Appropriating Cycling in Indonesia: Another Perspective on Technology Transfer

Master Thesis

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18 Augustus 2023

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Summary

In the last 5 years in Indonesia and especially after the covid pandemic, cycling appears to be regaining popularity. Before, cycling was perceived as an outdated means of transport that do not belong in the city. In the early 2000s, bicycles and various other non-motorised transport are prohibited in central areas of the city. However, in the last few years, more and more people are cycling. In 2019, in response to the increase in cycling popularity, the local government of Jakarta planned and built several bicycle lanes for a pilot project. This pilot project was deemed successful and resulted in the construction of permanent bicycle lanes in Jakarta. A similar trend was also observed in various cities in Indonesia. In response to that, the government issued an official guideline for designing bicycle lanes in urban areas.

However, in early 2022, there was a motion in Jakarta's Representative Assembly to cancel the bicycle lane construction. The fraction behind this motion argued that the bicycle path was useless because it is not used as it is supposed to be. They said that instead of being used by cyclists, the bicycle lanes are used by the *starling* (*starbucks keliling,* a type of street vendor that sells instant coffee using bicycles to move from one place to the other).

In this thesis, I argued that the motion is founded on a narrow interpretation of technology transfer that is typically done in Indonesia. They perceive that this bicycle lane and its related infrastructure are transferred from abroad. Therefore, they assume that the usage pattern of this bicycle lane should be the same as abroad. While this assumption would be true for some form of technology transfer, in the case of bicycle lanes and cycling infrastructure it is not. Unlike the typical transfer technology in Indonesia, the cycling infrastructure case runs in the mode of copying or reverse engineering. In this mode, the recipient plays an active in appropriating the technology. While in the other modes, the recipient is relegated to a passive role, only receiving the technology diffused by the source without a chance to reinterpret and modify it.

Then the questions are, how can we establish a more recipient-centric (or user-centric) approach to technology transfer? And what can we discover after establishing the user-centric approach? In this thesis, I suggest that the SCOT (Social Construction of Technology) framework is a good starting point. The SCOT framework put the user (or the recipient in the technology transfer term) in the focus point. Therefore, it is suitable to analyse a phenomenon in which the users are actively appropriating technology. Guided by the SCOT framework, the user groups (or the cyclist) in Indonesia are analysed as well as their relationship to cycling. The technology, the cycling infrastructure, is also analysed to uncover what kind of artefacts that labelled as cycling infrastructure in Indonesia.

Analysing the user groups, especially the daily cyclist, there are three personas that each represent a user group: the street vendor, the woman, and the cycling community member. Each of these personas have their interpretation of cycling. For street vendors, cycling is not separable from working. For the woman, cycling is the only means of transport available to them. For the community member, cycling can make the city more liveable. While, the source of the artefact, the cycling infrastructure, can be traced to various exemplary cases abroad, among others, the Netherlands.

Since the user groups in Indonesia exist in the Indonesian context, they develop a distinguished relationship when compared to their counterpart in the Netherlands. Since the relationship is different, the usage pattern would also be different. One cannot expect the usage pattern in the Netherlands will be copied to Indonesia since the usage pattern in the Netherlands is the effect of the relationship between the user and the technology in the Dutch context. If we flip the perspective around, the usage pattern in Indonesia ought to be unique because of the local Indonesian context. The ability of Indonesian to look inward and understand their own context became essential to pave our own way to closure.

1 Introduction

1.1 Using Bicycle Paths in Indonesia's Urban Areas

In the last few years in Indonesia, the local government of various cities in Indonesia have either planned or constructed bicycle paths in their jurisdiction. In 2019, the government of Jakarta launched a trial program to construct several bicycle paths in essential areas of the city (Umasugi, 2019). The citizen welcomed this trial, and the government issued an edict and guideline to regulate the construction of these bicycle paths (DKI Jakarta, 2019; Direktorat Jendral Bina Marga, 2021). At that time, the plan was to construct more bicycle paths and related facilities in the coming years.

However, in late 2022, there was a motion in the Jakarta Region Representative Assembly (*Dewan Perwakilan Rakyat Daerah DKI Jakarta, DPRD*) to cancel the budget that was allocated to construct the bicycle paths (Ivany Atina Arbi, 2022). The parties supporting this cancellation motion said the already constructed bicycle path was useless. They argued that cyclists do not use the bicycle paths and instead are used by *starling* (shorthand of *Starbucks keliling*, literally meaning 'travelling Starbucks') (Ivany Atina Arbi, 2022). It is worth noting there that these *starlings* are street vendors who usually sell instant coffee and travel from place to place using a bicycle (see Figure 1). It seems paradoxical to claim that these bicycle paths are useless while people are cycling on them.

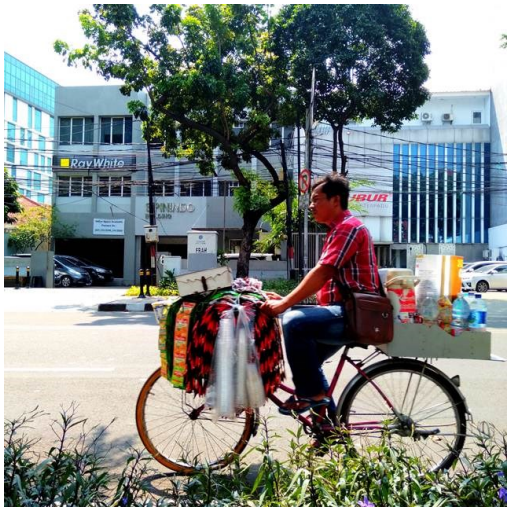

Figure 1 Starling is spotted in the streets of Jakarta (Ardyanto, 2019).

It is worth noting here that if we look closer at the reference list of the issued guideline, the government appears to take inspiration from similar cases abroad. Apparently, from the perspective of the politicians in the representative assembly, they view it as the guidelines were transferred from abroad. Therefore, they expected the same usage pattern also happens in Indonesia. However, as they saw that the usage of this bicycle path was not the same as the

usage pattern abroad, they deemed the bicycle path useless. In other words, they expect the usage pattern of these cycling infrastructures in Indonesia to be the same as the usage pattern abroad since the guideline to build the cycling infrastructure is transferred from abroad.

This perspective makes policymakers in Indonesia expect that technology transferred from abroad has the same usage pattern as abroad. This perspective is quite prevalent in Indonesia since Indonesia routinely transfers technology from abroad. Wie analysed several modes of technology transfer in Indonesia (Wie, 2005, p. 216). Most modes require that the transferred technology be built and used as similarly as possible to achieve the intended result. For example, machinery used in a factory to manufacture a car must be built and used according to the specification transferred from abroad. Deviation in the usage might cause the goal of manufacturing cars to be not achieved.

In this thesis, I would like to show that the understanding that transferring technology also entails transferring the way of using technology is too narrow. Using the study case of transferring cycling infrastructure to Indonesia, I would like to show that Indonesian developed our unique usage of the cycling infrastructure. Indonesians do not simply receive and use the cycling infrastructure the same as abroad. Indonesians appropriate the cycling infrastructure from abroad to fit with our context. Therefore, diverging usage patterns are expected to come. While it is difficult to say precisely what kind of usage is good for Indonesian, at least a good usage pattern is compatible with the Indonesian context.

1.2 Technology Transfer

Before going too far, I would like to clarify the term technology transfer and how I would like to add to the existing discussion. Technology transfer is a term often used to describe a process in which a technology from one place is introduced to be used in another. The literature discussing technology transfer often describes technology as having two principal components (Wahab, Rose and Osman, 2011, p. 62). The first component is the physical artefact, such as tools, equipment, infrastructure, and blueprint. The second component relates to the knowledge of using the physical artefact. Therefore, technology can be interpreted as a combination of physical artefacts and knowledge that enable people to accomplish a specific task or resolve a certain problem using a particular skill (Wahab, Rose and Osman, 2011, p. 62).

The term technology transfer covers a broad spectrum of phenomena. Based on the place in which technology transfer occurs, on one end of the spectrum, transfer technology happens within a lab or company (Wahab, Rose and Osman, 2011, p. 63). For example, a new measuring instrument created in a company's research department can be transferred to the production department. The production department uses the new instrument to improve a specific

production process or create an entirely new product. On the other end of the spectrum, transfer technology occurs globally across the country border (Wie, 2005). This kind of technology transfer is more common in transferring technologies to developing countries. One typical example is in the form of technical consultancies (Wie, 2005, p. 216). For example, developing countries often seek assistance from countries with more advanced technology when building a new manufacturing plant. The more advanced technology is transferred to the developing country and used to build the planned manufacturing plant.

The type of parties involved in technology transfer activity also varied. Technology Transfer can happen between universities and industries (Saidi, 2015; Villani, Rasmussen and Grimaldi, 2017; De Wit-de Vries *et al.*, 2019). In this case, the university often acts as the source of technology. The industry is the recipient of technology looking to build or improve products using the transferred technology. In the context of transfer technology in developing countries, technology transfer can happen with the explicit involvement of the recipient country's government (Wie, 2005, p. 216; Thalib *et al.*, 2016). When the recipient country's government is involved, the transferred technology often comes from the government of another country or multilateral institution, such as the World Bank or the United Nations. However, the technology transfer also can happen without explicit government involvement. For example, importing capital goods in the form of a technological artefact, such as machinery used in the manufacturing process (Wie, 2005, p. 162). In this case, a private firm in a country often purchases technology from a private firm in another country.

In the simplest terms, the notion of technology transfer is based on the idea that technological innovation consists of three major steps, invention, innovation, and diffusion (Visvanathan, 2015, p. 141). This idea assumes that the technology is invented in a place, whatever this place may be, in a university, a company, a research centre, or a country. Then this technology is diffused to reach other places trough technology transfer. The notion of technology transfer also places the parties who act as the source of technology has a more active role than their counterpart who act as the recipient of the transferred technology (Visvanathan, 2015, p. 142). In other words, the university, the company, or the country that acts as the technology producer have a more active role in technology diffusion. The recipient, whoever or whatever that might be, is relegated to the more passive recipient role.

However, in the context of technology transfer to a developing country, there is a mode of technology transfer in which the recipient can play a more active role. Transfer technology to a developing country can happen in the mode of copying or reverse engineering (Wie, 2005, p. 216). In this mode of transfer technology, the parties in the source place are not necessarily actively pushing the technology to be transferred to another place. The parties in the destination place actively pull the technology to their place.

In other modes of technology transfer where the source parties have a more active role, the source parties often prepare the technology to quickly diffuse it to other places. For example, if the technology transfer occurred via a technology licensing agreement (Wie, 2005, p. 220), the source party is expected to have documentation in which the inner workings of the technology are sufficiently detailed so that the technology can be built and used by the licensee.

On the other hand, when technology transfer occurs via copying or reverse engineering path, the source party is not expected to provide such documentation. Therefore, it falls to the recipient parties to not only figure out the inner workings of the technology but also to fit the technology into the context in the recipient's place. Despite the stark differences between the copying mode (active recipient) and the other mode (passive recipient), the copying mode is discussed less. Previous scholars seem to synonymise technology transfer with passively receiving technology (Thalib *et al.*, 2016; Iyer and Banerjee, 2018).

In this thesis project, I focused on a specific point on the technology transfer spectrum. Regarding the place in which technology transfer happens, I focused on technology transfer that happens across country borders. Regarding the parties' role, I focused on the transfer technology mode in which the recipient has a more active role, specifically how the people in the recipient country interpret the technology. Additionally, since the recipient party is more active, they also have the freedom to appropriate the technology from multiple source countries.

In the context that I will focus on, technology transfer can be understood as the transfer of both physical artefacts and know-how to accomplish specific actions. Technology transfer is not straightforward since it involves various user groups (Wahab, Rose and Osman, 2011, p. 63). In the context of transfer technology occurring across country borders, the user group from the original place might likely have a different view on value and the potential use of the technology than the user group in the destination place. Moreover, when we take a country as a recipient in this technology transfer process, there might be more than one (potential) user group in that country. Therefore, to ensure that the transferred technology is going to be used by the user in the recipient place, the technology needs to suit the condition of the destination user group (Wahab, Rose and Osman, 2011, p. 63). In the context of transferring technology from developed to developing countries, it is essential to not only transfer the technology but also generate knowledge suited to the user group in the destination place (Wahab, Rose and Osman, 2011). This knowledge might promote new usage of the technology.

It is also worth noting that technology transfer is often not only about making the technology available elsewhere. In the context of transferring technology from one country to another, technology transfer can also affect the bilateral relationship between countries (Long, 1996).

The technology transfer project between two countries can foster the parties' trade, economic, and political relationship. Technology transfer can function as a token of gratitude between the parties involved (Long, 1996, p. 78). Technology transfer can also function as a means to control the recipient's political behaviour in the global political landscape (Long, 1996, p. 79). In other words, the purpose of technology transfer is often not only about diffusing the technology to new users. Especially in the context of technology transfer between countries, there are other motives other than the need of the users to contribute to the technology transfer phenomena.

While it seems natural that the technology transfer between two countries also affects the bilateral relationship between those countries, there is a mode of technology transfer in which these motives are not so apparent, at least not from the outset. When a technology transfer is used to influence the bilateral relationship between countries, we can safely assume that the country which acts as the source of technology will have at least an active role as the recipient country. However, when technology transfer is happening in the mode of copying or reverse engineering, it is not to be expected that the source country will have an active role. It is even possible that the source country is unaware of the copying or reverse engineering efforts done by the recipient country. It is true that later, the source country can be aware of the technology transfer effort and use that leverage to influence the bilateral relationship. However, this is not something that the source country planned from the beginning. In contrast, other modes of technology transfer, such as licensing agreements, technical consultation, and importation of technological goods, require an agreement from the beginning (Wie, 2005, p. 205) or at least willingness from the source party (Iyer and Banerjee, 2018, sec. 6.4). In other words, it can be said that technology transfer that operates in copying or reverse engineering mode is more about fitting the technology to be used in the new place than influencing a bilateral relationship.

1.3 Typical Technology Transfer in Indonesia

Indonesia is a developing country that routinely transfers technology from developed countries (Wie, 2005, p. 2). The transferred technologies are often perceived as essential to generate and maintain economic growth, which is necessary to increase the standard of living of Indonesians. Transfer technology is often associated with transferring technology that the industry needs to manufacture goods, such as clothes, electronic components, and vehicles. (Wie, 2005).

Private firms are often involved in this kind of technology transfer in Indonesia (Wie, 2005, p. 215). The source of technology is a private firm in a developing country, and the recipient of technology is a private firm in Indonesia. Often, private firms abroad invest in Indonesia to

build a manufacturing plant or introduce their technology to the Indonesian market. Then along with this kind of investment, the technology also transferred to Indonesia.

However, another mode of technology transfer also happens in Indonesia, namely copying or reverse engineering. The key difference between copying or reverse engineering and the other mode of technology transfer that typically happen in Indonesia is the active role of parties on the recipient side. As the parties on the source side are not necessarily prepared for the technology to be transferred, the parties on the recipient side must do more work to transfer the technology successfully.

1.4 Study Case: Transferring Cycling Technologies to Indonesia

One example of technology transfer in the mode of copying or reverse engineering is the transfer of cycling infrastructure from developed countries to Indonesia. Indonesian academics often portray the cycling infrastructure in developed countries as a good example that needs to be copied to promote cycling in Indonesia (A Artiningsih, 2011; Pariyanto Pariyanto, 2015; Irawan, Bastarianto and Priyanto, 2022). This perception is not exclusive only to academics. Indonesia's biggest urban bicycle community, Bike2Work Indonesia, often uses examples from developed countries, especially the Netherlands, to convey that good cycling infrastructure in Indonesia's cities is not impossible (Bike To Work Indonesia, 2023c, 2023b).

It is worth noting that bicycle and cycling is not a new thing in Indonesia. The first bicycle was transferred to Indonesia around 1910 (Shanty Yulia, 2021). The Dutch brought a bicycle to Indonesia mainly to be used by Dutch people who worked for the colonial government. At that time, people working for the colonial government were perceived to have a higher social status than others. Therefore, the bicycle also played a role in showing higher social status. Then Indonesian nobles started to use bicycles. Slowly, ordinary people also started to use bicycles. The number of bicycles continued to rise after Indonesian independence in 1945. However, the usage of bicycles started to decline in the 1970s (Kusumo, 2021). Then around the 2000s, Jakarta and the satellite city around it (also known as the Jakarta metropolitan area) banned the usage of *becak*, Indonesian's version of tricycle, in certain parts of the metropolitan area (Carina, 2018). The law states that unmotorised vehicles, including becak and bicycles, are prohibited from being used in certain parts of the city (DKI Jakarta, 2007).

However, in the last five years and especially after the covid pandemic, the usage of bicycles in Indonesia is increasing again (Irawan, Bastarianto and Priyanto, 2022). This resurgence of cycling in Indonesia is also accompanied by the collective effort by the government and scholars to copy cycling infrastructure from overseas, such as bicycle lanes and bicycle parking facilities (A Artiningsih, 2011; Thoriq, 2015; Irawan, Bastarianto and Priyanto, 2022). In 2021,

the government, via the Ministry of general work and public housing (*Kementerian Pekerjaan Umum dan Perumahan Rakyat),* issued updated guidance on how to design and construct cycling-friendly facilities (Direktorat Jendral Bina Marga, 2021). This resurgence happened in Jakarta, Indonesia's Capital, and in cities and urban centres that spread in the Indonesian archipelago.

Nevertheless, not every citizen is happy about copying and constructing cycling infrastructure. Connecting to the controversy that I have mentioned at the beginning of this chapter (see section 1.1), in Jakarta, where the local government have built cycling lanes in the central areas of the cities, there was a motion in the local parliament to cancel the budget that initially planned to build more bicycle infrastructure in the city (Ivany Atina Arbi, 2022). The original plan was to build more than 500km of bicycle infrastructure in 2023. A fraction of the parliament that supports the cancellation of the construction says that as long as they can see, the existing bicycle infrastructure, especially the bicycle lane, is useless since it is mainly used by street vendors people to park their cars, and by motorcyclists to cut traffic jam (Ivany Atina Arbi, 2022).

This controversy culminating in the motion to cancel the budget for bicycle infrastructure construction offers us an interesting case to analyse. As I stated in the previous sub-section, Indonesia, which perceives itself as a developing country, is familiar with transfer technology. However, the type of transfer technology that is often analysed is the type in which the source of technology has an active role in diffusing the technology. (Wie, 2005; Wahab, Rose and Osman, 2011; Visvanathan, 2015; Iyer and Banerjee, 2018). When the parties who act as the source of technology are more active, they often also provide step-by-step guides on how to diffuse the technology to the new place successfully. Therefore, the transferred technology is intact when received in the recipient country. Intact means not only the technology is physically similar to the original, but also the way it is used is similar. This result of the source-party-dominated technology transfers affects how Indonesian perceives technology transfer. From the statement of a parliament member in the previous paragraph, it can be inferred that for the transferred technology to be successful, the usage must be similar to the usage in the original place. In this case, the bicycle infrastructure must be used mainly by cyclists, not just any cyclist, but the type of cyclist commonly encountered abroad.

However, there is a key difference in this case. In the case of transferring bicycles and their related infrastructure to Indonesia, the transfer technology is operating in the copying or reverse engineering mode. In this mode, the technology recipient is more active in transferring the technology. There is no guidance from the source parties to dictate the usage of the technology. In other words, the existing bicycle infrastructure in developed countries only serves as an example rather than a blueprint. In this copying or reverse engineering mode,

Indonesia's (potential) users have more freedom to determine their relationship with the transferred bicycle infrastructure. In contrast with other modes of technology transfer, this relationship is more dictated by the parties in the source place.

This freedom in establishing the relationship between the users and the bicycle infrastructure is incompatible with the paradigm that assumes the transferred technologies will be used the same way as it is in the original place. Therefore, we need another perspective to view transfer technology phenomena, especially those operating in copying or reverse engineering mode. A perspective from the users' point of view accommodates the emergence of new user-technology relationships to nurture new usage. The perspective that puts the user in the centre also enables us to analyse the existing user-technology relationship that might already be there. This perspective is vital since cycling is not entirely new in Indonesia.

1.5 An alternative view of technology transfer

Traditionally, in the context of technology transfer to a country, it is often associated with an effort to improve the economic condition of that country (Wie, 2005). However, there are technology transfer cases where the direct main goal is not economical. In the case of transferring cycling to urban areas in Indonesia, the goals are, among others, to reduce traffic jams, promote a sustainable lifestyle, to complement the public transport system (A Artiningsih, 2011; Hanavie and Setiawan, 2014; Song, Kirschen and Taylor, 2019; Irawan, Bastarianto and Priyanto, 2022). While some can argue that achieving these goals will impact the city's economy and its citizens, it is not the direct goal of this technology transfer project. The effect on the economy, if any, can only happen as a side implication of achieving the direct goal of transferring cycling infrastructures.

In the traditional view of technology transfer, the process is often described as the diffusion of the said technology to reach more users in the recipient place (*Transfer of technology*, 2001; Visvanathan, 2015). In this view, the role of the recipient is minimal. The recipient of the transferred technology is regarded as a passive party who only receives the technology and its related knowledge without contributing to the transferred technology's development (Visvanathan, 2015, p. 142). Using this point of view, local knowledge possessed by the recipient parties before the arrival of the transferred technology seems irrelevant. Since the recipient's knowledge is less relevant, it is also difficult to acknowledge that there is a possibility that a new user-technology relationship will emerge in the recipient's place.

This traditional view of technology transfer has been criticised for neglecting the knowledge possessed by the recipient party (Visvanathan, 2015, pp. 142–143). As technologies from the developed countries found their way to other parts of the world, especially after the second world war, the traditional view of technology transfer started to show its limitation. Local

knowledge that existed before the technology arrived made the recipient develop a new user-technology relation that is different from the original user-technology relation in the original place. This new user-technology relation then accounts for the new usage pattern in the recipient place. For example, Bar et al.'s studies about the transfer of mobile telephone technology to Latin America reveal that the local population in Latin America have developed a unique usage pattern of mobile telephone (Bar, Weber and Pisani, 2016). This unique usage pattern emerges not only because of the physical limitation but also because of the local knowledge embodied in their culture and social structure. In short, there is a trend to change the perspectives used to study technology transfer from the diffusion of rigid 'blueprints' to a participatory 'people-centred' approach (Warren, 1999).

1.6 Using a More User-centric Approach to Analyse Technology Transfer

The recipient (the user) is often judged as a passive party that only receives the technology without any input to the development of technology. However, as I indicated in the previous section, the user's role is essential to the local development of the technology. Therefore, there is a need to complement the traditional technology transfer approach with a more user-centric approach. In other words, we need a new perspective on technology transfer that enables us to acknowledge users' active and essential role in the recipient place.

To establish a more user-centric approach to technology transfer, I would like to begin with the Social Construction of Technology (SCOT) approach (Pinch and Bijker, 1984). According to the SCOT perspective, to assess whether a technology is successful, we need to analyse the relationship between the technology and its users (Pinch and Bijker, 1984; Saidi, 2015, p. 11). In the context of technology transfer, in which technology is transferred from one location to another location, the transferred technology would encounter a new set of users that might build a unique relationship with the technology that is different from the user-technology relationship in the original place. The difference in the user-technology relationship would entail a difference in the usage pattern of the technology. Therefore, according to the SCOT perspective, it is always expected that the transferred technology would have a usage pattern that is different from the usage pattern in the original location. Thus, similarities in usage pattern should not be used as a primary factor to guide technology transfer, particularly when the recipient have an active role. The primary factor to guide technology transfer process should be derived from the user-technology relationship that being build and the context in which the relationship is situated.

The SCOT perspective gives us several concepts that can be used as a starting point for our approach to technology transfer that is more user-centric. The concepts are relevant social groups, interpretative flexibility, stabilisation, and closure (Pinch and Bijker, 1984). The starting point of an analysis using the SCOT perspective is identifying the relevant social

groups. Institutions, organisations, and both structured and unorganised groups of people are all included in this idea of a relevant social group. The key idea to identifying a relevant social group is that the members of a relevant social group share the same perception of the technology in question (Pinch and Bijker, 1984, p. 414; Saidi, 2015, p. 11). This way, a relevant social group represent a unique user-technology relationship.

The second concept from the SCOT perspective is interpretative flexibility. According to the idea of interpretative flexibility, each relevant social group might have their interpretation of the technology (Pinch and Bijker, 1984, p. 409). In the context of technology transfer, it suggests that in the destination location, the technology can be interpreted differently from the original location. Additionally, since there are probably more than one relevant social group in the destination location, the transferred technology would also have more than one interpretation in the destination location. The concept of interpretative flexibility not only covers the flexibility of how people might interpret the technology but also how people can design, improve, or modify the technology (Pinch and Bijker, 1984, p. 421; Saidi, 2015, p. 11). It means that in the concept of technology transfer, the concept of interpretative flexibility also permits and expects the relevant social group in the destination location to actively modify the technology rather than only being the passive receiver of the technology.

The third concept from the SCOT perspective is closure and stabilisation. Since the various social groups would have different interpretations of the technology, the interpretative flexibility would create problems and controversies among the relevant social groups (Pinch and Bijker, 1984, p. 424; Saidi, 2015, p. 11). Every group will have their interpretation of the technology that might conflict with the interpretation from other groups. The technology in question would undergo a series of development and modification to resolve the controversies and problems. In this sense, the stabilisation of technology means the problem and controversies are disappearing (Pinch and Bijker, 1984, pp. 426–427). In other words, various relevant social groups reach a consensus after the technology has been modified and adapted so that the interpretation of these various social groups is not in conflict with each other. This stabilisation process serves as the closure mechanism for various problems and controversies associated with the technology. After the technology has been stabilised and the closure has been reached, there might still difference in interpretation among the various relevant social groups. However, this difference does not lead to controversies. In the context of technology transfer, the relevant social groups are not only facing controversies that stem from the difference among different social groups. Controversies also came from the difference in interpretation between the social groups in the original location and the destination location.

The SCOT perspective also has been used by scholars to develop a more user-centric approach to technology transfer. For example, Saidi used the SCOT approach to develop his notion of

travelling technology (Saidi, 2015). According to him, the key difference between technology transfer and travelling technology is that technology transfer is about diffusing a new technology to the (potential) users. The producer of the technology mainly drives this transfer technology. Therefore, the technology producer is the main focus of technology transfer. In contrast, travelling technology is about the (potential) users appropriating technologies being introduced to them (Saidi, 2015, p. 9). Since every relevant social group (or every relevant group of users) has their interpretation of the technology, every group has their way of appropriating the technology. In Saidi's work, we can already see the shift of focus. The notion of travelling technologies puts the (potential) users in the main focus, whereas in the traditional transfer technology perspective, the users are treated as receivers who do not have much to say in the diffusion process.

In his works, Saidi has used the case of nanotechnology in Africa as the object of his study (Saidi, 2015). According to him, nanotechnology is a novel technology in Africa whose use cases are still being developed. He studied nanotechnology as a technology that travels from laboratories to various users across geographical and country borders in Africa. These users are situated in a context that is different from the context in the laboratories. Therefore, the technology needs to be appropriated by the users to fit in the context of the users (Saidi, 2015, p. 9). On the one hand, Saidi's notion of travelling technologies has shifted the focus to the users. On the other hand, Saidi's study case has an element that is synonymous with the traditional transfer technology notion. The technology is defined as being novel, and the involvement of the technology producer still plays a significant role. In each study case that he presented, the scientists, who are playing a role as the source of technology, still play an important role in modifying the technologies being introduced to the citizen (Saidi, 2015) even though the scientist were dependent on the information and feedback that was provided to them to make such modifications.

As I already mentioned in section 1.4, in the case of transferring cycling-related technologies to Indonesia, the source of technology played a minor role. In the reverse engineering or copying mode of technology transfer, it is not the technology that the user is appropriating. It is the user that actively appropriates the technology. In this case, the concept of 'creole technology' put forward by Edgerton can further deepen our analysis (Edgerton, 2007). Edgerton defined creole technology as technology that "*finds a distinctive set of uses outside where it was first use in a significant scale*" (Edgerton, 2007, p. 101). This distinctive set of uses is the result of active action performed by the users. They continue to modify the available technology to make that technology fit better in their context. Using this perspective when analysing a transferred technology, particularly the case in reverse engineering mode, we

ought to focus more on the characteristics or use cases that the technology has in the recipient place rather than on the original characteristics or use cases it lacks.

Analysing the case of transferring cycling-related technologies to Indonesia would add to the discussion of the transfer technology phenomenon, particularly transfer technology initiated and done mainly by the recipient. As this cycling technology is not a technology that someone would say is novel, it would also complement Saidi's approach in mobilising the SCOT concept to analyse technology transfer (Saidi, 2015). Additionally, it would also resonate with the famous Indonesian saying "*Amati, Tiru, Modifikasi (ATM)*", which translates to "Observe, Imitate, Modify". This saying means that we do not need to reinvent the wheel. Instead, first, we could observe and analyse something (for example, a technology) that works in other countries or places. Then, we try to imitate to create it in Indonesia. Lastly, modifying the said technology to suit the Indonesian context is essential.

1.7 Current State of Research and Placement of This Thesis

On the one hand, there are already discussions regarding technology transfer and cycling, especially when cycling is painted as a sustainable means of mobility in urban areas. Ruth Oldenziel et al. compiled the stories of the development of cycling in 14 European cities (Oldenziel *et al.*, 2016). The development shares one general characteristic. In the 1970s-1990s, there was a shift in how the citizen and policymakers perceived bicycles (Oldenziel *et al.*, 2016, p. 188). Before, bicycles are seen as old-fashioned means of transport. After that, bicycles are seen as a sustainable transport method that promotes public health in those cities. However, the development of cycling in those 14 cities depends not only on that one shift. There are many factors at play, and each city is unique. Nevertheless, these 14 cities exchange best practices for promoting cycling, especially in the field of policymaking. These shared best practices then transferred to other cities in Europe when these other cities were eager to promote cycling in their area (Oldenziel *et al.*, 2016, pp. 190–191). However, despite the transfer of best practices, we do not have much proof of what practice actually worked (Oldenziel *et al.*, 2016, p. 194). What is the effect that transferred practice brings? What is the effect of local circumstances and appropriation?

Some studies focus on replicating the cycling culture that thrives in the Netherlands, Denmark, and Germany in other countries, especially in the USA (Pucher and Buehler, 2008; Stehlin, 2014, sec. 4). According to Pucher and Buehler, the government in those countries play a significant role in developing policies that promote cycling (Pucher and Buehler, 2008, p. 496). This governmental action is as important as other contextual factors such as climate, topography, history, and culture. They found that replicating cycling culture is more than just copying the Netherlands, Denmark, and German policies. Policies in these three countries are not limited to pro-cycling measures such as building more bicycle lanes and parking facilities.

The policies also deal with the restrictive measure that makes driving a car less desirable (Pucher and Buehler, 2008, p. 525). However, the USA's socio-political context makes restricting car usage challenging (Stehlin, 2014, pp. 9–10). In other words, transferring technology and policy about promoting cycling is not as straight forward as it sounds. It is not just picking the best practices that work in a country and placing them in another country. It is about appropriating the best practices to fit the local context. That is easier to be said than done.

Indonesian scholars also discussed the possibility of transferring technologies, infrastructure, and policy models from abroad to promote cycling in Indonesia (A Artiningsih, 2011). Cycling is viewed as an important factor in making living in urban areas more environment-friendly and sustainable. One key factor in achieving sustainable city design is incorporating debate and participatory decision-making mechanisms in the planning phase (A Artiningsih, 2011, p. 31). Therefore, similar to Pucher and Buehler's point, best practices from abroad are best viewed as a starting point to spark debate among its potential users, the citizens. Trough this debate, the best practices are mended to serve the context of the citizens.

In addition to academics, urban design practitioners also have discussed transferring best practices of micromobility from other places to improve transportation within a city (Yanocha and Allan, 2021). Micromobility here refers to "small and lightweight devices that operate at speeds below 25 km/h" (Yanocha and Allan, 2021, p. 5). Bicycles, e-bikes, shared bicycles, and rickshaws are examples of this micromobility. In one of their reports, Institute for Transportation & Development Policy (ITDP) gives several exemplary cases of micromobility worldwide (Yanocha and Allan, 2021). Since it has successfully promoted micromobility, the author perceives that those exemplary cases can be transferred to other cities eager to improve their micromobility condition.

On the other hand, some studies emphasise that the citizen has a significant role in promoting cycling in their city. In Yogyakarta, Indonesia, a local cycling community named Jogja Last Friday Ride (JLFR) repaired the broken cycling facilities in the city to protest against the local government's negligence (Thoriq, 2015). Through this protest, JLFR made cycling more visible not only in the eyes of the government but also in the eyes of other citizens. As more people became aware that people are cycling in their city, JLFR hoped it could motivate more people to cycle. A similar movement also happened in the USA. Movements such as Bike Party and *SFCriticalMass.org* in San Francisco was trying to show that bicycle and cyclist is part of the traffic in urban areas (Stehlin, 2014, p. 5). This kind of movement helps San Francisco become a bicycle culture hotspot in the USA (Stehlin, 2014, p. 6).

Even if initially unrelated to cycling, a community movement can still substantially impact promoting cycling. *Stop de kindermoord* (Stop the Children Murder) emerged in the Netherlands during the 1970s, aimed to ensure more excellent safety for children on the streets (Oldenziel *et al.*, 2016). They did not demand more cycling provisions in the city. However, more cycling-friendly policies can boost the number of cyclists in the city while reducing the number of cars. As bicycles pose less danger to the children, *stop de kindermoord* movement then indirectly positively affects cycling in the city.

In this thesis project, I would like to try to connect the technology transfer notion on the one hand and the role of the citizen as the potential user of the technology on the other hand, particularly regarding cycling as a form of urban mobility and its related technologies. My case of a more user-centric approach to transferring cycling technology would sit nicely between the two sides discussed above in this section.

1.8 Methodology and Structure of the Thesis

In this thesis, I would like to offer another perspective on the technology transfer phenomenon, precisely when the transfer happens across country borders. Since the technology transfer paradigm seems to be incomplete to analyse the technology transfer phenomenon that is mainly driven by the recipient (the user), How can we analyse such a case using a user-centric approach? Using the case of cycling infrastructure. I would like to show that we can shift the focus point from the source to the recipient. Furthermore, by shifting the focus point, there are meaningful insights that are otherwise difficult to discover if we put our focus on the source. Since the focus point in this thesis is the technology user, the SCOT framework is used to guide the research and writing process.

In Chapter 2, in line with the SCOT framework, I tried to identify the user groups and the technology related to cycling in Indonesia. In Section 2.1, the user groups who cycle in Indonesia are identified and analysed. In other words, I tried to answer the question: who is perceived as the user of a bicycle (cyclist) when people are talking or discussing cycling in Indonesia? Since the focus is on the cyclist in Indonesia, I searched for sources that discussed cycling specifically in Indonesia or authored by the author of Indonesia. I used Scopus to look for articles delivered in English. For articles delivered in Indonesian, I used Garuda (garuda.kemdikbud.go.id), which indexes journals and publications in Indonesian. The articles found on Scopus and Garuda are used as starting points to snowball. Additionally, I used articles published in Indonesian online newspapers to provide additional nuances often not captured in academic study. It is worth noting that the SCOT framework advocates us to look also for the marginalised user groups that are often overlooked. After that, I grouped the findings to try to construct various user groups (cyclists) in Indonesia.

In Section 2.2, the cycling infrastructure as the technology is identified. In other words, as Indonesian discussed cycling, what is being referred to as the infrastructure? Furthermore, where these infrastructures are (being) built? A strategy similar to the previous section is also used to locate the sources. Additionally, I also used sources from the government's official documents. The findings from these two sections then feed into the analysis in Section 2.3.

In Chapter 3, following the Idea of technology transfer, the source of cycling-friendly technology is identified. In other words, which country is perceived to have exemplary cases that Indonesians seek to copy? An approach similar to the previous chapter was also applied when locating the sources. Then following up the analysis in the previous chapter, the findings are grouped based on their proximity to the Indonesian government. Additionally, to capture better the view from cycling communities, I included their official social media channel as a source. I also included documents from institutions that sits in between the academics and the government (for example, Institute for Transportation and Development Policy (ITDP)) to capture the transfer process better.

In Chapter 4, I compared the context around cycling In Indonesia and other countries (in this case Netherlands) to show the difference in context among countries. The context in the Netherlands is mainly distilled from sources that mainly discuss the development of cycling in the Netherlands, for example, the book *Cycling Cities: The European Experience* (Oldenziel *et al.*, 2016). After depicting the differences, I tried to give several implications to how Indonesians are transferring these cycling-friendly technologies and policies.

In Chapter 5, I tried to put my findings into the context of fostering cycling in Indonesia. At the same time, I also reflect on the current studies about transferring cycling technologies to other countries. I used the findings and the reflection to formulate several suggestions for fostering cycling in Indonesia and encourage future research on this topic. Additionally, I also reflect on the way I used the SCOT framework.

2 Cycling in Indonesia

Since we are analysing this bicycle technology transfer from the user's perspective, taking the cyclist in Indonesia as the starting point is worthwhile. This perspective aligns with Edgerton's suggestion that we should focus on what characteristics exist on the recipient or the appropriating side. This perspective is also in line with the SCOT perspective in which the relevant social groups and their related interpretative flexibility are analysed. In other words, what is the typical user group that uses bicycles and its related infrastructure in Indonesia? This question will serve as a starting point for us to analyse further the perception of these users regarding bicycles and their related infrastructure and the user-technology relationship established between these users and cycling technology copied from abroad.

2.1 Indonesian Cyclist

In general, the user of bicycles in Indonesia can be categorised into two categories. The first one is people who cycle mainly for fun and perceive cycling as a recreational activity. Let us name this group “Recreational cyclist”. The second group is people who cycle to support their activities in daily life. Let us name the second group as “daily cyclists”. It is worth noting that these two user groups are not mutually exclusive. It means that a person can belong to one group at a time, then at some other time belong to the other group. For example, people who use bicycles in part of their daily weekday commute might also enjoy cycling for fun at the weekend. In this section, I will elaborate further on each group's characteristics.

2.1.1 Recreational Cyclist

As the name suggests, this group of bicycle users use their bikes to do leisure activities. One of the types of leisure activity in Indonesia is exercising, especially among men (Song, Kirschen and Taylor, 2019, p. 141). Another study conducted in Yogyakarta, a city in Indonesia, suggest the most popular intention for the citizen of Yogyakarta to use their bike is to exercise (Irawan, Bastarianto and Priyanto, 2022). In other words, this group of users perceive cycling as a sports activity, and they perceive cycling as a healthy activity. Because of their perception of cycling, this group perceives bicycles as sports equipment used to support their exercise activity. This perception affects the type of bicycle used by recreational cyclists. This recreational cyclist often chooses the “road bike” type of bicycle. (Alsadad Rudi, 2021).

2.1.2 Daily Cyclist

The second type of cyclist that exist in Indonesia is the daily cyclist. This type of cyclist uses a bicycle in their daily activities in their life. Within this type of daily cyclist, I would like to present three relevant social groups that, even though they would not cover the full spectrum of daily cyclists, can still represent the diversities. Each social group attaches a unique meaning to their bicycle, which would affect their interpretation of cycling.

2.1.2.1 Street Vendors

The first group of cyclists relies on their bicycles to earn a living. For example, street vendors in Jakarta use their bicycles as a means to showcase their products (Alsadad Rudi, 2021). For these street vendors, their bicycle is important since their bicycle enables them to earn money for a living. Without their bicycle, it is difficult for them to seek another job. It is worth noting that to these street vendors, the term bicycle is not limited to the typical bicycle with two wheels. They use a modified version of a bicycle with three wheels that enable them to carry their goods. Some street vendors use a bicycle with two wheels, but it is modified in such a way as to increase carrying capacity, for example, by the addition of big racks in the front or the back of the bicycle. Despite this variety, these street vendors still call them bicycles. Figure 2

below shows an example of a modified bike with racks to carry a hot water pot in the back and various kinds of instant drink sachets in the front. In short, the circumstances of the street vendors make them dependent on their bicycles and make them daily cyclists.

Figure 2 Example of street vendor using his bicycle in the street of Jakarta (Alsadad Rudi, 2021)

2.1.2.2 Woman

The second group of daily cyclists is those whose job or occupation is not dependent on a bicycle, yet due to other circumstances, they still use it in their daily life. For example, a group of women in Solo also use bicycles in their daily life (Song, Kirschen and Taylor, 2019). Similar to the case of street vendors in Jakarta, this group of woman cyclists also became daily cyclists because of their circumstances. In Indonesia, it is very much the custom that a man shall provide for his family. Therefore, a husband in a family is expected to work while their wife is taking care of the house and the children. Since the job location is not always near home, the husband is often prioritised using whatever personal transportation is available to the family. Often, the first motorised transportation a family acquires is a motorcycle. Due to the family's financial situation, they often can only afford one motorcycle. To illustrate, the cheapest motorcycle on the market is around 20 million rupiahs (Astra Honda, 2023), and the average income per month of a family in Indonesia is around 5.9 million rupiahs per month (Badan Pusat Statistik, 2023). Notably, most Indonesians work in the informal sector and earn less than the average (Mustajab, 2023). Therefore, due to the custom and financial circumstances, the man is often prioritised to use a motorcycle (Song, Kirschen and Taylor, 2019, p. 149). The rest of the family, the wife and the children must seek an alternative means of transport. In this case, the bicycle is preferred by women who live in Solo's urban and sub-urban areas (Song, Kirschen and Taylor, 2019). To these women, their bicycle is a means of transport that is economically feasible for them to use. In Surabaya, most cyclists who cycle in or through the city are students (Adiguna *et al.*, 2018, p. 6). They often cycle around 04:00 to 06:00 in the morning, five days a week or more. Although the authors do not specifically mention the

destination, it can be safely assumed that these students commute to school, typically from 6:30 to 7:00 in the morning. It is also mentioned in Adiguna's study that the majority of cyclists have an income of around 3-4 million rupiah, well below the average of Indonesians (Adiguna *et al.*, 2018, p. 7).

2.1.2.3 Cycling Community Member

The third group of daily cyclists is those who choose to bicycle to support their daily activities, but they choose to do it not because cycling is their only option. They choose to cycle as a means of transport, albeit they have other transportations choice. An example would be people who are members of the Bike2Work community. As the name already suggests, this community's members use bicycles when commuting to their workplaces. Bike2Work has chapters in most cities in Indonesia. What distinguishes this community from the street vendor and woman case mentioned before is that the members of Bike2Work do not necessarily depend on the bicycle to do their job or have no other choice. The Bike2Work member cycle to their workplaces while the street vendors cycle for work. Its members also have access to other means of transport, such as cars or motorcycles. Despite their more choices, the community member chooses bicycles as a means of transport in their daily activities. A glimpse into Bike2Work's vision can help explain this situation. Their vision is "*...making the quality of life better by cycling*" (Adityo, 2017, p. 60). In other words, the member of the Bike2Work community perceives that better quality of life, especially in the urban areas, can be achieved by popularising cycling in the daily commute. In line with this vision, the community positions their daily commute using bicycles as a campaign to promote cycling (Adityo, 2017, p. 62; Asasi and Astuti, 2019, p. 5). The community also tried to expand the definition of work in their name, "*... 'work' in Bike2Work in expanded from only working to covers all kind of daily activities...*". (Adityo, 2017, p. 60). In other words, the community tries to paint itself as inclusive and open to all cyclists who cycle to accomplish their daily activities. This campaigning activity distinguishes them from the street vendors and women case. While the two previous cases do not promote cycling, cyclists in the Bike2Work community actively try to influence others to cycle daily.

For the three groups of daily cyclists discussed above, being a daily cyclist does not mean that they do not enjoy cycling. The women in Solo also happened to cycle together if they happened to have the same destination on that day. One of the women stated, "*It is fun to bike to certain places together*" (Song, Kirschen and Taylor, 2019, p. 152). The members of the Bike2Work community enjoys their trip to their workplace and back despite the seemingly harsh condition they have to overcome (Bike To Work Indonesia, 2023a). They try to influence others to cycle since they enjoy their daily cycling activity.

It is also important to note that these daily cyclists, especially the street vendor case and the woman case, are less noticeable when compared to recreational cyclists. Recreational cyclists are often cycling in groups. In Figure 3 below, a group of sport bike users almost use the entire width of the street in Jakarta and make a motorcyclist angry at them. This behaviour creates inconvenience for other street users. Compared to the street vendor in Figure 2, the street vendor is almost unnoticeable if we pass them, thus creating no inconvenience. Due to this inconvenience, people started talking about them. Like a snowball effect, this leads to more and more attention towards this recreational cyclist. Eventually, this leads to the situation in which cyclist (*pesepeda* in Indonesian) is perceived as the synonym of recreational cyclist (Alsadad Rudi, 2021; Ivany Atina Arbi, 2022). Consequently, the already unnoticeable daily cyclist became more concealed.

Figure 3 A motorcyclist is angry towards a cyclist in the street of Jakarta (Gatra, 2021).

2.2 Cycling Infrastructure in Indonesia's Urban Area

Although cycling is already done in Indonesia since early 1910 when the Dutch colonial government brought bicycles to Indonesia to be used by government officials (Shanty Yulia, 2021), one of the earliest instances of the cycling infrastructure in Indonesia being discussed is on the standardisation document issued by Indonesia's Ministry of General Work (*Kementrian Pekerjaan Umum*) in 1992 (Direktorat Pembinaan Jalan Kota, 1992). This document serves as a guide to constructing new streets and roads in the city or urban environment. Then, the critical discussion about cycling infrastructure in Indonesia began around the 2000s (A Artiningsih, 2011). In defining what cycling infrastructure is, these discussions often refer to the cycling infrastructure that has already been built abroad (A Artiningsih, 2011, p. 36; Irawan, Bastarianto and Priyanto, 2022, pp. 385, 386). Cycling infrastructure abroad is perceived as a golden standard that should be treated as a base for the development of cycling infrastructure in Indonesia (A Artiningsih, 2011). Consequently, the

type of infrastructure that is often categorised as cycling infrastructure in this discussion is influenced by cycling infrastructure abroad. In this section, I investigated what type of artefact that mentioned when people in Indonesia were talking about cycling infrastructure in Indonesia.

2.2.1 Cycling infrastructure artefact

In the earliest guidance on how to design streets and roads in the city issued in 1992, the government of Indonesia already indicated how bicycle paths (*jalur sepeda*) should be designed (Direktorat Pembinaan Jalan Kota, 1992). Even though the sub-chapter about bicycle lane design only occupied two pages in the document with more than 200 pages. This guideline was then updated in 2021 to reflect the changes in Indonesian traffic law (Direktorat Jendral Bina Marga, 2021). The 2021 guideline is a dedicated guideline about the design of bicycle paths instead of a mere subchapter. The ministry which oversees this guidance document refers to several design guidelines from abroad, such as the United States of America, Australia, and the United Kingdom. This detail can be seen in the bibliography of the guideline. While they do not specifically mention why they chose this specific country, it can be assumed that since this guideline is in English, it is more accessible than other guidelines from countries whose official language is not English.

Furthermore, it is common in Indonesia, especially in the engineering context, to create a design guideline based on the American guidelines. For example, let us take the Indonesian National Standard (*Standar Nasional Indonesia, SNI*) SNI-1726-2019, which covers the guideline for constructing earthquake resilience houses and building in Indonesia (Badan Standardisasi Nasional, 2019). The Indonesian standard mentions that the American building code ASCE/SEI 7 consensus also applies to the Indonesian Standard. In other words, the resulting Indonesian standard would have the same basic assumption as the American version. The same situation also can be found in the Indonesian National Standard that covers how the road and streets in urban areas should be designed, RSNI T- 14 - 2004 (Badan Standardisasi Nasional, 2004). Many assumptions and consensus are taken from the American version of the standard in many parts of the Indonesian Standard. In short, in Indonesia's design and engineering context, creating a design guideline based on a similar standard already existing in English-speaking countries, especially the United States of America, is common and considered the best practice.

Nevertheless, the updated guideline also brings a new perspective to urban designers. In the preface of the newest guideline, bicycles are said to have the potential to be used as a means of transport for movement within the city and short-distance movements. Additionally, the increase in the usage of bicycles is expected to reduce the usage of motorised vehicles, reducing fossil fuel consumption (Direktorat Jendral Bina Marga, 2021, p. ix). Reducing motorised

vehicles is also synonymous with reducing pollution, which is believed to make living in the city healthier. This change in perspective is similar to the changes in the Netherlands. Around the 1970s in the Netherlands, there were movements headed by the citizen to reframe bicycles as an eco-friendly means of transport in the city that is sustainable and healthier for the environment (Albert de la Bruheze and Oldenziel, 2016, pp. 86–87). Albeit around 50 years time differences, the change of perspective in both countries is comparable. In short, by publishing this guideline, the government explicitly paints the picture of cycling as a more sustainable alternative to driving a car that needs to be fostered. The old guideline that was released in 1992 does not share this perspective.

The newest guideline has three types of bicycle paths (Direktorat Jendral Bina Marga, 2021). The first one is bicycle path type A. This type of bicycle path is physically protected from other street users, typically cars and situated outside of the area of the street that is designated for motorised traffic, such as cars and motorcycles (see Figure 4 below). The type of protection recommended are curbs, a strip of green area, or a row of planter boxes. The second one is bicycle path type B. This bicycle path is constructed on the sidewalk, thus sharing space with the pedestrian (see Figure 5 below). The third one is bicycle path type C. It is an unprotected bicycle path on the street that is only painted or marked, thus sharing space with cars and motorcycles (see Figure 6 below). The guide recommends that a type A bicycle path should be built on the street with a high volume of motorised traffic. Conversely, a type C bicycle path could be built in calmer areas with low motorised traffic (Direktorat Jendral Bina Marga, 2021, p. 18). While it seems logical to protect the cyclist, the recommendation is not always like this. On the old guidance (Direktorat Pembinaan Jalan Kota, 1992), the recommendation is based on the volume of bicycle traffic on that bicycle path. More bicycle traffic suggests more protected bicycle paths.

In contrast with the new guidelines, the old guideline uses bicycle traffic volume to determine the type of bicycle path. These changes infer that the justification to build (or plan to build) a more protected bicycle path no longer depends on the volume of bicycle traffic. Therefore, urban designers can propose a more protected bicycle path in an already busy street while the number of cyclists is still low, assuming that the number of cyclists will grow in the future. In other words, this new guideline assumes that the bicycle lane is perceived as an attractive factor for people to cycle. In contrast, in the old guideline, the bicycle lane is perceived as a means to protect the existing cyclist. These changes in technical details seem to align with the new guideline's perspective that portrays cycling as an alternative to driving a car or riding a motorcycle.

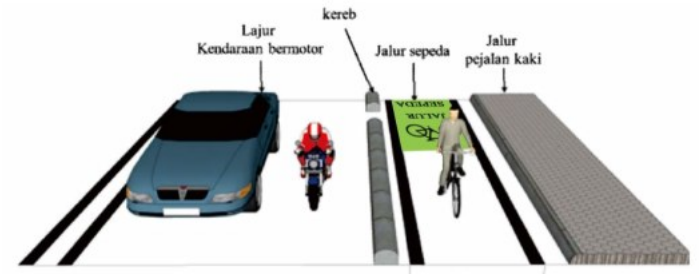

Figure 4 Bicycle path type A (Direktorat Jendral Bina Marga, 2021, p. 23).

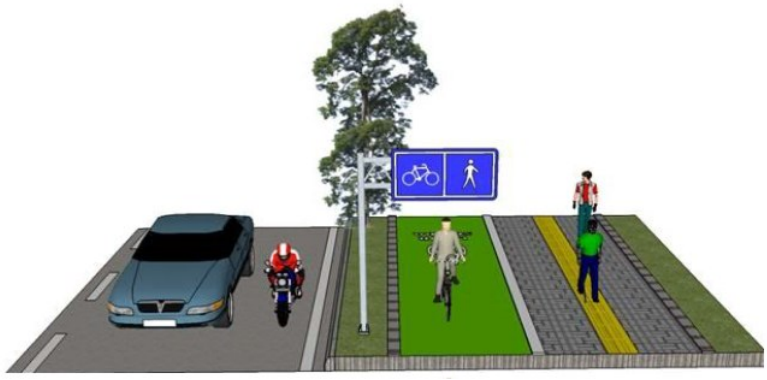

Figure 5 Bicycle path type B (Direktorat Jendral Bina Marga, 2021, p. 38).

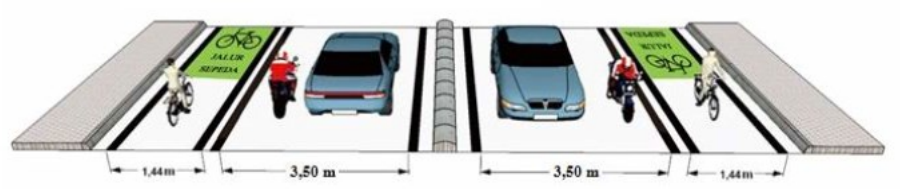

Figure 6 Bicycle Path type C (Direktorat Jendral Bina Marga, 2021, p. 44).

It is interesting to see here deeper about the type A bicycle path. The definition says that this type of bicycle path can be situated on or off the street as long as the bicycle traffic is separated from the rest of the traffic (Direktorat Jendral Bina Marga, 2021). According to this definition, this type of bicycle path can be designed and built where a street for motorised traffic does not exist. If we look at the countries where cycling is prevalent, such as the Netherlands, we see that this kind of bicycle path only reserved for cyclists is quite prevalent. For example, the bicycle-only path "Fiestsnelweg F35" connected the city of Enschede with other surrounding areas and villages (Fietssnelweg F35, 2020). However, if we look closer at the typical design provided in the Indonesian guidelines, this kind of bicycle-only bicycle path is not explicitly elaborated. In the guideline, the typical bicycle path type A design is always situated on or beside the street for motorised traffic. (Direktorat Jendral Bina Marga, 2021, sec. 4.2.6.7). There are two possible extreme explanations for why this is the case. The first explanation is that the bicycle path is seen only as a complement to the streets for motorised vehicles. The

second explanation is that there is not enough room to built dedicated bicycle paths in urban areas in Indonesia. Therefore, why bother to create a guide to build one? While it is difficult to pinpoint where exactly the proper explanation is in this spectrum, I would say that it is safe to assume the proper explanation must fall somewhere in the middle of this spectrum.

2.2.2 Location of the cycling infrastructures

After we discussed what is formally defined as cycling infrastructures, the next question that come up is where these cycling infrastructures are (being) built.

One common location where the cycling infrastructure is built is in the centre of the city. In 2019, in Jakarta, the municipal government of Jakarta (*Pemerintah Daerah DKI Jakarta*) launched a pilot program in which several bicycle lanes in several locations in Jakarta were being built and tried (Umasugi, 2019). The pilot program lasted for several months. Because of the positive feedback that the city gave during the pilot, at the end of the pilot program, the then-governor of Jakarta issued an edict that regulated the layout of bicycle lanes in Jakarta (DKI Jakarta, 2019). The location where these bicycle lanes are located is depicted in Figure 7 below. The bicycle lane seems to have a centre and three legs: the centre-east leg, centre-east leg, and centre-south leg. It is worth noting that the intersection of these legs is located in one of the busiest areas in Jakarta on the weekdays since there are many office buildings and government offices located in this area. As we move towards the opposite end of the leg, outward from the centre, the landscape changes to be more residential. Not saying that the area in the centre is devoid of residential buildings, but the office area is more common in the centre, as depicted in Figure 8 below. Therefore, it can be inferred from the layout of the mandated bicycle lane this bicycle lane is projected to be used by people who commute from their homes in the outskirts to their offices in the centre. However, this projection is not explicitly mentioned in the edict.

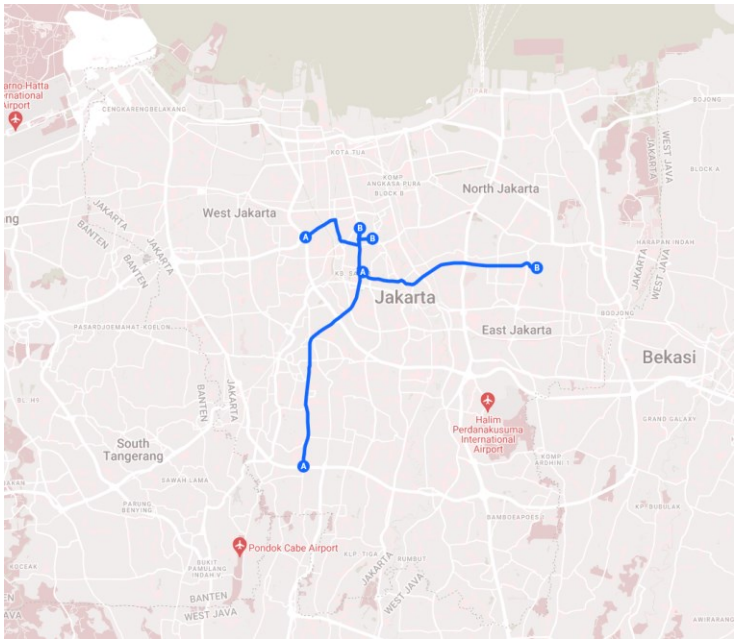

Figure 7 Location of bicycle lane that was built by Jakarta's municipal government (Pemerintah Daerah). The bicycle lances appear to be radial; one end of the leg starts at the outskirts and terminates at the centre. Adapted from (DKI Jakarta, 2019; Dinas Perhubungan Jakarta, 2022)

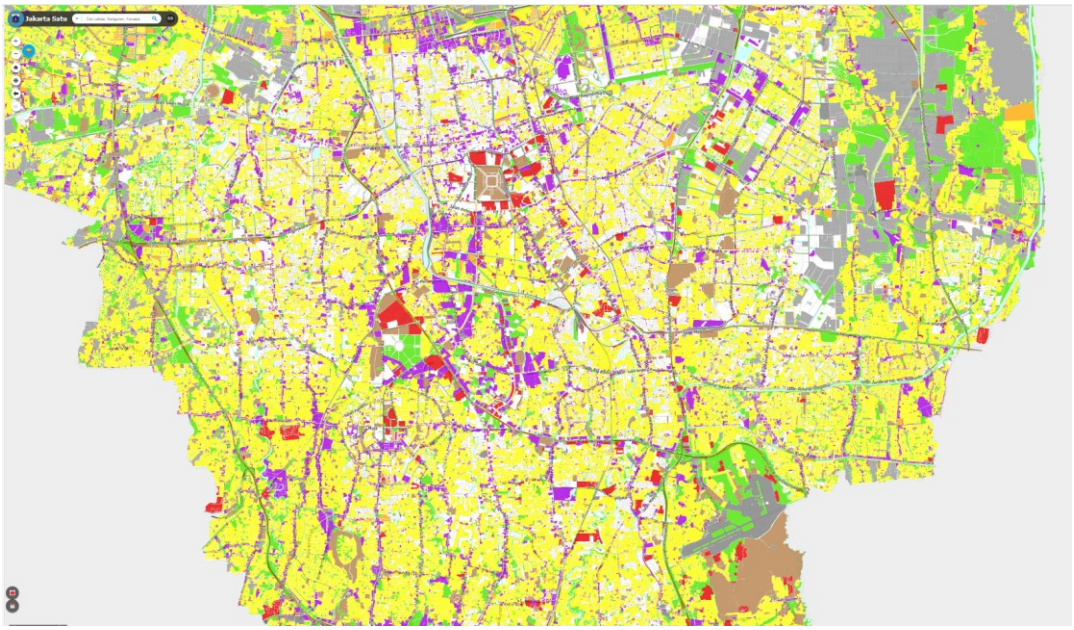

Figure 8 Map of Jakarta colour coded by land usage, yellow means a residential area, purple means offices designated for private use, and red means offices designated for the government. (GIS Jakarta Satu, no date).

Construction or planning construction of cycling infrastructure in the city centre is not unique to Jakarta. Other cities in Indonesia also tend to build cycling-friendly infrastructure in the centre of the city. Solo, a city in the Middle Java province, also has a cycling infrastructure that is concentrated mainly in the city centre (Song, Kirschen and Taylor, 2019, p. 153). In Tegal, also a city in Middle Java, a study is conducted to assess the feasibility of constructing six bike lanes. Four of which are on or terminated in the city centre (Rusmandani and Arifin, 2015). In Malang, the local government built a city centre bicycle lane (Sasongko, Ratnaningsih, and

Supiyono, 2017). In Wonosari, research is done to analyse the local government's plan to build bicycle lanes in the city centre (Prasetyo *et al.*, 2020). In Bandar Lampung, a study is done to analyse the perception of cyclists towards the already-built bicycle lane on Ryacudu Street (Murwadi, 2023). This bicycle lane originates from the city's outskirts and is built in the direction of the city centre, albeit not yet reaching the city centre. Nevertheless, this bicycle lane shares the radial pattern observed in Jakarta and other cities in Indonesia. In Bandung, there is a plan to build bicycle lanes and bicycle parking facilities mainly on or near the city centre (Weningtyas *et al.*, 2018). It is worth noting that the cities mentioned above varied in size. On the big end is Jakarta, with an area of around 600 km^2. On the small end is Wonosari, with an area of around 70 km^2. The difference in size is not perceived as a hindrance to building bicycle lanes in the city centre. In other words, there is a trend to build cycling-friendly infrastructure in the centre of various cities in Indonesia. Some cities have already built bicycle lanes, while others are still planning to do so. Nevertheless, the cities in Indonesia, no matter how big or small, appear to focus on radial-type bicycle lanes which connect the city's outskirts to the centre (see Figure 7).

Additionally, construction or planning the construction of cycling infrastructure is also popular in the area around and inside a university. The bicycle lane in Bandar Lampung city on Ryacudu Street passes by a local university, Sumatera Institute of Technology (*Institut Teknologi Sumatera, ITERA)* (Murwadi, 2023, p. 78). In Malang, the local university, *Universitas Brawijaya*, conducted research to study how people inside the university (students, teachers, and staff members) would perceive the new bicycle lane inside the university area that is planned to be constructed (Pranata *et al.*, 2015). The authors also suggested which type of bicycle lane is suitable for the planned lanes (see section 2.2.1). In Semarang, the then Rector of *Universitas Negeri Semarang* was eager to promote cycling as a mode of transport, at least within the university (Indrianingrum, Narendra and Arfitriyani, 2012, p. 78). In the planning phase, a study is conducted to analyse the potential demand for cycling in the university and the suitable infrastructure to support the demand (Indrianingrum, Narendra and Arfitriyani, 2012). A similar study was also conducted in Depok, in *Universitas Indonesia* (Gituri, Sumabrata and Tjahjono, 2014). *Universitas Indonesia* also has a bike-sharing system that was first introduced in 2007 (Putri and Tristiyono, 2019, p. 161). *Universitas Indonesia* is not the only university in Indonesia that introduced a bike-sharing system to be used in the university area. *Institut Teknologi Bandung* also introduced a similar bike-sharing system in 2019 (Mahbub and Fikri, 2018). In addition to the city centre, universities in Indonesia also happen to be the location where bicycle-friendly infrastructure is built or planned to be built. The infrastructure in the university is also more varied and experimental compared to the one that builds in the city centre. The bike-sharing system that introduced in *Universitas Indonesia* and *Institut*

Teknologi Bandung is positioned as prototype that can potentially implemented in the city where the university located, Depok and Bandung, respectively (Weningtyas *et al.*, 2018).

2.3 Cycling in Indonesia: Where exactly?

2.3.1 Daily Cycling

Up to this point, we have covered the types of bicycle users and the locations where the cycling infrastructure is built or planned to be built in Indonesia. However, one question lingers, where is cycling exactly happened? In this section, we tried to answer this question. In this section, I would like to analyse where the cyclist discussed in section 2.1 actually cycles and further see the relation with the kind of cycling infrastructure discussed in section 2.2.

First, let us start with the first type, the daily cyclist, the one that literally uses their bicycle to earn a living, the street vendor. These street vendors commute from their homes to their workplaces. However, most cycling happens in the workplace, which is the streets in the city centre, namely the busy street in the middle of the city where they can offer their goods (Alsadad Rudi, 2021). If we took the city of Jakarta as an example, these busy streets happen to be located where the three legs of the bicycle lane converge in the middle of the city, see Figure 7. This location is busy since this is where high-rise office buildings are located. The customers of these street vendors are actually the workers who work in these office buildings. The street vendors use the bicycle lane, especially the one that is built alongside the office area, to move around from one location to the other within that office area (Alsadad Rudi, 2021). They have to reposition themselves multiple times a day to have a better chance to meet more potential customers and sell their goods. Furthermore, these street vendors also have to reposition themselves if law enforcement is in sight since what they are doing is not entirely legal. The law stipulates that a permit is required to be a street vendor in this office area. Encounters with a law enforcement officer will likely result in either paying a fine or their bicycle, with all their goods, being impounded. The bicycle lane also helps them quickly escape these potential encounters (Alsadad Rudi, 2021).

The second type of daily cyclist is the group of cyclists that are relegated to using a bicycle in their daily life due to their circumstances. Examples of cyclists who belong in this group are women and students that use bicycles since their families cannot afford other types of transportation means. Where cycling actually happens depends on their activity for a particular day. For women, these activities might vary from day to day (Song, Kirschen and Taylor, 2019). For example, a woman who lives in Solo might need to go to the market on a particular day in a week. On another day, she might need to go to their neighbour's house to perform a social function. Depending on the situation, on another day, they might also need to go to their children's school to meet with the teachers. Although the destination seems to

vary depending on what activity these women do, what these destinations have in common is that the destinations are mainly located in the neighbourhood of the woman's home (Song, Kirschen and Taylor, 2019). Therefore, the cycling activities for these women mainly occurred in the area surrounding their homes. As the cycling infrastructure being built connects residential areas and office areas in the middle of the city (see section 2.2.2), these women consequently very seldom use the cycling infrastructure.

A similar situation also applies to the students who cycle to their school. A study conducted in another city in Indonesia, Surabaya, reports that most of the cyclists they interviewed are students (Adiguna *et al.*, 2018, p. 7). The majority also reported that the distance they have routinely cycled is less than 5km (Adiguna *et al.*, 2018, p. 7). We can infer from this study that cycling mainly happened within the neighbourhood of the cyclist. Comparable to the woman's case in Solo.

The third type of daily cyclist is the cyclist that chooses to commute to their workplace by cycling despite the fact they can choose other modes of transport. An example of this type of cyclist is a member of the Bike2Work community. As the member workplace tended to be the same throughout the week, their cycling route was more or less the same every day. Some of these workplaces are located in the centre of the city. Therefore, there is a member of this community that cycles on the bicycle lane that has been built by the government. For example, Bike2Work posted on their Instagram pages about the daily cycling routine of the members in Jakarta who happen to be on the bicycle lane (Bike To Work Indonesia, 2023a). However, the location of their cycling activity is not limited only to the bicycle lanes since the bicycle lane network is currently limited and only connects a limited number of residential areas. They are cycling from the residential areas, mainly on the city's outskirts, to the office areas in the city's centre.

2.3.2 Recreational Cycling

The other significant group of Indonesian cyclists is the recreational cyclist. One of the most popular locations for recreational cyclists in an urban area is the Car Free Day event, usually conducted in the middle of the city on weekends. For example, the local government of Jakarta issued a regulation stating that the Car Free Day event shall be conducted at least once a month (DKI Jakarta, 2005). In practice, the Car Free Day event is currently conducted twice a month (carfreedayindonesia.org, 2014). During a Car Free Day event, some streets—usually located in the city centre—are closed to motorised traffic. This closure encourages citizens to do all kinds of activities on the closed streets. Cycling is one of the popular activities among the citizen in the Car Free Day event. Figure 9 below depicts the Car Free Day event on M.H. Thamrin Street in Jakarta, where recreational cyclists can be seen among the many people participating. This street is located in one of the busiest office districts in Jakarta. This street

would be full of cars and motorcycles on an ordinary weekday. When the Car Free Day event is underway, this street is full of people walking, jogging, running, and cycling. Coincidentally in Jakarta, the streets where the Car Free Day event is conducted is also the street where the first bicycle lane was constructed. Figure 10 below captured the situation of a Car Free Day event in Jakarta. The barrier that usually separates motorised traffic and bicycle became a barrier that separates the cyclist and the runner. This barrier gave the cyclist more room for them to cycle. The cyclist can cycle faster without being obstructed by people jogging and walking. To the type of cyclist that perceive cyclist as a way to exercise, sure this separated condition is more favourable than mixed (Figure 9 vs Figure 10). However, it is worth noting that cycling in a Car Free Day event in Jakarta was already famous even before the construction of the bicycle lane. The introduction of bicycle lanes increases the popularity of cycling as a sport or exercise.

Figure 9 Situation of a Car Free Day event in Jakarta prior to the construction of the bicycle lane (Mariani, 2018)

Figure 10 Situation of a Car Free Day event in Jakarta after the construction of the bicycle lane (Didi, 2023)

Car Free Day event is not only routinely conducted in Jakarta. Other cities in Indonesia also have a Car Free Day event that is principally the same as the one in Jakarta. The event's name might be different, but the essence is the same. In these events, some streets close to the city centre are closed to motorised traffic. For example, a Car Free Day event in Surabaya is conducted every Sunday (Pariyanto Pariyanto, 2015, p. 7). These Car Free Day events also served as the meeting point of various cycling communities (Pariyanto Pariyanto, 2015). In Jogjakarta, *Sego Segawe*, a Car Free Day-like event was conducted every Friday around the city hall where the office of the city's major and most civil servants is stationed (Thoriq, 2015, p. 299). This event encourages anyone who works in this area to cycle. Additionally, this event was meant not only to make the area around the city hall more suitable for recreational activity but also to give the civil servants an example to make more citizens use bicycles in their daily life (Thoriq, 2015, p. 291).

Recreational cyclists can be found not only at the Car Free Day events. The streets in the centre of the city are also popular as the cycling location for the recreational cyclist even if no event resembles Car Free Day in the city, especially if a bicycle lane is already built. In Lampung, a bicycle lane is constructed along Ryacudu Street. A study by Romadhon and Murwadi indicated that more people cycle on this bicycle lane on the weekend compared to on the weekdays (Murwadi, 2023, pp. 79–80). Most of these cyclists also said they are cycling for leisure on the weekend. This way, Ryacudu Street serves as an extension of the street in their neighbourhood. The bicycle lane enables them to not only leisurely cycle on the street

immediately to their neighbourhood but also on the streets adjacent to their neighbourhood by cycling via Ryacudu Street. Additionally, Ryacudu Street is also relatively straight. Straight streets can attract more sport cyclists, more or less the same as Car Free Day in Jakarta (see Figure 10). In Jakarta, these sport cyclists also can be found outside Car Free Day events. Outside those events, the sport cyclist can be found cycling in the middle of the street despite the bicycle lane already built on the side of the street (see Figure 3).

In section 2.1, I have indicated that recreational and daily cyclists are not mutually exclusive. The following relationship between Car Free Day event cycling communities would provide a concrete illustration in which one person can be a daily cyclist at one time and be a recreational cyclist at the other time. When the Car Free Day event was recently introduced in Jakarta, only a few government personnel were assigned to prevent motorised traffic from entering the area. The Bike2Work community voluntarily joined forces with other cycling communities to guard the Car Free Day area, making it free of motorised traffic (Adityo, 2017, p. 63). They were ultimately enabling not only the member of the Bike2Work community to cycle leisurely but also the other cities as well. In other words, these members of the Bike2Work community act as a daily cyclists on the weekday when they commute to their workplace using bicycles. However, they act as recreational cyclists at the Car Free Day event. The first event resembling Car Free Day in Jakarta was initiated by cycling community members such as Bike2Work in collaboration with anti-pollution activists (Adityo, 2017, p. 63; Mariani, 2018).

In short, cycling in urban areas in Indonesia occurred at various locations and times. While there are cyclists who cycle using the cycling infrastructure that we have discussed in section 2.2, there are also cyclists who cycle despite the absence of the cycling infrastructure. It is worth noting that for both types, daily and recreational cycling was already happening before the construction. Daily cycling, represented by street vendors, women, students, and commuters, was already happening before the bicycle lane was built. Furthermore, especially for women and students, cycling continues to happen even without the bicycle lane. Recreational cycling also already happened without the cycling infrastructure in place, albeit the cycling infrastructure later incentivises the sportier cyclist by enabling them to cycle faster with fewer obstacles.

2.4 Chapter 2 Conclusion

In Chapter 2, we have characterised cycling activity that happens in Indonesia. We have used the perspective of the user, the cyclist. In section 2.1, we discussed the type of cyclists who cycled in urban areas in Indonesia and categorised them based on the cyclist's relation with cycling activity. The first type of cyclist is the recreational cyclist. This group of cyclists view cycling as a healthy activity they can also enjoy leisurely. The second type of cyclist is the daily cyclist. Contrary to the first type, daily cyclists view cycling as a part of their daily routine. They

perceive cycling as a utility to earn a living (for example, the street vendor case) or as a means of transport that can get them to where they need to be for the day. Interestingly, some of these daily cyclists simply have no choice but to cycle (for example, the woman's case and the street vendor's case). While at the same time, some people deliberately choose to cycle despite having other means of transport that they can choose (the cycling community member's case). The existence of both types of cyclists, recreational and daily cyclists, depends on the context. In other words, without the context that the urban environment in Indonesia offers, these types of cyclists might not have existed at all.

In section 2.2, we have discussed the cycling infrastructure in Indonesia's urban areas. The way that the government of Indonesia defined the cycling infrastructure is not static over time since Indonesia also observes the development of cycling abroad and is influenced by it. An interesting change in how the cycling infrastructure is defined can be inferred from the changes in Indonesia's official guidelines for constructing the cycling infrastructure. According to the old guideline, the planner must justify the construction of a bicycle lane using the number of cyclists who use that bicycle lane. However, in the new guideline, the planner can justify using the volume of the motorised traffic along the proposed bicycle lane. The old guideline focuses on creating a suitable bicycle lane for existing bicycle traffic. On the other hand, the new guideline is more focused on protecting the cyclist and giving the cyclist a sense of safety. By providing a safer cycling environment, the government hope that more people will cycle as an alternative to driving a car or riding a motorcycle. Besides analysing the cycling infrastructure, we also analysed the location in which this cycling infrastructure is built or planned to be built. The most popular place to build such cycling infrastructure is along the street that connects the city centre and the residential areas. Additionally, cycling infrastructure is also popular to be built in and around the university, mainly in connection with study and research on the topic of cycling.

In section 2.3, we have tried to connect the various types of cyclists and the cycling infrastructure that has been built. For the daily cyclist, it is not always the case that they use the cycling infrastructure. It depends on the location of their daily activity. The street vendors on bicycles surely cycle on the bicycle lane built in Jakarta's business centre since the offices are there. For them, office areas mean more people that might buy their drinks and snacks. Members of the Bike2Work community who commute to the office areas in the middle of the city also happen to use this bicycle lane. Other members whose office is not located on a street that is equipped with a bicycle lane simply cycle without using the cycling infrastructure. Similarly, the women and students who very seldomly need to go to the city's centre in their daily routine also simply cycle on regular streets and roads without bicycle lanes. There are also cases in which the recreational cyclist also happens to use this cycling infrastructure,

albeit not straightforwardly, during Car Free Day events. Although recreational cyclists are not per se using the bicycle lane on a Car Free Day event, the barrier initially built to separate motorised traffic from bicycle traffic is used to separate bicycle traffic from the others (see Figure 9 and Figure 10).

In short, the type of cycling that exist in Indonesia's urban areas is very contextual. While it surely does not cover all types of cyclists in Indonesia's urban areas, the three exemplary cases that we have discussed serve as a great example that cycling in Indonesia depends on the environment and context in which the cyclist is situated. In other words, using terminology from the SCOT perspective, each exemplary case represents a member of a relevant social group with their own perception of cycling. Each exemplary case has its own perception of cycling. This difference in perception causes interpretive flexibility to occur. The street vendor interprets cycling as a means to earn a living. The woman and student interpret cycling as the only means of transport available to them. The Bike2Work community member interprets cycling as a way to have better living conditions.

On the other hand, the development of cycling and cycling infrastructure abroad influences Indonesia's approach to foster cycling. The development of cycling infrastructure in Indonesia's urban areas hinges on the perception that cycling has the potential to be an alternative to driving a car or riding a motorcycle, at least according to official documents issued by the government. It is also worth noting that influence from other countries also plays a role in creating these official documents. When we compare the three exemplary cases, only one case, the member of the cycling community, perceives cycling as an alternative to driving. The other two cases simply do not have other choices other than cycling. In other words, Indonesia's approach to fostering cycling provides closure to only one of the relevant user groups. Therefore, according to the SCOT framework, the other two user groups should still be in the stabilisation process and ought to be actively involved in the effort to foster cycling in Indonesia.

3 The Source of Cycling-Friendly Technology

In the beginning of this thesis, I introduced a controversy around the construction of cycling infrastructure in Jakarta. There is a motion in the parliament to cancel the construction of bicycle lanes. They argued that the bicycle lane is not used by cyclists but by street vendors who are cycling around the city to sell their products.

Relating to that controversy, we can see deeper into the controversy after we have analysed the cycling that occurred in Indonesia's urban areas. On the one hand, using a more user-centric approach, we have concluded that there are various types of cyclists in Indonesia's urban areas and that usage pattern appears to be contextual. How they build relationships

with the cycling infrastructure and the resulting usage pattern depends on the environment where the users, the cyclists, are situated.

On the other hand, seeing things using the typical technology transfer paradigm, technology is seen as being actively diffused from the source place to the recipient place. While that practice allows the recipient party to make adjustment to fit better the context, the changes are limited to minor and ad-hoc change since the recipient is supplied with blueprints and guidelines. Within these blueprints and guidelines, it is not much wiggle room for the recipient to make changes.

I have briefly mentioned in section 2.2.1 that the official guideline about the construction of cycling infrastructure in Indonesia's urban areas is inspired by the similar guideline in English-speaking countries such as the United States of America, Australia, and the United Kingdom (Direktorat Jendral Bina Marga, 2021, p. 54). This guideline is issued by the Ministry of general work and public housing, which oversee infrastructure construction project in Indonesia. However, this is only one side of the story, namely the story of the government of Indonesia. In this chapter, I would like to investigate a bit more to uncover other parts of the story. If cycling infrastructures are perceived to be a technology transferred from other places, what are the sources according to the Indonesians? Which countries that they perceive as role models? What kind of technology and infrastructure that perceived as an example what worth copying for?

3.1 According to Agencies Close to the Government

Since we have analysed the official guideline issued by the government, let us shift our focus a bit to the group of people who do not belong to the government but have a close relationship with the government. In the bibliography page of the official guideline (Direktorat Jendral Bina Marga, 2021, p. 54), Institute for Transportation and Development Policy Indonesia (ITDP Indonesia) is also mentioned as a source. ITDP Indonesia is the Indonesian branch of the global ITDP organisation. Globally, ITDP has worked with many cities around the world to design and implement development in urban areas, especially in the transportation sector (ITDP, 2018). In Indonesia, ITDP Indonesia has collaborated with the Indonesian government in various cities in the field of transportation. For example, ITDP has shown support for Jakarta's regional government plan to electrify its buses (ITDP Indonesia, 2022).

ITDP Indonesia also published studies and documents that align with the government's plan to build bicycle lanes. One of the published documents is a study to make Jakarta friendlier to cycling (Sufa and Imran, 2020). This document is cited as a source of the official guideline issued by the government. The study covers the policy recommendation for the government to promote cycling and the technical design of the cycling infrastructures that are relevant in

Jakarta. If we look closer at the sources referenced in the documents, we can find Dutch and German documents (Sufa and Imran, 2020, p. 68). Additionally, the documents from the United States of America are also mentioned. However, as we look closer at the ITDP Indonesia's document, Dutch documents are more explicitly mentioned when the author discusses both the policy and technical design recommendations, namely the design guidelines for cycling infrastructure issued by Dutch Bicycle Council (*Fietsberaad*). The documents from other countries are often referred to as a complement to the Dutch documents. In other words, the people at ITDP perceive the Netherlands as a country with better cycling practices that can be treated as a role model if the Indonesian government wants to promote cycling in Indonesia's urban areas.

It is worth noting here that ITDP Indonesia does not create an official guideline that the designers must follow. ITDP Indonesia conducts a study to assist the regional government of Jakarta in promoting cycling. Therefore, they have more freedom in sourcing references. The official guideline, that meant to be technical and aimed toward engineers and designers, are created from the perspective of engineers. Therefore, it followed the consensus in the engineering community. They considered the US-issued guide as the best practice and use it as the main example (see Section 2.2.1 for further discussion). Meanwhile, the people who conduct the ITDP study do not restrict to such consensus. Thus, they have more freedom to incorporate examples from various countries.

3.2 According to Cycling Community Outside of the Government

ITDP Indonesia works not only with the government. ITDP Indonesia also works with the people who use the transportation system. In the context of cycling, ITDP Indonesia also works with the cycling community, such as Bike2Works, in their studies. Therefore, it is also interesting to analyse the perception of this cycling community regarding the source of cycling infrastructure.

Bike2Work is a community consisting of people who share a similar broad vision, namely that incorporating cycling into our daily life can improve the living condition of people living in urban areas. (Adityo, 2017, p. 60). While campaigning for their vision, Bike2Work as a community does not produce studies and documents. However, we can look into their social media page to infer their perception about the source of cycling infrastructures as the Bike2Work community uses their social media page to publish events and ideas that support their vision.

Among the ideas that Bike2Work have published, there are instances in which the Bike2Work community appeal to success stories abroad to support their vision. For example, Bike2Work uses the picture of a street in Amsterdam in 1970 to prove that it is not impossible to make

people cycle in the cities in Indonesia, such as Jakarta (Bike To Work Indonesia, 2023b). They basically argue against people who say it is impossible to make people cycle in Jakarta since there are too many cars already. They argue by depicting that in 1970, Amsterdam was packed with cars. However, now, Amsterdam is not packed with cars and cycling is regarded as a dependable mode of transport in the city, thanks to its cycling infrastructure, such as the bicycle lanes. Bike2Work argues that Jakarta is now similar to Amsterdam in 1970. It is not impossible to make people cycle in their daily routine in Jakarta as long as there is support from the citizen and the government. Another example is when Bike2Work Indonesia uses the video of the morning commute in Delft, where many people are cycling in a strip of bicycle path (Bike To Work Indonesia, 2023c). Bike2Work posted this video as an exemplar that the Indonesian government can copy to promote quality of living in urban areas instead of subsidising electric vehicles.

Another country portrayed as an example by Bike2Work is Japan (Bike To Work Indonesia, 2023d). In Japan, it is common for high schools to issue a policy that prohibits high school students from using motorcycles to go to school. While this practice is commonly linked to measures to limit delinquency (Rohlen and Studies, 1983, p. 41), Bike2Work perceive that this prohibition practically fosters bicycle use among high school students in Japan (Bike To Work Indonesia, 2023d). Based on these instances, we can safely infer that Bike2Work, a cycling community in Indonesia, uses cases from abroad to help them convey their ideas.

3.3 According to Indonesian Academics

The other group of people worth analysing is the Indonesian academics that often discuss cycling and its related infrastructure in the context of urban planning. Similar to the two previous groups of people we discussed above, Indonesian academics also used the cases from abroad as exemplary cases, which were then studied to improve their understanding of urban planning in Indonesia. However, compared with the two previous groups, there is more variety in the countries used as examples. While the two previous groups used very few examples from Asia, Indonesian academics use examples from Asian countries, such as Japan, Hongkong, China, Taiwan, and Singapore (A Artiningsih, 2011; Irawan, Bastarianto and Priyanto, 2022). Indonesian academics also use examples from the Americas and Europe, such as Greece, Germany, France, the Netherlands, the United States, Columbia, and England (Thoriq, 2015; Adityo, 2017; Weningtyas *et al.*, 2018; Irawan, Bastarianto and Priyanto, 2022). The countries that are used as examples are perceived as countries in which the majority of the citizens are actively cycling (Adityo, 2017, p. 55).

Since these scholars mainly discussed cycling infrastructures in the context of urban design and planning, they also discussed how these cycling infrastructures are integrated while also analysing the relevant context in each country. For example, Artiningsih perceives that the

development of cycling infrastructure in Japan, Singapore, and Hongkong is generally limited to public parks and their surrounding areas (A Artiningsih, 2011). It is because cycling in these countries is perceived to be more recreational than utilitarian. These countries prioritised building public transport infrastructure to provide a means of transport for its citizen. Because of that, the citizen also prefers to use public transport if they must move within the city. Consequently, cycling is seen more as a sport than a means of transport in these countries. Therefore, the development of cycling infrastructure in Indonesia is dependent on how the citizen perceives cycling. If Indonesian citizens perceive cycling as more of a sport, then the examples from these countries are worth looking for (A Artiningsih, 2011, p. 38).

Indonesian academics also discussed shared bicycles as part of a more extensive cycling infrastructure. Weningtyas discussed the history of the development of bicycle-sharing systems in Europe (Weningtyas *et al.*, 2018, pp. 110–111). Eventually, the bicycle-sharing system that was perceived as successful in the city of Paris, France, used to be an example to guide the development of bicycle sharing system in the city of Bandung, Indonesia (Weningtyas *et al.*, 2018). Irawan et al. used the bicycle-sharing system in Greece and Taiwan to argue that such a system would be able to nudge the citizen of Yogyakarta to move from using private cars to using a bicycle (Irawan, Bastarianto and Priyanto, 2022, p. 380). The bicycle-sharing system in Greece is perceived to be successful in making people prefer cycling to driving cars.

Even though these academics perceive examples of cycling infrastructure to be successful and make an effort to replicate its success in Indonesian cities, they also find that the cycling infrastructure abroad might not entirely fit with the context in Indonesian cities. Weningtyas stated that while bicycle-sharing systems might be proven successful in cities abroad, it might be challenging to develop and implement them in Southeast Asia, including Indonesia, because of the combination of contingent contexts, such as competition with motorcycles, the difference in cycling habits, and rules for cyclist protection (Weningtyas *et al.*, 2018). The study by Irawan et al. shows that many factors impact people's intention to cycle (Irawan, Bastarianto and Priyanto, 2022). Infrastructure, such as bicycle lanes, is only one of those factors. The other factors, such as the after-effect of the Covid-19 pandemic and the awareness level of climate change issues, are more contextual. Similarly, Thoriq also stated that the successfulness of cycling infrastructure in the Netherlands, specifically in Amsterdam, was heavily influenced by the movement initiated by the cycling community (*Fiestersbond*) (Thoriq, 2015, p. 284). This community perceived to exert pressure on Amsterdam's city government to accommodate the cyclist by building cycling infrastructures. While there are also cycling communities in Indonesia, the context in which the communities are situated might be different. Therefore, the relationship dynamic between the community and the

government might not develop as similarly as in Amsterdam (Thoriq, 2015, p. 305). This dynamic then affects the development and construction of cycling infrastructures. In short, the contextual factors in Indonesia are more likely than not to be different from the factors from the exemplary cases abroad. These differences made cycling infrastructures cannot be transferred as it is.

3.4 Chapter 3 Conclusion

In this chapter, we have analysed the perception of various sources in Indonesia regarding the source of the transferred cycling infrastructure. Firstly, Following the thread on the bicycle lane design guideline issued by the government, we can infer that the government is influenced heavily by similar guidelines issued by English-speaking countries, especially the United States of America, Australia, and the United Kingdom. It is worth noting that in Indonesia, engineering and technical guidelines issued by regulating bodies in the United States are regarded as the best practice. Accordingly, it is not unusual that the government used the guidelines from the United States as a foundation to build their own guidelines. On top of that, the government also used documents from ITDP Indonesia as a reference.

Secondly, we have analysed ITDP Indonesia as an agency that often works with the government but is independent and not part of the government. ITDP Indonesia has conducted an overarching study about the policy and technicalities of cycling infrastructure. In this study, ITDP Indonesia also looks up to countries abroad for examples and inspiration. However, there is one document that is repeatedly referenced both in the policy analysis part and the technical guideline part. That one document is the design guideline issued by Dutch Bicycle Council (*Fietsberaad*). Therefore, we can safely infer that ITDP Indonesia perceives the Netherlands as the best example Indonesians should look up to if we want to have cycling infrastructure.

Thirdly, we have also analysed Bike2Work as a cycling community that sits entirely outside the government. They also used examples from abroad to promote their vision of cycling in Indonesia. Specifically, they used examples from the Netherlands to convey their idea that incorporating cycling into the citizen's daily routine will improve the citizen quality of life. Moreover, constructing cycling infrastructure in urban is one of the many steps needed to fulfil their vision. This construction of cycling infrastructure must then be accompanied by, among others, the supportive government and citizens that actually cycle.

Fourthly, we also analysed the perception of Indonesian academics. Indonesian academics paint successful cases from abroad as an excellent example for Indonesia to follow. These academics have more freedom in defining what cycling infrastructure is. In addition to bicycle lanes and their related facilities, academics also included bike-sharing systems as cycling

infrastructure. Like the Bike2Work community, these academics also view cycling infrastructure as only one factor affecting cycling in Indonesia. The remaining factors, which arguably might be more influential, are unique to Indonesia and yet to be discovered.

In short, various entities in Indonesia, both within and outside the government, use the cycling infrastructure abroad as an example when developing policy strategies and infrastructure to promote cycling in Indonesia. In other words, these entities are trying to transfer cycling infrastructure technologies from abroad to Indonesia since they envision replicating the success stories from abroad to Indonesia. However, this successful replication process is not as simple as it sounds since the contexts in the cities abroad and the Indonesian cities are different.

It is worth noting that Indonesian academics also tried to enlarge the definition of cycling infrastructure. They include not only the artefact that we have already discussed in section 2.2.1 but also other artefacts, such as the bicycle-sharing system. In other words, using terminology from SCOT, these academics have a different interpretation of what constitutes cycling infrastructure.

Regarding the origin country that is perceived to be the source of cycling technologies, ITDP Indonesia and Bike2Work perceive the Netherlands as the country worth treating as the source of the cycling infrastructure. While the government, through the Ministry of general work and public housing, does not refer to the Dutch examples due to best practices that exist among engineers in Indonesia, the influence of the Dutch examples still can be traced since the official report mentions a study conducted by ITDP Indonesia as a source. On the other hand, while also using examples from abroad in their research, Indonesian academics seem to have more freedom in selecting the origin country of the examples. Academics use examples from the Netherlands or European countries and nearby countries in Asia and Southeast Asia.

4 Comparing Cycling in Indonesia and Abroad

In the previous chapter, we have concluded that various entities in Indonesia perceive cycling infrastructure abroad as a good example that can be imitated if Indonesians are going to make their cities more bicycle friendly. However, these entities, especially the cycling community and the academics, stated that this imitation process is not simple and straightforward (Ingeborgrud *et al.*, 2023, p. 3). This process resonates with the SCOT terminology of interpretative flexibility. As Indonesians try to appropriate the cycling infrastructures from abroad, Indonesian citizens develop multiple interpretations of the cycling infrastructures. This multiple interpretation leads to multiple cycling infrastructure usage patterns, as we also already discussed in Chapter 2. However, as cycling infrastructure is perceived to be appropriated from abroad, not only Indonesians' interpretations are involved in this process,

but also interpretations from the source country. As indicated in Chapter 3, these interpretations might differ because of the context difference. In this chapter, we will take a better look at this difference.

However, Indonesian do look up to examples from various countries abroad. Which country that we should select to analyse the difference? I would argue that the selection of the country does not matter much since it is safe to say that every country has their unique context. Therefore, any country we selected should have differences that we can analyse. Nevertheless, in this thesis project, I would like to illustrate the difference by investigating the context in the Netherlands to understand better the difference between Indonesia and the Netherlands. After all, the Netherlands is perceived as one of the key sources of cycling technologies and greatly influenced the official design guideline for designing cycling infrastructure in Indonesia.

4.1 Evolution of Perception of Cycling in the Netherlands

In the Netherlands, the usage and perception of cycling are not static. It has evolved throughout history (Albert de la Bruheze and Oldenziel, 2016; Oldenziel *et al.*, 2016; Feddes and de Lange, 2019). Around the 1880s to the 1890s, many European countries, including the Netherlands, imposed a luxury tax on bicycle ownership (Albert de la Bruheze and Oldenziel, 2016, p. 75). It means bicycles were perceived as a luxury that only rich people could own during this period. The bicycle became a status symbol for the rich. Then it started to change around the 1920s. Due to the mass production of bicycles, the bicycle price gradually decreased (Albert de la Bruheze and Oldenziel, 2016, p. 77). The bicycle tax was questioned in the Netherlands since it was paid mainly by the average citizen who uses bicycles to commute to their workplace (Oldenziel and Albert De La Bruhèze, 2011, p. 35). In other words, the perception of the citizen regarding bicycles started to shift from luxury items to utility items. By the 1960s, in Amsterdam, the typical sight of the city was swarms of workers with their bicycles waiting for the ferry that would take them across the river IJ (Oldenziel *et al.*, 2016, p. 17). In other words, a bicycle is perceived as a de facto means of transport for the working class. However, this perception was contested, and it started to shift. In the wake of the end of World War II, urban planners in Europe were looking forward to implementing their vision of modernity. Bicycles were not a part of their modern vision. They perceived bicycles as an obsolete means of transport that inevitably would be replaced by cars (Oldenziel and Albert De La Bruhèze, 2011, p. 38). Cycling lost popularity as the cities implemented this modern and car-oriented urban planning. Between the 1960s and 1970s, In Amsterdam, the number of cyclists was halved while the number of cars was doubled (Oldenziel *et al.*, 2016, p. 21). While this short account is incomplete, it sufficiently illustrates that the citizen perception of the bicycle was quite flexible as it shifted from time to time.

Nowadays, the Netherlands is synonymous with cycling. However, in the previous paragraph, cycling seems to be seen as obsolete and old-fashioned by the 1970s. Then it begs the question of how cycling in the Netherlands has rebounded to where it is now. There is no straightforward answer to this question. However, the big part of the answer does not lie in the bicycle itself. It lies in the contemporary context in which cycling is situated. On one part in the 1970s, a bicycle was seen as a sustainable means of transport that fits with the bigger sustainability movement (Oldenziel and Albert De La Bruhèze, 2011, p. 40; Oldenziel *et al.*, 2016, p. 188). This sustainability movement fought against the city's increasing air pollution and congestion. Bicycles were seen as the central part of the solution to pollution and congestion problems. In other words, this sustainable movement turned the discourse around. Before, bicycles were seen as the problem that obstructed the modernist vision of urban planners. After, bicycles were perceived as the solution that promoted a sustainable lifestyle in the city.

In another part, in the 1970s, bicycles were also seen as a means of transport that posed significantly less threat to the pedestrian. Parents at that time were worried about the continuously rising number of fatal traffic accidents (Oldenziel *et al.*, 2016, p. 189). While similar concerns also appeared in several European countries, parents in the Netherlands seem bolder and have more political traction. Their campaign, Stop Children Murder (*Stop de Kindermoord*), forced the Dutch government to issue a traffic-calming policy in the cities. While this traffic-calming policy does not directly promote the usage of bicycles, it practically made pedestrians and cyclists have more traffic-right in the city (Oldenziel and Albert De La Bruhèze, 2011, p. 42). In other words, the citizen problematised the high number of traffic accidents. Then the bicycle was perceived as a part of the solution to make the city safer.

This two citizen-movement was a relatively country-wide movement. On top of that, there were also citizen movements that were more localised. In Amsterdam and Utrecht, given that these two cities have a historic city centre, citizen movements have fought to preserve the city centre. In the 1970s and 1980s, the construction of wide streets and roads was interpreted as threatening the historical city centre (Oldenziel *et al.*, 2016, pp. 24, 33–34; Feddes and de Lange, 2019). The bicycle was interpreted as a means of transport that was still compatible with the existence of the historic city centre while also quick enough to bring people from point A to B in the city.

Since these citizens' movements commonly perceive bicycles as the solution to their problem, they converged into a national movement named the Cyclist Union (*Fiestersbond*) (Groot, 2016, p. 10). Then, the Dutch government initiated the Bicycle Master Plan (*Masterplan Fiets*) project in the 1990s. This project aimed to increase the number of travel conducted using bicycles (Bruno and Nikolaeva, 2020, p. 4). It consisted of many projects, ranging from

research studies and policy development to pilot and model projects. Eventually, it led cities in the Netherlands to ensure the connectivity of the bicycle lane network to encourage more people to cycle. In other words, this project can be interpreted as the government's reaction to accommodate the citizen's push to use more bicycles in the city. All these factors made the Netherlands synonymous with cycling. It is worth noting that in the 1970s, the various citizen movement portrayed bicycles as the solution to their problems. The sustainable movement saw the bicycle as the environment-friendly means of transport. The parents saw the bicycle as the means to make the streets safer for their children. The historic preservation movement saw the bicycle as a means of transport compatible with their vision of preserving the historic city centre. In SCOT terms, various user groups redefined the problem, and the bicycle became the common solution. This solution convergence led to the closure, which later the government supported with the nationwide project.

4.2 Unique Contexts in Indonesia

After discussing the context that plays a significant role in the Netherlands, let us return to the Indonesian context to see the difference better. We would see that these differences in the context made the Indonesians perceive the bicycle and its related infrastructure differently that their counterparts abroad.

The first one is the sustainability narrative. As I indicated in section 2.1.2, a group of cyclists in Indonesia also portrays the bicycle as a sustainable and environment-friendly means of transport, namely the cyclist who joins a cycling community, for example, Bike2Work. While Bike2Work is a nationwide community, some communities are more localised. For example, in Jogjakarta, there are Sego Segawe (*Sepeda nggo Sekolah lan Nyambut Gawe;* cycling to school and workplace) and JLFR (Jogja Last Friday Ride) that also portray bicycles as a sustainable means of transport, particularly in the urban area (Thoriq, 2015). As we also noted in section 3.2, this cycling communities' perception is influenced by similar community movements abroad.

In section 2.2.1, it has been indicated that Indonesia's government also endorsed this sustainability narrative. In the introduction of the new guideline for designing and constructing facilities, it is explicitly said that the massive usage of bicycles is expected to lower the usage of cars in the city. This less car usage would lead to less consumption of fossil fuels and less pollution (Direktorat Jendral Bina Marga, 2021, p. ix). In other words, this sustainability narrative is a significant factor that influences the construction of bicycle lanes, at least in Jakarta. Furthermore, both the cycling community and the government perceive bicycles as a sustainable means of transport. When we compare with the context in the Netherlands, in both countries, the sustainable narrative has influenced the development of cycling infrastructures as it paved the way for more cycling lanes to be built.

The second one is the safety narrative. In the Netherlands, the perceived dangerousness of motorised traffic made the citizen cycle more since cycling is perceived as safer for both cyclists and pedestrians. However, in Indonesia, the effect is almost the opposite. In section 2.1.2, we discussed the woman that relegated to using bicycles in their daily life. The perceived dangerousness of the faster cars and motorcycles made it harder for the woman to cycle (Song, Kirschen and Taylor, 2019, p. 147). Therefore, they avoid cycling in the streets that are busy with cars and motorcycles. The woman then cycles mainly in their immediate neighbourhood where the streets are narrower than the centre. Narrow streets force cars and motorcycles to slow down. However, they prefer to be dropped off by their husband using a motorcycle for a further destination. In short, in the Netherlands, the citizen uses the safety narrative to argue that there should be more cycling in the city and that the government should provide provisions for that (Oldenziel *et al.*, 2016, p. 189). In contrast, the safety narrative in Indonesia made people, especially women, cycle less. This narrative leads to the marginalisation of cyclists in the city (Song, Kirschen and Taylor, 2019, p. 147).

The third one is the heritage preservation narrative. While in the Netherlands, the prevention of demolishing canals and buildings in the historical city centre positively influences cycling, in Indonesia, it is unlikely that this narrative will gain traction in the first place. For example, in Jakarta, the area of the historical old city centre (*Kota Tua*) is only 8.46 km^2 (Aryanto and So, 2012, p. 976). For comparison, the province of Jakarta is over 650 km^2. Therefore, the old city centre area is too small to make this narrative work. Moreover, the condition of the historical building often has fallen into a state of disrepair or has already been demolished (Aryanto and So, 2012).

The three aspects above illustrate that the context in Indonesia is different from the context in the Netherlands, so the progression of cycling infrastructure development in the Netherlands cannot be copied to Indonesia. In Indonesia, different contexts exist in society, for example, the existence of street vendors who use bicycles in their work, which we have discussed in section 2.1.2. Unlike in the Netherlands, street vendors are very abundant in Indonesia. Nevertheless, the design requirement issued by the Indonesian author (both inside and outside the government) seems to neglect the street vendors. In the ITDP Indonesia's version of the general guideline, cyclists are divided into two categories: utility cyclists (*pesepeda utilitarian*) and recreational cyclists (*pesepeda rekreasi*) (Sufa and Imran, 2020, p. 10). On the one hand, utility cyclist is defined more as cyclist that use a bicycle as a means of transport. The goal of the utility cyclist is to reach their destination, where they perform activities, such as studying, working, and shopping. On the other hand, the recreational cyclist is defined as a cyclist that uses a bicycle to seek something fun. Both categories exclude street vendors. The

street vendors do not have a clear destination. Their destination is where the crowd are for that very moment. They also do not cycle for the sake of having fun.

In the Western context, categorising cyclist into utility and recreational are typical (American Association of State Highway and Transportation Officials, 2012, pp. 24–25; Jordi-Sánchez *et al.*, 2022; Ingeborgrud *et al.*, 2023, p. 11). This assumption of categorisation of cyclists is often taken for granted in the Western context. In their analysis of cycling in the Netherlands, Pucher and Buehler directly used this categorisation in assuming that if the cycling in question does not fall into one category, it indeed falls into the other (Pucher and Buehler, 2008). However, outside of the Western world, these street vendors are starting to get recognition. In the wake of the Covid-19 pandemic, ITDP contributors in Mexico argued the importance of street vendors' contribution to the well-being of people residing in urban areas (ITDP, 2021, pp. 9–10). They argued for including these street vendors in Mexico's urban planning instead of the current status quo of exclusion. Similarly, In Indonesia, this Western assumption of categorisation does not hold since the context is different from the context in Western countries.

Another unique context is the competition with motorcycles. In Indonesia and other Southeast Asia countries, many motorcycles exist in urban areas. For example, in Jakarta, more than 17 million motorcycles are registered (BPS Provinsi DKI Jakarta, no date). It is worth noting that this number excludes the motorcycles registered not in Jakarta but used daily to commute to Jakarta. For comparison, only around 3.7 million cars are registered in Jakarta (BPS Provinsi DKI Jakarta, no date). Therefore, it can be said that motorcycles are the main competitor of cyclists in Jakarta (and in other cities in Indonesia). Although a motorcycle is motorised, its physical dimension is more like a bicycle than a car. Therefore, it is more difficult to physically separate a bicycle from a motorcycle than a car. Infrastructures such as bicycle lanes that are built for bicycles can be used by motorcyclists as well. In a publication intended to transfer knowledge about cycling-friendly policy development, a group of Western scholars acknowledge that the sheer number of motorcycles in Asia and Latin America requires a unique policy development (GIZ GmbH, 2009, pp. 18, 152–153). However, they do not expand much on that and tend to put cars and motorcycles in the same category. They said that "*… if the streets have not been designed for safe and pleasant cycling, … they [the citizen] will use their car or motorcycle even for short trips, needlessly congesting roads …*" (GIZ GmbH, 2009, p. 99). Since these Western scholars most likely do not have sufficient experience in dealing with motorcycles, it can be said that they have minimal knowledge in this context. Therefore, the only way to understand this context is to look inward to analyse various user groups instead of looking and copying from abroad.

However, on the other side, Indonesian's experience in dealing with motorcycles might give them an advantage in promoting cycling. Existing infrastructure that has been built to serve motorcyclists can be used also to serve cyclists. For example, motorcycle parking facilities that built around stations in Jakarta (see Figure 11 below). Currently, the citizens perceive this facility as a motorcycle parking place. However due to the interpretative flexibility, in the future, they might perceive it as a bicycle and motorcycle parking facility, without a significant physical change. The operator of this parking facility had already the know-how to operate such a facility and little adaptation is needed if his customers want to use this parking facility to park their bicycles.

*Figure 11 Example of Motorcycle Parking Facility Nearby a Station (*Google Maps*, no date)*

The abundance of motorcycle taxi services, especially in the busy area around offices, might give the commuters a chance to cycle more. Many people commute enterally by motorcycle or car. And for people who choose public transport, their typical commute is as follows: first leg, home to station A; second leg, station A to station B using train, metro, or bus; third leg, station B to their office. Since not all commuters have a high determination (compared to a cycling community member in section 2.1.2), not all commuter is willing to swap their commuting routine with cycling entirely. However, if only a part of the commuting routine is swapped by cycling, many might be interested. The first leg of the commute can be done by cycling while the third leg can be done by using a motorcycle taxi service. People that use an enterally car or motorcycle might be attracted to cycle, at least for part of their commute. Sunitiyoso et al discussed the importance of motorcycle taxi services in enabling multimodal commuting in Jakarta (Sunitiyoso *et al.*, 2022). However, cycling is not yet mentioned as one of the

commuting modes. It might be worthwhile to explore the possibilities in which cycling and motorcycling are complementing instead of competing with each other.

4.3 Chapter 4 Conclusion

To conclude this chapter, I would like to reiterate the differences between the context of Indonesia and the context of the example country, such as the Netherlands. In the Netherlands, the citizens play a significant role in fostering cycling in their respective cities. Although the way a citizen perceives a bicycle may vary from one group to another group, they see bicycles as the solution to their problem. The sustainability group perceive that bicycle is the city's most sustainable means of transport. The parent group perceive that more bicycles in the city would make the city safer for their children. The architecture conservatism group saw bicycles as means of transport that were compatible with preserving historical architecture in the city. These groups' movement gained enough traction that the government reactively supported it, at least at the city level (GIZ GmbH, 2009, p. 3; Oldenziel *et al.*, 2016, p. 23). This reactive action prompted the government to start a national policy to make the cities more suitable for cycling (GIZ GmbH, 2009, p. 3; Bruno and Nikolaeva, 2020, p. 4). In SCOT terms, although each group has defined their problem, the closure has been reached by supporting more cycling in the city. Initially only shared by the citizens, the governments later supported this closure.

In Indonesia, the context is different. Jakarta, and other cities in Indonesia, have grown so big that their historical centre is too small to make preservation narrative work. The safety narrative has the opposite effect. It makes people cycle less due to the perceived dangerousness of cycling in the city alongside motorised traffic. The sustainable narrative works only to a certain level, nowhere as massive as in the Netherlands. On the other hand, cities in Indonesia also have a context that cannot be found abroad. One of them is the existence of the cycling street vendors (and anyone else that share their perception of bicycle). The other one is the competition with motorcycles. These issues are very seldom discussed in Western literature. However, some scholars from Asia and Latin America have begun to uncover these issues. It is worth noting that I tend to simplify that cities in Indonesia have similar context to Jakarta. This simplification is only partially true at best since cities in Indonesia are likely to have their own context. Nevertheless, this unique context is unlikely to resemble those in the cities abroad. In SCOT terms, due to the unique context in Indonesia's cities, user groups in Indonesia have a distinct perception of the bicycle compared to the Netherlands' counterpart. Therefore, the closure route in the Netherlands cannot be applied to Indonesia.

To conclude, I would like to clarify that it is not the intention here to argue that the context from abroad should be transferred to Indonesia so that Indonesia can have a similar trajectory of cycling policy development. The intention here is to make clear that the development of

cycling infrastructure and cycling policy in Indonesia can take a different route from the Netherlands (or any other country) since the context in Indonesia is unique. The experience from abroad can be seen as a source of inspiration so that Indonesian does not have to create everything from scratch. However, due to differences in context, Indonesians should not take the inspiration as it is but modify it according to context. It also means Indonesians do not have to stick to one source of inspiration. Indonesians can have multiple sources of inspiration from multiple countries. After all, inspiration is not diffused from one country to another, but the Indonesians appropriate inspiration from many countries. Using the SCOT framework, the context in which cycling infrastructure and cycling policy develop are placed as the main object of inquiry. By analysing the various user groups' perceptions of the technology, we also understand the context to which these user groups belong. Then, since the closure is the result of negotiation among various user groups, Indonesians, with our unique user groups, do not have to follow the closure mechanism abroad. Indonesians can (or should) pave their route to closure. After all, there is no universal blueprint to follow to foster cycling in the city (Ingeborgrud *et al.*, 2023, p. 3).

5 Concluding Remarks

Let us go back to the controversy introduced at this thesis's beginning. There seems to be a mismatch between what the parliament members perceived as bicycle lane usage and the usage observed on the ground. In Chapter 1, I argued that this mismatch can be explained by analysing the typical technology transfer in Indonesia. The typical technology transfer project, especially in Indonesia, often occurs in the diffusion mode (Visvanathan, 2015, p. 141; Thalib *et al.*, 2016; Iyer and Banerjee, 2018). In this diffusion mode, the parties that act as the source of technology, countries abroad, have a more active role than the recipient in dictating the development of technology in the recipient country. Therefore, the resulting usage pattern in the recipient country is similar to the pattern in the source country. Since this type of technology transfer is common in Indonesia, the parliament members use this understanding of technology transfer when they judge the usage of the bicycle lane. The parliament members view the bicycle lane as useless since it is used differently than abroad. Although the street vendors are cycling on the bicycle lane, the parliament members labelled it as incorrect usage. According to their technology transfer perspective, the bicycle lane should be used the way it is used abroad.

Then I argued that this understanding of technology transfer is too narrow. Some modes of technology transfer require the recipient, the (potential) user, to be more active than the source. I use the SCOT framework to establish this user-centric understanding of technology transfer (Pinch and Bijker, 1984). By using this framework, we flip the understanding of

technology transfer. Instead of the source actively diffusing their technology to other countries, the recipient is the active party that appropriates technology from abroad (Saidi, 2015). The recipient appropriates the technology to fit with their local context. During the appropriation, the possibility of using the technology in a new unique way is not excluded (Edgerton, 2007; Bar, Weber and Pisani, 2016). This flip also allows the recipient to appropriate the technology from multiple sources.

In Chapter 2, following the SCOT framework, several user groups (or cyclist groups) are identified based on their perception of bicycles. The analysis started with the typical categorisation of recreational and daily cyclists. Then, the daily cyclist group is further divided into sub-groups. Three personas are constructed to represent the sub-groups in Indonesia. The street vendors use bicycles to earn a living. They work on their bicycle. The women are relegated to using a bicycle because of their economic condition. The cycling community member sees the bicycle as sustainable means of transport. Also, this chapter analysed the cycling infrastructure artefact to get a better picture of the Indonesian's perception of cycling infrastructure, mainly how cycling infrastructure is described by Indonesian when they discuss cycling, especially daily cycling. Sources closer to the government mainly define cycling infrastructure as bicycle lanes and related infrastructures. Academics have a broader definition that includes bicycle-sharing systems. Equipped with the information about the user and the artefact, the location of the cycling activity is analysed. On the one hand, we found that there is a daily cyclist that very seldom uses the cycling infrastructure that is already built. On the other hand, this cycling infrastructure is also useful for recreational cyclist that cycles on the weekends. This phenomenon indicates that the cycling infrastructure as technology does not quite fit with Indonesia's context.

In Chapter 3, we investigated the perception of the influential actors in developing cycling infrastructure and policy in Indonesia. We discovered that these actors perceive countries abroad as examples Indonesia can imitate. While the sources close to the government tend to look to policies and development in Western countries, the academics also include Asian countries as examples. Furthermore, the academics included more artefacts under the umbrella of cycling infrastructure. Academics considered the bicycle-sharing system as a part of the cycling infrastructure, while the government seems to be only focused on bicycle paths and lanes.

In Chapter 4, comparing the Netherlands and Indonesia, I argue that since the context in respective countries differs, Indonesians should pave their own policy to foster cycling. In other words, it is better to see cycling infrastructure and policy as technology that must be appropriated by the recipient country rather than a technology that is diffused by the source country. The recipient could and should assume a more active role in the appropriation

process. To better play this more active role, the recipient must understand the context that exists in the recipient's society. Unique user contexts would induce a unique perception of the technology. Due to the difference in context, a narrative that positively affects cycling-friendly infrastructure development in the Netherlands negatively impacts Indonesia, for example, the safety narrative. There are also unique contexts in Indonesia that did not exist abroad, among other the competition with motorcycles. Therefore, the route to closure should be paved by not only appropriating ideas from abroad but also incorporating users' contexts in the recipient country. In other words, the idea from abroad should be modified to fit the local context better.

Modifying things to fit into context is not an entirely new topic in Indonesia. In section 1.6, I indicated that there is a saying among engineering students in Indonesia, "*Amati, Tiru, dan Modifikasi (ATM)*", which translates to "Observe, Imitate, and Modify". It is traditionally done in the context of appropriating a technological artefact. Observe to gain knowledge on how the technology is used originally. Imitate to replicate the original version of the technology in Indonesia. Modify to adjust the technology to suit the local context. Fliert's research gives us a detailed process of how the GSM technology is appropriated by Indonesian (Fliert, 2001). During the appropriation process, modifications were crucial to fit the technology into the Indonesian context. Therefore, the path to the closure of GSM technology in Indonesia is unique.

The "Observe, Imitate, and Modify" perspective is compatible with the SCOT framework and can help Indonesians appropriate cycling infrastructure and policy. In Chapter 3 and Section 2.2, it can be inferred that Indonesians already observe and imitate policy to build cycling infrastructure from abroad. However, in Section 2.3, it can be inferred that some user groups seem to be neglected. It means that the imitated policy is not quite fit yet with the context. According to the SCOT framework, interpretive flexibility also means the artefacts can be redesigned. Applying it to our cycling case means that the policy can be modified to fit the Indonesian context. Furthermore, in Chapter 4, it is revealed that the cycling-friendly policies in the Netherlands can be linked to the contemporary local context. Only imitating that cycling infrastructure and policy in Indonesia without fitting it into the context would not make more people cycle. Indonesians should modify the cycling infrastructure and policy to fit the context better. Through this modification, the usage patterns abroad would not be perfectly replicated. However, the goal here is not to emulate the same usage as abroad perfectly. The goal is to appropriate cycling infrastructure and policy.

5.1 Suggestions for Indonesia's Cycling Development

Following the conclusion in Chapter 4, one might then ask what the suggestions for Indonesian are to better appropriate the cycling infrastructure and policy. In other words, how should the

cycling infrastructure and policy from abroad be modified to fit the Indonesian context? While this question requires in-depth research, I try to suggest several implications. These implications are not apparent if the user-centric approach is not adopted. Hopefully, it can be used in further research on this topic.

The first implication is the inclusion of marginal user groups. The SCOT framework requires us to identify relevant user groups. However, the relevant user groups are not always oblivious. There might be obscured and marginalised social groups that should also be included (Pinch and Bijker, 1984, p. 414). Section 2.1.2 contains three personas of daily cyclists, each representing a user group. The member of the cycling community is obvious to be included as the relevant user groups. However, the other two—the street vendors and the woman—are not. While the cycling community members associate themselves with the term cyclist, the street vendors and the women do not explicitly call themselves cyclists. While the cycling community and the recreational cyclist are in the foreground, the street vendors and the woman are relegated to the background (Song, Kirschen and Taylor, 2019; Alsadad Rudi, 2021). Nevertheless, the street vendors (and the woman to a certain extent) have a unique perception of the bicycle that must be considered (see section 4.2). It would be beneficial for future research to investigate more into the marginalised user and consider the differences among cities in Indonesia.

The second implication is the possibility of exploring emerging types of policy perspectives. In Section 2.2, it can be inferred from the official document issued by Indonesia's government that the construction of bicycle lanes and other cycling-friendly facilities would induce the motorist to convert to becoming a cyclist. In other words, the policy emphasises replacing a less sustainable mode of transport with a more sustainable one (Bruno and Nikolaeva, 2020, p. 1). Using the SCOT framework, we are required to identify the user groups. These user groups are essential since they are already cycling. If we know the perception of the cyclist towards the bicycle, we can establish a new policy perspective that focuses on reducing the number of cyclists that convert to motorists (Bruno and Nikolaeva, 2020). In other words, a new policy emphasises maintaining the already cyclist to keep cycling. In Section 2.1.2, the women are cycling because they are relegated to do so. In other words, they might abandon cycling as more options are available. In section 4.2, the women already feel unsafe to cycle on the busy street and prefer to be dropped off by their family members. Maintenance-based policy perspective seeks to minimise this abandonment. Furthermore, this maintenance-based policy perspective can complement the convert-based policy perspective. On one side, people who are already cycling will keep on cycling. On the other side, there will be motorists that convert to become cyclists. Further research on his maintenance-based policy in the Indonesian context would be beneficial.

In short, adopting a user-centric perspective would enable us to focus not only on apparent user groups but also on marginalised user groups. It is essential to make cycling a sustainable means of transport accessible to people who label themselves cyclists and those who do not. Additionally, a user-centric perspective helps the policymaker check the assumptions behind any exemplary case abroad. For example, the definition of daily and recreational cyclists from abroad is not quite fit with the context in Indonesia (see section 4.2). As we better understand the context and the user groups in Indonesia, it opens possibilities to diverge from the closure route abroad and pave our Indonesian way to closure.

5.2 Reflection on the SCOT Framework

The SCOT framework is traditionally used to analyse a technology that is new to the (local) society, among others, early bicycle (Pinch and Bijker, 1984), bakelite (Bijker, 1987), GSM technology in Indonesia (Fliert, 2001), nanotechnology in Africa (Saidi, 2015). In these accounts, problems arise because of introducing a technology that seems to be novel, at least to the society that is discussed. For example, some user groups saw the introduction of early bicycles as problematic (Pinch and Bijker, 1984). The introduction of nanotechnology to combat tuberculosis was seen as a solution by some user groups but problematic for others (Saidi, 2015, chap. 2).

In this thesis, I tried to use the SCOT framework to analyse technology that is not novel, bicycle in the 21st century. Sure, there have been improvements since the first introduction of the safety bicycle in the 19th century. However, the improvement is incremental. Our contemporary bicycle today might get lighter due to the better material, have more gears to be faster, and rubber belt driven instead of metal chain. Despite the improvement, the typical bicycle is still equipped with two tires, powered by human muscle[1], and steered by the front wheels.

However, without the radical change of the bicycle as an artefact, the perception of the bicycle drastically changes. At one time, bicycles were perceived as a problem that must be eradicated. At the other time, it is perceived as a solution to several problems in the urban area (mainly in the Netherlands), such as safety, historic preservation, and sustainability (see section 4.1). In other words, it is not always the novelty of the technology that starts the co-evolution process of the technology and society. The novel perception of an old and mundane technology also can (re)start the co-evolution process.

The notion that the emergence of novel perception can restart the co-evolution process has implications for the closure notion. Pinch and Bijker used the closure notion to convey

[1] At least powered partly by human muscle, due to the emergence of e-bike.

stabilisation (Bijker, 1987, p. 424). After the closure has been reached, the relationship between technology and society stabilises, and the process is over. Since we now have an account that the changes of perspective can perturb this stability, I would say that it is best to view this stability as temporary. As the perturbation is forceful enough, the relationship between technology and society will be pushed out of the stable point, and the co-evolution process will begin again. Additionally, we can also say that stabilisation and closure are also dependent on place and time. A stable technology that is brought to another place would undergo the stabilisation process again in the context that exists in the new place. Perception of a stable technology might change as time passes. Thus, it became more of a cycle that switched back and forth between flexible and stable phases rather than a linear one from flexible to stable.

In this thesis, the T in the SCOT abbreviation is also augmented. The perception of bicycles as a solution to our sustainability problem in urban areas seems to spread to other countries, including Indonesia. In other words, it is not the technology per se that is being transferred and appropriated but the perception of the technology. The appropriation of bicycles as a solution to the sustainability problem leads to the appropriation of cycling-friendly policies and infrastructure. In other words, not only the technological artefact is being appropriated, but also the socio-technical apparatus surrounding it. Therefore, in this thesis, the T in the SCOT abbreviation covers more than a technological artefact. In our case of Indonesian appropriating bicycle, the T covers not only the bicycle but also its related infrastructure and policy in the source country. This socio-technical union consisting of the bicycle, the related infrastructure, and the policy then interacts with the society in the recipient country. Thus, the object of study is not the co-evolution of novel technological devices and society. The object of study is the co-evolution of the appropriated socio-technical union with society in the recipient country.

This redefinition of the object of study means that the interpretative flexibility traditionally attributed to technology should be attributed to the socio-technical union, including the policy. This means two things. Firstly, a policy can be interpreted differently by different user groups. Secondly, a policy can be flexibly designed depending on the user groups. Although the perception is the same among countries—bicycle as a solution to sustainability problems in urban areas—the policy to implement it could and should be different from country to country since the context in each country is also different.

The term techno-social might also open up the possibility to analyse this problem using Multi-Level Perspective (MLP) (Geels, 2019). The 3 daily cyclists (the street vendors, the woman, and the cycling community member) that we can encounter in Indonesia would fit into niches that operate under the 'grassroots innovation' scheme (Seyfang and Smith, 2007; Geels, 2019,

p. 193). Since these grassroots innovators do not necessarily need to diffuse their innovation, policymaking can assume a more active role in changing the meso-level socio-technical system (Seyfang and Smith, 2007, p. 593).

However, the SCOT framework still can play a significant role that complements the MLP approach. Using the SCOT framework, the analysis' point of departure would be the grassroots innovators in their own country, Indonesia. In other words, the analyst would begin by profiling and analysing these grassroots innovators in their niche or context. Thus, instead of importing foreign technology as a niche to be developed, they can take their own niche that native to the Indonesian context.

6 References

A Artiningsih (2011) 'JALUR SEPEDA SEBAGAI BAGIAN DARI SISTEM TRANSPORTASI KOTA YANG BERWAWASAN LINGKUNGAN', *TATALOKA*, (Vol 13, No 1 (2011): Volume 13 Number 1, February 2011), pp. 27–41.

Adiguna, A. *et al.* (2018) 'MODEL PREDIKSI PELUANG KECELAKAAN YANG MELIBATKAN PENGENDARA SEPEDA DI KOTA SURABAYA', *Jurnal Mahasiswa Jurusan Teknik Sipil*, (Vol 1, No 1 (2018)), p. pp.209-214.

Adityo, I.D. (2017) 'Peran Komunitas dalam Membangun Kultur Bersepeda (Studi Kasus Pada Komunitas Bike To Work Indonesia di Jakarta)'.

Albert de la Bruheze, A.A. and Oldenziel, R. (2016) 'Who Pays, Who Benefits? Bicycle Taxes as Policy Tools, 1890-2012', in R. Oldenziel and H. Trischler (eds) *Cycling and Recycling: Histories of Sustainable Practices*. New York: Berghahn (Environment in history: international perspectives), pp. 73–101.

Alsadad Rudi (2021) *Belajar Memaknai Jalur Sepeda dari Penjual Kopi dan Roti Keliling Halaman all - Kompas.com*. Available at: https://megapolitan.kompas.com/read/2021/05/30/15512331/belajar-memaknai-jalur-sepeda-dari-penjual-kopi-dan-roti-keliling?page=all (Accessed: 28 January 2023).

American Association of State Highway and Transportation Officials (ed.) (2012) *Guide for the development of bicycle facilities*. Fourth edition. Washington, DC: American Association of State Highway and Transportation Officials.

Ardyanto, A. (2019) 'Starling = Starbucks Keliling di Jakarta – SI ANTON', 10 July. Available at: https://antonardyanto.com/starling-starbucks-keliling-di-jakarta/ (Accessed: 2 June 2023).

Aryanto, R. and So, I.G. (2012) 'Perencanaan Manajemen Lanskap Zonasi Destinasi Wisata Budaya Kota Tua Jakarta', *Binus Business Review*, 3(2), p. 973. Available at: https://doi.org/10.21512/bbr.v3i2.1368.

Asasi, A.N. and Astuti, P. (2019) 'PANDANGAN KOMUNITAS BIKE TO WORK SEMARANG TERHADAP FASILITAS JALUR SEPEDA DI KOTA SEMARANG', *Journal of Politic and Government Studies*, (Vol 8, No 04 (2019): Periode Wisuda Oktober 2019), pp. 1–10.

Astra Honda (2023) *Sepeda Motor Honda Terbaru | PT Astra Honda Motor*, *Astra Honda*. Available at: https://www.astra-honda.com/product/price-list (Accessed: 13 April 2023).

Badan Pusat Statistik (2023) 'Berita Resmi Statistik No. 15/02/Th. XXVI, 6 Februari 2023 - Pertumbuhan Ekonomi Indonesia Triwulan IV-2022'. Badan Pusat Statistik Indonesia. Available at: https://www.bps.go.id/pressrelease/2023/02/06/1997/ekonomi-indonesia-tahun-2022-tumbuh-5-31-persen.html.

Badan Standardisasi Nasional (2004) 'Geometri Jalan Perkotaan - RSNI T- 14 - 2004'.

Badan Standardisasi Nasional (2019) 'SNI-1726-2019 Persyaratan Beton Struktural Untuk Bangunan Gedung'.

Bar, F., Weber, M.S. and Pisani, F. (2016) 'Mobile technology appropriation in a distant mirror: Baroquization, creolization, and cannibalism', *New Media & Society*, 18(4), pp. 617–636. Available at: https://doi.org/10.1177/1461444816629474.

Bijker, W.E. (1987) 'The social construction of bakelite', in *toward a theory of invention*. Cambridge, Mass [etc.]: MIT Press, pp. 159–187.

Bike To Work Indonesia (2023a) *Bike To Work Indonesia (@b2w_indonesia) | Hari yang cerah! bikin semangat bagi para pesepeda menuju kantor*. Available at: https://www.instagram.com/p/Cq654rJJZ8C/ (Accessed: 25 May 2023).

Bike To Work Indonesia (2023b) *Bike To Work Indonesia (@b2w_indonesia) • Ini Jakarta Bukan Amsterdam!*, *Ini Jakarta Bukan Amsterdam!* Available at: https://www.instagram.com/p/Cp5dSHXheUX/ (Accessed: 6 April 2023).

Bike To Work Indonesia (2023c) *Bike To Work Indonesia (@b2w_indonesia) • Suasana rutinitas pagi di jalanan Kota Delft*, *Suasana rutinitas pagi di jalanan Kota Delft*. Available at: https://www.instagram.com/p/CqkD501AjJ_/ (Accessed: 6 April 2023).

Bike To Work Indonesia (2023d) *Bike To Work Indonesia (@b2w_indonesia) • Yang bike-bike dan patut ditiru*. Available at: https://www.instagram.com/p/CrsnEaSpDWv/ (Accessed: 16 June 2023).

BPS Provinsi DKI Jakarta (no date) *Jumlah Kendaraan Bermotor Menurut Jenis Kendaraan (unit) di Provinsi DKI Jakarta 2020-2022*. Available at: https://jakarta.bps.go.id/indicator/17/786/1/jumlah-kendaraan-bermotor-menurut-jenis-kendaraan-unit-di-provinsi-dki-jakarta.html (Accessed: 4 July 2023).

Bruno, M. and Nikolaeva, A. (2020) 'Towards a maintenance-based approach to mode shift: Comparing two cases of Dutch cycling policy using social practice theory', *Journal of Transport Geography*, 86, p. 102772. Available at: https://doi.org/10.1016/j.jtrangeo.2020.102772.

carfreedayindonesia.org (2014) *Sejarah Car Free Day*. Available at: https://carfreedayindonesia.org/index.php/informasi/sejarah-car-free-day (Accessed: 29 May 2023).

Carina, J. (2018) *Melihat Perbedaan Aturan Pelarangan Becak di Jakarta dan Kota-kota Mitra... Halaman all*, *KOMPAS.com*. Available at: https://megapolitan.kompas.com/read/2018/10/10/07542491/melihat-perbedaan-aturan-pelarangan-becak-di-jakarta-dan-kota-kota-mitra (Accessed: 6 April 2023).

De Wit-de Vries, E. *et al.* (2019) 'Knowledge transfer in university–industry research partnerships: a review', *The Journal of Technology Transfer*, 44(4), pp. 1236–1255. Available at: https://doi.org/10.1007/s10961-018-9660-x.

Didi (2023) 'Libur Lebaran, Car Free Day di Jakarta Ditiadakan', *NTMC POLRI*, 22 April. Available at: https://ntmcpolri.info/libur-lebaran-car-free-day-di-jakarta-ditiadakan/ (Accessed: 29 May 2023).

Dinas Perhubungan Jakarta (2022) *Jalur Sepeda di Jakarta*. Available at: https://www.jakarta.go.id/jalur-sepeda-di-jakarta (Accessed: 11 May 2023).

Direktorat Jendral Bina Marga (2021) 'Perancangan Fasilitas Pesepeda'. Kementerian Pekerjaan Umum dan Perumahan Rakyat Indonesia.

Direktorat Pembinaan Jalan Kota (1992) 'Standar Perencanaan Geometrik untuk Jalan Perkotaan',. Direktorat Pembinaan Jalan Kota - Kementerian Pekerjaan Umum Indonesia.

DKI Jakarta (2005) 'PERATURAN DAERAH PROVINSI DAERAH KHUSUS IBUKOTA JAKARTA NOMOR 2 TAHUN 2005 TENTANG PENGENDALIAN PENCEMARAN UDARA'.

DKI Jakarta (2007) 'PERATURAN DAERAH PROVINSI DAERAH KHUSUS IBUKOTA JAKARTA NOMOR 8 TAHUN 2007 TENTANG KETERTIBAN UMUM'. DKI Jakarta.

DKI Jakarta (2019) 'Peraturan Gubernur Nomor 128 Tahun 2019 Tentang Penyediaan Lajur Sepeda'.

Edgerton, D.E.H. (2007) 'Creole technologies and global histories: rethinking how things travel in space and time', *History of Science and Technology Journal*, 1(1), pp. 75–112.

Feddes, F. and de Lange, M. (2019) *Bike City Amsterdam: How Amsterdam became the cycling capital of the world*. Bas Lubberhuizen.

Fietssnelweg F35 (2020) *Home, Fietssnelweg F35*. Available at: https://www.fietssnelwegf35.nl/ (Accessed: 18 April 2023).

Fliert, J.E. van de (2001) *GSM in the rural and urban jungles of Indonesia. A case study of an emerging localized socio-technical system*. University of Twente. Available at: http://essay.utwente.nl/50738/.

Gatra, S. (2021) *Karpet Merah untuk Pesepeda Road Bike di Jakarta...* Available at: https://megapolitan.kompas.com/read/2021/06/01/06000091/karpet-merah-untuk-pesepeda-road-bike-di-jakarta (Accessed: 20 April 2023).

Geels, F.W. (2019) 'Socio-technical transitions to sustainability: a review of criticisms and elaborations of the Multi-Level Perspective', *Current Opinion in Environmental Sustainability*, 39, pp. 187–201. Available at: https://doi.org/10.1016/j.cosust.2019.06.009.

GIS Jakarta Satu (no date). Available at: https://jakartasatu.jakarta.go.id/portal/apps/webappviewer/index.html?id=1c1bfcced2cb4852bbeaefcd968a6d04 (Accessed: 11 May 2023).

Gituri, M.I., Sumabrata, R.J. and Tjahjono, T. (2014) 'Studi Analisis Faktor-Faktor Pengaruh Ketersediaan Infrastruktur Transportasi Sepeda Dan Pemilihan Moda Transportasi Sepeda Di Universitas Indonesia', in *Prosiding Forum Studi Transportasi Antar Perguruan Tinggi The 17th FSTPT of International Symposium*. Forum Studi Transportasi Antar Perguruan Tinggi.

GIZ GmbH (2009) 'Cycling-Inclusive Policy Development: A Handbook'. Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH on behalf of Federal Ministry for Economic Cooperation and Development of Germany. Available at: https://sutp.org/publications/cycling-inclusive-policy-development-a-handbook/ (Accessed: 5 July 2023).

Google Maps (no date) *Google Maps*. Available at: https://www.google.com/maps/@-6.2183082,106.9395787,3a,75y,82.32h,81.4t/data=!3m6!1e1!3m4!1sa6sO6Zo7K2XGRguDFlLOAw!2e0!7i16384!8i8192?entry=ttu (Accessed: 16 August 2023).

Groot, R. de (ed.) (2016) *Ontwerpwijzer fietsverkeer*. Ede: CROW.

Hanavie, A. and Setiawan, R. (2014) 'FAKTOR-FAKTOR YANG MEMPENGARUHI MAHASISWA MENGGUNAKAN SEPEDA', *Jurnal Dimensi Pratama Teknik Sipil* [Preprint], (Vol 3, No 2 (2014)). Available at: http://studentjournal.petra.ac.id/index.php/teknik-sipil/article/view/2590.

Indrianingrum, L., Narendra, A. and Arfitriyani, A. (2012) 'ANALISIS POLA PERMINTAAN SEPEDA KAMPUS BAGI MAHASISWA UNIVERSITAS NEGERI SEMARANG', *Jurnal Teknik Sipil dan Perencanaan*, (Vol 14, No 1 (2012): Jurnal Teknik Sipil&Perencanaan), pp. 61–70.

Ingeborgrud, L. *et al.* (2023) 'Planners as middle actors in facilitating for city cycling', *Mobilities*, pp. 1–13. Available at: https://doi.org/10.1080/17450101.2023.2186799.

Irawan, M.Z., Bastarianto, F.F. and Priyanto, S. (2022) 'Using an integrated model of TPB and TAM to analyze the pandemic impacts on the intention to use bicycles in the post-COVID-19 period', *IATSS Research*, 46(3), pp. 380–387. Available at: https://doi.org/10.1016/j.iatssr.2022.05.001.

ITDP (2018) *About Us - Institute for Transportation and Development Policy*. Available at: https://www.itdp.org/about/ (Accessed: 6 June 2023).

ITDP (2021) 'SUSTAINABLE TRANSPORT No 32'.

ITDP Indonesia (2022) 'Jakarta E-mobility Event Day 1', *Institute for Transportation and Development Policy*, 7 March. Available at: https://itdp-indonesia.org/2022/03/jakarta-e-mobility-event-day-1/ (Accessed: 6 June 2023).

Ivany Atina Arbi (2022) *Anggaran Jalur Sepeda Dihapus di RAPBD DKI 2023, Upaya Hilangkan Warisan Anies? Halaman all*, *KOMPAS.com*. Available at: https://megapolitan.kompas.com/read/2022/11/14/15442721/anggaran-jalur-sepeda-dihapus-di-rapbd-dki-2023-upaya-hilangkan-warisan (Accessed: 29 March 2023).

Iyer, K.C. and Banerjee, P.S. (2018) 'Facilitators and inhibitors in sector wide technology transfer projects in developing economies: an empirical study', *The Journal of Technology Transfer*, 43(1), pp. 172–197. Available at: https://doi.org/10.1007/s10961-015-9456-1.

Jordi-Sánchez, M. *et al.* (2022) 'Deconstructing the categories of urban cycling: beyond transport, leisure and sport', *Mobilities*, 17(6), pp. 795–813. Available at: https://doi.org/10.1080/17450101.2022.2057811.

Kusumo, R. (2021) *Sepeda yang Kuasai Jalan Ibu Kota pada Zaman Hindia Belanda*. Available at: https://www.goodnewsfromindonesia.id/2021/05/31/mengenang-sepeda-yang-kuasai-jalan-ibu-kota-pada-zaman-hindia-belanda (Accessed: 28 January 2023).

Long, W.J. (1996) 'Trade and Technology Incentives and Bilateral Cooperation', *International Studies Quarterly*, 40(1), pp. 77–106. Available at: https://doi.org/10.2307/2600932.

Mahbub, A. and Fikri, A. (2018) *Bike Sharing Bukalapak akan Hadir di ITB, Ini Keseruannya*, *Tempo*. Available at: https://tekno.tempo.co/read/1156326/bike-sharing-bukalapak-akan-hadir-di-itb-ini-keseruannya (Accessed: 16 May 2023).

Mariani, E. (2018) *Commentary: Car Free Day chaotic, but provides free civic space*, *The Jakarta Post*. Available at: https://www.thejakartapost.com/academia/2018/05/04/commentary-car-free-day-chaotic-but-provides-free-civic-space.html (Accessed: 29 May 2023).

Murwadi, R.A.R.H. (2023) 'Evaluasi Layanan Jalur Sepeda pada Rute Jalan Ryacudu Kota Bandarlampung', *MARKA (Media Arsitektur dan Kota) : Jurnal Ilmiah Penelitian*, (Vol 6 No 2 (2023)), pp. 75–84.

Mustajab, R. (2023) *Mayoritas Tenaga Kerja RI dari Sektor Informal pada Agustus 2022*, *Dataindonesia.id*. Available at: https://dataindonesia.id/sektor-riil/detail/mayoritas-tenaga-kerja-ri-dari-sektor-informal-pada-agustus-2022 (Accessed: 13 April 2023).

Oldenziel, R. and Albert De La Bruhèze, A. (2011) 'Contested Spaces', *Transfers*, 1(2), pp. 29–49. Available at: https://doi.org/10.3167/trans.2011.010203.

Oldenziel, R. (Ruth), 1958- *et al.* (2016) *Cycling Cities : the European experience : hundred years of policy and practice*. Eindhoven: Foundation for the History of Technology.

Pariyanto Pariyanto (2015) 'MAKNA DAN IDEOLOGI KOMUNITAS SEPEDA KEBO DI SURABAYA DALAM KAJIAN SUBKULTUR', *Lakon : Jurnal Kajian Sastra dan Budaya*, (Vol. 4 No. 1 (2015): Jurnal Lakon), pp. 80–102.

Pinch, T.J. and Bijker, W.E. (1984) 'The Social Construction of Facts and Artefacts: or How the Sociology of Science and the Sociology of Technology might Benefit Each Other', *Social Studies of Science*, 14(3), pp. 399–441. Available at: https://doi.org/10.1177/030631284014003004.

Pranata, Y. *et al.* (2015) 'KAJIAN PENYEDIAAN LAJUR SEPEDA DI LINGKUNGAN UNIVERSITAS BRAWIJAYA', *Jurnal Mahasiswa Jurusan Teknik Sipil*, (Vol 1, No 1 (2015)), p. pp.1-8.

Prasetyo, A. *et al.* (2020) 'Kajian Awal Perencanaan Lajur Khusus Sepeda Dengan Menggunakan Metode IPA (Importance Performance Analysis) dan SWOT', *Publikasi Riset Orientasi Teknik Sipil (Proteksi)*, 2(2), p. 41. Available at: https://doi.org/10.26740/proteksi.v2n2.p41-47.

Pucher, J. and Buehler, R. (2008) 'Making Cycling Irresistible: Lessons from The Netherlands, Denmark and Germany', *Transport Reviews*, 28(4), pp. 495–528. Available at: https://doi.org/10.1080/01441640701806612.

Putri, M.P. and Tristiyono, B. (2019) 'Desain Sepeda Kampus Yang Menunjang Sistem Bike-Share Generasi Keempat(+) Untuk Kawasan Kampus Universitas Indonesia Dengan Konsep Unisex', *Jurnal Sains dan Seni ITS*, 7(2), pp. 161–167. Available at: https://doi.org/10.12962/j23373520.v7i2.36357.

Rohlen, T.P. and Studies, U. of C., Berkeley Center for Japanese (1983) *Japan's High Schools*. University of California Press.

Rusmandani, P. and Arifin, M.Z. (2015) 'Perencanaan Implementasi Lajur Sepeda Di Kota Tegal', *Rekayasa Sipil*, (Vol 9, No 1 (2015)), p. pp.64-73.

Saidi, T. (2015) *Travelling Nanotechnologies*. Maastricht University.

Sasongko, R., Ratnaningsih, D., and Supiyono (2017) 'KINERJA RUAS JALAN KH. HASYIM ASHARI KOTA MALANG DENGAN JALUR SEPEDA', *Prokons: Jurnal Teknik Sipil*, (Vol. 11 No. 2 Agustus 2017), pp. 76–80.

Seyfang, G. and Smith, A. (2007) 'Grassroots innovations for sustainable development: Towards a new research and policy agenda', *Environmental Politics*, 16(4), pp. 584–603. Available at: https://doi.org/10.1080/09644010701419121.

Shanty Yulia (2021) *Sejarah Sepeda dan Perkembangannya di Indonesia*. Available at: https://kompaspedia.kompas.id/baca/infografik/kronologi/sejarah-sepeda-dan-perkembangannya-di-indonesia?track_source=kompaspedia-

paywall&track_medium=login-paywall&track_content=https%3A%2F%2Fkompaspedia.kompas.id%2Fbaca%2Finfografik%2Fkronologi%2Fsejarah-sepeda-dan-perkembangannya-di-indonesia%2F&status=sukses_login&status_login=login (Accessed: 28 January 2023).

Song, L., Kirschen, M. and Taylor, J. (2019) 'Women on wheels: Gender and cycling in Solo, Indonesia: Gender and cycling in Solo, Indonesia', *Singapore Journal of Tropical Geography*, 40(1), pp. 140–157. Available at: https://doi.org/10.1111/sjtg.12257.

Stehlin, J. (2014) 'Regulating Inclusion: Spatial Form, Social Process, and the Normalization of Cycling Practice in the USA', *Mobilities*, 9(1), pp. 21–41. Available at: https://doi.org/10.1080/17450101.2013.784527.

Sufa, F. and Imran, A.M. (2020) 'Panduan Jakarta Ramah Bersepeda'. Institute for Transportation and Development Policy (ITDP).

Sunitiyoso, Y. *et al.* (2022) 'Role of ride-hailing in multimodal commuting', *Case Studies on Transport Policy*, 10(2), pp. 1283–1298. Available at: https://doi.org/10.1016/j.cstp.2022.04.013.

Thalib, A. *et al.* (2016) 'Shortcomings technology transfer in Indonesia: A critical appraisal', *Information (Japan)*, 19(6A), pp. 1719–1727.

Thoriq, M.J. (2015) 'AKSI KOLEKTIF DALAM BERSEPEDA: Studi Banding Atas Sego Segawe (Sepeda Kanggo Sekolah lan Nyambut Gawe) dan JLFR (Jogja Last Friday Ride) di Kota Yogyakarta', *Jurnal Sosiologi Reflektif*, (Vol 9, No 2 (2015)), pp. 281–308.

Transfer of technology (2001). New York: United Nations (UNCTAD series on issues in international investment agreements / United Nations Conference on Trade and Development, Tra).

Umasugi, R.A. (2019) *Mulai 20 September, Ada Uji Coba Jalur Sepeda di 17 Jalur di Jakarta Halaman all*, *KOMPAS.com*. Available at: https://megapolitan.kompas.com/read/2019/09/17/20091531/mulai-20-september-ada-uji-coba-jalur-sepeda-di-17-jalur-di-jakarta (Accessed: 11 May 2023).

Villani, E., Rasmussen, E. and Grimaldi, R. (2017) 'How intermediary organizations facilitate university–industry technology transfer: A proximity approach', *Technological Forecasting and Social Change*, 114, pp. 86–102. Available at: https://doi.org/10.1016/j.techfore.2016.06.004.

Visvanathan, S. (2015) 'Technology Transfer', in J.D. Wright (ed.) *International Encyclopedia of the Social & Behavioral Sciences (Second Edition)*. Oxford: Elsevier, pp. 141–145. Available at: https://doi.org/10.1016/B978-0-08-097086-8.85037-0.

Wahab, S.A., Rose, R.C. and Osman, S.I.W. (2011) 'Defining the Concepts of Technology and Technology Transfer: A Literature Analysis', *International Business Research*, 5(1), p. p61. Available at: https://doi.org/10.5539/ibr.v5n1p61.

Warren, D.M. (ed.) (1999) *The cultural dimension of development: indigenous knowledge systems*. Reprinted. London: Intermediate Technology Publ (IT studies in indigenous knowledge and development).

Weningtyas, W. *et al.* (2018) 'Bike Lane Design for Bicyclists and Bike Sharing in Bandung City', *CSID Journal of Infrastructure Development*, 1(1), p. 110. Available at: https://doi.org/10.32783/csid-jid.v1i1.14.

Wie, T.K. (2005) 'The Major Channels of International Technology Transfer to Indonesia: An Assessment', *Journal of the Asia Pacific Economy*, 10(2), pp. 214–236. Available at: https://doi.org/10.1080/13547860500071493.

Yanocha, D. and Allan, M. (2021) 'Maximizing Micromobility: unlocking opportunities to integrate micromobility and public transportation'. ITDP.