts Today. *Philippine Star*.

Mongabay. (2020). Manila Gets Its Skyline Back as Air Quality Improves Amid COVID-19 Lockdown. URL: https://news.mongabay.com/2020/04/manila-gets-its-skyline-back-as-air-quality-improves-amid-covid-19-lockdown/. Last retrieved: 25-05-2020.

Mrkajic, V., Vukelic, D., & Mihajlov, A. (2015). Reduction of CO2 Emission and Non-Environmental Co-Benefits of Bicycle Infrastructure Provision: The Case of the University of Novi Sad, Serbia. *Renewable and Sustainable Energy Reviews*, *49*, 232-242.

Mullan, E. (2012). Swapping the Lycra for the Suit: Determinants of Cycling for Transport Among Leisure Cyclists in Ireland, *International Journal of Health Promotion and Education*, 50(5), 229-237.

NASA (2019). Climate Change: How Do We Know?. URL: climate.nasa.gov/evidence/. Last retrieved: 28-10-2019.

Nankervis, M. (1999). The Effect of Weather and Climate on Bicycle Commuting, *Transportation Research Part A: Policy and Practice*, *33*(6), 417-431.

Nederlands Dagblad (21-04-2020). Auto's in Brussel Maximaal 20 km/h in Coronatijd. *Nederlands Dagblad*.

Njenga, P., & Davis, A. (2003). Drawing the Road Map to Rural Poverty Reduction. *Transport Reviews*, *23*(2), 217-241.

Oltermann, P. (13-04-2020). Pop-up Bike Lanes Help with Coronavirus Physical Distancing in Germany. *The Guardian*.

Ornedo, J.M. (29-10-2019). For 2nd Straight Year, Metro Manila Looms as Worst City in the World to Drive In —Waze. *GMA News*.

Ornedo, J.M. (30-01-2020). Manila is World's Second Most Traffic-Congested City — Index. *GMA News*.

Oxfam (2018). Cycling Out of Poverty. URL: https://www.oxfamamerica.org/explore/stories/cycling-out-of-poverty/ Last retrieved: 07-05-2020.

Philippine Statistics Authority (2016). Population of the National Capital Region. URL: https://psa.gov.ph/content/population-national-capital-region-based-2015-census-population-0 Last retrieved: 24-03-2020.

Philippine Statistics Authority (2017). The Philippine SDGs. URL: http://www.psa.gov.ph/sdg/Philippines/indicators. Last retrieved: 29-05-2020.

Philippine Statistics Authority (2017). SDG Brochure. URL: http://www.psa.gov.ph/system/files/kmcd/SDG%20Brochure.pdf. Last retrieved: 29-04-2020.

Philippine Cities (2020). National Capitol Region. URL: https://philippinescities.com/ncr-national-capital-region/ Last retrieved: 24-03-2020.

Prati, G. (2018). Gender equality and women's participation in transport cycling. *Journal of transport geography*, *66*, 369-375.

Pucher, J., Buehler, R. (2008). Making Cycling Irresistible: Lessons from The Netherlands, Denmark and Germany, *Transport Reviews*, 28:4, 495-528.

Pucher, J., Buehler, R. (2017). Cycling Towards a More Sustainable Transport Future, *Transport Reviews*, 37:6, 689-694.

Pucher, J., Peng, Z. R., Mittal, N., Zhu, Y., & Korattyswaroopam, N. (2007). Urban Transport Trends and Policies in China and India: Impacts of Rapid Economic Growth. *Transport reviews*, *27*(4), 379-410.

Ranshuysen, L. (2012). Oude onderzoeken, nieuwe relevantie. *Broekman*, *91*, 51-69.

Racioppi, F., Dora, C., Rutter, H. (2005). Urban Settings and Opportunities for Healthy Lifestyles: Rediscovering walking and Cycling and Understanding Their Health Benefits. *Built Environment*, *31*(4), 302-314.

Ravindranath, N., Sathaye, J. (2002). Climate change and developing countries. In: *Climate Change and Developing Countries* (pp. 247-265). Springer, Dordrecht.

Sarmiento, O., Torres, A., Jacoby, E., Pratt, M., Schmid, T. L., & Stierling, G. (2010). The Ciclovía-Recreativa: A Mass-Recreational Program with Public Health Potential. *Journal of Physical Activity and Health*, *7*(2), 163-180.

Sathaye, J., Najam, A., Cocklin, C., Heller, T., Lecocq, F., Llanes-Regueiro, J., ... & Schaeffer, R. (2007). Sustainable Development and Mitigation. In: *Climate Change 2007: Mitigation of Climate Change* (pp. 691-743). Cambridge University Press.

Schoner, E., Levinson, D. (2014). The Missing Link: Bicycle Infrastructure Networks and Ridership in 74 US Cities, *Transportation*, 41(6), 1187-1204.

da Silva Bandeira, A., da Silva, K. S., Del Duca, G. F., Zilch, G. R., de Oliveira, E. S. A., de Barros, M. V. G., Nahas, M. V. (2017). Factors Associated with Bicycle Use for Commuting and for Leisure among Brazilian Workers, *Sport Sciences for Health*, *13*(1), 63-68.

St-Louis, E., Manaugh, K., van Lierop, D., El-Geneidy, A. (2014). The Happy Commuter: A Comparison of Commuter Satisfaction Across Modes, *Transportation Research Part F: Traffic Psychology and Behaviour*, *26*, 160-170.

Tainio, M., de Nazelle, A. J., Götschi, T., Kahlmeier, S., Rojas-Rueda, D., Nieuwenhuijsen, M. J., Hérickde Sá, T., Kelly, P., Woodcock, J. (2016). Can Air Pollution Negate the Health Benefits of Cycling and Walking?, *Preventive Medicine*, *87*, 233-236.

The Asia Foundation. Internet Inaccessibility Plagues "Social Media Capital of the World". URL: https://asiafoundation.org/2018/10/24/internet-inaccessibility-plagues-social-media-capital-of-the-world/. Last retrieved: 20-05-2020.

United Nations (2019). *Sustainable Development Goals*. URL: un.org/sustainabledevelopment/sustainable-development-goals/. Last retrieved: 07-11-2019.

United Nations Environment Program (2020). *Cycling, the Better Mode of Transport*. URL: https://www.unenvironment.org/news-and-stories/story/cycling-better-mode-transport. Last retrieved: 25-11-2019.

VijayaVenkataRaman, S., Iniyan, S., Goic, R. (2012). A Review of Climate Change, Mitigation and Adaptation, *Renewable and Sustainable Energy Reviews*, *16*(1), 878-897.

Wilhoit, E. D., & Kisselburgh, L. G. (2015). Collective Action Without Organization: The Material Constitution of Bike Commuters as Collective. *Organization Studies*, *36*(5), 573-592.

Willis, D., Manaugh, K., El-Geneidy, A. (2015) Cycling Under Influence: Summarizing the Influence of Perceptions, Attitudes, Habits, and Social Environments on Cycling for Transportation, International Journal of Sustainable Transportation, 9(8), 565-579.

Winters, M., Davidson, G., Kao, D., Teschke, K. (2011). Motivators and Deterrents of Bicycling: Comparing Influences on Decisions to Ride, *Transportation*, *38*(1), 153-168.

Woodcock, J., Banister, D., Edwards, P., Prentice, A., Roberts, I. (2007). Energy and Transport, *The Lancet*, 370, 1078-1088.

Wuerzer, T., Mason, S. (2015). Cycling Willingness: Investigating Distance as a Dependent Variable in Cycling Behavior Among College Students, *Applied Geography,* 60, 95-106.

Yin, R. (2003). *Case Study Research: Design and Methods* (3rd ed.). Thousand Oaks, CA: Sage.

Yumul, G., Cruz, N., Servando, N., Dimalanta, C. (2011). Extreme Weather Events and Related Disasters in the Philippines, 2004–08: A Sign of What Climate Change Will Mean?, *Disasters*, *35*(2), 362-382.