

Intizar Hussain

# **USE OF PUBLIC TRANSPORT AMONG IMMIGRANTS AND NON-NATIVE FINNISH SPEAKERS**

Master's Thesis  
Faculty of Built Environment  
Examiner: Prof. Heikki Liimatainen  
Dr. Hanne Tiikkaja  
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# ABSTRACT

Title : Use of Public transport among immigrants and non-native Finnish speakers

Author : Intizar Hussain

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Public transport is an important mode of transport among diverse groups of people which include immigrants and non-native Finnish speakers. To improve accessibility and inclusivity, it is crucial to understand their travel behaviors and the challenges they face while using public transport. This research mainly focuses on identifying the barriers that influence transport decisions among immigrants and non-native Finnish speakers in Tampere, Finland. The study is guided by the main research question: "*What are the factors affecting public transport usage among immigrants and non-native Finnish speakers?*". To explore this further, the study addresses the following sub-research questions: (1) How do demographic factors such as age, gender, income, and length of residence in Finland affect public transport use and the use of other modes among immigrants and non-native Finnish speakers? (2) What are the barriers encountered and perceived by immigrants and non-native Finnish speakers when using public transport? (3) How do these barriers affect the use of public transport among immigrants and non-native Finnish speakers?

The data for this study was collected via online surveys and structured interviews with immigrants and non-native Finnish speakers. Fisher's Exact Test was conducted for quantitative analysis to investigate connections between key variables. In terms of travel behaviors, the findings indicate that newly arrived immigrants, and those with lower yearly income are more dependent on public transport, but as their duration of residence in Finland increases, they tend to shift towards using private cars for their travel.

The results of the study indicated that cost of public transport is a major barrier which significantly affects public transport use, especially among newly arrived immigrants and those with lower incomes. Language difficulties, poor connectivity and comfort-related concerns were also highlighted as barriers affecting some proportion of immigrants. Discomfort about mixed-gender seating arrangement was reported by female immigrants. Although safety concerns were found to be not a significant barrier for most respondents, but those perceiving safety as barrier were mostly females. Additionally, language barrier was a challenge for some immigrants, particularly among immigrants with poor Finnish language proficiency.

The study concludes that although public transport usage frequency is high among immigrants and non-native Finnish speakers, however, several barriers affect its usage frequency among some portion of immigrants. Further increase in their public transport usage frequency could be possible if cost-related issues are addressed, multilingual information systems in public transport are implemented, connectivity is improved, and cultural sensitivities related to safety and seating arrangements is acknowledged. To better serve the diverse population and reduce transport poverty, future policies should focus on promoting inclusive and equitable transport systems.

Keywords: Public transport, immigrants, non-native Finnish speakers, travel behavior, barriers, accessibility, Tampere

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## PREFACE

This thesis aimed to find out barriers that affect the public transport use of immigrants and non-native Finnish speakers. The aim of this research was to gain an understanding of these barriers to recommend measures that can make public transport more accessible for immigrants. I expect this study will contribute to removing these barriers and, in doing so, reducing the social exclusion and transport poverty of immigrants and they are encouraged to use more public transport. It has both positive impact on sustainability and integrating the immigrants into Finnish society.

Various people have made this research possible by offering invaluable support and guidance. Above all, I would like to thank my supervisor, Prof. Heikki Liimatainen, and my co-supervisor, Dr. Hanne Tiikkaja, for their consistent guidance during the entire master's thesis research. More specifically, I want to thank Dr. Hanne Tiikkaja, who translated the survey questionnaire and other necessary documents into Finnish, which was essential for ensuring the correct data collection. I also want to thank Usama Qureshi for translating the questionnaire into Arabic and Muhammad Zain Abid for being my companion in the interviews, which made the data collection process easier.

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Tampere, 19 March 2025

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# 1. INTRODUCTION

Like other cities in Finland, diversity has been increasing in Tampere due to the increase in the number of immigrants and non-native Finnish speakers settling in the region. As of 2023, the population of immigrants and non-native Finnish speakers living in Finland is around 372,000 which is almost 6.6% of the total population of Finland. (Statista 2024).

Tampere is a vibrant city of Finland with cultural diversity, and people with around 160 different languages living in Tampere. The most spoken languages are Arabic, Chinese, English, Estonian, Farsi, Kurdish, Russian, Somali, Spanish and Swedish (Tampere City 2023). The population of immigrants has been increasing in the city, with currently around 17,400 immigrants' population in the city which is around 9% of the total population of the city (City Population 2024). As the population increases, the demand for mobility increases as well (Lodovici and Torchio 2015). This increase in overall population, especially the rapid increase in the population of immigrants can bring challenges and opportunities, particularly in the use of public transport which is an important component of life in urban environment.

Tampere is the third largest municipality and second largest city of Finland (Tampere City 2024) where public transport plays a vital role in the accessibility of people to jobs, education and other important activities. With the increase in population, the demand for public transport also increases. Easily accessible transport is important in city planning because it helps people get around and improves their lives (Chowdhury 2023).

Understanding the use of public transport by immigrants and non-native Finnish speakers in Tampere can give us valuable insights to their life challenges and barriers that they face while using public transport. With the increase in population of immigrants and non-native Finnish speakers, their travel behavior may differ from that of native Finnish residents. For instance, they may frequently use public transport to travel to language course centers or language-specific healthcare facilities, which are not common destinations for native Finnish speakers.

Public transport may not provide easy accessibility to all those places where immigrants are intended to travel. Similarly cultural diversity could also influence the travel behavior and decisions of the people. (Awaworyi Churchill 2020)

## 1.1 Scope and objectives

Considering the factors affecting the travel behaviors and usage of public transport among immigrants, and the increase in population of immigrants in Tampere, this proposed master's thesis aims to investigate the factors that are affecting usage of public transport among immigrants and non-native Finnish speakers in Tampere, Finland. By conducting a comprehensive examination of the factors influencing public transport utilization, the study seeks to identify barriers to access opportunities for improvement within the public transport system.

In this study “immigrants” refer to the individuals who have moved from another country to Finland for work, study, business or any other purpose. This category includes those who were born in other country and have moved to Finland and those who were born in Finland but do not have citizenship of Finland and have strong cultural identity to their country of origin whereas, “Non-native Finnish speakers” refer to those individuals who can speak Finnish fluently but their native language or first language is not Finnish. This includes both citizens and non-citizens of Finland who have raised in Finland using other language than Finnish at home.

The scope of this study is limited to the city of Tampere, Finland, and the study would be conducted by online survey and interviews. More details about the survey and interview will be explained in the methodology section of this thesis.

This study will answer the main research question as “What are the factors affecting public transport usage among immigrants and non-native Finnish speakers?” covering the following sub-research questions:

1. How do demographic factors such as age, gender, income, and length of residence in Finland affect public transport use and the use of other modes among immigrants and non-native Finnish speakers?
2. What are the barriers encountered and perceived by immigrants and non-native Finnish speakers when using public transport?
3. How do these barriers affect the use of public transport among immigrants and non-native Finnish speakers?

## 1.2 Structure of thesis

The thesis is structured as follows:

Chapter 2 provides the existing literature review related to travel behaviors of immigrants particularly public transport usage, with a focus on the challenges faced by immigrants

and non-native residents in relation to quality-of-service factors of public transport. This chapter explores different studies about travel behaviors of immigrants with focus on barriers and how they can lead to social exclusion and transport poverty.

Chapter 3 outlines the methodology of this study. It explains the research philosophy of this study, data collection methods, and the analytical techniques used to analyze the data. Details about the questionnaire design, sampling methods, and statistical tests are included to ensure transparency and reproducibility. It also includes a section on research ethics that covers how participants were informed about the study, measures about data protection, and a risk analysis to tackle potential ethical concerns. The chapter also mentions the inclusion of information sheet and a data privacy notice, provided as an appendix, which outlines how participant data was collected, stored, and processed to ensure compliance with ethical standards and legal regulations.

Chapter 4 presents the results of the analysis conducted for this research to address each of the sub-research questions of the thesis. It includes statistical findings and visual representations such as tables and charts, highlighting the associations between different transport modes usage frequency and various demographic and perceptual factors. Moreover, the analysis about what type of challenges is faced by immigrants and non-native Finnish speakers and how are those challenges associated with different demographic factors of the immigrants. This chapter provides an objective description of the results addressing the research questions of the thesis.

Chapter 5 combines discussion and conclusion. In the discussion section, the results are interpreted considering the research questions and compared to the findings from the literature review. This chapter also highlights the implications of the findings for public transport policy and planning, especially concerning the needs of immigrant and non-native populations. The conclusion summarizes the key findings, addresses the research objectives, and provides recommendations for improving public transport systems. Suggestions for future research are also included.

This structure ensures a logical flow of information from the theoretical background to the research findings and their implications, offering a clear and comprehensive understanding of the topic.

## 2. LITERATURE REVIEW

### 2.1 Social exclusion and mobility

Social exclusion refers to the lack of access of the people to basic resources, rights and services and inability to participate in the daily activities which most of the people in society can enjoy. This can happen in jobs, politics or culture which can negatively affect the quality of life of individuals and unity in society (Levitas et al. 2015). When it comes to mobility, social exclusion refers to the limited accessibility of people to their jobs, services, and social networks. It is essential for social interaction to have proper accessibility for people to fully participate in society. The planning and design of cities and transport systems influence the people's participation in society. (Stanley and Lucas 2008)

Since the lack of transport accessibility leads to social exclusion, planners and policy makers focus on an efficient public transport system that provides easy and affordable accessibility of the people to important destinations. Additionally, accessible public transport plays an important role in the employment opportunities. More job opportunities and higher incomes are possible because of better public transport system such as in Copenhagen, residents living closer to metro stations had higher employment rates and earnings than those living farther away. (Saif, Zefreh and Torok 2019)

Several studies show that transport plays a major role in either supporting or limiting social inclusion, especially for people from underserved communities. Access to transport is of high importance to participate in daily activities like employment, education and healthcare. Lack of proper access to transport or lack of transport opportunities leads to social exclusion that makes it challenging for people to access their daily activities, especially it affects those with low income and disabilities. Social exclusion is more than poverty; it includes a lack of resources and opportunities, impacting individuals' quality of life and community connections. Additionally, social exclusion in transport is influenced by various dimensions like geographic location, economic challenges, time constraints, and personal safety concerns. (Lucas 2012)

Additionally, Luz and Portugal (2022) argue that transport-related exclusion isn't just about lacking money or access but about a lack of freedom to take part in everyday life. They identify specific barriers, like physical accessibility issues, fear of certain areas or routes, and lack of access to digital tools, that can limit mobility and independence. These studies together emphasize that transport policies need to focus on connecting

people to essential services in ways that consider individual and community needs, aiming to reduce social inequality and foster a more inclusive society.

## **2.2 Travel behaviors of immigrants**

The travel behavior of immigrants is influenced by various factors such as ethnicity (Allen et al. 2021), education, income, duration of stay in the country. Use of public transport is more among immigrants as compared to natives, but in some countries, carpooling is also common among immigrants because it is a way for both earning and reducing the cost of car ownership for car owner (Chatman and Klein 2009). Moreover, in some countries, immigrants live in areas where there are less employment opportunities and the public transit is not accessible to their employment places, so they have the only option of using personal car (Blumenberg 2008).

However, not all immigrants can use car for their travel because they either do not hold driving license and even cannot take the test to get driving license because of their limited budget. They cannot even use taxis for their travel due to their financial situation. In such situations they have the only left option is to use public transport or bicycle for their travel however, most of the women among immigrants cannot ride a bike (Geis 2019).

Conversely, immigrants also use personal car for their travel. It has been indicated in several studies that duration of residence is associated with modal shift among immigrants, especially as immigrants' duration of residence increases in a country and they get settled, their dependency on personal car usage increases (Chatman 2014; Shafi et al. 2020; Hu et al. 2021). Similarly, immigrants with higher income are more likely to use personal car for their travel (Hanna 2021). Because of the fact that with the duration of residence in a country, immigrants are more probably settled, and their income is more likely to increase (Delbosc and Shafi 2023).

Furthermore, immigrants generally have shorter travel distances as compared to non-immigrants; however, travel distance also increases with the duration of stay. Travel distance is also associated with other factors like ethnicity, income, age and household size. (Bruce Newbold, Scott and Burke 2017)

Among all other modes of transport, walking is also considered as a mode of transport. In general, walking is considered as the second most preferred mode of transport among aged people. Overall, throughout life, as compared to males, females walk more for daily activities like going to the grocery store, picking up something from the pharmacy, or mailing a letter which might be due to less access to cars. (Brüchert et al. 2020) Whereas in particular, immigrants are 1.4 times more likely to make their trips by walking and

cycling as compare to native residents (Blumenberg 2009). Similarly, a study indicates that walking and public transport were the most frequently used modes of transport for recent immigrants in the Durham region of Canada (Chahar Mahali and Ray-Yol 2020). Considering the association of gender and age with walking, the walking frequency of immigrants was analyzed based on their age and gender.

Cycling as a mode of transport is also more likely used among immigrants as compared to native people (Blumenberg 2009). Use of cycle among immigrants also vary based on their demographics particularly when it comes to gender. For male, bicycle was just a toy or a machine but for female, it was like a sign of freedom for mobility (Macy 2011, pp. 9-25.). In some countries, even today women are not allowed to ride a bicycle or allowed only if women is accompanied by a male relative (Ramdani 2013; Noury and Speciale 2016) hence when women from such culture or counties move to another, they are still less likely to use bicycle for their mobility therefore male immigrants are more likely to use bicycle as compare to female immigrants (Assum 2011).

### **2.3 Public transport use among immigrants**

Public transport is an important mode for travelling. Research has shown that immigrants are more likely to rely on public transport compared to native-born residents, especially in the early years after their arrival. For instance, in Toronto, recent immigrants are twice as likely to use public transport compared to Canadian-born residents (Heisz and Schellenberg 2004). Similarly, in US immigrants are more likely to use public transport, bike and walking rather than relying on their own vehicle (Lee, Smart and Golub 2021). Similarly, according to Clark and Wang (2010) in various states across the U.S., immigrants are nearly eight times more likely to use public transport compared to native-born individuals. In the Rhine-main region in Germany, 55.0% of immigrants use public transport for visiting official authorities or healthcare services, 35.0% use it for leisure activities and outings, while 31.0% for religious sites (Geis 2019). However, use of public transport among immigrants is associated with factors such as income, gender, age, distance to and from work and city center respectively (Heisz and Schellenberg 2004).

Additionally, it has been stated in several other studies that the use of public transport is higher among immigrants as compared to non-immigrants particularly in their initial years of moving to a country. However, as they reside longer in a country then they are less likely to use public transport. For instance, around one third of the immigrants that had resided in Canada for five years used public transit whereas, this portion had dropped to 16.0% for those immigrants who had been living there for more than 15 years. Similarly, 13.0% of immigrants who had lived for five years or less in US used public transport for

their commute to work, whereas this trend had decrease to 10.0% with the immigrants who had lived for 5-10 years and to 8% for those who had lived for 15 years or more (Hanna 2021). This travel behavior is influenced by factors like lower car ownership and financial constraints (Heisz and Schellenberg 2004; Blumenberg and Evans 2010; Lo, Shalaby and Alshalalfah 2011; Smart 2015). They often live in the areas where they can easily get public transport (Lo, Shalaby and Alshalalfah 2011; Chatman and Klein 2013). Although, there are fewer studies about immigrants' travel behaviors in Europe, however several foreign studies show that immigrants more likely use public transport, walking or cycling for their travel as compared to native individuals (Brandt 2021).

## **2.4 Public transport quality of service factors and immigrants**

Public transport quality of service has become an essential topic in transport and urban planning research. Over the years, transport researchers and authorities have found out the factors that affect the overall public transport quality of service. According to Vanhanen and Kurri (2005), route network, intervals, reliability, and travel time are the important factors that make up around one third of the people to perceive the service quality of public transport.

Additionally, Dell'Olio et al. (2017) has outlined that reliability, comfort, safety, accessibility, and information are some of the crucial aspects that affect public transport service quality that aligns closely with the findings of the International Transport Forum, which emphasizes the importance of availability, reliability, comfort, accessibility, information provision, and customer care (Anderson et al. 2014).

Similarly, Dell'Olio, Ibeas, and Cecin (2011) used stated preference surveys and discrete choice models, found that service frequency, punctuality, and cleanliness are the most valued aspects of public transport. These factors were found to be important for improving user satisfaction and increasing the use of public transport. It was emphasized in this study that improvements in these factors can make public transport more appealing for the users, especially for those who may otherwise use private vehicles.

While these quality factors such as route network, intervals, reliability, travel time, comfort, safety, accessibility, cleanliness and convenience apply to all public transport users, immigrants and non-natives probably face several challenges while navigating and using public transport such as language barriers and unfamiliarity with the local transport system can cause challenges which may lead the immigrants to face difficulties with understanding routes and maps, schedules, and announcements, making navigation (Chahar



Mahali and Ray-Yol 2020). Such difficulties can result in missed connections and increased travel times, which can negatively impact immigrants' perception of public transport service quality.

## **2.5 Use of mobile apps for trip planning**

Since mobile phone applications are used for various purposes. The purpose of mobile phone applications that is associated with our study is trip planning. Use of mobile applications for the purpose of trip planning is also associated with different socio-demographic characteristics like age, gender, and income level. In terms of age, the use of cellphones and internet is very common among younger and middle-aged individuals (Srinivasan and Reddy Athuru 2004; Sinha and Gupta 2023), hence younger people rely more on smartphones applications for trip planning (Jamal and Habib 2019).

## **2.6 Challenges in public transport for immigrants**

Immigrants are more likely to use public transport; however, they still face many challenges and barriers while using public transport such as language difficulties, discrimination, understanding of public transport schedules and routes, and unfamiliarity with the local transport system, confusion and transfer policies prevent efficient use of public transport and limit their mobility and high cost of public transport (Farber et al. 2018; Geis 2019).

Immigrants living in suburban areas have less access to public transport which can make their travel more challenging (Lo, Shalaby and Alshalalfah 2011). Additionally, accessibility of public transport is an important factor to be considered for finding and keeping job (Johnson, Ercolani and Mackie 2017). Therefore, the unreliability and poor connectivity of public transport to immigrants' workplaces limit their access to job opportunities (Blumenberg 2008). Moreover, the travel behavior of immigrants and non-native people could be different from non-immigrants and native such as visiting to culturally specific grocery store, culturally appropriate food, language centers, language specific health care service while using public transport may not provide easy accessibility to all those places where immigrants are intended to travel (Allen et al. 2021).

Travel behavior and decisions of the people could be influenced by cultural diversity (Awaworyi Churchill 2020) such as most of the female immigrants walk for longer distances instead of using public transport because they do not feel comfortable and certain or avoiding of service meant for mixed gender (Geis 2019). Such barriers to a specific gender group among immigrants while using public transport can lead to social exclusion

and transport poverty which causes them difficulty to access their needs and participate in their daily activities.

Language barrier limits the public transport use of immigrants, as due to language difficulty, immigrants find it challenging to navigate the public transport system, routes, schedules and fare system. For instance, according to Blumenberg (2008), despite the availability of public transport in California, immigrants are less likely to travel by public transport because of the language barrier and unfamiliarity with the transit system. As most of the information are in English and immigrants have less proficiency of English language, which makes it difficult for them to use public transport. Therefore, most of the immigrants rely on using their personal car. However, immigrants typically own over ten years old cars which requires frequent maintenance, that limits their travel and access to work.

Moreover, high cost of public transport is also a significant barrier for immigrants and non-natives. Many newly arrive immigrants live their lives on tight budgets, making expensive fares cause a significant obstacle to their mobility (Chahar Mahali and Ray-Yol 2020). For instance, if the public transport would be affordable in US, then around 60% of low-income immigrants would have used public transport for one or more days in a week (Barajas, Agrawal and Chatman 2018). Additionally, according to Assum et al. (2020), many immigrants in Europe especially those with low-income background rely on walking and public transport as they cannot afford personal car because of their financial situation. However, due to language difficulty and unfamiliarity with the transit system, they find it challenging to use public transport effectively which affects their effective daily travel. As they get financially stable, they tend to shift towards using a personal car. This financial constraint and expensive fare can lead to social isolation, as immigrants are more likely to limit their travel to the most important trips only and avoid such trips that could be helpful in building social connections which are crucial for integration.

Additionally, when it comes to safety, immigrants are more unlikely to use public transport in those areas that are considered unsafe. Some of the immigrants also don't possess monthly recurring bus card which can provide cost saving over time. The reasons behind the lack of this card could be their financial situation or not having a bank card which could be required to obtain this card. Moreover, travel complexity such as traveling on public transport with children or with multiple stops is also considered a difficulty for immigrants perhaps due to their household size. (Barajas et al. 2018)

Furthermore, discrimination is another challenge that immigrants may face while using public transport. Discriminatory behavior from transport staff and other passengers have been reported in some studies, particularly towards visible minorities and women with children (Chahar Mahali and Ray-Yol 2020). Immigrants may feel unwelcome and discouraged to use public transport if they face such experiences even if their primary mode is public transport.

Moreover, barriers in public transport can have extensive consequences on health and well-being of immigrants. For instance, barriers to healthcare access can lead to missed medical appointments, delayed care, and poor management of chronic illnesses (Syed, Gerber and Sharp 2013). For immigrants, who may already face other challenges, these transport related health issues could make it even harder to settle and adapt to new communities.

Despite these challenges, public transport plays an important role in help immigrants integrate. A well-designed, accessible, and reliable public transport systems can facilitate immigrants to access employment opportunities, healthcare, and community resources. The Migration Policy Institute reports that over 6.8 million immigrants in North America and Europe heavily depend on public transport for their daily commutes and other travel needs (Hanna 2021). However, poor transport quality can make it harder to integrate and make their existing problems worse.

## **2.7 Public transport of Tampere city**

Tampere is the third largest city of Finland and as of December 2023, its population is 255,000 individuals with a density of approximately 460 persons/sq.km. A large share of the population (around 50,000 individuals) is comprised of young people with age group ranging from 20-29 years since these young people are students and mostly attracted towards Tampere universities. The number of individuals under the age of 41 are 138,000 whereas above 65 are 50,000. The city of Tampere spans over an area of approximately 690 km<sup>2</sup>, out of which approximately 165 km<sup>2</sup> of the area is covered with water (Tampere City 2023).

The city of Tampere has seven neighboring municipalities. Together with city and these seven neighboring municipalities it is known as City of Tampere region. The neighboring municipalities are the towns of Kangasala, Nokia, Orivesi and Ylöjärvi, and the municipalities of Lempäälä, Pirkkala and Vesilahti (Tampere City 2024). As of 2024, the overall population of Tampere region is approximately 349,300 inhabitants (World Population

Review 2024). All the neighboring municipalities of the Tampere region are almost covered by public transport. The available modes of public transport in Tampere region are trams, buses, and taxis. Moreover, e-scooters and cycles are also available for travel on rental offered by different companies such as Tier and Voi. Separate cycle lanes are almost everywhere in Tampere which makes the short trips sustainable, economical, and convenient.



**Figure 1.** Zones for public transport in Tampere region (Nysse 2024)

All the neighboring municipalities are connected by the public transport service Nysse which is operated by the cooperation of eight municipalities. The responsibilities of transport service Nysse are providing public transport services, scheduling and route planning in the Tampere region. Moreover, information about public transport schedules, routes, ticket fares and payment methods are provided to the public on Nysse website and mobile application (Tampere City 2024). This information is provided in Finnish, Swedish and English languages on Nysse mobile application whereas in Finnish and English languages on Nysse website.

The Tampere region is divided into three zones i.e. A, B and C for the public transport services. The center of Tampere region is considered as zone A and B which is surrounded by zone C as shown in figure 1. The zone boundaries are determined based on the services provided in each region (Nysse 2024).

### 3. METHODOLOGY

#### 3.1 Research philosophy

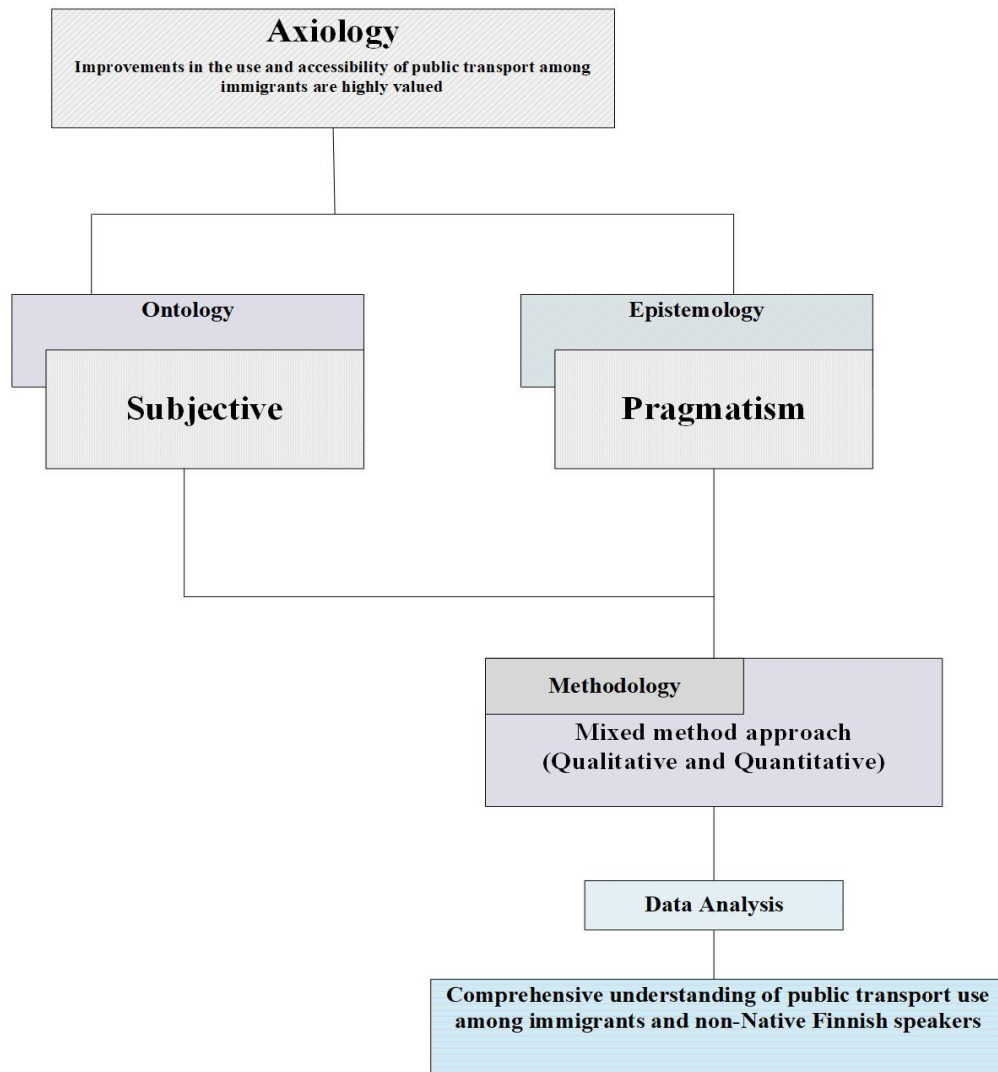
There are beliefs by various researchers regarding research philosophies. According to Saunders et al. (2019), research philosophy is referred to as the set of beliefs that shape how knowledge is approached, and research is designed. The research philosophy for this master's thesis is based on a set of beliefs and assumptions about how knowledge is developed and by understanding the key concepts of axiology, ontology, and epistemology. These concepts lay the foundation for designing the research and analyzing existing studies. To create a strong research framework and ensure that the work is aligned with the nature of the study and the question being addressed, it is important to understand research philosophy (Brown and Irby 2000).

Axiology refers to the role of values and ethics in research. The word "axiology" has been originated from Greek term "axiā" which means worth or value. Axiology is the study of nature, types, and criteria of values and of value judgments. Axiology plays a role in ensuring that is influenced by our values as researchers. (Heron and Reason 1997) The goal of this study is to improve the use and accessibility of public transport among immigrants and non-native Finnish speakers, which reflects our values. The aim is to be open and transparent about how our values and potential biases might influence the research process and how we interpret the results.

Ontology focuses on the nature of reality and what can be known about it. The word "ontology" has also been derived from Greek words "Onto" which means "being" and "logia" which means "science or study". Ontology can be defined as assumptions about the nature of reality (Saunders et al. 2019). In this study, a relativist ontological approach is adopted, which means that reality is seen as subjective and shaped by individual experiences and perceptions (Guba & Lincoln 1994). This approach is suitable when studying diverse groups because it identifies that each person's experience with public transport is subjective and probably influenced by their background, such as their socio-demographic characteristics, culture, and personal experiences. It acknowledges that there isn't one "true" reality since every participant's reality is different from one another.

Epistemology is the study of how knowledge is obtained or in another words it addresses the nature of knowledge. The term "Epistemology" has also been derived from Greek word "Episteme" meaning "knowledge". Epistemology refers to the study or idea of what knowledge is and how it works, especially when it comes to its limits and reliability. Each

type of knowledge requires its own unique approach such as using different methods to catch fish or hunt birds. Just as a person would either use a fishing rod for fish and a bow for birds, similarly, researchers use different methods to gather information. (Farrow et al.2020) This master's thesis is based on pragmatism in its epistemology, focusing on the practical use and real-world impact of knowledge. Pragmatism acknowledges that knowledge comes from experience and that our understanding of the world is shaped by our social and cultural contexts (Kaushik and Walsh 2019).



**Figure 2.** Research philosophical and methodological positioning of this master's thesis

Additionally, pragmatism focuses on practical, real-world applications of knowledge. It is like choosing the most effective tool for the job at hand. This approach recognizes that our understanding of the world is shaped by our experiences and social contexts. In this master's thesis, while studying the use of public transport among immigrants and non-native Finnish speakers, pragmatism allows for a combination of methods. It is like using

both a net and a fishing rod to catch more fish. By using surveys and structured interviews, while having both quantitative and open-ended questions, we can gain a deeper understanding of the topic (Allemang, Sitter and Dimitropoulos 2022).

Bringing these ideas together creates a pragmatic research philosophy by combining different approaches i.e. quantitative and qualitative to give richer insight into real-world challenges in urban mobility (Saunders et al. 2019). While this study primarily employs a quantitative approach, it incorporates a qualitative component as a supportive layer to enrich the analysis (Prime 2024). The mixed method approach used here is not equally balanced but rather mostly quantitative with a smaller qualitative element. Online surveys form the main data collection method and the same set of questions being used for interviews which are supplemented by a limited number of open-ended questions. While focusing on quantifiable data, this combined data collection strategy helps to gather more detailed information about experiencing use of public transport by immigrants and non-native Finnish speakers, including those who may face challenges like limited digital literacy. Figure 2 shows the research philosophical and methodological positioning of this master's thesis.

In a nutshell, this master's thesis is based on pragmatism as a research philosophy that uses mixed-method approach i.e. both quantitative and qualitative to gather and analyze data. This framework is helpful to plan about data collection, analyzing and interpreting data, aiming to get a clear picture of how immigrants and non-native Finnish speakers use public transport in Finland. By combining survey and interview data as one data set, the aim is to get a complete view of the study problem, and it is helpful to address challenges and capture a variety of participant experiences.

### **3.2 Questionnaire development**

The primary tool for data collection was a structured questionnaire, which is included in appendix A of this thesis. The questions in the survey were developed based on literature review and based on the research questions of this study. The questionnaire aimed to explore factors such as frequency of using different modes of transport, perceptions of several challenges while using public transport such as language, comfort, safety etc. as well as demographic information like age, gender, profession, income, and duration of residence in Finland. The questions were designed to be clear and easy to understand, ensuring that participants could provide an honest and accurate response.

Each question was carefully formed to capture specific insights. Similarly, perceptions of different barriers were measured using a Likert scale, where respondents could indicate



their level of agreement or disagreement with various statements. The demographic section was kept concise to ensure participants felt comfortable providing their background information while still obtaining the necessary details for analysis.

To improve the clarity and readability of the questions, a pilot test of the questionnaire was conducted before the survey. A small group of participants like the target population i.e. immigrants, responded to the drafted questionnaire and provided feedback about the readability and understanding of the questions. This step helped identify any unclear questions and ensured that the questionnaire was reader friendly. Based on the feedback from the pilot study, some adjustments were made to the wordings and structure of a few questions to enhance their understanding and readability.

After the changes as per the feedback in the pilot testing of the questionnaire were made, the final version of the questionnaire was distributed for the collection of data from the target group of people from 28<sup>th</sup> November 2024 to 19<sup>th</sup> December 2024.

### **3.3 Data collection methods**

This study needed to collect information about the use of public transport among immigrants, focusing on barriers that they face while using public transport. To collect such data from immigrants, survey and interviews were the methods chosen for this study because it is easy to share survey electronically and is low-cost and barriers are low for respondents to participate. Additionally, the same survey questions were asked in interviews from certain participants that were either not able to use smart phones or laptops for online surveys or were not able to read and write because of their age factor or literacy level.

#### **3.3.1 Online surveys**

The online survey served as an important tool for collecting data. A web link to the electronic survey, created using Microsoft forms (MS Forms), was distributed across a variety of social media platforms and through the Tampere University intranet (TUNI Intra) that allowed for a wide-ranging reach, targeting a diverse range of people across different age groups, languages, professions, travel behaviors, and cultural backgrounds. The survey was also inclusive of students, who form a significant part of the immigrant population in Hervanta. Additionally, the online survey link was shared across various social media platforms, including WhatsApp and Telegram, targeting groups where most of the members were immigrants and non-native Finnish speakers. There was an information

sheet and data privacy notice linked to the online survey. The details about the information sheet and data privacy notice are included in the "Research Ethics" section of this chapter.

To ensure inclusivity for most of the immigrants and non-native Finnish speakers, the survey was offered in three languages i.e. Finnish, English and Arabic which allowed those immigrants and non-native Finnish speakers to participate, who may not be proficient in Finnish or English. The goal was to eliminate language barriers and gather a wide range of responses from various groups.

### **3.3.2 Interviews**

In addition to the online surveys, structured interviews were conducted. These interviews were carried out at public transport stops, stations, and community centers where the immigrants gather particularly during certain events. Interviews were conducted to include individuals who may have limited access to online platforms due to age, lack of digital literacy, or education level.

The interview questionnaire was the same as the online survey. By engaging with participants in diverse settings, these interviews provided an opportunity to explore a broader range of perspectives, offering deeper insights into the unique challenges faced by immigrants when using public transport. Before conducting the interviews, the participants were provided with a printed information sheet and data privacy notice along with orally explaining the information sheet and data privacy notice. The interviews were conducted considering the privacy of the interviewees and following the research ethics. More details about research ethics are provided in the next section of this chapter.

## **3.4 Research ethics**

Strict ethical research guidelines were followed in this thesis to ensure the participants' rights, i.e. ensuring their data protection and privacy and maintaining the quality of the research. The focus was on informing the participants about the purpose of the research and how the data collected from them would be protected and concise risk assessment of the data. Participants were also informed that all collected data would be completely deleted after this master's thesis is accepted. Additionally, any data collected in paper form from interviews was already disposed of after being digitized.

### **3.4.1 Informing participants**

A detailed information sheet was linked to the online survey that explained the purpose of the research, and how the data would be used. The participants were informed in the information sheet that their participation was voluntary, and they could stop at any time without giving a reason. The sheet also made it clear that their responses would remain anonymous and no personal details, like names or contact information, would be linked to their answers. This information sheet helped participants understand the study and feel comfortable about participating in the survey. A copy of the information sheet is included in appendix B.

### **3.4.2 Data protection**

Data privacy was a top priority in this research. The data was collected anonymously, meaning the participants cannot be identified from their answers. The data was stored securely on password-protected devices, and only the researcher had access to it. None of direct personal information were asked in the survey like name, email addresses or IP addresses to ensure participants' privacy. Following the GDPR regulations and Tampere University's guidelines, a data privacy notice was shared with participants, explaining how their data would be collected, stored, and used. The data privacy notice is also included in appendix C for reference.

### **3.4.3 Risk assessment**

Following the guidelines by Office of the Data Protection Ombudsman and Tampere University, a concise risk assessment was done to identify and handle any potential issues (Tietosuoja.fi 2024). One concern was that some participants might feel uncomfortable answering questions about their travel behaviors or background. To address this, the participants were allowed to skip any question they did not want to answer.

Another potential risk was data security. To prevent any breaches, the data was collected anonymously and stored in a secure and encrypted format. These measures ensured that participants' privacy was protected throughout the study.

## **3.5 Statistical analysis**

In this study, Fisher's Exact Test was used to analyze categorical data when certain assumptions of the Chi-Square test were not met. Specifically, this test was applied instead of the chi-square test when the expected frequencies of one or more cells of the contingency table were too small, particularly less than 5, as other tests particularly Chi-

Square test may not be reliable in such cases (Giannini 2005; Williams and Quave 2019; Gill et al. 2020).

The test was chosen to examine the significant association between two variables in the thesis. By using this method, it was aimed to determine if the relationship between two variables analyzed in the next chapter was due to chance or if it suggested a meaningful pattern. The p-value in the test indicates whether the observed differences are statistically significant.

Since Fisher's Exact Test is based on calculating all possible outcomes, it is computationally intensive, particularly for larger datasets (Williams and Quave, 2019). To address this, Monte Carlo simulations were used in cases where exact computation was not feasible. The confidence level for Monte Carlo estimation was set at 95% with 10,000 samples to ensure reliable results.

Fisher's Exact Test was conducted using SPSS software version 25. The results were interpreted based on the conventional significance threshold of  $p < 0.05$ , where the value below 0.05 indicates a statistically significant association.

## 4. ANALYSIS AND RESULTS

The data collection was done by two methods, i.e. online survey and interviews as explained in the previous section of this thesis. Overall, 180 responses were collected from both methods, out of which 139 were collected from online surveys and 41 from interviews. There were 2 incomplete responses in the collected set of data which were excluded from analysis. Rest of all 178 responses were analyzed together as same set of questions were used for both online survey and interviews. Descriptive analysis of the collected data was done with Microsoft Excel and SPSS version 25.

### 4.1 Demographics

Demographic characteristics of the participants are illustrated in Table 1. In terms of gender, out of total participants 59.0% were male, 38.8% were female, 1.7% were other, while 0.6% of the participants preferred not to say anything about gender.

The age of participants was categorized into seven ranges, starting from 18 up to over 74 years. Among the participants, 17.4% belonged to the age group of 18-24, 50.6% were aged 25-34, 12.4% fell within the age range of 35-44, 6.7% were aged 45-54, 5.6% belonged to the 55-64 age group, 4.5% were aged 65-74, and only 2.8% were over 74. A high percentage of young people, specifically those aged 18-34, participated in the survey because the link was widely shared in social media groups with a significant presence of younger individuals. In contrast, most older participants were targeted for data collection through interviews conducted at community centers and public transport stops.

Household size among immigrants and non-native Finnish speakers was categorized into five groups, ranging from individuals living alone to households with more than five members. According to the responses collected through the online survey and interviews, 38.8% of participants live alone, 23.6% live in households of two, 11.2% in households of three, 15.7% in households of four, and 10.2% in households with five or more members.

Additionally, yearly income was categorized into five ranges in the questionnaire, from less than €10,000 to €80,000 per year. Based on the responses collected through the online survey and interviews, 44.9% of participants reported a yearly income of less than 10,000€, 27.0% fell within the range of 10,000€ to 20,000€, 15.7% reported an income between 20,001€ and 40,000€, 6.7% fell within the range of 40,001€ to 60,000€, 4.5%

reported a yearly income of 60,001€ to 80,000€, and 1.1% of participants chose not to disclose their yearly income.

Table 1. *Demographics of the respondents*

		Frequency	Percentage
Gender	Male	105	59.0
	Female	69	38.8
	Other	3	1.7
	Preferred not to say	1	0.6
Age Group	18-24	31	17.4
	25-34	90	50.6
	35-44	22	12.4
	45-54	12	6.7
	55-64	10	5.6
	65-74	8	4.5
	More than 74	5	2.8
Household size	1 (I live alone)	69	38.8
	2	42	23.6
	3	20	11.2
	4	28	15.7
	5 or more	19	10.7
Yearly income	Less than 10000 €	80	44.9
	10000 to 20000 €	48	27.0
	20001 to 40000 €	28	15.7

	40001 to 60000 €	12	6.7
	60001 to 80000 €	8	4.5
	Missing	2	1.1
Duration in Finland	Less than 1 year	49	27.5
	1 to 5 years	84	47.2
	6 to 10 years	24	13.5
	More than 10 years	20	11.2
	Missing	1	0.6
Profession	Student	69	38.8
	Full time employee	35	19.7
	Part time employee	8	4.5
	Student and part time employee	25	14.0
	Entrepreneur	4	2.2
	Stay at home parent	5	2.8
	Pensioner or part time pensioner	13	7.3
	Unemployed	19	10.7

Moreover, the duration of residence in Finland was asked in five categories i.e. less than 1 year, 1-5 years, 6-10 years, and more than 10 years. Among the respondents, 38.8% had reported residing in Finland for less than 1 year, 47.2% has been residing for 1 to 5 years, 13.5% has been residing for 6 to 10 years, whereas 11.2% has been residing for more than 10 years in Finland. 0.6% of the respondents have not responded to the question asked about residence and therefore it is considered missing.

Finally, in the demographics, the question asked about profession was classified in different professions as student, full-time employee, part-time employee, student and part-

time employee, entrepreneur, stay at home parent, pensioner or part-time pensioner, and unemployed. Among the total respondents 38.8% are students, 19.7% are full-time employees, 4.5% are part-time employees, 14.0% are students & part-time employees, 2.2% are entrepreneurs, 2.8% are stay at home parents, 7.3% are pensioners or part-time pensioners, whereas 10.7% are unemployed.

However, among the total population of Tampere, which is approximately 255,000 inhabitants, 51.5% are male and 48.5% are female. This population includes both native and non-native residents. In terms of citizenship, 93.2% of the total population are Finnish citizens, 2.4% are European citizens, and 4.4% are foreign citizens living in Tampere.

Regarding age distribution, 65.7% of the population falls within the 18-64 years age group, 18.9% are 65 years and older, while 15.3% belong to the 0-17 years age group. When considering language distribution, 89.0% of the total population speaks Finnish, 0.5% speaks Swedish, and 10.4% speaks foreign languages (City Population 2024).

## **4.2 Travel behaviors of immigrants and non-native Finnish speakers**

Travel behaviors of immigrants and non-native Finnish speakers are analyzed from the data based on their demographics such as their gender, age, income, and duration of residence in Finland. The frequency of using various modes of transport among immigrants and non-native Finnish speakers are analyzed and findings are explained in the following sections.

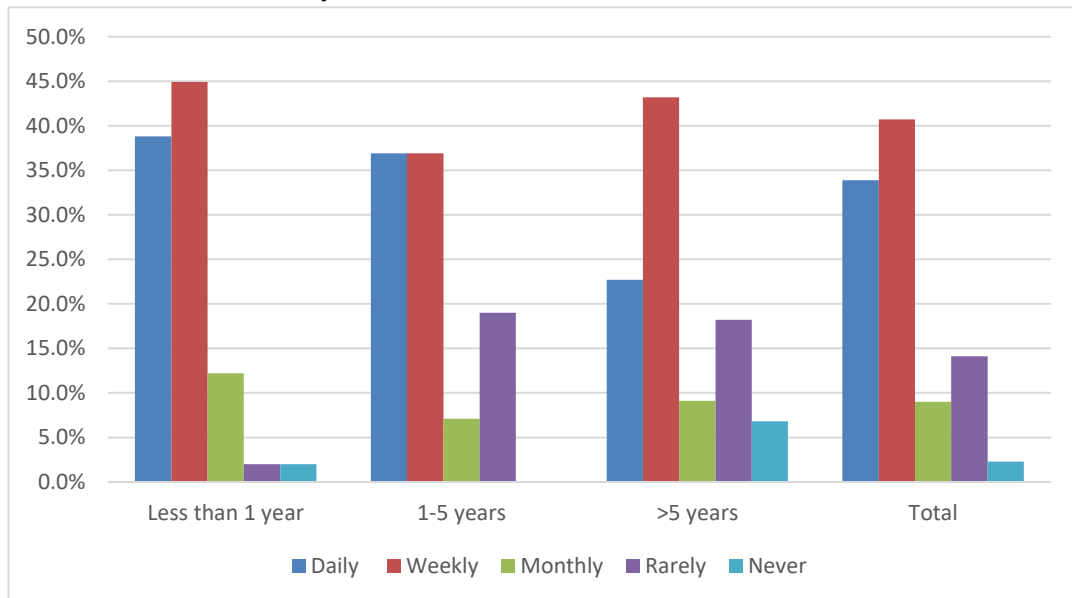
### **4.2.1 Use of public transport**

As explained in the literature review of this thesis that the use of public transport is associated with the demographic characteristics of the immigrants such as income, gender, and age. Therefore, in this study, the public transport usage frequency of immigrants and non-native Finnish speakers was analyzed based on their living duration in Finland, income, gender and age respectively. First, the analysis was done based on the living duration of immigrants in Finland. Out of 177 respondents, 49 have been living in Finland for less than a year, 84 have been living for 1 to 5 years, 24 for 6 to 10 years, and 20 for more than 10 years.

The chart in figure 3 illustrates the use of public transport frequency with the living duration of immigrants in Finland. It provides an overview of how often participants use public transport, highlighting the variations in usage patterns among immigrants that have been residing in Finland for different duration.



Based on their duration of residence in Finland, the data reveal an interesting trend in how immigrants and non-native Finnish speakers use public transport. Those who have been living in Finland less than a year or 1 to 5 years are more likely to use public transport daily or weekly for their travel. For individuals who have been living in Finland less than a year, for instance, 38.8% of them use public transport daily, which decreases to 36.9% for those who have been living for 1 to 5 years and to 22.7% for those who had resided for more than 5 years.



**Figure 3.** Public transport usage frequency among immigrants with different duration of residence in Finland

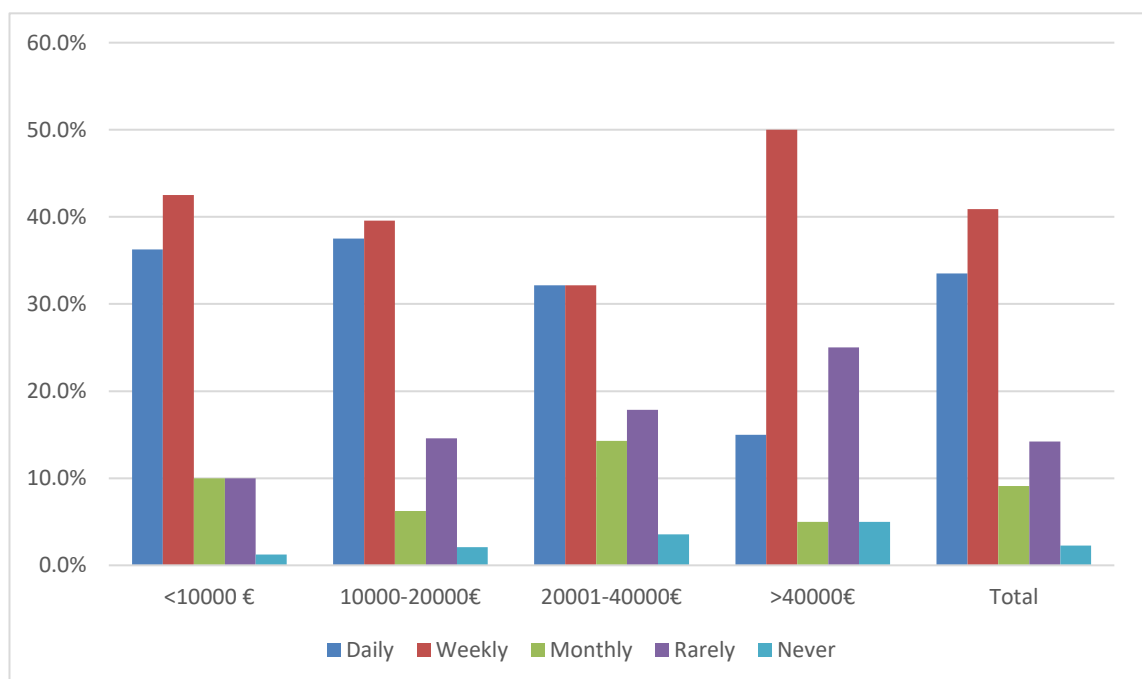
Similarly, this pattern of using public transport frequency changes as people stay longer in Finland. When the duration of living in Finland increases, the usage frequency of public transport decreases. For instance, 18.2% of people who have been living in Finland for more than 5 years rarely use public transport, and 6.8% of them never use public transport for their travel.

Immigrants who have been living in Finland for less than 5 years are most likely to use public transport, as shown in the chart, their portion is higher for daily, weekly and monthly use of public transport as compared to those residing for more than 5 years., whereas, the respondents who never use public transport for their travel are more among the group that have been residing in Finland for more than 5 years. Looking at the overall trend, weekly public transport usage remains the most common frequency across all groups. The total pattern reveals a gradual decrease in daily and monthly use, followed by a noticeable rise in rare usage, and then a drop in the number of respondents who never use public transport. This pattern highlights that as the duration of immigrants living in Finland increases, their dependence on public transport tends to decrease. This change could be associated to factors such as adjustments in lifestyle, improved financial

situations, or greater access to private vehicles. These findings highlight the need to consider how the length of settlement impacts travel habits to design public transport services that effectively meet the needs of diverse groups.

The relationship between public transport frequency and duration of stay in Finland was analyzed using Fisher's Exact Test. The test showed a statistically significant result with  $p=0.015$ , which means that the frequency of public transport use varies depend on living duration of immigrants in Finland. This finding suggests that the length of time an individual has lived in Finland has a measurable influence on their use of public transport.

Additionally, public transport usage frequency of immigrants and non-native Finnish speakers was analyzed based on their yearly average income from the data. Figure 4 illustrates the findings of how frequently immigrants and non-native Finnish speakers with different yearly average incomes use public transport. A total of 176 participants were grouped into income categories ranging from less than 10,000€ to more than 40,000€.



**Figure 4.** Public transport usage frequency among immigrants of different income groups

The results show that daily public transport usage is more common among immigrants with lower income, with 36.3% of those earning less than 10,000€ using public transport daily. This percentage decreases as income increases, with only 15% of those earning more than 40,000€ using public transport daily. However, weekly usage of public transport is the most dominant frequency across all income groups, particularly among higher-income earners, with 50% of the >40,000 € group using public transport weekly.

Monthly usage is relatively low across all groups, with only 10% or fewer respondents using public transport monthly for their travel.

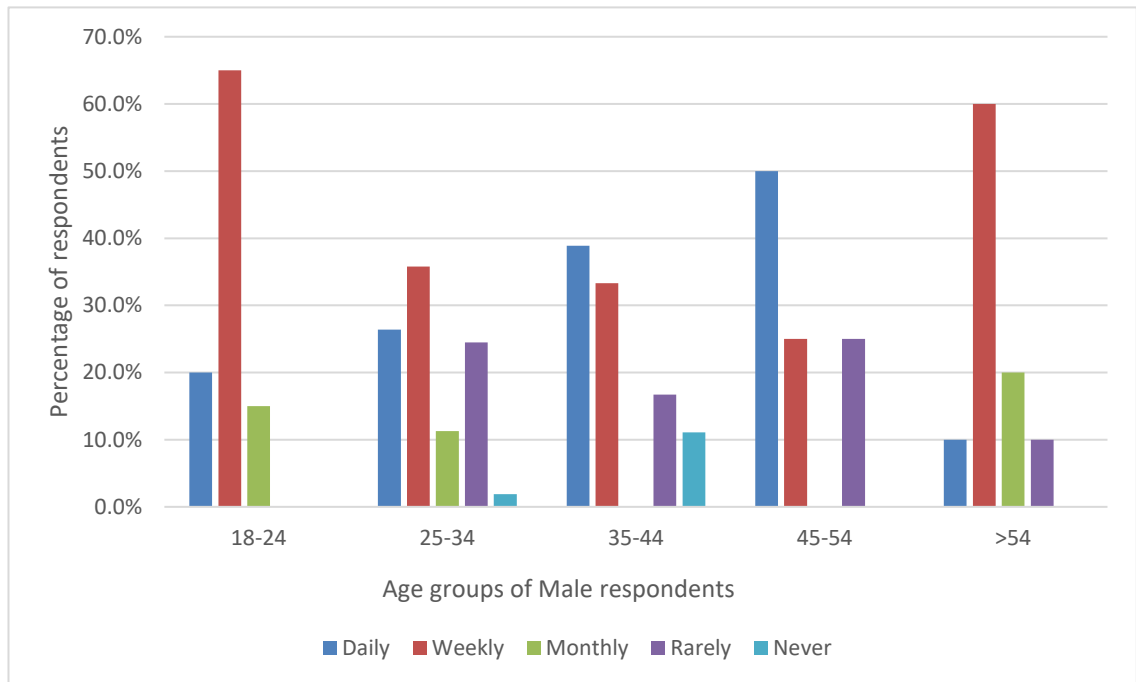
As the income increases, there is an increase in the rare usage of public transport from 10% among those earning less than 10,000€ to 25% in the highest income group, indicating that higher-income individuals have less reliance on public transport for their travel. Similarly, the proportion of respondents who never use public transport for their travel is small across all income groups but slightly higher among the income group of more than 40,000€ earners which is 5%.

The total bar gives an overall view of public transport usage frequency across all income groups. It highlights that daily usage of public transport is 33.5% among all the respondents and weekly usage is the most common frequency of public transport use, with 40.9% of all respondents. There is a sharp decline with only 9.1% of respondents using public transport monthly. Rare usage is reported by 14.2% among all the respondents rarely use public transport, while 2.3% of all never use public transport for their travel. It shows that most respondents use public transport regularly, with the majority traveling either daily or weekly. Only a small number of respondents use public transport rarely or never, which underlines its importance as a key mode of transport for the population studied.

Overall, the findings highlight that public transport is an essential mode of mobility for lower-income groups who use it more frequently, while higher-income individuals are more likely to use public transport occasionally or rely on alternative modes of transport. These findings emphasize the role of public transport as a critical resource for lower-income populations while highlighting how usage patterns shift with increased financial capacity.

A Fisher's Exact Test was conducted to examine whether there is a significant association between public transport usage frequency and different income groups among immigrants. The test result showed a p-value of 0.529, indicating that the relationship between these two variables is not statistically significant. This means that differences in public transport usage across income groups appear to be due to random variation rather than a meaningful pattern. In other words, income level does not seem to have a significant impact on how frequently immigrants use public transport.

Moreover, the usage frequency of public transport among different genders and age groups of immigrants and non-native Finnish speakers was analyzed from the data. Figure 5 illustrates how public transport usage frequency varies among different age groups of male respondents. The chart illustrates the frequency of public transport usage among male respondents across different age groups, categorized as daily, weekly, monthly, rarely, and never. The data shows significant differences in usage patterns between the age groups.



**Figure 5.** Public transport usage frequency among male immigrants of different age groups

Among total of 178 respondent, 105 were males. For the youngest age group 18-24 among male participants, 20.0% of males use public transport daily, while 65% use it weekly. Monthly usage accounts for 15% of the respondents, and none of the respondents among this group reported using public transport rarely or never. This indicates that younger males in this group rely heavily on weekly public transport usage.

In the 25–34 age group among male respondents, 26.4% of respondents use public transport daily, showing an increase from the younger group. Weekly usage is 35.8%, which is slightly less compared to the younger age group, while 11.3% of respondents use public transport monthly. Rare usage increases significantly in this group, with 24.5% of males falling into this category, and 1.9% never use public transport for their travel.

The male respondents of 35–44 age group shows a significant shift, with 38.9% of males in this age group using public transport daily, making it the most common frequency for this group. Weekly usage declines slightly to 33.3%, and 16.7% of respondents rarely use public transport for their travel. None of the respondent among this age group use

public transport monthly, while 11.1% of respondents never use public transport, which makes this male age group a mix of frequent and infrequent users.

In the male respondents of 45–54 age group, daily usage continues to increase, with half of the respondents, 50% public transport daily. Weekly and rare usage are reported equally, with 25% of males in each category. Monthly and never use are not observed in this age group, reflecting a strong reliance on daily or occasional public transport.

For the oldest age group among males, over 54 years, 10.0% of males use public transport daily, while 60.0% use it weekly, making it the most common frequency. 20.0% of the respondents among the oldest age group use public transport monthly, while 10.0% use it rarely. None of the respondents in this age group reported never using public transport, showing continued engagement with public transport, though at varying levels.

The pattern shows a clear change in the use of public transport patterns across different age groups among male respondents. Younger males mostly rely daily and weekly on public transport, while middle-aged males shift toward more frequent daily use. Older males, on the other hand, tend to use public transport weekly or monthly, reflecting changes in mobility needs, lifestyle, or access to alternative modes of transport as they age.

Figure 6 illustrates the frequency of public transport usage among female respondents across different age groups, categorized into daily, weekly, monthly, rarely, and never. The data highlights how public transport habits change with different age groups among female immigrants.

For the 18–24 age group of female respondents, public transport usage is evenly split between daily and weekly, with 45.5% of respondents in each category. A smaller proportion, 9.1%, uses public transport monthly, and none of the respondents have reported using it rarely or never. This shows that young females in this group rely heavily on both daily and weekly public transport for their mobility needs.

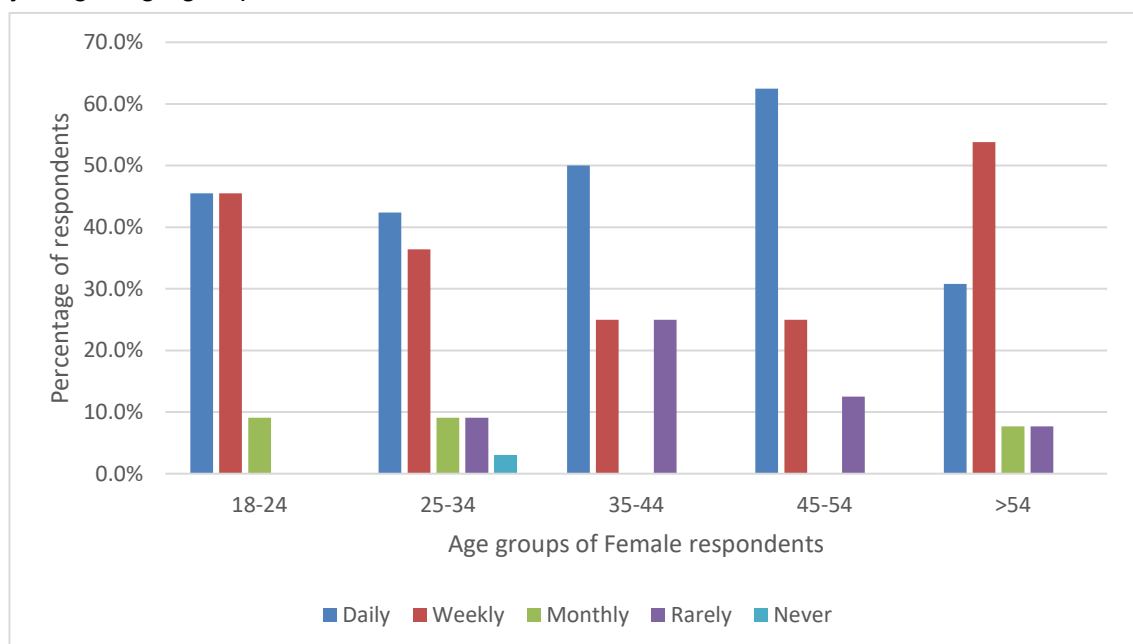
In the 25–34 age group of females, the percentage of daily users drops slightly to 42.4%, while weekly usage decreases to 36.4%. Monthly usage remains consistent with the younger group at 9.1%. Rare usage appears in this age group, with 9.1% of respondents reporting it, and 3.0% of respondents never use public transport.

The female respondents of 35–44 age group shows a shift, with 50.0% of respondents using public transport daily. Weekly usage declines to 25.0%, while rare usage increases

to 25.0%. Monthly usage is no longer observed in this group, and none of the respondents report never using public transport. This suggests that daily usage becomes more dominant as females transition into middle age, but some also reduce their reliance on public transport.

Among the female respondents of 45–54 age group, daily public transport usage reaches its peak, with 62.5% of respondents using it every day. Weekly usage remains consistent with the previous age group at 25.0%, while rare usage decreases to 12.5%. None of the respondents have reported monthly and never use of public transport in this group, which highlights a strong reliance on public transport for daily needs.

For the age group of more than 54 years among females, weekly usage becomes the most common frequency again, with 53.8% of respondents reporting it. Daily usage drops significantly to 30.8%, while monthly and rare usage are observed at 7.7% each. None of the respondents in this group report never using public transport, indicating that older females continue to engage with public transport, albeit less frequently than younger age groups.

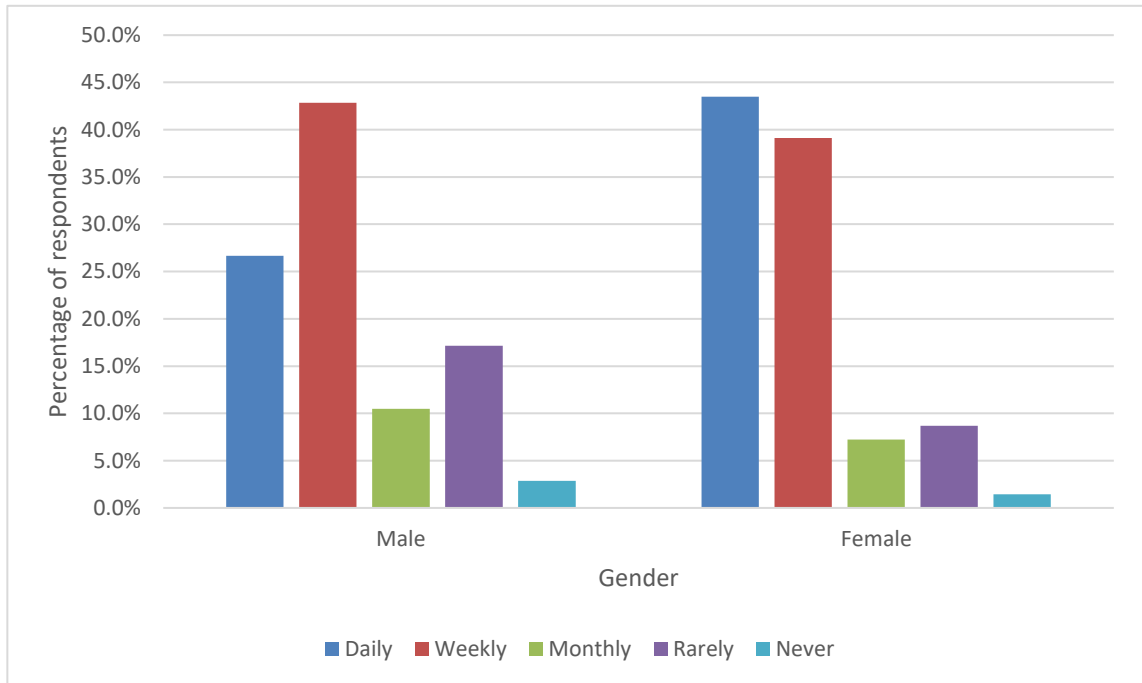


**Figure 6.** *Public transport usage frequency among female immigrants and non-native Finnish speakers of different age groups*

The chart in figure 6 highlights that younger and middle-aged females rely more on daily or weekly public transport, with daily usage peaking in the 45–54 age group. However, older females, however, show a preference for weekly usage, reflecting changes in mobility patterns, lifestyle needs, or access to alternative transport as they age.

Figure 7 illustrates the frequency of public transport usage among male and female respondents. The results indicate that daily usage of public transport is common among

female immigrants where 43.5% of females and 26.7% of males use public transport daily. Conversely, although the difference is relatively small, yet weekly usage is more common among males where 42.9% of males and 39.1% of females use public transport weekly for their travel,



**Figure 7.** Public transport usage frequency by gender among immigrants and non-native Finnish speakers

Monthly and rarely use of public transport is higher among male respondents as compared to females where 10.5% of males and 7.2% of females use public transport monthly for their travel. Similarly, 17.1% of males and 8.7% of females use public transport rarely. The percentage of respondents who never use public transport is the lowest among both genders, with 2.9% of males and 1.4% of females falling into this category.

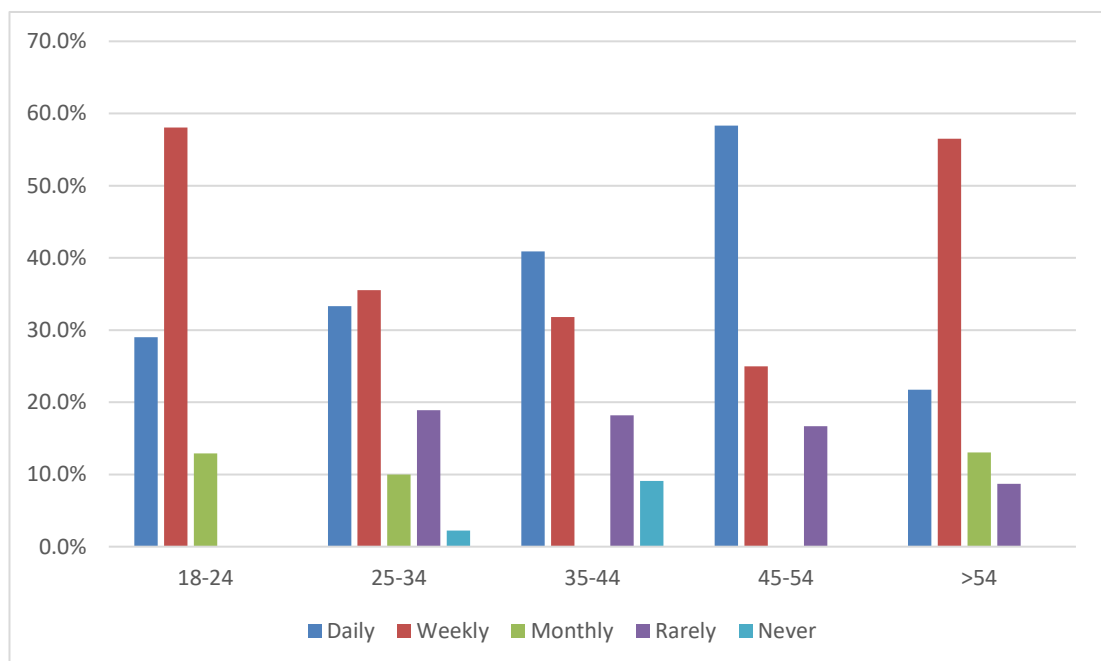
Overall, the results state that female immigrants rely more than male immigrants on daily use of public transport, whereas male immigrants are more likely to rely on weekly or less frequent use of public transport as compared to female immigrants. This could indicate potential differences in travel behavior and mobility needs between genders.

Figure 8 illustrates the frequency of public transport usage across different age groups of the respondents. The data shows that daily usage is highest among individuals aged 45-54, with 58.3% using public transport daily. This is followed by the 35-44 age group, where 40.9% use it daily. On the other hand, the lowest daily usage is observed among those aged above 54 where only 21.7% of respondents use public transport daily for their travel.

Weekly usage is the most common travel frequency across all age groups, with the highest percentage found in the age group of 18-24 and those above 54 years, where 58.1% of the respondents in the age group of 18-24 years and 56.5% among the age group of above 54 years use public transport weekly.

Monthly use of public transport is relatively low across all age groups of the respondents, ranging from the lowest 10.0% among the age group of 25-34 years to the highest 13.0% among the age group of more than 54 years. The proportion of respondents who rarely use public transport decreases with age, with 18.9% among the age group of 25-34 years drops to 8.7% among the age group of above 54 years.

The percentage of individuals who never use public transport is minimal, with the highest percentage of 9.1% among the age group of 35-44 years followed by the respondents among the age group of 25-34 years with 2.2% reported that they never use public transport for their travel, whereas none of the respondents among all other age groups reported that they never use public transport for their travel.



**Figure 8.** Public transport usage frequency across different age groups among immigrants and non-native Finnish speakers

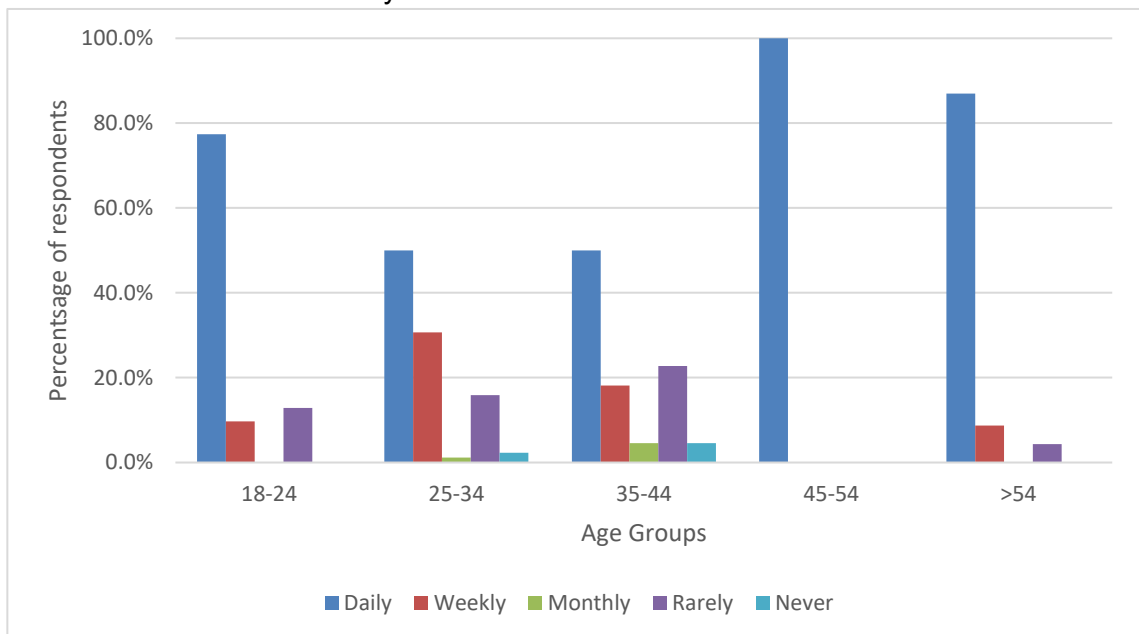
A Fisher's Exact Test was conducted to examine whether public transport usage frequency varies based on gender and age group among immigrants. The results showed that the association between public transport frequency and gender was not statistically significant ( $p = 0.233$ ), indicating that there is no strong evidence to suggest that males and females differ significantly in their frequency of public transport use. However, for the association of public transport frequency and age groups, the test showed a statistically significant result with  $p = 0.042$ , which means that age has a meaningful impact on



how often immigrants use public transport. This implies that the use of public transport differs among age groups, whereas gender does not appear to play a significant role in determining public transport frequency among the surveyed population.

#### 4.2.2 Walking

Based on the explanation in the literature review chapter of this thesis that previous studies have found that walking as a mode of transport is common among old age people and among females. Therefore, in this study, the walking for a whole trip frequency of immigrants and non-native Finnish speakers was analyzed for age groups and gender respectively. A total of 176 responded to the question asked about walking frequency, grouped into different age groups which are categorized as the youngest 18-24 years and the oldest more than 54 years.



**Figure 9.** Walking frequency among immigrants and non-native Finnish speakers of different age groups

The bar chart shown in figure 9 illustrates the frequency of walking across different age groups which shows that comparatively daily walking is most common among the age group of 45-54 years followed by the oldest age group of more than 54 years.

Particularly, among the age group of 18-24, 77.4% of individuals aged 18-24 and 87% of those over 54 years walk daily. Interestingly, 100% of respondents among the age group of 45-54 walk daily for their whole trip, which makes this group the most active age group in terms of walking for the whole trip. However, among the age groups of 25-34 and 35-44, the percentage of respondents who walk daily for their whole trip decreases to 50%. This pattern highlights that younger immigrants of age group 18-24 years and older immigrants of age group more than 54 years rely more on walking, probably due

to lifestyle choices, mobility preferences, near destinations or differences in transport access.

Weekly walking patterns are most noticeable in the 25-34 age group, where 30.7% of respondents walk for their whole trip daily. In contrast, only 9.7% among the age group of 18-24 and 8.7% among the age group of more than 54 years walk for their whole trip weekly. This suggests that younger and older individuals are either walking daily or rarely, while those in their late 20s and early 30s may be balancing walking with other transport options.

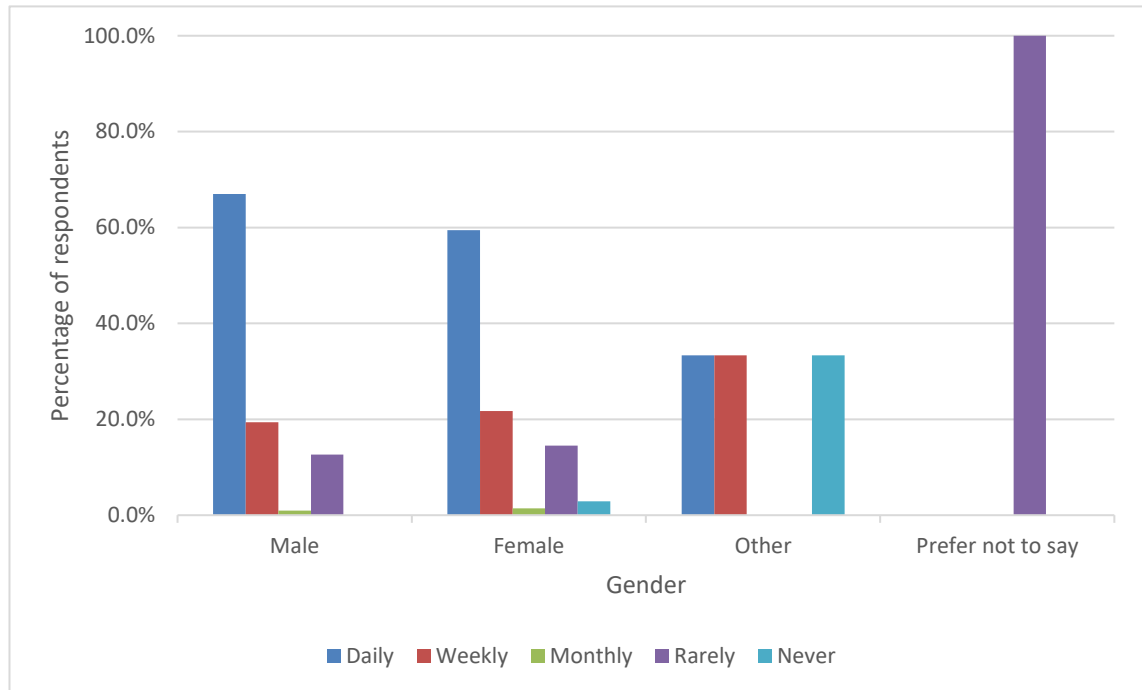
Monthly walking frequency is relatively low across all age groups, with the highest percentage of 4.5% respondents among the age group of 35-44 years, a small portion of respondents falling into this category. Similarly, 22.7% of respondents among the age group of 35-44 is the highest among those who rarely walk for their whole trip followed by 15.9% among the age group of 25-34 years. Among all age groups, never walking remains minimal across all age groups, with only 2.3% in the youngest group and 4.5% in the 35-44 and 45-54 age group which highlights that walking remains a common mode of mobility, even if at varying frequencies.

In summary, the chart highlights that walking is most frequent among younger and older immigrants, whereas middle-aged immigrants are more likely to balance walking with other modes of transport. The trend highlights how age influences walking behavior, with younger people relying on walking for daily mobility, middle-aged individuals incorporating it less frequently, and older individuals maintaining a high level of daily walking.

A Fisher's Exact Test was conducted to assess the relationship between walking frequency and age groups among immigrants. The test resulted in a p-value of 0.009, indicating a statistically significant association between walking frequency and age of immigrants. This suggests that walking for the whole trip vary significantly across different age groups, meaning that certain age groups are more likely to walk frequently than others. The findings highlight that age plays an important role in walking for the whole trip among immigrants.

Similarly, the bar chart as shown in figure 10 presents the walking frequency of respondents categorized by gender, illustrating notable variations in mobility habits. The pattern in the bar chart shows some interesting differences. Male immigrants are more likely to walk for their whole trip daily as compared to female immigrants. Among male respondents, 67.0% walk for their whole trip daily, 19.3% weekly, 1.0% monthly, 12.6% rarely, while none of the male respondent has reported that they never walk for their whole trip.

On the other hand, 59.4% of the female immigrants walk for their whole trip daily which is slightly less as compared to male immigrants, while 21.7% walk weekly, 1.4% monthly, 14.5% rarely and 2.9% of the female immigrants never walk for their whole trip. These percentages highlight that female immigrants less frequently walk for their whole trip as compared to male immigrants. As there are very few respondents in the gender categories of "Other" and "Prefer not to say" so it makes it difficult to draw strong conclusions from their data.



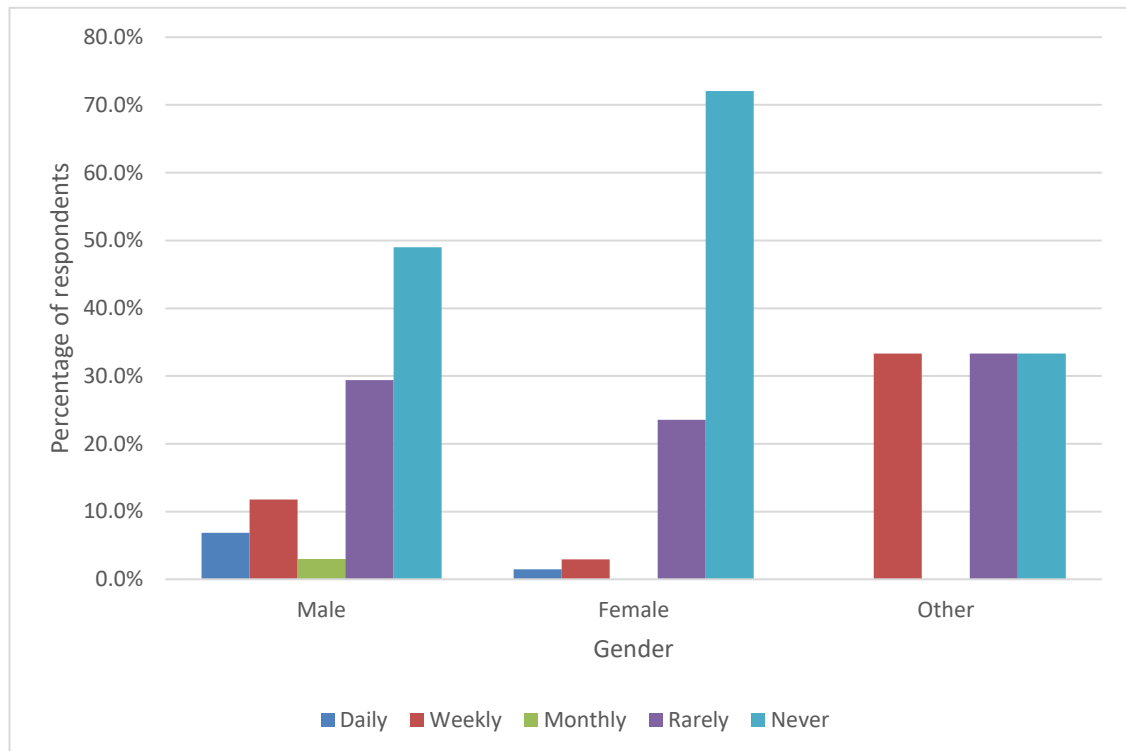
**Figure 10.** *Walking frequency among immigrants and non-native Finnish speakers of different genders*

Fisher's Exact Test resulted in a p-value of 0.097, which indicates there is no statistically significant association between walking frequency and gender at the conventional 0.05 threshold. This suggests that there is no strong evidence to conclude that males, females or other genders differ significantly in their walking habits, although some variation may still exist.

### 4.2.3 Cycling

Based on findings from previous studies that have been explained in literature review section of this this thesis, which suggest that bicycle use among immigrants varies by gender, this study analyzed the frequency of bicycle usage in relation to gender. A total of 173 participants responded to the question asked about bicycle use frequency. These were comprised of 102 males, 68 females, and 3 specified themselves as "other" in terms of gender.

As shown in the figure 11, the bar chart illustrates that daily use of cycling for travel is not very common among both males and females, with 6.9% of males use bicycle daily for their travel, while only 1.5% of females use it daily for their travel. Similar pattern is followed in the weekly frequency of bicycle us, as 11.8% of males use bicycle weekly, compared to just 2.9% of females.



**Figure 11.** *Bicycle usage frequency among immigrants and non-native Finnish speakers of different genders*

Monthly use of bicycle for travel is also less common, with only 2.9% of males, while none of the female use cycle monthly for making trips. A significant number of respondents use cycle for making trips only rarely, with 29.4% of males, 23.5% of females. This suggests that while some people use bicycles from time to time, it is not a primary way of getting around for many.

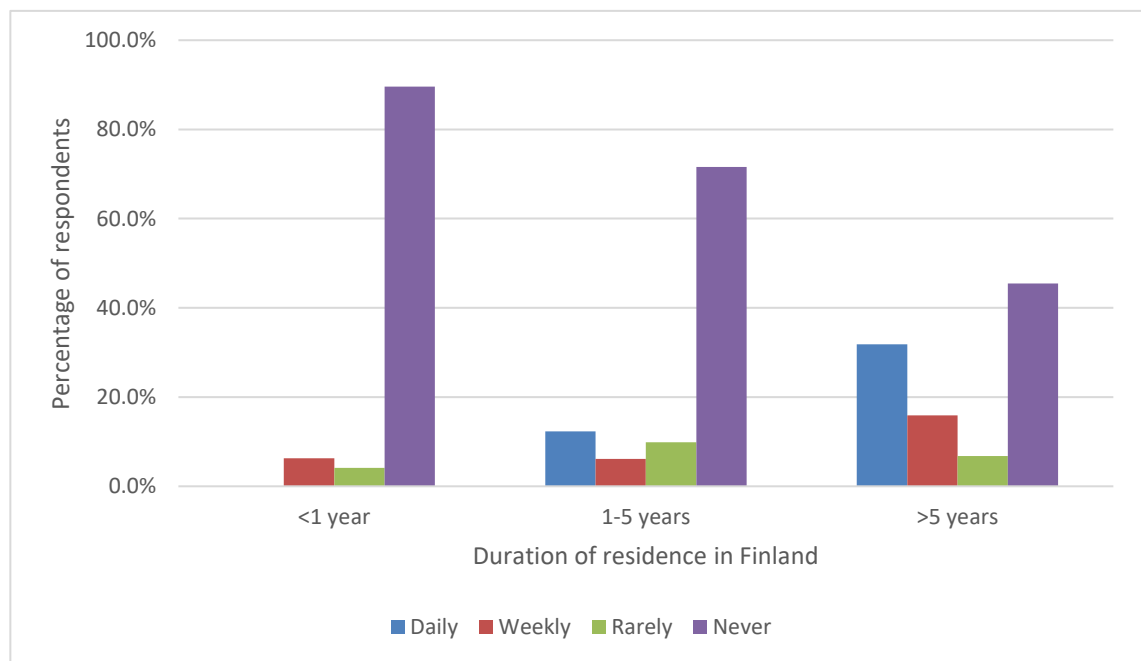
There is a significant difference in the number of people who never bicycle. Significant number of respondents with 72.1% among females never use bicycle, while 49.0% among male never use bicycle for their travel. This pattern shows that bicycle use is generally less among all immigrants but there is noticeable difference in bicycle use among male and female immigrants, where females are much less likely to use bicycles for making trips than males. As there are less numbers of respondents identified as “other” in terms of gender, therefore it is difficult to conclude about their usage frequency of bicycle based on the percentage shown in the graph.

The Fisher's exact test was conducted to examine the relationship between bicycle usage frequency and gender among respondents. The test resulted in a p-value of 0.021 which is less than commonly used significance threshold of 0.05, indicating a statistically significant association between these two variables. This highlights that the use of bicycle for travel varies among different genders are not due to random chance.

#### 4.2.4 Personal car

The use of personal car frequency was analyzed in relation of the duration of immigrants living in Finland and income based on the findings from previous studies that use of personal car is associated with duration of residence of immigrants in a country and their income which is explained in the literature review section of this thesis.

A significant difference of personal car usage frequency among immigrants with different duration of stay in Finland can be noticed. A total of 173 people participated, and they were grouped based on their duration of living in Finland comprised of less than a year, 1 to 5 years, and more than 5 years.

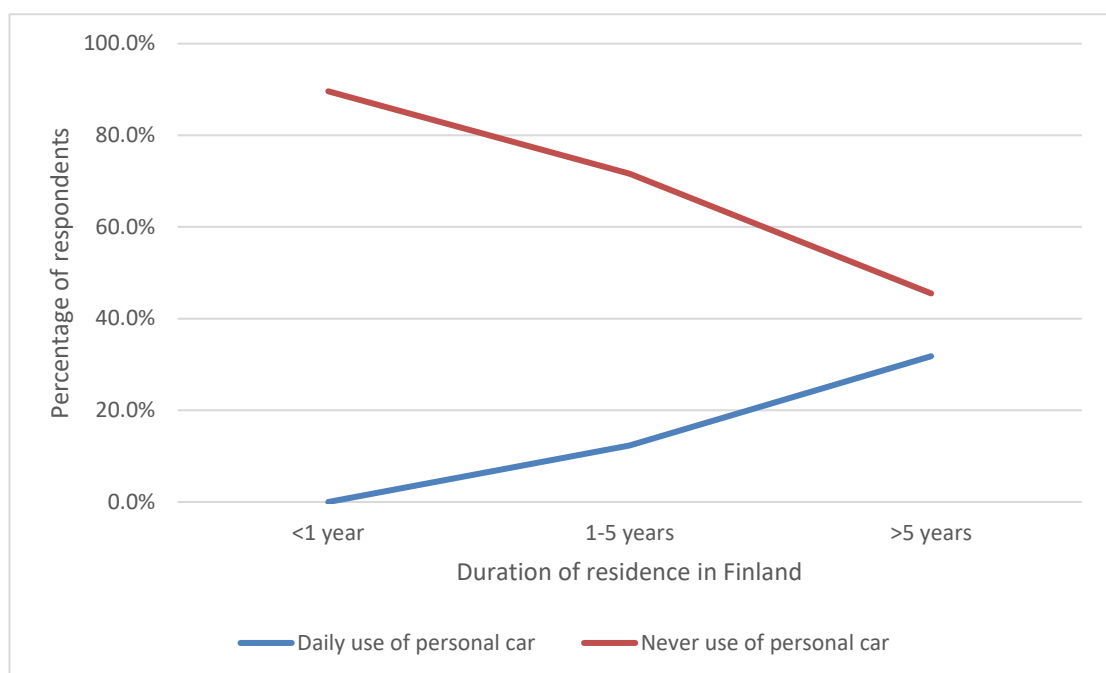


**Figure 12.** *Personal car usage frequency among immigrants and non-native Finnish speakers with different duration of residence in Finland*

A clear pattern is shown in the results as depicted in figure 12. Immigrants who have recently moved to Finland are much less likely to use personal cars. Among the recently moved respondents that have been living in Finland for less than a year, respondents 89.6% never use personal cars for their travel. However, as the living duration increases, dependency on personal cars also increases similarly. 12.3% among the immigrants who

have lived in Finland for 1 to 5 years use personal cars daily for their travel, while this figure is 31.8% for those who have been residing here for more than 5 years.

On the other hand, people who have been living in Finland for a shorter time rely less on personal cars overall. For instance, the percentage of people who reported “never” using personal cars drop significantly as the duration of residence in Finland increase from 89.6% for those staying less than a year to 45.5% for those who have been living in Finland for more than 5 years. Figure 13 illustrates the association between the duration of residence in Finland and the changing pattern of personal car usage, indicating that daily car use increases, while non-usage of personal car decreases with increase in the duration of residence in Finland.



**Figure 13.** *Daily and never usage frequency of personal car by duration of residence in Finland*

The statistical test backs up these trends. The results of Fisher’s exact test with  $p=0.000$  reveal a strong significant relationship the duration of living in Finland and personal car usage frequency which confirms that these differences are not random but represent real changes in behavior over time.

These findings highlight an important shift that as immigrants settle in Finland, they become more likely to use personal cars for transport. This could be probably due to several factors, such as increased financial stability, better access to vehicles, or changes in lifestyle and needs.

Additionally, the personal car usage frequency by immigrants was analyzed from the data with respect to the yearly average income as well due to the fact that income of immigrants is associated with their duration of residence in a country. As shown in the figure 14, a significant difference of personal car usage frequency among immigrants having different yearly income can be noticed. The chart illustrates that daily use of personal cars is more common, which is 35% in the highest income group of more than 40,000 €, but with a decrease in income the percentage of daily users of personal cars decreases. For instance, among the income group of 20,001 € to 40,000 €, 25.9% use personal cars for their travel which declines to 14.6% among the income group of 10,000€ to 20,000€ and following the same pattern, it is reduced to 3.9% among the income group of less than 10,000€. This trend shows a clear pattern of increase in personal car with increase in income of immigrants.

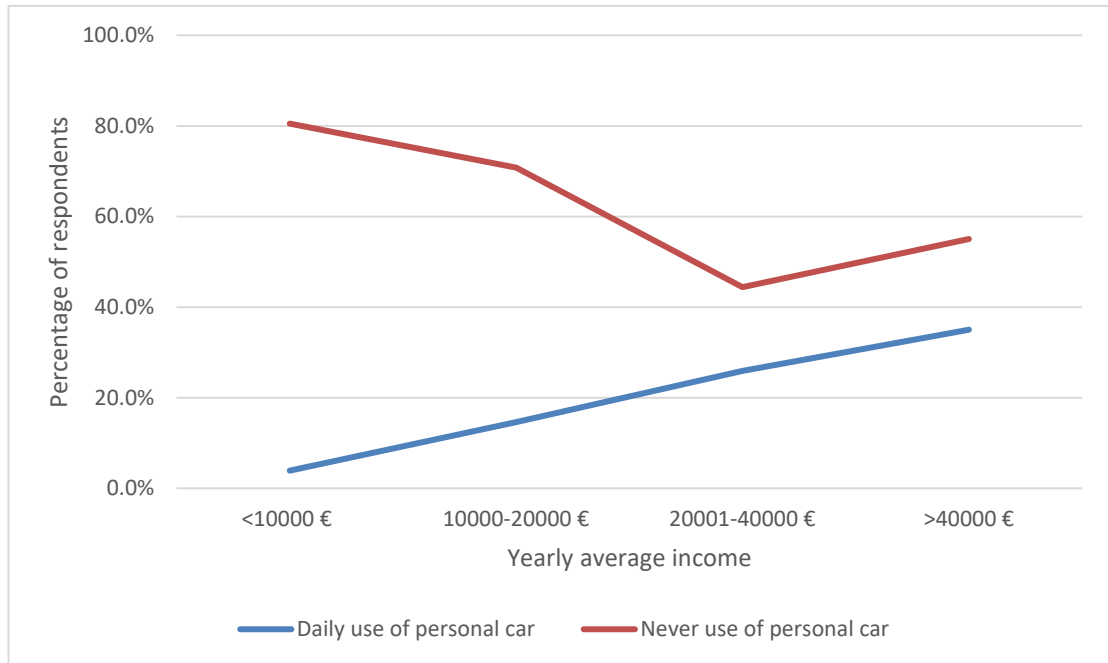


**Figure 14.** *Personal car usage frequency among immigrants and non-native Finnish speakers of different income groups*

Weekly use of personal cars is highest among the income group of 20,001€ to 40,000€ which is 22.2%, followed by income group of less than 10,000€ which is 7.8%. There is no clear pattern in relation of income to weekly use of personal car for travel, as among the income groups of 10,000€ to 20,000€ and more than 40,000€, the percentage of weekly personal car users is 6.3% and 5.0% respectively.

However, the most notable difference is in the "never" category of personal car use frequency, where most respondents (80.5%) in the lowest income bracket never use a personal car for their travel, whereas, with increase in income to the 20,001–40,000€ range, the share of non-car users reduces sharply, while the proportion of daily users rises.

Interestingly, for the highest income group (more than 40,000€), there is a slight increase in the percentage of individuals who never use a car as shown in the figure 15, which may indicate that some high-income individuals opt for alternative modes of transport despite financial capability. These findings emphasize the strong correlation between income and car dependency, highlighting how economic factors influence mobility choices.



**Figure 15.** *Daily and never usage frequency of personal cars among immigrants and non-native Finnish speakers of different income groups*

The p-value of 0.002 from the Fisher's exact test indicates that there is a statistically significant association between income levels and personal car usage. This suggests that income plays an important role in determining how frequently immigrants use personal cars, with higher or lower income groups exhibiting different patterns of car usage. The results highlight that financial resources may influence access to private vehicles, which may lead to variations in car dependency among different income groups.

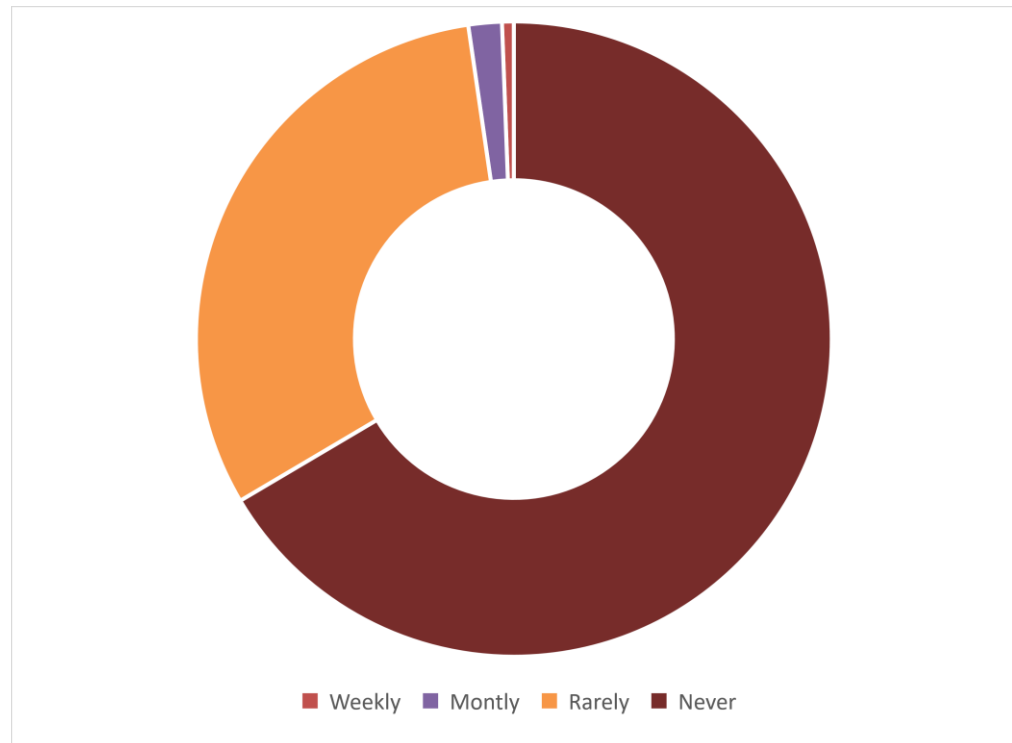
#### 4.2.5 Taxi

The use of taxi for making trips by immigrants was also analyzed from the collected data based in correlation of yearly income of immigrants. A total of 172 participants shared their responses about the frequency of using taxis for making trips.

The analysis of taxi usage frequency among immigrants and non-native Finnish speakers demonstrates that taxis are used very infrequently, therefore this analysis was done on aggregate level for all the respondents.



As shown in figure 16, a significant number of respondents (66.5%) never use taxis for their travel and another significant portion of 31.2% rarely use taxis for their travel. These two groups together account for nearly 98% of the respondents, underlining that taxis are not a commonly utilized transport option for most immigrants and non-native Finnish speakers.

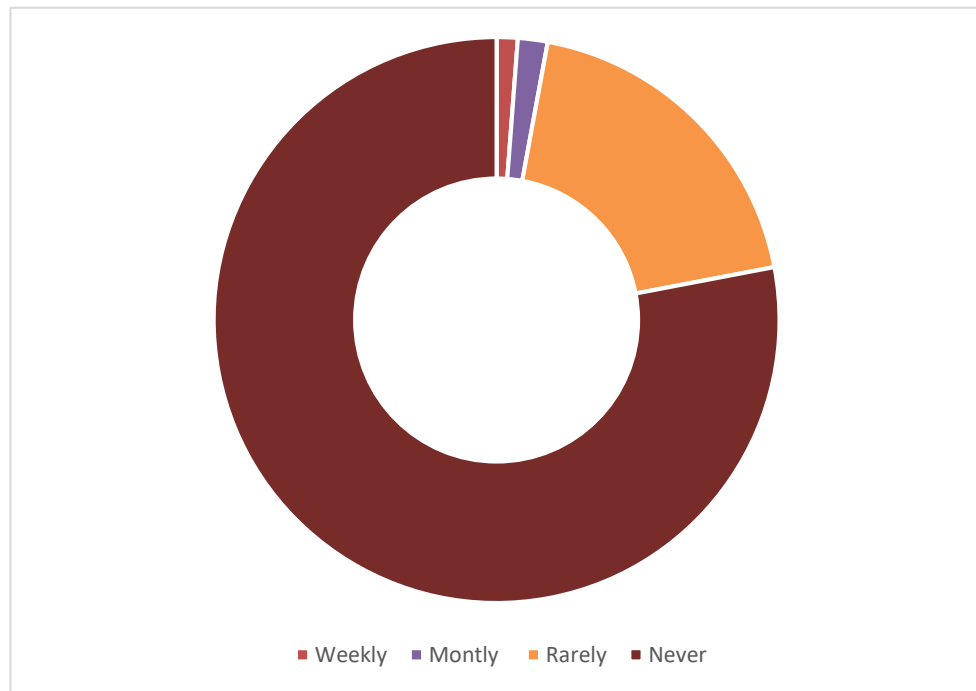


**Figure 16.** *Distribution of taxi usage frequency among immigrants and non-native Finnish speakers*

Only a very small percentage of respondents use taxis, specifically 1.7% of the respondents use taxis monthly, and 0.6% of respondents use taxis on a weekly basis for their travel. However, there is none of the daily users of taxi among all respondents. This absence of daily taxi users further reinforces the limited reliance on taxis within immigrants and non-native Finnish speakers.

#### **4.2.6 Car-sharing**

From the data collected, the car-sharing frequency was also analyzed. Like taxi, car-sharing is also infrequently used by immigrants and non-natives for making trips. Therefore, the analysis was done at an aggregate level rather than for different demographic groups separately.



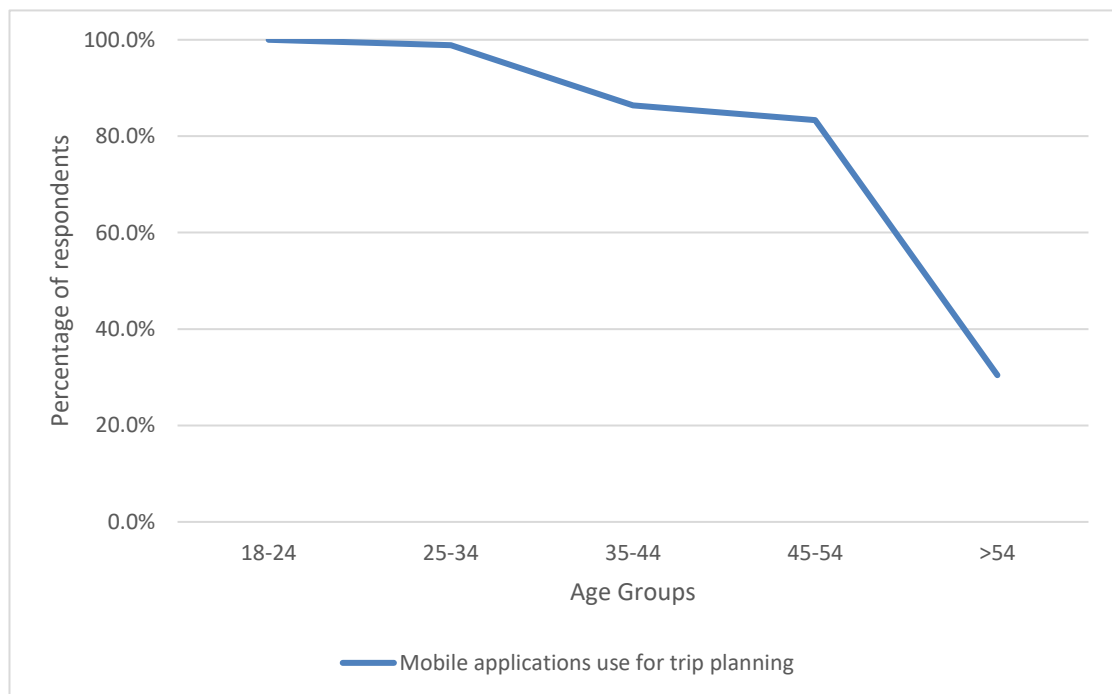
**Figure 17.** *Distribution of car-sharing usage frequency among immigrants and non-native Finnish speakers*

A total of 172 respondents had responded to the question asked about car-sharing frequency. Figure 17 illustrates the usage frequency of car-sharing among immigrants and non-natives. Results show that 78.0% of the respondents never use car-sharing with 19.1%, use it rarely for making trips which is 97.1% in total, indicating that a significant number of immigrants do not use car-sharing for their travel. However, none of the respondents reported on using car-sharing on a regular basis and only 1.7% reported using car-sharing monthly and an even smaller percentage, 1.2%, using it weekly. These findings suggest that car-sharing is not a common mode of transport among immigrants and non-natives.

#### **4.2.7 Use of mobile apps for trip planning**

The use of mobile phone applications varies among different age groups particularly applications for trip planning which are found in several studies and is explained in the literature review section of this thesis. Considering the association of age with use of mobile phone application for trip planning, the use of mobile phone application was analyzed among different age groups of immigrants from the data. A total of 178 respondents had responded to the question asked about the use of trip planning applications.

The relationship between the use of smartphone applications for trip planning and age is illustrated in figure 18 which clearly highlights that as the age of the immigrants increases, the use of smartphone applications for trip planning is reduced. Younger immigrants are significantly more likely to use smartphone application for trip planning, with 100% of the respondents using such applications among age group of 18–24 years. Similarly, this pattern is still high with 98.9% using at least one trip-planning app among the age group of 25–34 years. However, with increase in age, the percentage of app users for trip planning gradually declines. Among the age group of 35–44 years, app usage drops to 86.4%, and it further decreases to 83.3% in the 45–54 age group. A significant decline is observed among immigrants aged over 54 years, where any of trip planning app is used by only 30.4%, which states that around 70.0% of respondents in this age group do not rely on trip planning app.



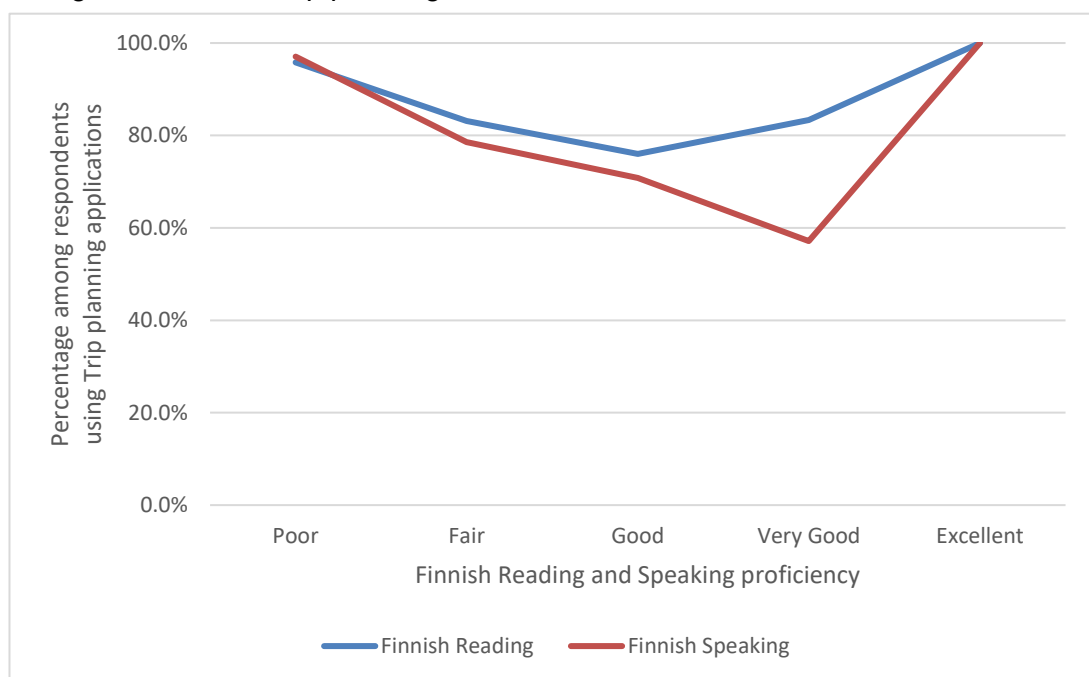
**Figure 18.** *Use of smartphone applications among immigrants and non-native Finnish speakers of different age groups*

The results of Fisher's exact test relationship between the use of applications for trip planning and age is statistically significant with  $p=0.000$  which confirms that these differences are not random but represent that younger immigrants mostly use smartphone applications for trip planning whereas older immigrants do not rely on smartphones applications.

These findings highlight that digital trip-planning tools are more commonly used by younger individuals, probably due to higher digital literacy, greater familiarity with smartphone apps, and possibly a stronger reliance on technology for everyday tasks. On

the other hand, old-aged immigrants show a much lower rate of adoption, indicating that they probably use traditional methods of trip planning or limited engagement with smartphone technology or probably due to limited digital literacy.

As the question about the trip planning application was asked in a way that respondents were able to select multiple options from the list of applications. There were three apps mentioned in the options i.e. Google maps, Nysse which is the local public transport application and moovit. The results revealed that Google map is highly used application for trip planning, which is being used by 65.5% of the immigrants, followed by Nysse, which is used by 61.2% of the immigrants for trip planning. However, the use of moovit application is not so common among immigrants for trip planning with only 0.6% of the immigrants use it for trip planning.

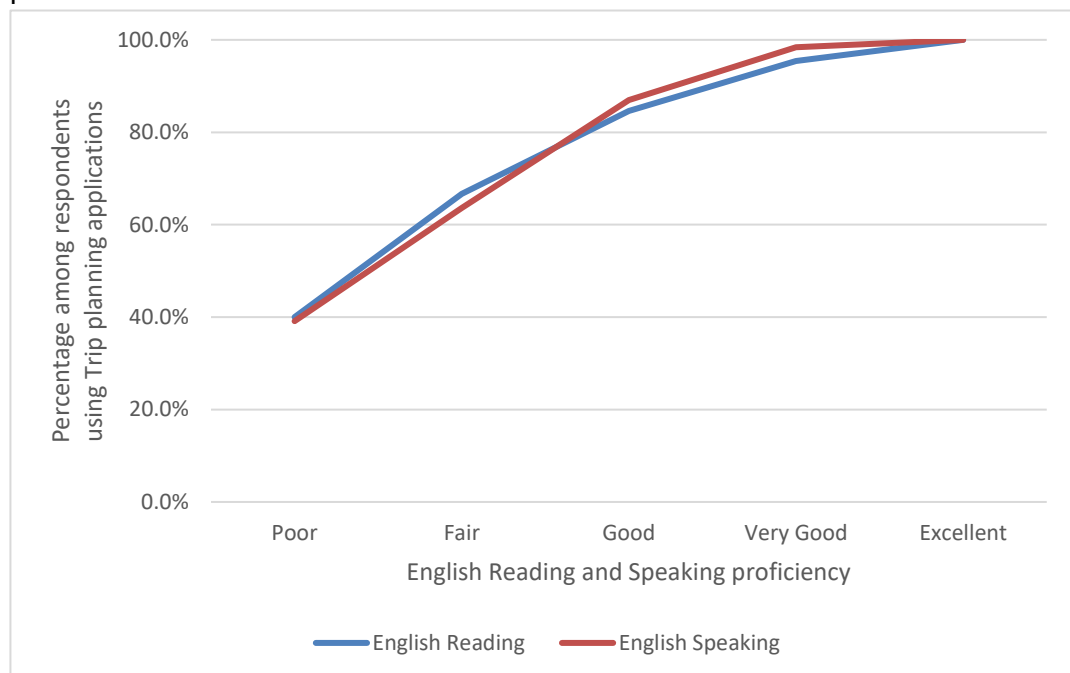


**Figure 19.** Association between Finnish language skills and mobile apps for trip-planning usage among immigrants and non-native Finnish speakers

Additionally, the study investigated the impact of Finnish language proficiency on respondents' use of mobile applications for trip planning. Figure 19 illustrated that respondents with lower Finnish reading and speaking skills are more likely to use trip planning applications. Among those with poor Finnish reading proficiency, 95.8% reported using these applications, while 97.1% of respondents with poor Finnish speaking skills also relied on them. As proficiency improves, the percentage of users generally decreases. For instance, among those with good Finnish reading skills, 76.0% use trip planning apps, whereas only 70.8% of individuals with good Finnish speaking skills do the same. However, an interesting trend emerges for individuals with very good Finnish reading skills, as their usage increases to 83.3%, while those with very good speaking skills show

a further decline to 57.1%. Finally, among respondents with excellent proficiency in both reading and speaking, trip planning app usage reaches 100%. This suggests that while individuals with weaker language skills rely heavily on these applications, those with mid-level proficiency may feel more comfortable navigating the transport system without them. However, individuals with excellent proficiency still use the applications at the highest rate, possibly due to their overall familiarity with digital tools and urban mobility.

Additionally, the impact of English language proficiency on respondents' use of mobile applications for trip planning was also investigated. Figure 20 shows a clear upward trend, indicating that as English proficiency improves, the likelihood of using trip planning applications also increases.



**Figure 20.** Association of English language skills and mobile apps for trip-planning usage among immigrants and non-native Finnish speakers

Among respondents with poor English reading skills, 40.0% reported using these applications, while 39.1% of those with poor speaking skills also relied on them. The percentage rises significantly for those with fair proficiency, with 66.7% of individuals with fair reading skills and 63.6% with fair speaking skills using the apps. As proficiency improves further, usage continues to grow, reaching 84.6% for those with good reading skills and 87.0% for those with good speaking skills.

The highest usage rates are observed among individuals with very good and excellent English proficiency. Specifically, 95.5% of those with very good reading skills and 98.4% of those with very good speaking skills use trip planning applications. Finally, among those with excellent proficiency in both reading and speaking, app usage reaches 100%.

This pattern suggests that individuals with stronger English skills are more likely to rely on trip planning applications, possibly due to the availability of these apps in English, making them more accessible and easier to use for those who are proficient in the language.

Fisher's exact test was conducted to examine the relationship between Finnish and English proficiency in speaking and reading with the use of apps for trip planning. The test resulted in p-value of 0.029 for Finnish reading association with apps usage for trip planning, 0.000 for each Finnish speaking, English speaking and reading association with mobile apps use for trips planning. These results indicated that association of Finnish and English speaking and reading skills with apps usage for trips planning is strongly statistically significant.

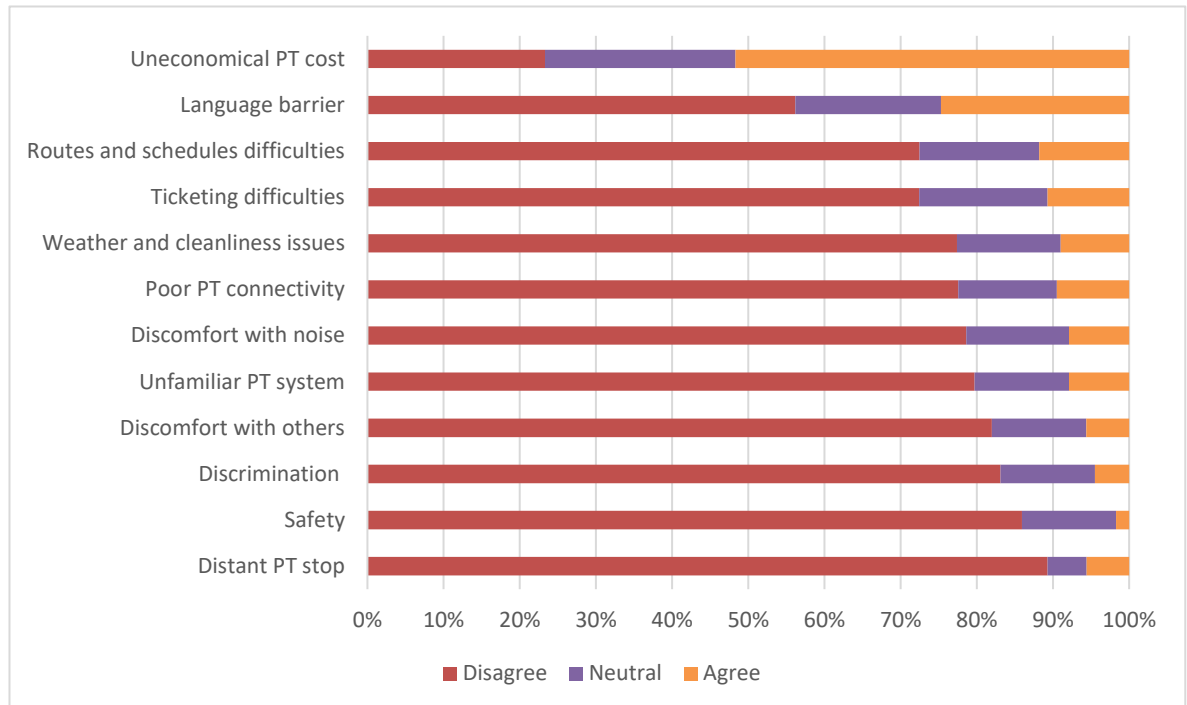
### **4.3 Encountered or perceived barriers in public transport**

Addressing the research question of this study "*What are the barriers encountered or perceived by immigrants and non-native Finnish speakers when using public transport?*", descriptive analysis was done in SPSS version 25. In the survey and interviews, respondents were asked about the challenges that immigrants might face or had already faced while using public transport. These challenges were presented as statements, and participants indicated their level of agreement on a scale strongly disagree, disagree, neither agree nor disagree, agree, and strongly agree. For the analysis the level of agreement from strongly disagree to strongly agree was coded as 1 to 5 in SPSS. The analysis aimed to figure out identify the most significant barriers based on the percentages of respondents to the agreement levels for each barrier.

In presenting the results, the response categories have been grouped for a clearer and more concise analysis. The percentage of responses with "strongly disagree" and "disagree" have been combined together as "disagree", while "strongly agree" and "agree" have been merged together as "agree". This method makes it easier to identify overall trends and understand the significance of different barriers without unnecessary complexity. The neutral responses have been kept separate to reflect those who neither agree nor disagree. A detailed table showing the breakdown of responses into five categories i.e. from strongly disagree to strongly agree is included in appendix D of this thesis.

The chart shown in figure 21 clearly presents the barriers faced by respondents when using public transport, arranged from the most significant to the least significant.

Among all the listed barriers, public transport cost is the most significant barrier, with 51.7% of respondents agreeing that it is not economical for them. This indicates that affordability is a major issue for many, possibly limiting their ability to use public transport regularly.



**Figure 21.** *Encountered or perceived barriers to public transport use, ranked from most to least significant*

After public transport cost, language barrier is the second most significant barrier, with 24.7% agreeing that they have encountered language difficulties while using public transport. This highlights that although language is not a barrier for significant number of immigrants, but it is still a barrier for a notable proportion of immigrants who could be probably facing difficulties while using public transport which could influence their travel behaviors.

Although difficulties with routes and schedules are not a barrier for 72.5% of the respondents, however, 11.8% of respondents still agree that they have encountered difficulties while understanding or accessing route information. Similarly, ticketing difficulties (difficulties in understanding ticketing system of public transport) is encountered by 10.7% of the respondents while using public transport, indicating that comparatively a small number of immigrants find the ticketing process confusing, inconvenient or might causing problem in understanding because of language difficulties.

Weather and cleanliness issues are encountered by 9.0% of respondents with agreeing that these factors make public transport uncomfortable, whereas poor public transport connectivity is encountered by 9.5% of respondents only, meaning that a high number

of respondents have not faced this barrier while using public transport while comparatively a very less amount of respondents have encountered that public transport does not provide convenient links to their destinations.

Regarding comfort, 7.9% of respondents have perceived that noise levels in public transport make travel uncomfortable. Additionally, 7.9% also agree that they feel unfamiliar with the public transport system, making it harder for them to navigate.

Discrimination and safety concerns, however, are not major barriers. Only 4.5% agree that they have encountered discrimination while using public transport, and even fewer (1.7%) feel unsafe, whereas major proportions of respondents with 83.1% disagree with the statement that they have encountered discrimination and 86.0% with encountering safety issues while using public transport.

The least significant barrier is the distance to the nearest public transport stop, as only 5.6% agree that they have difficulties due to stops being too far from their location, whereas 89.3% disagree and 5.1% of the respondents are neutral about this barrier. This suggests that most respondents have not encountered or perceived accessibility to a nearby public transport stop.

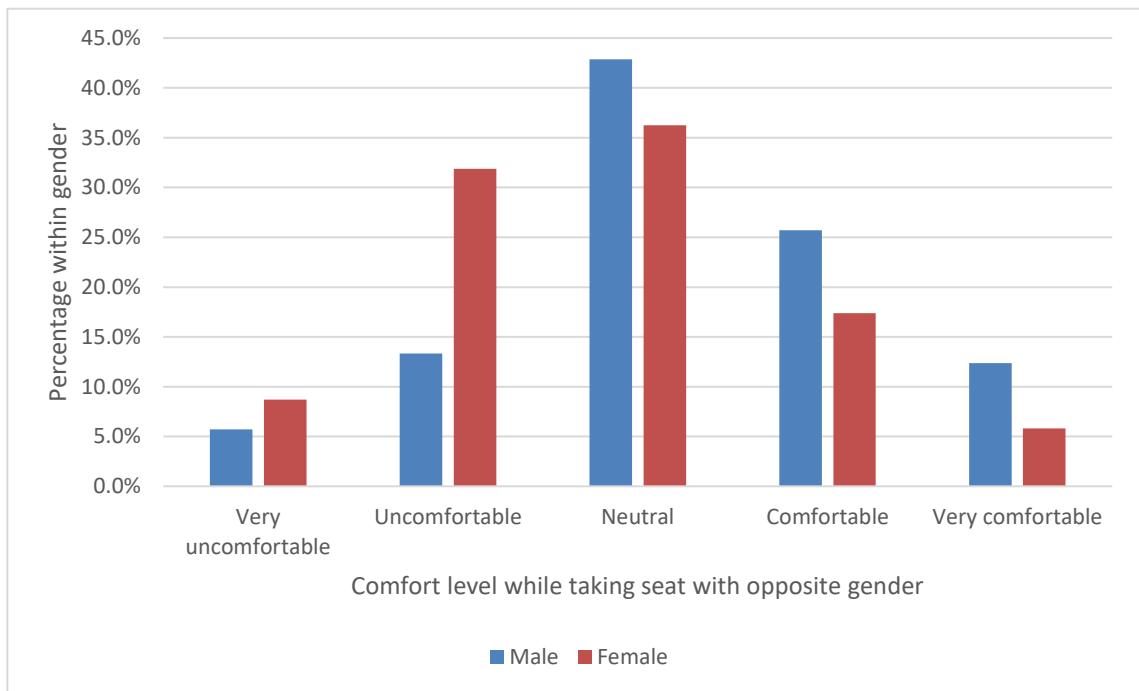
Overall, the result of this analysis indicates that cost, and language difficulties are the most significant barriers encountered by immigrants and non-native Finnish speakers while using public transport. Whereas difficulties in understanding routes and ticketing systems are encountered by more than 10.0% of the immigrants which can be considered as moderate barriers that can affect public transport use among some of the immigrants. However, factors related to comfort, connectivity to work/study place, safety, discrimination, connectivity, and distance of public transport stop were not encountered or perceived as barrier by most of the immigrants while using public transport.

Moreover, the question asked about cultural factors or factors related to beliefs that could influence the immigrants' transport choice was optioned to be responded in either yes or no. From the collected data, it was analyzed that only 10.2% of the total respondents agreed that there are certain cultural factors or factors related to their beliefs that could influence their transport choices, whereas 89.8% of the respondents which is significant number of respondents did not agree to the statement that their transport choices are influenced by either cultural factors or factors related to their beliefs. Furthermore, the next open-ended question was only asked from the respondents who had agreed that cultural factors or beliefs influence their transport choices. As a result, many responses were missing, and most of the responses were not relevant to be classified as cultural or belief-related factors.



As highlighted in the literature review chapter of this thesis that female immigrants avoid travelling with mixed gender, therefore in the survey specifically a question was asked about the extent of comfortability while taking seat with opposite gender in public transport. The level of comfortability was scaled as very uncomfortable, uncomfortable, neutral, comfortable, and very comfortable.

To investigate the potential differences in perception, a cross-tabulation analysis was performed to assess the relationship between gender and comfort level when seated with an individual of opposite gender. The bar chart in figure 22 illustrates the differences in responses between male and female participants.



**Figure 22.** *Comfort levels of males and females when taking a seat opposite an individual of the opposite gender in public transport.*

Among female respondents 8.7% reported as very uncomfortable, and 31.9% reported as uncomfortable while taking seat with opposite gender in public transport, suggesting a higher level of discomfort among female immigrants. Conversely, a lesser proportion of male respondents reported discomfort, with 5.7% feeling very uncomfortable and 13.3% feeling uncomfortable. However, a significant proportion of respondents among both genders had reported to be feeling neutral while taking seat with an individual of opposite gender in public transport, with 42.9% of males and 36.2% of females expressing this view.

The proportion of males is higher as compared to that of female who have reported to be either comfortable or very comfortable while taking seat with individual of opposite gender. 25.7% of male respondents have reported as comfortable, and 12.4% reported

as very comfortable while taking seat with opposite gender in public transport. In contrast, a lesser proportion of female respondents reported comfort, with 17.4% feeling comfortable, while only 5.8% of female have reported to be feeling very comfortable while taking seat in public transport with an individual of opposite gender.

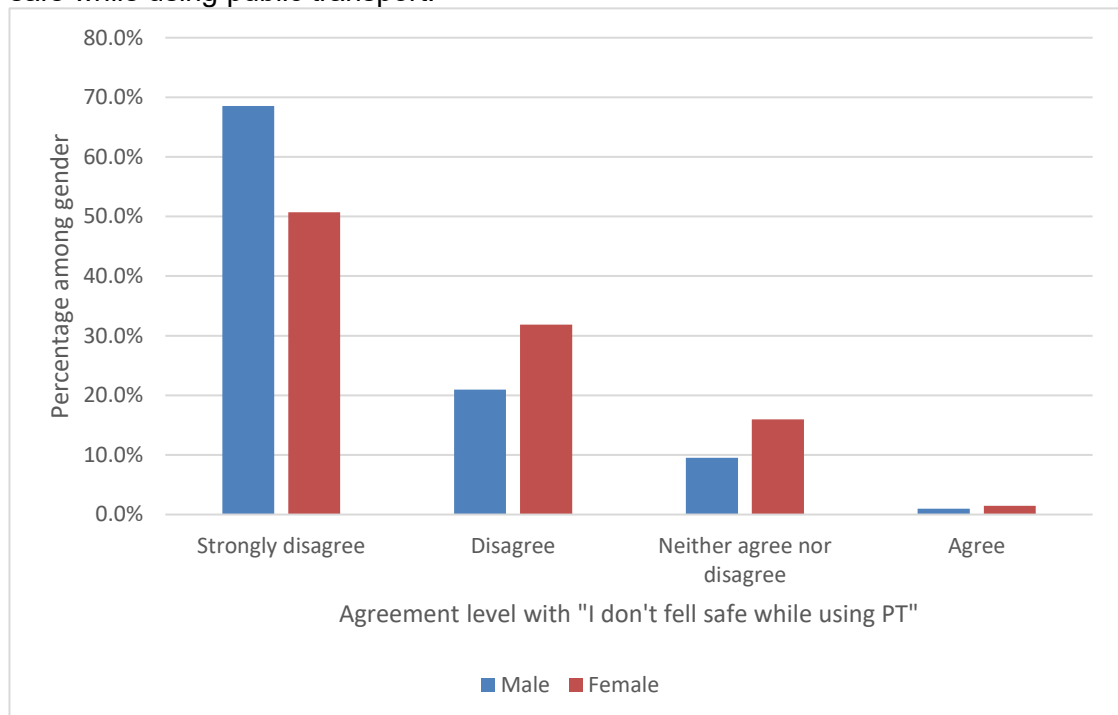
Fisher's exact test was performed to assess the statistical significance of this association, resulting in a p-value of 0.033. This indicates that the correlation between gender and comfort level when seated with an individual of the opposite gender, is statistically significant.

As safety is not considered a major concern from the above explained analysis, however, based on the analysis of gender and comfortability while seating with individual of opposite gender, the result states that mostly female immigrants are less likely to be comfortable while taking seat with individual of opposite gender. Considering this association, an additional cross-tabulation analysis was conducted to examine the relationship between gender and perceptions of safety while using public transport. Respondents were asked to express their level of agreement with the statement, "I don't feel safe while using public transport," using a scale ranging from "strongly disagree" to "strongly agree."

The results illustrated in the figure 23 indicate that a significant proportion of both males and females disagreed with the statement, suggesting that many respondents generally feel safe while using public transport.

Among male respondents, 68.6% strongly disagreed with the statement, indicating a high level of confidence in their safety while using public transport. In comparison, 50.7% of female respondents strongly disagreed, which is still a majority but lower than the male percentage. Additionally, 21.0% of males and 31.9% of females selected "disagree," further reinforcing that most respondents, regardless of gender, do not perceive safety as a major concern. However, a higher proportion of female respondents (15.9%) neither agreed nor disagreed compared to males (9.5%), indicating that some women may have mixed feelings or situational concerns about safety. On the other hand, only a very small percentage of both genders agreed with the statement, suggesting that feeling unsafe on public transport is not a common experience among the surveyed group, whereas

none of the respondents of both genders reported to be strongly agree with feeling unsafe while using public transport.



**Figure 23.** *Safety concerns among different gender groups of immigrants and non-native Finnish speakers while using PT*

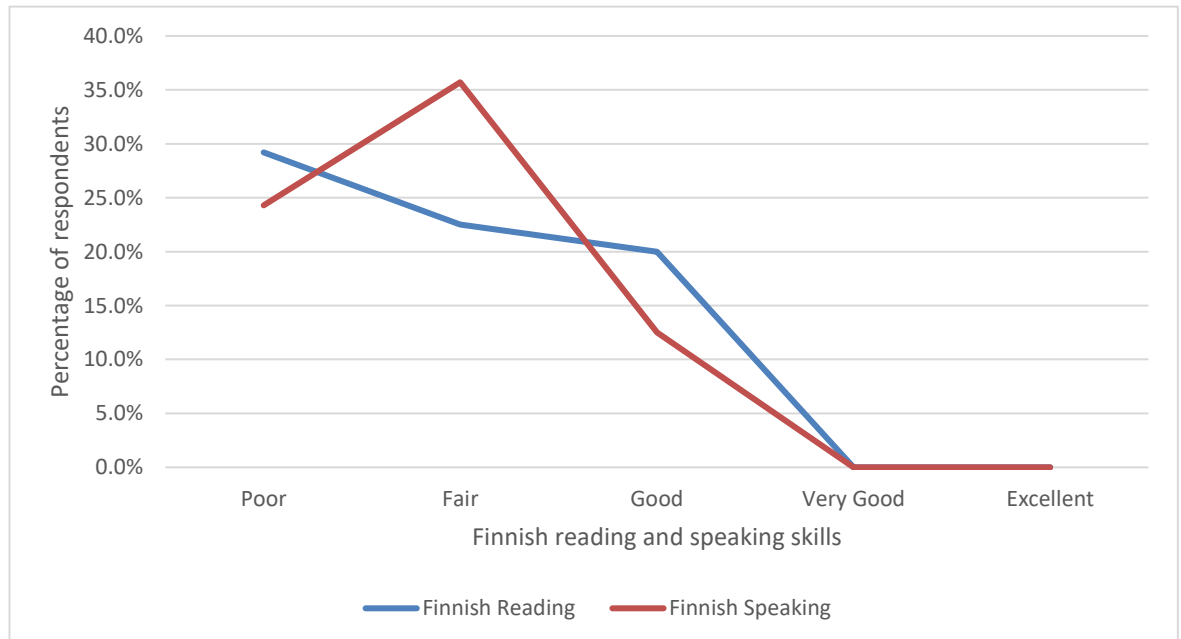
To assess the statistical significance of the relationship between gender and perceptions of safety, Fisher's exact test was conducted, yielding a p-value of 0.012. This indicates that the differences in responses between males and females are statistically significant, meaning that gender does play a role in how individuals perceive safety while using public transport.

Furthermore, as from the descriptive analysis results explained in the current section of this thesis above, language difficulties were considered one of the most significant barriers encountered by immigrants and non-native Finnish speakers while using public transport, therefore an additional cross-tabulation analysis was performed to assess whether this language barrier is associated with proficiency of Finnish and English language skills. Cross-tabulation was performed between the variable of language barrier and language skills, where the language barrier was measured on respondents indicating their agreement to the statement that they face language difficulties while using public transport (ranging from strongly disagree to strongly agree). The results indicated in figure 24 show the percentage of respondents who agreed and strongly agreed to the statement that they face language difficulties while using public transport. There is a clear

trend in the graph that as the individuals with lower Finnish language proficiency experience greater difficulties in using public transport, while those with better language skills report no difficulties.

The chart shows a clear pattern that as the Finnish language skills of immigrants increase, there is decrease in facing language difficulties while using public transport. Among respondents with poor Finnish reading skills, 29.2% reported encountering language challenges, while decreased to 22.5% for immigrants with average skills and further fell to 20.0% for those with good skills. However, none of the respondents with very good or excellent Finnish language reading abilities indicated encountering any language challenges while using public transport. A similar trend was observed for Finnish speaking skills, where 24.3% of those with poor proficiency faced language difficulties, increasing slightly to 35.7% for those with fair skills. However, the percentage dropped to 12.5% for those with good proficiency, whereas none of the respondents with very good or excellent Finnish speaking skills reported any language difficulties.

As the information in public transport of Tampere is primarily available in Finnish, therefore individuals with limited Finnish proficiency may struggle to understand key travel details such as public transport stops information, route maps, schedules, and announcements.

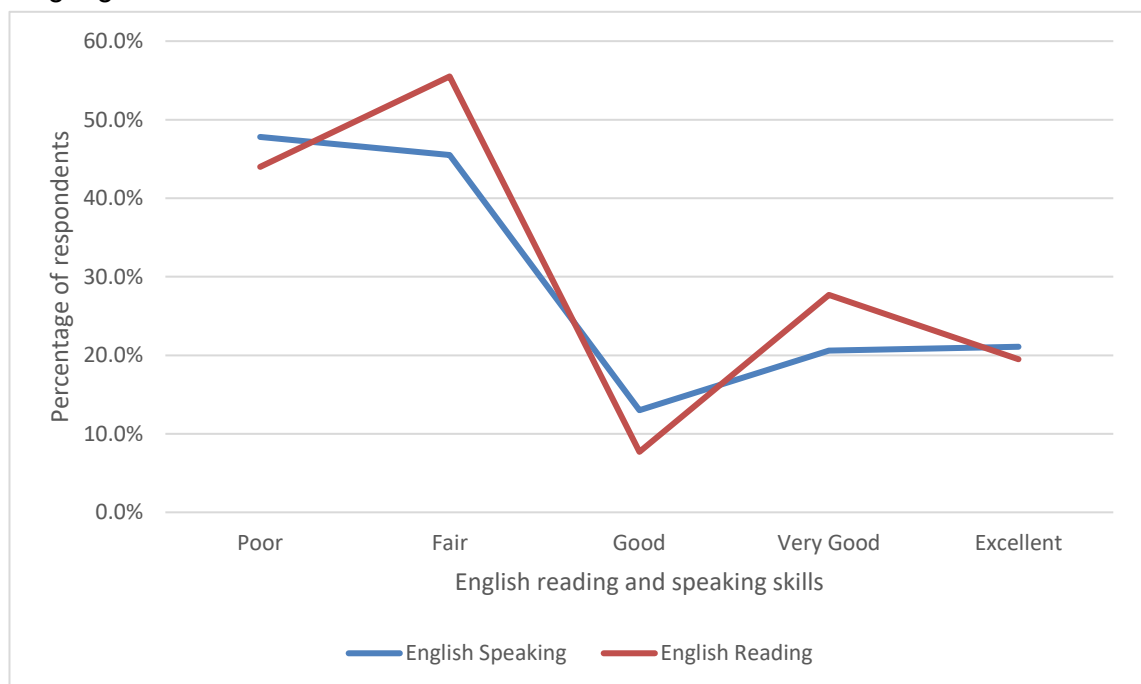


**Figure 24.** Relationship between Finnish language skills of immigrants and non-native Finnish speakers and language difficulties in public transport

The correlation between Finnish speaking and Finnish reading skills with language difficulties while using public transport was tested using Fisher's exact test. The language

barrier was measured on a 5-point Likert scale, where respondents indicated their agreement with the statement that they face language difficulties while using public transport (ranging from strongly disagree to strongly agree). The test results showed a p-value of 0.011 for Finnish reading skills and 0.14 for Finnish speaking skills, indicating a statistically significant correlation between Finnish reading proficiency and perceived language difficulties while using public transport, whereas the relationship between Finnish speaking skills and language difficulties while using public transport was not statistically significant.

Additionally, a cross-tabulation analysis was conducted to examine the relationship between English language proficiency (both speaking and reading) and the perceived and encountered language barrier while using public transport. The language barrier was measured on a 5-point Likert scale, where respondents indicated their agreement with the statement that they face language difficulties while using public transport, ranging from strongly disagree to strongly agree. Unlike Finnish language skills, English proficiency does not show a clear pattern where an increase in skills leads to a reduction in language difficulties which is probably because of public transport information in Tampere is primarily available in Finnish, making English skills less relevant in overcoming language barriers.



**Figure 25.** Relationship of English language skills of immigrants and non-native Finnish speakers and language difficulties in public transport

The trend in figure 25 shows that a high rate of 47.5% respondents with poor English-speaking skills reported that they face language difficulties, while the percentage of respondents for those with fair skills remained 45.5% which is almost same. However,

among those with good English-speaking skills, the percentage of respondents drops to 13.0%, indicating a potential reduction in difficulties. Interestingly, the percentage of respondents rise to 20.6% again for those with very good and 21.1% for those with excellent English-speaking skills. These figures indicate that even individuals with higher English proficiency still face challenges in using public transport probably because information in public transport of Tampere are in Finnish language.

A similar trend is observed in English reading proficiency. 44.0% of respondents with poor reading skills reported facing language difficulties, while the respondents' percentage increased to 55.5% for those with fair reading skills, indicating that moderate proficiency does not necessarily reduce the language barrier. However, there was a sudden reduction in the percentage of respondents among those with good reading skills, as only 7.7% of them reported that they face language difficulties while using public transport. However, for those with *very good* English reading skills, the percentage increases again to 27.7%, and for excellent readers, it remains relatively high at 19.5%.

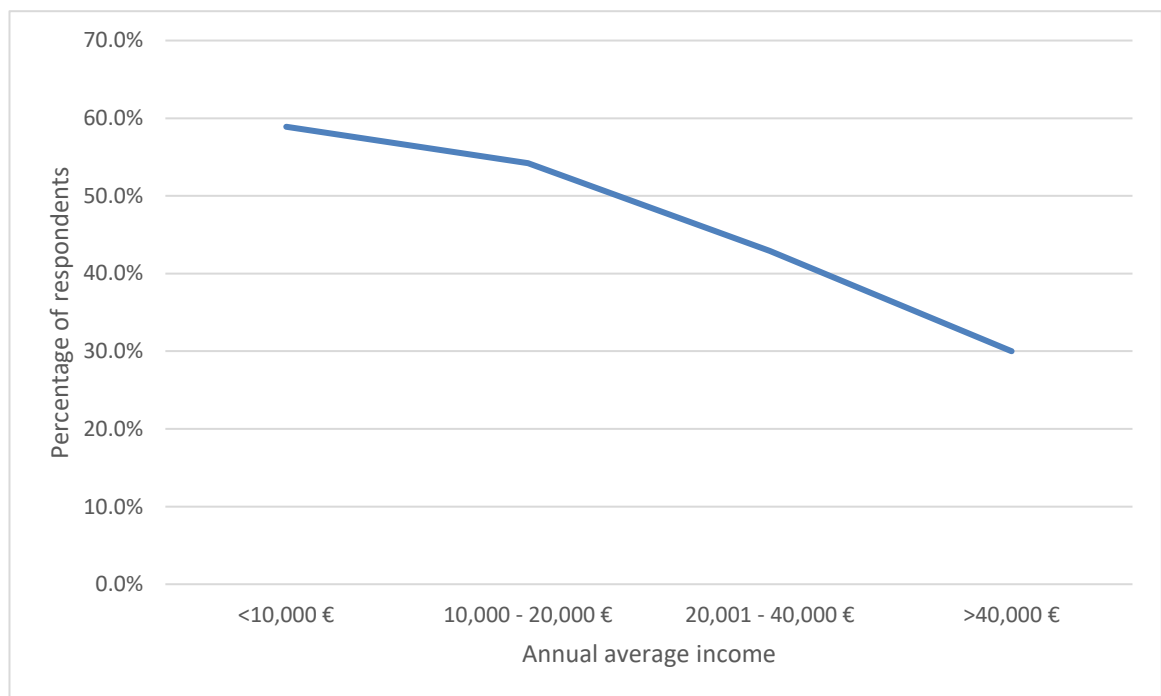
The correlation between English speaking and English reading proficiency with language difficulties while using public transport was tested using Fisher's exact test. The language barrier was measured on a 5-point Likert scale, where respondents indicated their agreement with the statement that they face language difficulties while using public transport, ranging from strongly disagree to strongly agree. The results suggest that English proficiency alone does not significantly reduce language barriers in using public transport, likely due to the lack of English translations in Tampere's public transport system. The test resulted in a p-value of 0.01 for English speaking and 0.03 for English reading, indicating that reading proficiency has a stronger association with language difficulties than speaking proficiency.

Moreover, as cost is the most significant barriers encountered by immigrants and non-native Finnish speakers from the descriptive analysis. Several cross-tabulation analyses are performed with various demographics such as income of immigrants and duration of residence of immigrants in Finland with cost as barrier. The cost barrier was measured on a 5-point Likert scale, where respondents indicated their agreement with the statement that the cost of public transport is not economical for them, ranging from strongly disagree to strongly agree. This cross-tabulation is performed to examine whether the cost of public transport is not economical for all immigrants or immigrants with certain yearly income. Additionally, immigrants coming from different countries may compare their own country's public transport cost with cost of Tampere's public transport, therefore cost barrier was analyzed related to duration of residence in Finland to examine that

whether this uneconomical cost perception of immigrants is same among all immigrants, or it varies based on their duration of residence in Finland.

Figure 26 illustrates the association of annual income and the perception that public transport (PT) costs are a financial barrier for immigrants. A clear pattern is followed in the chart that as income of the immigrants increases, their perception about the cost as barrier in public transport reduces.

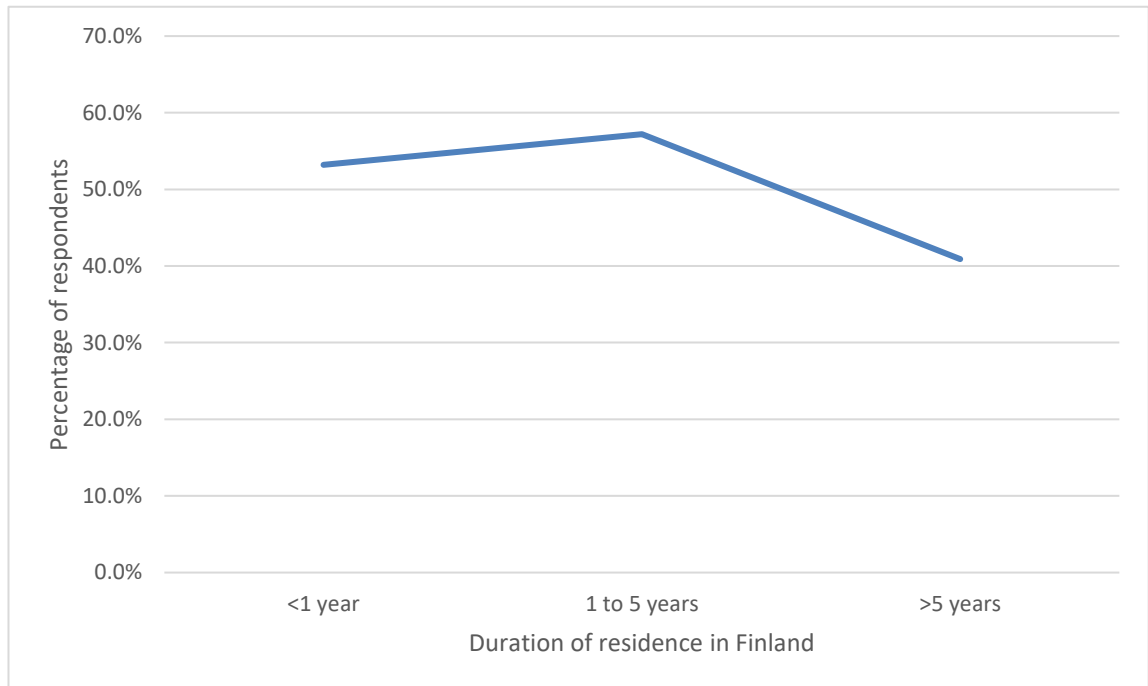
58.9% of the respondents among the least income group of “less than 10,000 €” perceive cost as barrier in public transport which slightly decreases to 54.2% for those earning between 10,000 € and 20,000 €. These higher percentages of respondents among lower income groups suggest that cost concerns persist upto the income level of 20,000 €. There is a significant drop among individuals earning between 20,001 € and 40,000 €, where 42.9% still consider public transport costs a barrier. The lowest percentage is observed among those with an income exceeding 40,000 €, where only 30.0% perceive cost as a significant issue.



**Figure 26.** *Perception of public transport cost as a barrier among immigrants across different yearly income levels*

These results highlight that immigrants with lower incomes perceive the current cost of public transport as barrier and unaffordable, while fewer immigrants with higher incomes consider the current public transport cost as barrier. The findings highlight the financial burden of public transport costs on lower-income immigrants, suggesting that affordability remains a key concern for this group.

Additionally, perception of public transport cost as barrier was analyzed based on the duration of residence of immigrants in Finland. As illustrated in figure 27, the findings indicate that immigrants who have been living in Finland for shorter period are more likely to see the current cost of public transport as a significant barrier, whereas those with a longer residency period are less likely to see public transport costs as a significant challenge. This graph shows the percentages of respondents who either strongly agreed or agreed with the statement that the cost of public transport is not economical for them.



**Figure 27.** *Perception of public transport cost as a barrier among immigrants based on their duration of residence in Finland*

Among the immigrants who have been living in Finland for less than one year, 53.2% reported that public transport costs are a barrier. This percentage slightly increases to 57.2% among those who have lived in Finland for one to five years, which indicates that cost concerns remain common during the early years of settlement. However, this percentage drops to 40.9% among those who have lived in Finland for more than five years, which suggests that over time, immigrants probably either adapt to the cost of public transport, experience improved financial stability, or better travel planning, or increased reliance on other forms of mobility.

The trend in the chart suggests that newly arrived immigrants and those in their early years of residence in Finland are more likely to consider cost of public transport experience as a barrier and financial challenge. In contrast, those who have resided in the country longer seem to perceive public transport as affordable, with few of them still perceive it as a barrier.



Fisher's exact test resulted in  $p = 0.360$  for the association between yearly income and public transport cost as a barrier, while  $p = 0.171$  for the association between duration of residence and public transport cost as a barrier indicate that neither income level nor duration of residence has a statistically significant association with perceiving PT cost as a barrier. The cost barrier was measured on a 5-point Likert scale, where respondents indicated their agreement with the statement that the cost of public transport is not economical for them, ranging from strongly disagree to strongly agree. A p-value greater than 0.05 suggests that the observed variations in responses across income groups and residence duration could be due to chance rather than a systematic pattern.

#### **4.4 Barriers affecting use of public transport among immigrants and non-native Finnish speakers**

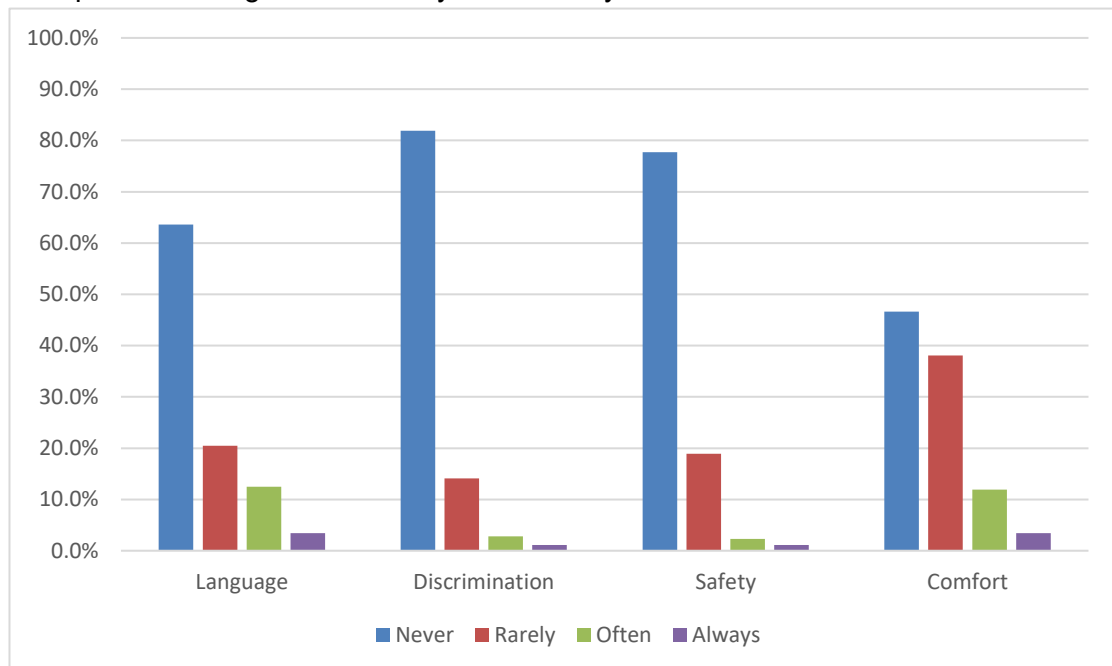
To address the research question, *“How do these barriers affect the use of public transport among immigrants and non-native Finnish speakers?”*, the responses regarding the impact of barriers on public transport use were analyzed from the collected data. In the survey, this was asked with the question: “How often do the following challenges stop you from using public transport?” Respondents were presented with a list of barriers, including language, discrimination, safety, comfort, understanding of the public transport ticketing system, cost, poor connectivity, and public transport stop distance from home. They could select from five response options: *never*, *rarely*, *often*, *always*, and *I don't know*. For the analysis, responses marked as *“I don't know”* were treated as missing data. The results are presented in two separate charts for better clarity and readability.

Figure 28 highlights the barriers related to language, discrimination, safety, and comfort. The results indicate that a significant proportion of respondents reported that their use of public transport is never or rarely affected by any of these four barriers.

For the language barrier, 63.6% of the respondents stated that their public transport use is never affected by it, and 20.5% reported that it is rarely affected. However, 12.5% indicated that this barrier often affects their use of public transport, and 3.4% stated that it always affects them. These results indicate that a total of 15.9% of respondents experience difficulties due to the language barrier, making it a notable challenge for some users.

Discrimination is also not a major factor affecting public transport use among immigrants, as the majority (81.9%) reported that it never impacts their usage. Additionally, 14.1% stated that their use of public transport is rarely affected by discrimination. However,

3.9% of respondents reported experiencing frequent discrimination, with their public transport use being often or always affected by it.



**Figure 28.** *Effect of barriers on public transport use of immigrants and non-native Finnish speakers*

Similarly, safety concerns were not identified as a major barrier. A total of 77.7% of respondents reported that their public transport use is never affected by safety concerns, while 18.9% stated that safety concerns rarely impact their usage. In contrast, only 2.3% and 1.1% of respondents reported that their use of public transport is often or always affected by safety concerns, respectively.

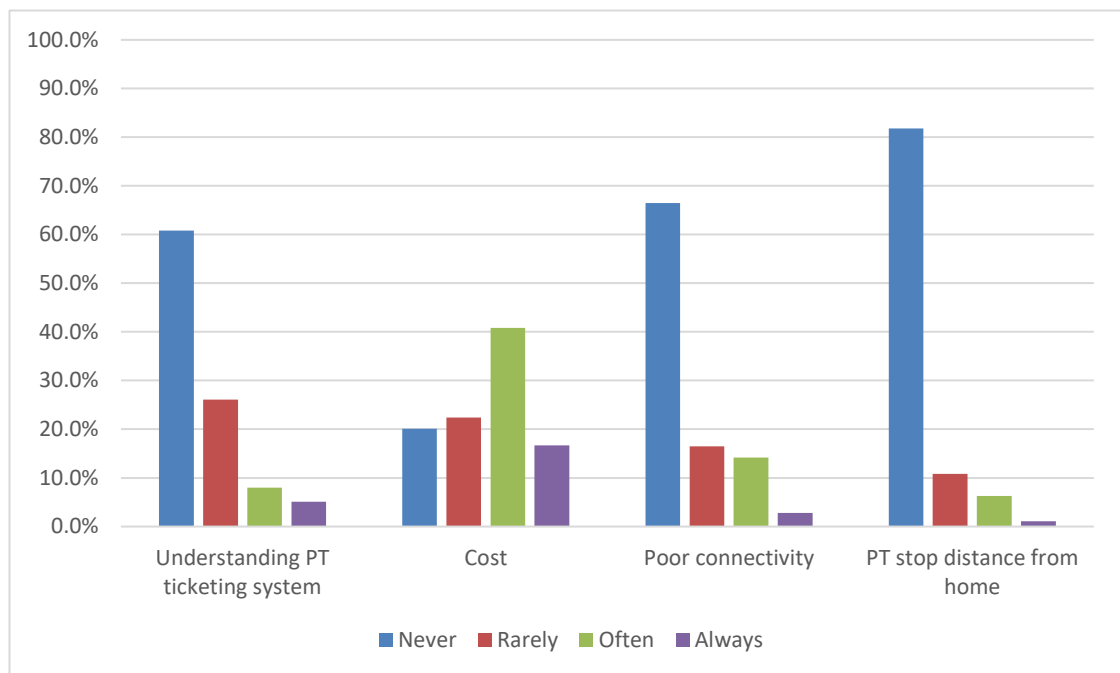
However, comfort-related issues appear to have a somewhat greater impact. A total of 46.6% of respondents indicated that comfort never affects their public transport use, while 38.1% reported that it rarely affects them. In contrast, 15.3% of respondents stated that discomfort often or always influences their decision to use public transport, highlighting that comfort could be a notable concern for some users.

Figure 29 highlights the barriers related to understanding the public transport ticketing system, cost, connectivity, and stop distance from home. The results indicate that a significant proportion of respondents reported that their use of public transport is never or rarely affected by any of these barriers except cost which is affecting the use of public transport among most of the respondents frequently.

Although understanding the public transport ticketing system is not a barrier for most of the respondents, yet in total 13.1% of the respondents have reported that this barrier is either often or always influencing their use of public transport. However, most respondents have reported that this barrier is never affecting their use of public transport whereas

26.1% of respondents have reported that their use of public transport is rarely influenced by the barrier that they do not understand the ticketing system of public transport.

Among all other barriers, public transport use is significantly affected by cost. Most of the respondents have reported that the cost of public transport frequently affects their ability to use it. Specifically, 40.8% stated that cost often impacts their public transport use, while 16.7% indicated that it always influences their decision to use public transport. In contrast, less than half of the respondents reported with 20.1% stating that cost never affects their public transport usage, and 22.4% report that it rarely affects the use of public transport.



**Figure 29.** *Effect of barriers on public transport use of immigrants and non-native Finnish speakers*

In addition to cost, poor connectivity also influences the use of public transport for some respondents. A majority (66.5%) stated that poor connectivity never affects their public transport use, while 16.5% reported that it rarely impacts them. However, 14.2% of respondents mentioned that poor connectivity often affects their ability to use public transport, and 2.8% stated that it always impacts them.

Similarly, the distance of public transport stops from home does not significantly affect most respondents. A large proportion (81.8%) stated that public transport stop distance never affects their use of public transport, while 10.8% reported that it rarely impacts them. In contrast, 6.3% of respondents indicated that public transport stop distance often affects their transport use, and 1.1% stated that it always influences their decision to use public transport.

The analysis of barriers affecting public transport use among immigrants and non-native Finnish speakers reveals that while public transport use of most respondents are not significantly impacted by these challenges, certain barriers do affect a notable proportion of users. Discrimination and safety concerns are generally not major obstacles, as most respondents reported that these factors never or rarely impact their public transport use. However, language difficulties, and comfort-related issues appear to be more influential, with 15.9% of respondents stating that language barrier often or always influences their use of public transport and 15.3% of respondents stating that discomfort often or always affects their decision to use public transport. Among all barriers, cost is the most significant, with 57.5% of respondents indicating that it often or always influences their transport use. Poor connectivity also impacts the use of public transport among a notable portion of respondents, with 17% stating that it frequently affects their travel choices. Meanwhile, understanding the ticketing system and the distance of transport stops from home were reported as barriers affecting the public transport use of a small percentage of respondents. Overall, while most immigrants and non-native Finnish speakers do not face severe challenges in using public transport, cost remains the most critical issue, followed by comfort and connectivity, highlighting areas where improvements could enhance public transport accessibility for immigrants and non-natives.

## 5. DISCUSSION AND CONCLUSION

### 5.1 Discussion

The aim of this master's thesis was to investigate the factors affecting the use of public transport among immigrants and non-native Finnish speakers in Tampere, Finland. The findings from this study reveal important understandings about travel behaviors of immigrants and non-native Finnish speakers, challenges, and barriers faced by them when using public transport, and how their use of public transport is affected by certain barriers. The discussion combines the main findings from the analysis with existing literature to provide a broader understanding of public transport use among immigrants and non-native Finnish speakers.

#### 5.1.1 Travel behaviors of immigrants and non-native Finnish speakers

The travel behavior of immigrants and non-native Finnish speakers differs based on their demographic factors such as income, gender, and duration of stay in Finland. The analysis of the data resulted that most commonly used mode of transport among immigrants is public transport, particularly among new immigrants. However, it is associated with their duration of residence in Finland, as their duration of residence increases, they tend to gradually shift toward alternative transport options such as personal cars. This finding aligns with previous research that suggest that newly arrived immigrants often rely on public transport due to financial constraints and limited access to private vehicles (Heisz and Schellenberg, 2004; Blumenberg and Evans, 2010).

Income is an important factor associated with travel behavior. The findings from the analysis reveal that public transport use is common among immigrants with lower income while those with higher incomes are more likely to use personal car for their travel. This finding aligns with the previous research suggesting transport mode choice is influenced by financial stability (Barajas et al. 2018; Hanna 2021). Similarly, duration of residence is also associated with travel behavior of immigrants. The findings from the analysis indicated that with increase in the duration of immigrants there is reduction in public transport use and increase in personal car usage. These findings align with the prior research where duration of residence of immigrants in a country influence their travel behavior. Similarly, immigrants with higher income are more likely to use personal car for their travel (Delbosc and Shafi 2023).

Walking and cycling frequencies were also analyzed among immigrants for various demographics, with findings showing that walking is a preferred mode of transport among both younger and older immigrants, however, comparatively immigrants of older age groups are more likely to walk for their whole trip more frequently as compare to younger immigrants which aligns with the previous research stating that walking is second preferred mode of transport among aged people (Brüchert et al. 2020). Use of bicycle among all immigrants is less, however, among female immigrants it was notably lower than male immigrants, which aligns with cultural and mobility constraints observed in prior studies (Assum 2011; Ramdani 2013; Noury and Speciale 2016; Geis 2019).

Use of taxi and car-sharing services were found to be less frequently used among immigrants. The analysis showed that 66.5% of the respondents never use taxis and 78.0% never use car-sharing service. This implies that most immigrants and non-native Finnish speakers could not be financially able, or these modes are probably not much practicable or needed to be used. The finding of infrequent use of taxi align with the prior research that due to financial constraints most probably immigrants do not use taxi for their travel (Geis 2019). On the other hand the finding of infrequent use of car-sharing contradicts with the prior research where it is stated that car-sharing usage is common among immigrants in order to save cost of their travel and it is a way for both earning and reducing the cost of car ownership for car owner (Chatman and Klein 2009). This contradiction could be probably due to lack of some information in the data collected for this study such as information about car-ownership or probably that prior research is for different country where demographic characteristics of immigrants are different the immigrants participated in this study.

### **5.1.2 Barriers to public transport use**

Several barriers were identified with their influence on public transport use and were analyzed in the study which includes cost, language, connectivity, safety concerns, and comfort. Among all the barriers, cost was found to be a more significant barrier, with majority of respondents had agreed that they have encountered cost as uneconomical while using public transport and is affecting their choice to use public transport more frequently. Particularly cost is affecting use of public transport among immigrants of lower income groups and individuals that have been residing in Finland for less than 5 years. This finding aligns with previous research where affordability has been identified affordability as a critical issue for immigrants, particularly those with lower income levels (Barajas et al. 2018; Chahar Mahali and Ray-Yol, 2020).

Although poor connectivity is not a barrier for significant number of immigrants, but it still affects the use of public transport among some proportion of respondents. Since public transport in Tampere is generally efficient, however, certain routes and schedules are probably not adequately serving immigrant communities which leads to challenges in reaching workplaces, education centers, and culturally specific services. The impact of limited public transport accessibility on social inclusion and employment opportunities have been highlighted in previous studies (Blumenberg 2008; Allen et al. 2021).

Language barrier is found to be a major challenge that most of the immigrants have faced while using public transport, but it was also found from the analysis that language barrier is not majorly affecting their public transport use. Similarly, understanding public transport ticketing system and understanding routes and schedules are found as major challenge that mostly immigrants have face while using public transport but from the additional analysis it is also not affecting the public transport use among major proportion of immigrants. Although it is not affecting the majority but still impacted on a notable portion of respondents. These difficulties in understanding schedules, ticketing system, and announcement might be faced by certain immigrants and non-native Finnish speakers because of language barrier, which can deter them from using public transport effectively (Chahar Mahali and Ray-Yol, 2020).

Discrimination was reported as a relatively minor issue, with most respondents indicating that they have neither faced it while using public transport nor does it affect their public transport use. Nevertheless, even a small percentage experiencing discrimination can contribute to feelings of exclusion and they may feel unwell to use public transport even if it is their primary mode of transport, as reported in other research on immigrant travel experiences (Geis 2019).

Safety concerns were analyzed in detail to assess whether immigrants and non-native Finnish speakers feel secure while using public transport. The results indicate that while most respondents do not see safety as a major concern, a small proportion of users experience safety-related discomfort. Furthermore, comfort-related concerns, particularly from the analysis of seating arrangements with the opposite gender, a notable proportion of respondents, especially female users, reported feeling discomfort when required to sit next to someone of the opposite gender. These findings suggest that cultural and personal preferences play a role in shaping comfort perceptions, and addressing these concerns through awareness campaigns or seating flexibility could enhance the overall public transport experience. Such concerns are further reflected in previous research, such as Geis (2019) found that many female immigrants prefer to walk longer distances rather than use public transport due to discomfort with mixed-gender seating

arrangements and travel behavior could be influenced by cultural diversity (Awaworyi Churchill 2020).

### **5.1.3 Role of digital tools in transport accessibility**

The use of mobile applications for trip planning was analyzed in relation to different age groups of immigrants and in relation to language proficiency of immigrants. The results indicated that younger immigrants are more likely to use mobile application for their trip planning whereas among older age immigrants, use of mobile applications for trip planning is not very common. This finding aligns closely with the previous studies where it is stated that mobile and internet use is common among youngers as compared to aged-people particularly mobile application use for trip planning (Srinivasan and Reddy Athuru 2004; Jamal and Habib 2019; Sinha and Gupta 2023).

In terms of association of trip planning applications use with language proficiency, the results indicate that Finnish language skills significantly impact the use of trip-planning applications, as individuals with stronger Finnish skills are more likely to utilize these tools effectively. However, the same pattern was not observed for English proficiency, as information in public transport apps is already available in Finnish, Swedish, and English. This finding suggests that immigrants may rely on English or other languages rather than Finnish for digital navigation, as previously noted in studies on immigrant technology use (Jamal and Habib 2019).

## **5.2 Conclusion and recommendations**

In conclusion, public transport remains preferred mode of transport among most of the immigrants and non-native Finnish speakers, however, several barriers reduce its accessibility, and convenience. Addressing high public transport cost for certain groups, introducing multi-lingual information systems in public transport, improving connectivity, and considering cultural sensitivities regarding safety and seating arrangements could enhance public transport experiences for immigrants and non-natives. Inclusive strategies should be focused on future transport policies that facilitate diverse populations, ensuring that all residents, regardless of their background, can navigate and utilize public transport efficiently.

This study provides a comprehensive understanding of the factors influencing public transport use among immigrants and non-native Finnish speakers in Tampere, Finland. The findings highlight an important role of public transport in improving mobility for immi-



grants, especially those with lower incomes or limited access to personal vehicles. However, several barriers, particularly cost and poor connectivity, limit accessibility and must be addressed to enhance transport equity.

Key takeaways from the study include:

- Cost is the most significant barrier that affects a large proportion of immigrants and non-native Finnish speakers and limit their ability to use public transport more frequently and freely which can lead to transport poverty for certain individuals particularly newly arrived immigrants and those having less income.
- Language barriers exist but is not affecting many immigrants. Still a multi-lingual information system in public transport could be helpful to facilitate a wide range of people from diverse backgrounds and different languages. Languages that are mostly spoken or used in Tampere can be chosen to be used in a multi-lingual system for announcements and displays in public transport.
- Public transport use decreases as immigrants stay longer in Finland, with an increased shift toward personal vehicle ownership. To address this, policies promoting affordable long-term public transport passes and incentives for continued public transport use, such as loyalty discounts or flexible ticketing options, could encourage sustained reliance on public transport instead of transitioning to personal cars. Direct connectivity to certain places that are mostly work-related areas could also be a better solution so that people can rely on public transport to make trips to their workplaces as most immigrants that are settled since long may shift towards personal cars so that they can save their travel time.
- Poor connectivity and comfort issues remain concerns among small portion of immigrants. Expanding public transport routes, increasing frequency during peak hours, and improving station facilities could make public transport more reliable and attractive for daily users.
- Safety and gender-based seating concerns influence public transport experience, requiring targeted measures to enhance comfort and security. Implementing women-friendly or some other genders priority seating areas in public transport can help alleviate safety concerns particularly among female immigrants and create a more inclusive transport environment.

Several suggestions are also given by respondents while responding to an open-ended question in a survey. Most of the suggestions are related to reducing the public transport cost in Tampere and increase of direct connectivity to certain workplaces of immigrants

but locations are not specified in the responses. A few of the suggestions are about introducing a universal ticketing system, meaning that one ticket and one mobile application could be used to travel in public transport. Whereas some respondents had suggested renewing the buses as most of the buses use in public transport in Tampere are older and screens are not working inside some buses which can be problematic for certain public transport users to navigate their desired destination and desired bus stop where they have to get off.

## **5.3 Limitations and future research directions**

### **5.3.1 Limitations**

This study provides valuable insights into the barriers that affect public transport use among immigrants and non-native Finnish speakers. However, there are also certain limitations of this study like the data collected primarily through an online survey. While this method allowed for a broad reach, but it also meant that respondents were self-selected, as the survey link was shared in several social media platforms which were not accessible to all immigrants. As a result, most of the young respondents and particularly and students participated in the survey, which may not fully represent the experiences of older immigrants or individuals with lower digital literacy.

Additionally, while efforts were made to include perspectives from different age groups, the same set of survey questions was used for interviews with older participants, but old age participants were comparatively low due to the issues that were faced during interviewing the respondents as most of the old-age respondents were not ready to participate in the survey. Additionally, the complexity and detail of their answers could possibly have been influenced by the planned questions of the interview since they might not have adequately caught their experiences and difficulties.

The language barrier presents still another limitation on this study. Although the questionnaire was available in three languages i.e. English, Finnish, and Arabic in order to increase accessibility and target varied group of people who can understand different languages, but it is likely that some immigrants who speak other languages were unable to participate or encountered problems understanding the questions. This can have influenced the variety of responses as well as the general representation of immigrant and non-native Finnish speakers.

Lastly, the data was randomly collected without considering the population of immigrants and non-native Finnish speakers in Tampere, Finland. This lack of population data of

immigrants and non-native Finnish speakers makes it difficult to guarantee a totally representative sample, thereby maybe influencing the generalizability of the results.

### **5.3.2 Future research directions**

Despite these limitations, this study offers significant insights in investigating barriers that affect public transport use among immigrants and non-native Finnish speakers, however, further research is required to investigate additional dimensions of immigrant mobility in Finland. Future studies could:

- Investigate how travel behaviors of immigrants change with integrating into the Finnish society.
- Explore qualitative experiences of immigrants facing discrimination, cultural barriers and other safety issues.
- Investigate public transport use among immigrants in different cities of Finland and conduct comparative analysis to identify regional differences.
- Explore qualitative experiences of immigrants' modal shift towards personal car from public transport over time and income.

By focusing on these aspects, future research might enhance understanding transport difficulties of immigrants and non-native Finnish speakers and inform policies that promote inclusive and equitable urban mobility.

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# APPENDICES

## Appendix A: Questionnaire

This survey questionnaire was designed to collect data on the use of public transport among immigrants and non-native Finnish speakers in Tampere. The survey was conducted online between 28<sup>th</sup> November 2024 to 19<sup>th</sup> December 2024. It included both multiple-choice and open-ended questions. The questionnaire was structured into sections covering demographic information, daily travel habits, and perceptions of several barriers while using public transport. The same set of questionnaires was used for interviews as well. Below is the full survey as presented to respondents.

1. Title of the study: Use of Public transport among immigrants and non-native Finnish speakers.

### Consent for participation

I have been requested to participate in the research study identified above. I have received information about the study in writing and have had the opportunity to ask questions from the researcher conducting the study.

I understand that participating in the study is voluntary. I am aware that I have the right to refuse to participate and the right to withdraw from the study permanently or for a temporary period at any time and without giving a reason. I understand that any personal data collected in the course of the study will remain confidential.

**Before you begin to participate in the survey, please review the following documents to understand how your data will be handled:**


- **Information Sheet:** This document provides details about the purpose of this research, what participation involves, and contact information for further questions.  
[[https://drive.google.com/file/d/1IEmF\\_8chWBNCGX0J9jUQ095oSfkalvcN/view?usp=sharing](https://drive.google.com/file/d/1IEmF_8chWBNCGX0J9jUQ095oSfkalvcN/view?usp=sharing)]
- **Data Privacy Notice:** This document outlines the details about data to be collected, how the data will be stored, and protected to ensure privacy.  
[<https://drive.google.com/file/d/1ZZT4hsqN0qOVVu8wQSy4MuyDbE3WvLHg/view?usp=sharing>]

*This questionnaire will take around five minutes to complete. Thanks for your time.*

**I hereby give my voluntary consent for participation in this study.**

☐ Yes

☐ No

2. What is your gender? 


☐ Male

☐ Female


☐ Other

☐ Prefer not to say




3. What is your age group? 


- ☐ 18-24
- ☐ 25-34
- ☐ 35-44
- ☐ 45-54
- ☐ 55-64
- ☐ 65-74
- ☐ More than 74

4. What is your household size in Finland (including yourself)? 


- ☐ 1 (I live alone)
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5 or more

5. How much is your yearly household income (income before taxes)? 


- ☐ Less than 10000 €
- ☐ 10000 to 20000 €
- ☐ 20001 to 40000 €
- ☐ 40001 to 60000 €
- ☐ 60001 to 80000 €
- ☐ More than 80000 €

6. How long have you been living in Finland? 


- ☐ Less than 1 year
- ☐ 1 to 5 years
- ☐ 6 to 10 years
- ☐ More than 10 years

7. What level best describes your understanding of Finnish and English language? 


	Poor	Fair	Good	Very Good	Excellent
Finnish Speaking	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Finnish Reading	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
English Speaking	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
English Reading	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

8. What is your Profession? 


- ☐ Student
- ☐ Full-time employee
- ☐ Part-time employee
- ☐ Student and part-time employee
- ☐ Entrepreneur
- ☐ Stay at home parent
- ☐ Pensioner or part-time pensioner
- ☐ Unemployed
- ☐ Other

9. Please indicate how often you use the following modes of transport by selecting the appropriate frequency. 


	Daily	Weekly	Monthly	Rarely	Never
Public Transport	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Walking (whole trip)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Bicycle	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Taxi	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Personal car	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Car-sharing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

10. Which mode of public transport do you prefer? 

- ☐ Bus
- ☐ Tram
- ☐ Both bus and tram


11. Which mobile app do you use for public transport or trip planning in Tampere? (Check all that apply) 

- ☐ Nysse
- ☐ Google Maps
- ☐ Moovit
- ☐ I don't use any app for trip planning
- ☐ Other

12. Please indicate the extent to which you agree or disagree with the following statements related to challenges in using public transport. 

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
I face language difficulties while using public transport	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I experience discrimination while using public transport	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I don't feel safe while using public transport	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I don't feel comfortable traveling together with other people	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I don't feel comfortable because of noise in public transport	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I don't feel comfortable (because of weather conditions and cleanliness) while using public transport	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
It is difficult to understand the ticketing system of public transport	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
It is difficult to understand the routes and schedules of public transport	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>


It is difficult to understand the routes and schedules of public transport	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am not familiar with the local public transport system	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The cost of public transport is not economical for me	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Public transport provides poor connectivity to my workplace/study place	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Public transport provides poor connectivity to the places that I frequently visit (Grocery stores, language centers, community center, healthcare center)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The public transport stop is too far from my home	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

13. How often do the following challenges stop you from using public transport? 

	Never	Rarely	Often	Always	I don't know
Language	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Discrimination	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Safety	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Comfort	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Understanding public transport ticketing system	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cost	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Poor connectivity to my workplace/studyplace	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Poor connectivity to places I frequently visit (Grocery stores, language centers, community center, healthcare center)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The public transport stop is too far from my home	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>


14. What are the most important destinations for you? 

Enter your answer


15. Are there any specific cultural factors or factors related to your beliefs that influence your transport choices? 

☐ Yes

☐ No

16. What specific cultural factors or factors related to your beliefs influence your transport choices?  


Enter your answer

17. How comfortable do you feel when taking a seat next to someone of the opposite gender in public transport? 


☐ Very uncomfortable

☐ Uncomfortable


☐ Neutral

☐ Comfortable

☐ Very comfortable

18. As an immigrant or non-native Finnish speaker, how would you rate the public transport system in Tampere overall? 



19. What suggestions can you give to remove the barriers and improve the use of public transport?  


Enter your answer

## Appendix B: Information Sheet

The following information sheet was provided to all participants before they responded to the questionnaire. It explains the purpose of the study and outlines key details regarding participation.

### **Research study title: Use of public transport among immigrants and non-native Finnish speakers**

You are invited to participate in a research study that explores the use of public transport among immigrants and non-native Finnish speakers in Tampere.

After reading this information sheet, you will have the opportunity to ask any questions you may have. You will be separately requested to provide consent for participating in the study.

### **Purpose of the research**

The purpose of this study is to understand the experiences, challenges, and barriers faced by immigrants and non-native Finnish speakers when using public transport in Tampere. The research aims to provide insights that may help improve inclusivity and accessibility within the city's public transport system.

### **Description of the process**

The study will involve two methods of data collection:

**Online Survey:** Participants will fill out an online questionnaire. The survey link will be shared via social media platforms and TUNI Intra, and the survey is available in three languages, including English, to ensure inclusivity.

**Structured Interviews:** Face-to-face interviews will be conducted at public transport stops, stations, and community centers. These interviews will provide an opportunity to gather additional insights from those who may not have access to the online survey.

Both the online survey and interviews will cover questions related to public transport usage, travel behaviors, and challenges faced.

Participation in this study is completely voluntary. Participants will not receive any financial compensation to take part in this study.

### **Procedures for collecting research data**

**Online Survey:** You will be asked to fill out a short survey that takes about 5 minutes to complete.

**Structured Interviews:** Interviews will last around 10 minutes and will take place in public areas, such as transport stops or community centers.

No direct personal or identifying information will be collected. All data will be used solely for this study and will be disposed of after the research is completed.

### **Potential risks and benefits of participation**

You will not receive any direct benefit; however, your participation will contribute to a better understanding of how public transport can be improved for immigrant and non-native Finnish communities in Tampere. The findings may help policymakers and transport planners enhance accessibility and inclusivity in the public transport system.

There are no risks involved in participating in this study. The procedures and methods used for participating in this study do not involve health risks, social risks, financial risks and risks relating to personal data breaches.

### **Data confidentiality, processing and storage**

All data collected will remain anonymous, and no direct personal information will be recorded. The study data will be processed in compliance with the EU's General Data Protection Regulation (GDPR) and Finnish data protection laws. Only the research team will have access to the data, and it will not be shared with external parties. The data will be securely stored and disposed of after the completion of the study.

### **Protecting the privacy of participants in research papers/publications**

The research materials and data collected during the study will be destroyed after the master's thesis is completed.

### **Voluntary participation**

Participation in this study is entirely voluntary. You have the right to withdraw at any time without providing any reason, and this will not affect your relationship with Tampere University or any other service you may receive. However, any data collected before withdrawal may still be used in the study.

### **Privacy protection in the context of research papers and communicating about the study**

All results will be analyzed and presented at an aggregate level and individual responses will remain anonymous. The results will be available for the participants in the finalized Master's thesis and will be accessible at: <https://trepo.tuni.fi/>

**Use of data for non-research/later research purposes**

The collected data will only be used for master's thesis research purposes and will not be used for other research and non-research purposes.

**Inquiries**

For any questions or further information about this study, please contact:

**Researcher's contact details**

Name: Intizar Hussain

Unit: Master' student in Sustainable Transport (Faculty of Built Environment)

Phone number, email address: +358-417046334, [Intizar.hussain@tuni.fi](mailto:Intizar.hussain@tuni.fi)



## Appendix C: Data Privacy Notice

The following privacy notice was provided to survey participants to inform them about how their data would be handled, stored, and protected in compliance with ethical guidelines.

<b>Title of the registry</b>	Public Transport use among immigrants and non-native Finnish speakers [Master's Thesis]
<b>Date</b>	25.10.2024
<b>Data controller(s)</b>	Intizar Hussain, +358417046334, <a href="mailto:intizar.hussain@tuni.fi">intizar.hussain@tuni.fi</a>
<b>Supervisor or the contact person of the institution</b>	Professor Heikki Liimatainen, <a href="mailto:heikki.liimatainen@tuni.fi">heikki.liimatainen@tuni.fi</a> , +358408490320
<b>Purpose and lawful basis for processing personal data</b>	<p>Your personal data will be processed in the thesis regarding public transport use. The purpose of this study is to understand the experiences, challenges, and barriers faced by immigrants and non-native Finnish speakers when using public transport in Tampere. The research aims to provide insights that may help improve inclusivity and accessibility within the city's public transport system.</p> <p>Participation is voluntary. The lawful basis for processing is consent. You can withdraw your consent any time by informing the data controller.</p>
<b>Duration of processing personal data</b>	<p>Data will be stored to be used for the master's thesis of the data controller.</p> <p>After the thesis has been accepted, the data will be destroyed.</p>
<b>Content of research records and sources of personal data</b>	<ul style="list-style-type: none"> <li>• Age group</li> <li>• Gender</li> <li>• Household size</li> <li>• Household income</li> <li>• Duration of living in Finland</li> <li>• Finnish and English skills</li> <li>• Profession</li> </ul> <p>The data are being collected from the data subject.</p>
<b>Data subject's rights</b>	Under the EU's General Data Protection Regulation (GDPR) you have the right to access your data, right to rectify your data, right to have your personal data erased ('right to be forgotten'), right to restrict processing and right to object to the processing of your data. In case you would like to use any right, contact the data controller.
<b>Right to lodge a complaint with a supervisory authority</b>	Data subjects have the right to lodge a complaint with a supervisory authority in their permanent place of residence or place of work, if they consider the processing of their personal data to violate the provisions of the GDPR (EU 2016/679). tietosuoja.fi, tel. 0295666700, email: <a href="mailto:tietosuoja@om.fi">tietosuoja@om.fi</a>
<b>Recipients of the personal data</b>	Your personal data will only be disclosed to parties mentioned in this privacy notice.
<b>Data protection principles</b>	The manual data will be stored in a locked cupboard/room which will be disposed of after digitization. Digital data will be protected with username and password or multi-factor authentication (MFA). Direct identifiers will be removed from the data.

## Appendix D

The table below presents the detailed percentage of responses on barriers that respondents have encountered or perceived while using public transport.

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Language barrier	25.8%	30.3%	19.1%	20.8%	3.9%
Discrimination	45.5%	37.6%	12.4%	3.9%	0.6%
Safety	60.7%	25.3%	12.4%	1.7%	
Discomfort with others	50.8%	31.1%	12.4%	4.5%	1.1%
Discomfort with noise	43.3%	35.4%	13.5%	7.3%	0.6%
Weather and cleanliness issues	43.5%	33.9%	13.6%	7.9%	1.1%
Ticketing difficulties	37.1%	35.4%	16.9%	9.0%	1.7%
Routes and schedules difficulties	32.6%	39.9%	15.7%	9.6%	2.2%
Unfamiliar PT system	44.1%	35.6%	12.4%	7.3%	0.6%
Uneconomical PT cost	7.4%	15.9%	25.0%	38.1%	13.6%
Poor PT connectivity	39.3%	38.2%	12.9%	8.4%	1.1%
Distant PT stop	56.5%	32.8%	5.1%	4.5%	1.1%