A time-based study on the spatial distribution of kindergartens in the city of Stavanger in Norway; with a focus on accessibility,travel bahaviours and the gender role of parents with pre school children.

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Abstract

This thesis tries to study the distribution of kindergartens in Stavanger metropolitan area in Norway and figure out how the distribution of kindergartens can affect the physical accessibility and travel behaviors of families with preschool children. The conceptual framework of this study is based on theories regarding space-time prism and urban structure like compact city and new urbanism theories. It is important to mention that the idea of 10-minute city is considered an inspirational concept in this research since the accessibility and distribution of the kindergartens (with network analysis method in GIS) have been done according to the methodology of this new trend notion in urbanism.

As children need their parents, or an adult person to escort them to the kindergarten, it provides an opportunity to analyze the gender role in this issue. The aim here is to understand the role of mothers, who probably take more responsibilities than fathers in bringing children to the kindergarten and consequently spending more time commuting.

Furthermore, the second sub-question of this study is trying to examine the correlation between the location of kindergartens and urban density and the travel behaviors of parents. To address the subquestions of this research, beside using the network analysis method, an observation method has been used.

For an in-depth analysis, five kindergartens among 320 have been chosen to obtain more profound results. The analysis results for the case studies reveal that four out of five kindergartens provide convenient accessibility for the children. Furthermore, according to the result of observations, the number of mothers who take children to kindergartens and deliver them is higher than fathers, but it is essential to mention that the difference is not significant, almost with a ten percent difference. Moreover, in four cases, the observation results support a positive correlation between the level of residential building density and the travel mode of parents. It means that in areas with higher density in residential buildings, walking toward the kindergarten is the parents' dominant travel mode, and the car is the primary travel mode in areas with lower density levels. Overall, the results show that using the car has the highest popularity among parents.

Key words: accessibility, space-time prism, travel behaviors, urban form, 10-minute city, gender role

Preface

During my master's studies in Milan, I had the opportunity to do an exchange semester abroad. I choose the University of Stavanger in Norway. Norway has attracted me greatly for its renowned social equity and quality of life. Gender equality is a pillar of the remarkable achievements of Norwegian society. Women participate actively in the country's economic life almost in the same proportion as men. However, in my general observations, for biological and cultural reasons, the care of children continue to be largely women's responsibility. I was curious to understand in greater detail if this was also the case in Norway; and I especially wanted to use the tools to study cities I have gained through my studies. With these ideas in mind, and with the guidance of Fabio Hernández Palacio, my tutor at the University of Stavanger, and Todor Kesarovski, a Ph.D. fellow, who helped me in providing the maps and performing the analysis, I decided to study the distribution of kindergarten in the region of Stavanger from the perspective of accessibility and time.

It is true to say that, without the help and guidance of these two lovely people, it would be a challenging procedure for me to conduct this research since I have their support from the beginning and among all the steps. I want to appreciate their help, not only as a tutor but also as a friend, and I am looking forward to having future research projects together.

In the end, I want to be grateful of my main supervisor at Politecnico di Milano, Professor Ugo Fratesi, for his guidance that helps me to have more clear perspective for writing my thesis.

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Chapter One

Introduction

1.Introduction

This thesis studies time as a critical dimension in city planning for more equitable and sustainable cities. Time is a limited resource equally allocated to all individuals and everybody has a 24 hours day. However, how people use this time varies greatly depending on where people live, where the services they need to access are located, and what means of transport they can use. From this perspective, a balanced distribution of services is a critical factor in improving the quality of life for people, regardless of other socio-economic aspects. City planning can do a lot to develop a more just society by addressing the spatial development of cities from this perspective.

This research uses the distribution of kindergartens in Stavanger, Norway, as a case study. Kindergarten in Norway are provided mainly by municipalities and are regarded as a critical infrastructure to allow mothers' participation in the labor market. This is not only about gender equality but also about social equality in general. Double-income families have a more robust economy, and children who attend kindergarten tend to perform better in their future life. Since this service is widely used, and kindergartens are abundant, it is an interesting case to study how the distribution of a given service can affect time allocation patterns, eventually affecting equity in the urban space. Furthermore, since this study uses an in-depth observation to study gender roles, the city of Stavanger in Norway, where the author has done the research, was chosen to proceed with the observation.

The thesis uses geographic information system (GIS; arc map) software to analyze accessibility to kindergartens within a given travel time. It considers three travel modes for reaching kindergartens, including walking, cycling, and cycling with e-bikes. As children need their parents or an adult person to take them to kindergarten, it provides a good opportunity to study gender roles in this sense. The presented sub- question, is trying to figure out what is the role of mothers in scoring their children to the kindergartens in comparison to the roles of fathers. In order to answer this question, a survey has been done in five kindergartens in the Stavanger region.

The analysis results for the case studies reveal that four out of five kindergartens provide convenient accessibility for the children. Furthermore, according to the result of observation, the number of mothers

who take children to kindergartens and deliver them is higher than fathers, but it is essential to mention that the difference is not significant, almost with a ten percent difference. Moreover, in four cases, the observation results support a positive correlation between the level of residential building density and the travel mode of parents. It means that in areas with higher density in residential buildings, walking toward the kindergarten is parents' dominant travel mode, and the car is the primary travel mode in areas with lower density levels. Overall, the results show that using car has the highest popularity among parents.

This chapter discusses the theoretical structure of the research and introduces the related theories and ideas such as time geography.

1.1. The Importance of Time in Urban Life

Time is of fundamental importance in the proper functioning and interaction of people and things in socio-economic systems. Time is a limited resource and is naturally evenly distributed to all individuals. During a fixed interval of time, a given population has a particular amount of time at its disposal. This limitation sets a framework for the activities' volume and distribution within the group's individuals. The same argument can be applied to each person. Production, consumption, and other occupations have to be fitted into the framework formed by the total available time income available within the population. Therefore, in principle, any economic system, with all its components of technology and policy, can be projected onto the people's time utilization (Ellegård, Hägerstrand et al. 1977)

Human beings have an inherent economic logic regarding time use; humans are utility-optimizing beings, according to Hupkes (Hupkes, 1982). In this logic, rational choice behavior asserts that a decision-maker can rank possible alternatives according to personal preference and choose the highest one, subject to relevant constraints placed on the choice decision (Golob, Beckmann et al. 1981).

Cities are, in essence, socio-economic systems. How a city is organized, its form, the quality of its infrastructure, and its distribution of functions and amenities affect how individuals decide on their time use. Moreover, not all individuals have equal access to urban services; their place of residence, work location, and accessibility to the means of transport vary enormously. This fact can affect remarkably the amount of time an individual must invest in fulfilling many of the necessary activities in everyday life, depending on gender, income, or social status. Distributing possibilities more evenly, making cities more just, is central city planning. The perspective of time, despite not being new, is a somewhat neglected aspect in how we study cities.

1.1.1 Time Geography; Space-Time Framework

The Swedish geographer Torsten Hägerstrand developed the concept of time geography in the 1960s and 1970s as a regional policy and planning tool. At one level of analysis, time - geography deals with the time-space choreography of the individual's existence at a daily, yearly, or lifetime (biographical) observation scale. Time and space are seen as inseparable; every one of the actions and events which in sequence compose the individual's existence has both temporal and spatial attributes, not merely one or the other (Pred, 1977).

Time geography recognizes three significant classes of constraints on a person's space-time autonomy, including capability constraints, coupling constraints, and authority constraints. **Capability** constraints are about limiting individuals' activities through their physical capabilities or the resources they can have. They limit the activities of the individual through both his biological makeup (for instance, the need to sleep) and the capacity of the tools he can command (Thrift, 1977). **Coupling** constraints define where, when, and for how long an individual has to join with other individuals for shared activities. These constraints arise because individuals, tools, and materials must be bound together at given places at given times (for instance, during work hours). **Authority** constraints self-evidently refer to limitations and control of access. They occur at different levels to produce hierarchies of accessibility and impose fiat restrictions over particular space-time domains (Hagerstrand, 1970).

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1.1.2 Time as a finite resource

The time-space prism is one of the central concepts of time geography considered for writing this thesis. This concept demarcates the possible locations for the space-time path and directly measures a person's accessibility to the environment and activities.

The space-time prism concept recognizes that a significant factor influencing an individual's participation in spatially dispersed activities is the ability to trade time for space in movement. The objective of transport planning can be seen as complementary to this perspective: to provide individuals with the ability to trade less time for more space when traveling. Space-time prism constructs in a GIS can assess progress towards this goal and analyze the effects on this relationship from changes in transportation and infrastructure (Miller, 1991). Regarding this concept, one of the goals of this research is to determine how proximity to urban services(kindergartens) can weaken residents' capability constraints in travel time to reach these services.

1.2 Parents Time Allocation in Childcare Activities

According to the statistics Norway website, 92.8 % of all children aged between 1-6 have attended kindergartens in 2020 and 2021. We can interpret this significant percent to illustrate the importance of kindergartens as a social and cultural institution in Norwegian society with high demand for it. For example, we can find one reason for the importance of kindergartens in the public childcare policies since these policies are trying to achieve some goals by increasing childcare services and facilities. In other words, publicly funded childcare serves various policy aims, and It can be a social policy instrument for increasing employment and gender equality.

Following the child welfare act that resulted in an ambitious plan to escalate publicly subsidized childcare, Norway witnessed tremendous children's daycare attendance growth. The parental payment for a place in the daycare has also been substantially reduced. From 2009, all children who became one year old by the end of August in the year of application were guaranteed a place in publicly subsidized daycare. In 2010 as much as 79 percent of children 1-2 years and 97 percent of children 3-5 years attended a daycare center, mainly full-time. In Norway, it is now widely recognized that publicly subsidized daycare centers are good pedagogical institutions that provide ample opportunities for development, activity, and socialization, give vital preparation for formal schooling, and reduce social inequality (Drange and Telle, 2010). Parents have also become more favorable to very young children in daycare centers.

According to Kitterød and her colleague (Kitterød and Rønsen,2013), who tried to explore possible changes in the relationship between parenthood and the division of labor in Norway from 1980 to 2010, for women, there is a strong positive association between the age of the youngest child and time spent on household work at all the time points studied. Moreover, contrary to expectations, the estimated effects were almost as significant in 2010 as in 1980. However, the gender difference in household work time was more minor in 2010 than in 1980, although women still spent considerably more time on household work than men. In addition, It is essential to consider that, according to the Norwegian time use survey, the employment rate for women has had an upward trend since 1970. However, it has not reduced time use patterns in their childcare responsibilities than fathers.

Kitterød and Rønsen's study suggests that the presence of children in the household, particularly children below two years of age, still involves a more traditional division of household labor in couples in Norway. Having very young children still reinforces a traditional division of labor is as expected since mothers still take more parental leave than fathers in most couples.

In table 1, the time use patterns of men and women in childcare activities are illustrated. There is a strong correlation between the child's age and the number of time parents spend on childcare activities. As expected, children younger than two years old need more time from parents, and the share of mothers is significantly higher than fathers. Although the share of fathers has been increased slightly from 1980, mothers allocate significantly greater time for childcare activities, and this trend has remained almost steady since 1980. A logical interpretation is that children, especially under two years old, strengthen a gendered division of childcare among mothers and fathers.

Table 1: Estimates on parent's time spent (minutes per week) on direct childcare activities.1980-2010

Age of youngest child	Men				Women			
	1980	1990	2000	2010	1980	1990	2000	2010
0-1 years	70.8	97.2	101.5	97.4	224.6	227.5	202.2	224.0
2-3 years	61.2	69.4	58.2	81.8	114.9	157.4	107.0	130.8
4-6 years	31.4	54.3	46.5	65.6	80.9	104.8	65.5	83.6
7-19 years	9.0	12.2	4.5	6.7	27.7	29.0	20.1	18.9

Source: Kitterod,2002

Moreover, according to Vaage(2002) and the Norwegian time use survey conducted in 2000, there is a big difference between men and women regarding the amount of time spent with their children. Table2 shows that the difference in 2010 was huge among those who have small children and that it evens out more as the children get older. Among those who had children under three years, women used on average 7 hours and 30 minutes of being together with them per day, while the time was 4 hours and 49 minutes for men. Women were thus over 60 percent more with the young children than men were.

Table 2: Parents' time spent in hours and minutes, and its percentage with own children in different age groups

Parent	Time spent in hours and minute for different age groups of children				Percentage of time spent for different age groups of children			
	Under 3	3-6	7-12	12-17	Under 3	3-6	7-12	12-17
Father	4.49	4.23	3.38	3.02	90	91	83	78
Mother	7.30	5.09	4.35	3.13	96	91	92	85

Source: Vaage,2002& the Norwegian time use survey in 2000.

All the facts and figures in previous paragraphs lead to formulate a research question in this thesis. The Norwegian time use survey is a valid reference to show a higher rate of participation of mothers in childcare activities, especially active childcare time. According to kittord (Kitterod, 2002), time spent on active childcare is when actively focusing on the children constitutes the parents' main activity. Everyday tasks are nursing and assistance, playing, talking, reading aloud, and escorting to and from various arrangements.

1.2.1 Gender Equality in Parenthood in Norway

The Nordic welfare states pioneered the transformation of parenthood into a political question, offering extensive policy packages to parents of young children. However, such policies have not primarily been motivated by pro-natalist objectives but by gender equality ideologies and concern for children and their families (Rønsen ,2004).

According to Korpi (Korpi, 2000), who has studied the typologies of welfare states within the Norwegian family support context, dual-earner support is trying to gain gender equality. It tries to encourage women's continuous employment and enable parents, men, and women to combine parenthood with paid work, thereby redistributing caring work within the family. Parental leave and public daycare for young children are two leading indicators of this type of support for families with young children. The

governmental intention behind the parental leave program has been to make the combination of female employment and family life more feasible. First, the program secures mothers' rights in the labor market, i.e., gives mothers the right to return to the same position after the paid leave period and a possible additional unpaid leave period of one year. The policy also reduces the direct costs of forgone income during an absence from work connected with childbirth. Regarding parental leave, father's leave encourages fathers to be more involved in childcare and is associated with gender equality in the couple. Duvander (Duvander and Andersson, 2006) and her colleague mention that there are good reasons to believe that gender equality in the family sphere may allow the father to participate in childrearing, increasing interest in children easing women's burden of having the primary responsibility in the family sphere.

Moreover, in 1993, Norway was the first country to introduce an earmarked part of the leave for the father. The governmental intention behind the father's leave was to contribute to a fundamental change in the gendering of caring responsibilities and restructuring the gendered division of unpaid work. In addition, according to Lappegård(Lappegård, 2010), the demand for public childcare facilities in Norway is greater than the supply for available places. To respond to this demand, the government has gradually increased its subsidy to daycare centers; its motivation for public transfer to childcare centers is to facilitate parents' employment and provide the child with a maturing, stimulating, and safe preschool period. The impact of increases in the availability of subsidized childcare and lower parental payment is more clear cut; a lower price will raise the full wage net of childcare costs, increase the demand for a place in a kindergarten, and greater availability this demand will be met. There will be less need for the mother's time in childcare, which will reduce her reservation wage and accelerate job entry after birth. Such positive effects of daycare availability on after-birth employment have previously been documented for Norway and Sweden. Moreover, a recent analysis from Norway indicates that cheaper childcare can spur employment activity among mothers even in an economy where women's labor supply is already high(Kitterød and Rønsen, 2013).

According to the Norwegian time-use surveys' analyses, fathers' and mothers' time-use patterns have become more similar in recent decades, although there are still significant gender differences. Fathers have reduced their time on paid work and enhanced their parenthood responsibilities, while the opposite changes have occurred in mothers' time-use patterns (Kitterød, 2013). Even though fathers want to spend time with their children, many work long hours in the labor market, although this became somewhat less common during the 1990s (Kitterød and Kjeldstad, 2004), part-time work is still mainly a female option in

Norway, whereas long-hours arrangements are mostly found among fathers. Overall, although gender differences in time spent on paid and unpaid labor have been considerably reduced in many Western countries in recent decades, men's and women's time-use patterns still tend to diverge when children arrive (Kitterød and Rønsen, 2013).

1.2.2 Motherhoods and Employment Opportunities

There is a correlation between spatial accessibility to kindergartens and their effects on the time-space budget of mothers. For example, some authors have studied working mothers and show that this correlation profoundly affects their job opportunities. According to them, women face severe day-to-day space-time constraints because of their domestic workload, limiting the time available for work and getting to work. These constraints form a serious geographical barrier to labor-force participation because they restrict the spatial opportunity set of available jobs. The tight time budget caused by gender differences in household roles is thought to be an essential cause of women's orientation to the local labor market(Hanson ,1990).

Some authors, like Van ham and his colleague (Van Ham and Mulder, 2005), have suggested that geographical access to childcare facilities is an essential factor determining access to employment opportunities for mothers with young children. Mothers with good geographical access to childcare facilities can be expected to have more opportunities to combine having children with a paid job and participate more often in the labor market. Furthermore, it is an essential factor determining access to specific job locations for women with young children.

Overall, the facts in the previous paragraphs develop an argument which suggest that proximity or easy access to kindergartens is a critical aspect to contribute to a more gender-balanced society because mothers still are the main actors in childcare responsibilities.

1.3 Care trips and means of transport in Norway

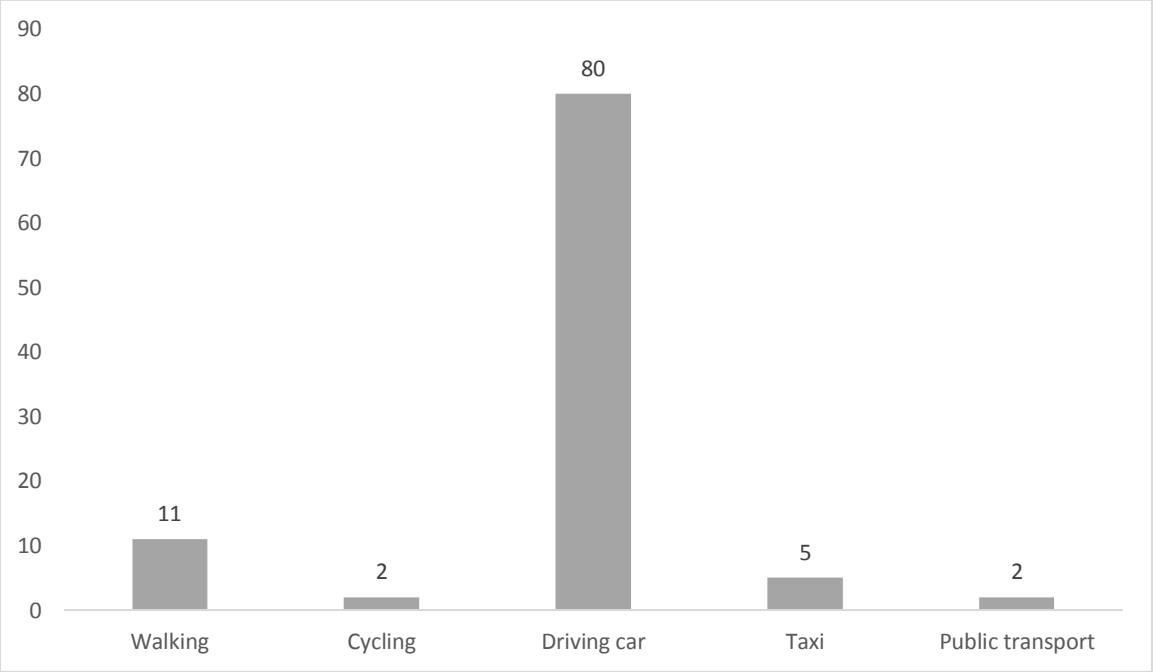
Care trips are trips where the purpose is to follow, bring or pick up others, most often children. One in ten of the travels in Norway is a care journey. There are three types of care journey and we just focus on the first group.

- Follow / pick up / bring children to / from kindergarten, park, daycare or school.
- Follow / pick up / bring children to / from sports and leisure activities.

• Follow / pick up / bring children or others to different activities.

The care journeys take place in most cases because the one who is followed is not old enough to travel alone, the person is ill, does not have a driver's license, or lacks access to a car. In addition, the care journeys are part of a longer travel chain between homes, kindergarten/school, and the workplace.That's why the dominant means of transport on care journeys is the car. According to figure 1 eighty percent of the care journeys is by driving the car, while only 11 percent take place on foot.

Figure 1: Percentages on means of transport for care trips



Source: National travel survey in Norway 2013/14

Based on table 3 the means of transport is about the same as in 2009, and it has been relatively unchanged since 2005. The proportion is highest in Oslo, with 28 percent, while car use is highest in the surrounding municipalities of Bergen, Trondheim, and Stavanger.

Regarding the age of children, those who have the youngest children walk the most. The results reveal an interesting fact related to the previous section concerning gender roles. The data shows that women have more care journeys than men and use the car less often.

Table3 : Percentages on means of transport for care trips divided by city, gender, and family type

City,Gender, & Family type	Walking	Cycling	Driving car	Taxi	Public transport
City					
Oslo	28	4	58	3	7
Bergen/Trondheim/Stavanger	15	4	71	7	3
Other cities	7	1	86	5	1
Gender					
Male	9	2	85	2	2
Female	13	3	75	7	2
Fmily type					
Couples with children under7	17	3	75	3	2
All	11	2	80	5	2

Source: National travel survey in Norway 2013/14

1.4 Research questions

This thesis aims to study time-geography accessibility to kindergartens in Stavanger metropolitan area in Norway. The conceptual framework for this analysis is based on a time-geographic perspective, and the goal is to analyze physical accessibility to kindergartens with consideration of travel time factors. Accessibility in terms of time might be a neglected aspect in city planning for the distribution of urban facilities since most studies try to analyze accessibility to facilities in terms of distance and the pattern of distribution of urban services.

Besides that, this research aims to study the gender role in parenthood responsibility in taking children to kindergartens and bringing them back home since young children should be escorted to kindergartens by adults. Several studies indicate that despite changes in gender roles in the last few decades, women are still primarily responsible for most household and childcare responsibilities, even when spouses have paid jobs (Van Ham and Mulder,2005). Thus, convenient accessibility to kindergartens can be considered a leading factor in improving or worsening gender disparities in spending time commuting.

The main research question underpinning this work is:

How can the distribution of kindergartens in Stavanger, MA, affect families' physical accessibility and travel behavior with preschool children?

Furthermore, this research has two sub-questions;

What is the role of mothers in escorting children to kindergartens in the Stavanger region?

How does kindergarten location correlate with urban density and the travel behavior of parents?

The first one regards gender roles, and the other is about travel modes and urban density. To be more precise, according to what was discussed in the previous parts about gender roles in parenthood responsibilities, the assumption supports the idea of more share of mothers in parenthood responsibilities to take children to kindergartens. To examine this, five kindergartens in different parts of Stavanger have been chosen, and a survey has been done. The methodology chapter contains detailed information about the procedure of answering to this sub-question.

Regarding travel mode and urban density, it is assumed that there is a correlation between the level of density in the residential buildings and the travel behavior of parents. According to this, in areas with denser residential buildings, parents tend to walk or cycle to reach the kindergartens, but in areas with lower levels of density, driving the car is the first choice of the majority of the parents.

1.5 Layout of the research

As mentioned in this chapter, this research studies accessibility with a time perspective to kindergartens in Stavanger and conduct fieldwork to figure out the share of parenthoods regarding gender role in taking children to the kindergartens.

The second chapter discusses the theoretical framework and the core concepts regarding time, geography, and accessibility. Furthermore, it presents theories and studies regarding the urban structure and different trends related to time geography and accessibility to urban services.

The third chapter explains the methodology approach, including data collection and analysis. In order to analyze the data and test the assumption, two different approaches have been used. For analyzing accessibility, a quantitative method, using GIS software, has been used, and for testing the assumption, a qualitative method, fieldwork, has been conducted. The fourth chapter releases the findings in both analyses. Moreover, the final chapter comes up for the discussion and conclusion.

Chapter Two

Literature Review

2. Literature Review

This chapter presents the core concepts that are used for conducting this research. As mentioned in the previous chapter, the analysis of accessibility in this research is done on a time based agenda. This chapter discusses theories regarding time and its importance in urban life, urban structure and accessibility to urban services.

Ultimately, it is true to say that the 10-minute city concept is one of the inspirational sources for conducting this research, and since it is considering both travel time and urban structure concepts and other aspects, a detailed discussion will be provided for this part besides some critiques regarding this concept.

2.1 core concepts

In this part, core concepts of this research will be discussed. The previous chapter introduced the importance of time in urban life, and this chapter presents some studies that have worked on the concept of utilization in travel time. The following presents the concepts regarding urban structure, accessibility, and the current trends in urban planning that are trying to address the issue of travel time for reaching urban services.

2.1.1 Space-time framework

The space-time or time-geographical framework is a broad and powerful perspective from which to analyze human behavior. Initially developed by Hiigerstrand, this framework focuses on the behavioral possibilities of individuals. By recognizing that individuals must operate within fundamental spatial and temporal constraints on their behavior, the space-time framework can complement a wide variety of approaches to modeling human behavior in addition to aiding the planning and location of activities and infrastructure (Hiigerstrand 1970, Pred 1977)(Miller ,1991).

The space-time prism is one of the focal concepts in time geography, which is a powerful yet neglected approach to analyzing the accessibility of individuals to an environment. With the space-time prism, accessibility can be assessed relative to spatial and temporal constraints on individual behavior. The perspective does not require restrictive behavioral assumptions or adopting a particular behavioral stance-it addresses individuals' behavioral possibilities given some primary constraints. The most valuable

aspect of the space-time prism is that it allows the direct incorporation of considerations of accessibility into locational analysis and transportation planning.

2.1.2 Utilization of travel time

Many transportation policies currently under consideration seek to make significant changes in the relative price of travel in general and the comparable cost of competing modes to alter household travel behavior sustainably (Gunn 1981). In general, "Travel budget" is the amount of time and money individuals allocate to travel. The notion of travel budget plays a leading role in forming individuals' travel behavior, besides some crucial features of individuals, including age, gender, socio-economic status, and household size. For example, according to Goodwin, both time and money expenditures on travel is strongly related to income levels at an aggregate level. Time spent per head increases roughly proportional to disposed income, and money expenditure relatively faster (Goodwin ,1973).

For understanding the travel behavior of individuals, the "Utility theory" will be helpful. Utility theory is based upon the premise of rational choice behavior. Rational choice behavior asserts that a decision-maker can rank possible alternatives in order of personal preference and choose the highest alternative subject to relevant constraints placed on the choice decision (Golob, Beckmann et al. 1981).

The rationale of valuing travel time and money savings is based entirely on the assumption that, when saved, they will be used for some unstated alternative purpose, valued because it brings some utility to the traveler or somebody else, now or in the future. Therefore, the value of time saved is simply a proxy for the utility of time spent in some alternative activity. If time is saved from one journey and the traveler chooses to spend it on another journey, the same logic applies; the value of time saved is now being used as a proxy for the utility of a wider choice of destinations (Goodwin ,1981).

The question here is why utilization does matter? People are assumed to benefit from spending less time on travel to spend more time on some other more beneficial activities in more productive and enjoyable ways. Also, society may benefit by reducing the time spent traveling, either from individuals' benefits or by enabling greater economic productivity (Goodwin ,2019).

Saving on commuting time also saves the urban environment through the reduced emissions from both vehicles and power plants when fuels are extracted and processed (Moreno, Allam et al. 2021).

2.1.3 Compact city

The idea of a compact city is to mix shared civic spaces with concentrated arrangements of structures. It defines a highly organized complex system in which each component supports and is connected to the whole (Salingaros, 2006). Among all of these, a compact city provides more significant opportunities for walking and cycling and is perceived as a pedestrian-friendly city or a walking city, a more equitable alternative to car-led urban sprawl.

A compact city is defined by internal cohesion achieved via a centripetal (center supporting) arrangement, versus a centrifugal (directing away from the center) arrangement. Buildings are connected via a network of paths into clusters. A number of buildings should define a cluster perceived by a pedestrian as accessible (a low-speed setting). By contrast, buildings in suburban sprawl are outward looking and connect to nodes in the far distance, but not to each other (a high-speed setting). There are rarely any local connections in a monofunctional region.

The compact city mixes shared civic spaces with concentrated arrangements of structures. It defines a highly-organized complex system, in which each component supports and is connected to the whole. A city for people consists of buildings of local character and specific function that contribute to the immersive context of their Transect Zone. This is the opposite of modern 'generic' building types, which are strictly utilitarian and connect only to the parking lot. Fixated on fast speed, governments or developers spend much of their money on paving wide roads and vast parking lots, neglecting urban space design. When building a low-speed parking ribbon (described in the following Section), parking costs should be the last priority, thus permitting gravel, and brick/grass surfaces. Such surfaces slow cars down.

2.1.4 Neo-Traditional Development

The neo-traditional development that looks and functions like towns of times past is seen as a possible solution for the crisis of metropolitan areas such as congestion, high housing costs, and air pollution.

Pearson(Pearson, 1990) has found five characteristics that define the neo-traditional concept. First, NTD proposals include a mixed-use core from which most residents live within walking distance or not more than a quarter to a half-mile away. The core generally includes retail and services, as well as residential development. Second, the plans include employment centers so that residents have the opportunity to both live and work within the development. Third, this concept is trying to create a sense of community by focusing on public spaces and civic centers as the project's focal points. Higher densities, and mixed land use, and other design features are seen as a way of recapturing the sense of community that

proponents claim has vanished from typical suburban developments(Handy,1991). Fourth, the designs aim to generate street life by creating pedestrian-friendly environments, narrower streets, wider walks, and more street trees. Finally, the establishment of a sense of tradition, despite their newness; front porches, detached and set-back garages, and granny flats, for instance, are typical design requirements.

The focal aim of this concept is to reduce the need for travel, particularly non-work travel by automobile, in two ways. Handy (Handy,1992) believes that the first source for reaching this goal is a greater internalization of trips. The concentration of activity in the town center will strongly attract residents so that a substantially higher percentage of non-work travel, particularly home-to-shopping trips, will remain within the development. The combination of density and mixed land uses reduces travel demand since residential areas will be closer to needed services, and automobile trips will be shorter and fewer, as walking trips will often replace them. The Neo-traditional development concept claims that most of the needs of daily life can be met within a 3000-4000-acre mixed-use development, so that very few automobile trips would ever hit the collector road.

2.1.5 Accessibility and sustainable mobility

Accessibility refers to people's overall ability to reach desired services and activities (together called opportunities) and the time and money that people and businesses must devote to transportation. Accessibility is the ultimate goal of most transportation planning. Several factors can affect this accessibility, including mobility, proximity, transportation system connectivity, affordability, convenience, and social acceptability.

Since accessibility is the ultimate goal of most transportation activities (except the small amount of travel with no desired destination), transport planning should be based on the accessibility.

It is essential to mention that accessibility-based planning is significant for achieving social equity goals. It recognizes the unique and vital roles walking, bicycling, and public transport play in an efficient and equitable transport system. It recognizes common trade-offs between different modes, such as the tendency of wider roads and higher traffic speeds to degrade pedestrian and bicycle travel conditions, to the detriment of people who cannot, should not, or prefer not to drive. It also recognizes location as an accessibility factor and, therefore, the importance of evaluating where disadvantaged people live and their ability to access essential services and activities such as schools, jobs, affordable grocery stores, and healthcare (Litman, 2017).

Accessibility measures how much stuff (jobs, workers, etc.)someone can reach from a specific point in a given travel time by a particular transport mode to a specific time of day((Levinson 2019). According to Hansen (Hansen,1959), accessibility is an opportunity for an individual to participate in a particular activity or set of actions at a given location.

Accessibility has two dimensions: spatial accessibility and non-spatial accessibility or aspatial accessibility. Spatial accessibility to urban services deals with the geographic distribution of facilities, number of users, and distance between users and services (Luo and Wang 2003).

Moreover, some authors consider more dimensions for accessibility. For example, Khan (Khan 1992), in his article, claimed that access to health care might classify into two dichotomous sizes (potential versus revealed and spatial versus aspatial) into four categories such as potential spatial access, potential aspatial access, revealed spatial access, and revealed spatial access. Regarding accessibility to health care services, revealed accessibility focuses on the actual use of services. In contrast, potential accessibility signifies the probable entry into the health care system but does not ensure the offered services' automatic utilization. Spatial access emphasizes the importance of the spatial/distance variable (as a barrier or a facilitator), whereas aspatial access stresses nongeographic barriers or facilitators, such as social class, income, ethnicity, age, sex, etc (Joseph and Phillips ,1984).

It is essential to mention that accessibility is a tool for measuring two important human life features: equality/equity and quality of life. In terms of accessibility to urban facilities, equality means all the people have the same opportunity to access services; equal distribution of facilities to all people. However, equity considers the distribution of services to people based on their needs. The concept of spatial equity in facility distribution has two categories: horizontal spatial equity and vertical spatial equity. Horizontal spatial equity means equal distribution of facilities among residents regardless of their location or socio-economic condition (Tsou, Hung et al, 2005).

This approach aims to increase equality in terms of access of residents to facilities. In contrast, vertical spatial equity refers to an equitable distribution of facilities over space concerning the user population's needs or demands (Wang and Yaung 2013). Convenient accessibility to urban services plays a leading role in the improvement of quality of life. It helps to achieve the satisfaction of urban residents' basic needs, as it profoundly influences urban residents' participation in particular physical activities (Dempsey, Bramley et al,2011). As a result, poor spatial accessibility to urban facilities can exacerbate residents' quality of life in the affected neighborhoods(Lee and Miller ,2018).

There is another classification of accessibility base on its level; Local versus regional. Local accessibility is primarily determined by nearby activity, mainly oriented to convenience goods, such as supermarkets, drug stores, and small centers. The pattern of local accessibility in a community will be closely associated with the pattern of relatively short and frequent local trips made by residents. On the other hand, regional accessibility is defined concerning sizeable regional shopping centers, which tend to be farther away and offer a wide range of comparison goods (Handy ,1992).

Sustainable mobility; The automobile-dominated mobility systems have huge costs, including lousy health outcomes due to poor air quality and physical inactivity, climate change due to greenhouse gas emissions, depletion of non-renewable resources such as petroleum, high levels of injuries and death due to road trauma, wasted time, and energy due to congestion, and social inequities due to the high costs and capabilities required to own and operate a personal motor vehicle. Because of their high social and environmental costs, automobile-dominated mobility systems are not sustainable: they cannot last over the long run, especially as the world population grows and urbanizes (Ellegård ,2018).

Transitioning to more sustainable mobility systems requires a reorientation of our approaches to transportation systems planning: away from facilitating mobility and towards managing mobility, including shifting people to substitute other forms of interaction for travel, taking shorter trips, and using greener and healthier travel modes such as walking, biking and public transit (Banister, 2008).

According to Banister (2008), there are four transition lines towards sustainability: the first is the reduction of the need to travel; the second is fostering modal shifts towards environmentally friendly modes; the third is the reduction of trip lengths by land-use decisions, and; the fourth is by encouraging better energy efficiency in the transport system. In consequence, the transition towards sustainable mobility is based on policies, subsidies, and investments in infrastructure in favor of public and non-motorized transport, integration of land-use and transport planning, the implementation of compact ad mixed-use land developments to shorten commuting distances, and technological innovations to enable remote access to work and services (Foltýnová, Vejchodská et al,2020).

2.2 The inspirational concept; the 10-Minute City

The concept of 10-minute city or its alternatives (15- and 20-minute city) may be defined as an ideal geography where most human needs and many desires are located within a travel distance of "x" minutes. This concept emphasises different scales of city, thus can be seen to activate different set of policies from hyper local street scale at one end, to the metropolitan scale on the other. From a standpoint, these time-based rhetorics represent distinct areas of focus of these respective cities and give a clue of what cities value or aspire to be. However, a common element binding these 'X' minute urban geographies is the dimension of 'proximity', measured in temporal units rather than conventionally used spatial metrics. Perhaps, its an intended rhetoric to align to the urban citizen's perception of proximity, who use time as a unit to schedule everyday life taking constraints of time and space in consideration (Tarwani,2021).

The details of acceptable distances, average velocities and, respectively, time isochrones are fundamental for operationalising the notions of 20, 15, or 10-minute cities. Kesarovski & and Hernandez(2021) considered different studies to choose acceptable walking and cycling distance for their study to measure accessibility to grocery stores in Stavanger, MA. They believe that exact walking/cycling distances and time range to be considered as a threshold seem to be a contextual question. This acceptability is affected by factors such as the purpose of the trip, if this is a primary or complementary transport mode, the quality of the infrastructure, the weather, and the attractiveness of the area, or if the trip implies carrying things. In large and rather sprawl urban agglomerations, such as cases in North America, researchers seem to utilise the 20-minute city (Da Silva et al., 2020; McNeil, 2011). In large but more compact cities, such as Paris, planners prioritise the 15-minute city (Moreno et al., 2021). While in the Norwegian context, characterised by smaller urban settlements, the thresholds of 15, 10 or even 5 minutes are considered (Øksenholt et al., 2016). The latter group of researchers concludes that 10 minutes should be regarded as the most extensive time isochrone of travelling to urban services if the aim is to facilitate a high share of pedestrians and cyclists. In addition, according to the Norwegian travel survey from 2014, most people (68%) walk for trips shorter than 1 km (approx. 12 minutes), while the percentage drops significantly for longer distances (Hjorthol et al., 2014). The shares regarding cycling follow a similar trend, particularly for trips under 3 km (approx. 12 minutes). Although cycling represents only 7% of the daily travels within 3 km, 54% of all bike trips are executed within this distance; for longer distances, this percentage drops (Hjorthol et al., 2014). According to this facts, the 10-minute isochrone has been chosen for measuring accessibility to kindergartens in the Stavanger metropolitan area.

The x-minute city is not a new trend in urban planning, and its trace goes back to some relevant concepts such as transportation accessibility and time geography. The components of this concepts are accessibility and transportation, proximity-based strategy and sustainability which will be discussed in the following. The emphasis on **Accessibility and Proximity** advanced in the 10-,15-,20-minute city concept is paramount since this mode (micro-mobility) has been showcased to have numerous benefits on social, economic, and environmental scales. For instance, cities benefit from reduced congestion, reduced pollution (noise, emissions, and others), and benefit from increased green spaces and well-thought and ordered structures. On the same note, urban residents derive health and economic benefits. They also benefit from increased time and opportunities to exercise and gain social interactions (Moreno, Allam et al,2021). This concept is chasing sustainability in different forms, including environmental and social, and trying to reach SDG's 11 [1] and is considered as an indicator of the smart city.

Moreover, for reaching sustainability, the usage of technologies plays a leading role. Thus it is novel, especially in ensuring that alternative solutions align with the tenets of the SDG 11-are available in diverse areas, including that of the transport sector to repair cities from the decades of fractured car-driven policies left as a legacy. For instance, with AI [2], IoT [3], and Big Data, technologies such as bike-sharing, online shopping, car sharing, and drone delivery services, amongst others, are on the rise in different cities. Such services are geared to ensure that people are safe and on time by eliminating the need to travel to purchase different items, and where they have to travel, the use of bicycles or walking ensures they experience no traffic and can safe on costs that would have gone to autos. However, technology here should be about removing the need to access and engage in the primary activities necessary to sustain an urban life and aid -through policies to ensure that a high quality of life is achieved.

According to Stanley (Stanley and Stanley, 2014), The 20-minute city will benefit from improved accessibility, which will lead to other benefits, such as facilitating a sense of place and a stronger local community, growth in social capital, and other health and wellbeing benefits from more active and included lifestyles. These outcomes can be further enhanced by attention to affordable housing, good urban design and architecture, safe living, managing noise and pollution, and providing local opportunities to engage with nature, open space for children, and recreational activities.

[1] . Sustainable development goal 11 is sustainable cities and communities. The suggested way to reach this goal is to make cities and human settlements inclusive, safe, resilient, and sustainable.
[2] . Artificial intelligence
[3] . Internet of Things

Sustainability of community will be possible through equal access to facilities and opportunities, local social interaction, participation in local community activities, community stability, pride of place, a sense of belonging, and feeling safe and secure. The notion of inclusiveness refers to essential urban services and amenities that include access to quality affordable housing, mobility infrastructure for all ages and abilities, affordable transportation options, equal employment, education opportunities, and the right to lead a healthy life(Pozoukidou and Chatziyiannaki, 2021).

In terms of environmental sustainability, within a 15-minute city context, it is expected that cars' usage will be decreased. Consequently, greenhouse gas emissions will reduce, and residents can enjoy living in a healthier environment. Furthermore, they will be at lower exposure to health risks regarding air and noise pollution.

In conclusion, it is important to mention that some critiques on the x-minute city concept are worthy to mention. For example, according to Jay pitter, at the CityLab conference 2021, The core principles behind the 15-minute city aren’t new to urban planning. They derive from an old history of designing cities around people rather than cars, and many European cities that were planned before the invention of the automobile are better suited to this notion. But the idea that has been popularized during the pandemic is that all cities including European ones must center future planning on the goal of ensuring car - free access to basic necessities, such as health care, schools, employment and food. It’s a lofty goal, but unlikely to reach all neighborhoods in many cities without drastic interventions and investments. Pitter warns that simply injecting design changes such as bike lanes and parklets into a neighborhood will not reverse segregation that has been embedded into city planning.

Furthermore, she added that we have to have a spectrum approach here and think incrementally, taking an approach that is very hyper-local. So, what is interesting about the 15-minute city approach is that it claims to be hyper-local, but it doesn't acknowledge the hyper-local context of different cities in different places. It doesn't take into account the histories of urban inequity, intentionally imposed by technocratic and colonial planning approaches, such as segregated neighborhoods, deep amenity inequity and discriminatory policing of our public spaces.

2.3 state of the art; an overview of similar studies

This part reviews some research papers with the same goal of assessing the accessibility of kindergartens and schools.

In their study, Chen and his colleagues (Chen et al,2021) examine accessibility to kindergartens by considering both types of school trips. The basic two-step floating catchment area method is used to measure the accessibility of “Home School” trips, and the computer-based two-step floating catchment area is used for “Home–School–Work” trips. This study proposes a spectrum combinational approach, which combines both types of trips according to their actual percentages, to provide a realistic assessment of accessibility to kindergartens. An empirical study is conducted in Shanghai by combining cellphone big data and traditional data from a census. Results indicate that compared with the spectrum combinational approach, the inequality of accessibility would be underestimated if we only focus on “Home–School” trips in the measurement of accessibility, but overestimated if we only focus on “Home–School–Work” trips. By modifying the trip assumptions on which accessibility evaluation is based, the proposed spectrum combinational approach constitutes a novel and more realistic accessibility measurement of spatial accessibility to kindergartens.

In another study, the authors (Kim & Wang, 2019) tried to analyze spatial accessibility to public daycare and kindergartens in Seoul, South Korea, using a two-step floating catchment area model at a 100 m _ 100 m cell level. A GIS-automated regionalization method, Mixed-Level Regionalization (MLR), divides the study area into homogenous regions based on a concentrated disadvantage index (CDI). The analysis then proceeds to examine the disparity of public daycares and kindergartens accessibility across these constructed regions; this is an important factor for choosing daycare services fo parents because the distance from services does matter for them.

Bulti et al. (2019) evaluated spatial distribution and accessibility to primary schools in Bishoftu town. The significant feature in this study is that the authors try to find the patterns of distribution of primary schools and by that evaluate the level of accessibility to these facilities.The result reveals that primary schools in Bishoftu town are distributed unevenly across all Kebeles indicating inequality of the service provision between neighbors. Further, the overall spatial distribution of the schools exhibited in a clustered pattern. Considering population is an important element in this study to analyze accessibility in terms of population coverage, besides geographical accessibility.

The distinctive feature of this thesis with the mentioned studies is having an objective perspective in studying people's travel behaviors. The researchers tried to understand people's travel behaviors in the previous studies by using surveys and questionnaires or social media to collect the data. These kinds of data are considered self-reported data, but this thesis has chosen an alternative for data collection and reporting travel behaviors of people. The author performed an observation for each case study in different times of the day and in different seasons(summer and winter) to collect data regarding travel behaviors.

Chapter Three

Methodology

3. Methodology

This chapter explains various methodologies used in gathering data and analysis relevant to the research and are the correct option for answering the research question and examining the assumption.

This thesis has a spatial analytical perspective to evaluate geographical accessibility to kindergartens at the neighborhood level in the region of Stavanger in Norway. The evaluation of accessibility is place-based, which serves as a characteristic of a place, with the coverage approach. In the coverage approach, coverage is sometimes referred to as the "cumulative opportunities" of a given location; one counts the number of facilities within a given spatial unit or range (Talen, 2003). There are two main factors for this measurement, including types of travel and the origin of the measurement. Pedestrians and cycle paths are for the first, and kindergartens are for the other. Besides this quantitative research approach, in order to examine the research assumption.

3.1 Case Study and Data Collection

In this research, the region of Stavanger in Norway and it's all 320 kindergartens, have been considered. The initial target group for this analysis is children less than five years old who are potential users of kindergartens. It is essential to mention that the children population used for the study is grasped from census data, and in this type of data, the population has been divided into 19 age groups, starting from 0-4 and ending with plus 90 years old. As the second age group, 5-9 years old, mainly consists of children who attend the schools, the five-year-old age was omitted in this analysis. Because if the second age group had been considered in the study, the results would not be precise.

The data sources for conducting the analyses are Statistics Norway[4]and George[5], in which data regarding population, based on census data, networks of mobility routes, location of kindergartens within some practical information, map of the region of Stavanger with all its municipalities, and finally all the building blocks within this region have been used. All these used data will be updated in 2020 by the reference websites mentioned before.

Furthermore, five kindergartens have been chosen for conducting the fieldwork to examine the assumption regarding gender role in parenthood responsibilities for taking children to kindergartens in the Stavanger region.

[4] . SSB.no
[5] . Geonorge.no

3.2 Data analyzing steps

3.2.1 Network Analysis and Creation of Network Dataset

For calculating accessibility to kindergartens in terms of distance and travel time, the "Network analysis" technique and its measures, including service area in Arc GIS, have been used. A network data source is an intelligent model of the road system. It contains the location and attributes of roads and information about how roads relate to one another, such as which roads are connected, which turns between connected roads are allowed or prohibited, and other information that affects the possible travel paths and how long travel takes. The service area solver references the network data source to determine which roads can be reached in a given time to create travel-time areas. Service areas created by Network Analysts also help evaluate accessibility. Concentric service areas show how accessibility varies with impedance. Once service areas are created, it is possible to identify how much land, how many people, or how much of anything else is within the neighborhood or region.

A network is a system of interconnected elements, such as edges (lines) and connecting junctions (points), representing possible routes from one location to another. People, resources, and goods travel along with networks: cars and trucks travel on roads, airliners fly on predetermined flight paths, oil flows in pipelines. By modeling potential travel paths with a network, it is possible to perform analyses related to the movement of the oil, trucks, or other agents on the network.

Network analyses can answer a range of questions related to linear networks such as roads, railways, rivers, facilities, and utilities. This spatial analysis technique uses network data (usually linear features such as roads, footpaths) to calculate distances between points or nodes on the network. This approach underpins the satellite navigation systems found in many cars. Typical applications are route finding, route planning, identifying the closest facility by travel time or distance, calculating service areas (e.g., areas within 10 minutes' walk of a bus stop). There are various ways of parameterizing the analysis based on typical road speeds, blockages, and minimizing the use of smaller or remote parts of the network depending on the task (Comber, Brunsdon et al. 2008).

For performing a network analysis, a network dataset is needed. Therefore, the first step is the creation of a network dataset layer in ArcMap or Arc Catalog. The network dataset in this research has been made through mobility network routes in the region of Stavanger. Network analyses are done based on a network dataset that is built by using transportation routes. In ArcMap, a network dataset must be added

first so that when an analysis layer is created, the network analyst can bind the analysis layer to the network dataset.

3.2.2 Creation of Service Area

After building a network dataset, the next step is making a service area layer that aims to create a series of polygons representing the distance that can be reached from a facility within a specified amount of time. A network service area is a region that encompasses all streets that can be accessed within a given distance or travel time from one or more facilities. For instance, the 10-minute service area for a facility includes all the streets that can be reached within 10 minutes. Service areas are commonly used to visualize and measure accessibility. For example, a three-minute drive-time polygon around a grocery store can determine which residents can reach the store within three minutes and are more likely to shop there. The service area could be a jurisdictional boundary or a radius of a given distance around a facility(Hass, 2009).

The initial step for creating a service area in the network analysis process is adding facilities as points to the network dataset, which was built based on the walking and cycling paths in the region of Stavanger.For doing so, all the 392 kindergartens in the case study have been added, and then in the next step, the parameters of the analysis are defined. As mentioned, this research aims to analyze accessibility by walk and cycling, so in this step, the travel mode for the calculation of service area is set as walking and cycling, and also E-biking . Furthermore, the unit of travel time is set based on the seconds to get a more precise result; in this section, three travel modes have been added, including walking ,cycling by standard bike ,and cycling with E-bike. Since this study is trying to analyses accessibility to kindergartens within 10 minutes, the travel time for each mode of transport is considered as 600 seconds. By defining three different travel modes, three service area polygons will be calculated and each will provide different results based on the coverage level for built area and population.

As this analysis is trying to study accessibility to kindergarten, it is necessary to consider the population, especially the target group, children between 0-4 years old. Consequently, the service area polygons have been joined with the census data and residential building blocks. Each service area polygon provides a set of useful information that help to perform the analyses and find some correlations with these data. These data include how many of the population, children in specific, are within each service area that have accessibility to each kindergarten. Moreover, it shows how much space and residential built up area can be covered by each service area. In this regard, some indexes include, population density, dwelling density

per hectare (DW/ha), floor area ratio (FAR), floor area ratio for residential use (FAR re), gross floor area per capita (GFAp), gross floor residential built-up area (GFAre) will be calculated.

Table 4: Idexes for calculating some features in population and the built area

Index	**Description**
Population density	The indicator is calculated by the number of residents per unit area. It is pre-dominantly calculated in people per hectare and in “gross densities”.
DWd/ha Dwelling density per hectare	This indicator is one of the most frequently used measures employed in urban planning. It is calculated via dwellings per hectare within a certain area in either “gross” or “net densities”. DWd=(Dw/A)*10000
FAR Floor area ratio	The indicator represents the ratio between the gross floor area (GFA) and the base land area (A) of aggregation. FAR is also called Floor Space Ratio, Floor Space Index, Site Ratio or Plot Ratio. FAR=GFA/A(area)
FARre Floor area ratio for residential use	This index is calculated through the same logic as FAR, but onlythe floor built-up area for residential use is considered a numerator.
GFA Gross floor built-up area	This indicator draws the relationship between built-up area for specific purpose (residential, commercial, or other use) and the demographic characteristics for the aggregation of a certain base land area.
GFAre Gross residential built-up area	the residential GFA per capita is, perhaps, the most used indicator of this type. It has been defined as ‘internal density’.

3.3 Observation on the selected kindergartens

In the introduction chapter, there is a sub-question regarding gender role in parents' responsibilities toward taking children to the kindergartens. According to that,mothers have the dominant role in taking children to kindergartens and bringing them back home.To answer this question, five kindergartens in different parts of Stavanger region have been chosen for conducting the observation. The criteria for selecting these kindergartens are mainly based on the location of kindergartens and the density of residential buildings. Besides that, the percentage of the population of children has been considered in the selection procedure. At the final stage, one more criterion has been considered for the selection of these kindergartens, and it was the number of entrance doors for each of these places since it is logical to observe kindergartens with an entrance door to get a precise result.

After doing the observation for each case study, the results will be considered to find any probable correlations with the mentioned criteria. Regarding density of residential buildings, there is a sub-research question regarding correlation between the mode of travel and the level of density in residential buildings. In chapter four, the results including, maps and tables will provide some evidences to examine this correlation.

In addition, as the capacity of each kindergarten in terms of how many children they can provide service is available, it provides a good opportunity to compare these numbers with the number of children in each service area polygone. This comparison provide usefull information regarding the fact that weather the capacity of each kindergarten is able to provide service to the majority of children who live near to it or not.

It is important to mention that the observation for each kindergarten have been done in two different seasons, summer and winter, to compare the situations in terms of travel modes preferences and also the gender roles in each season. Furthermore, it was necessary to do the observation twice for each kindergarten, once in the morning (from 7 to 9:30), while children come to the kindergartens and the afternoon (from 3 to 5:30) when they want to come back home. Table 3 shows the information needed to examine the assumption through observation.

Table 5: The required data for observation

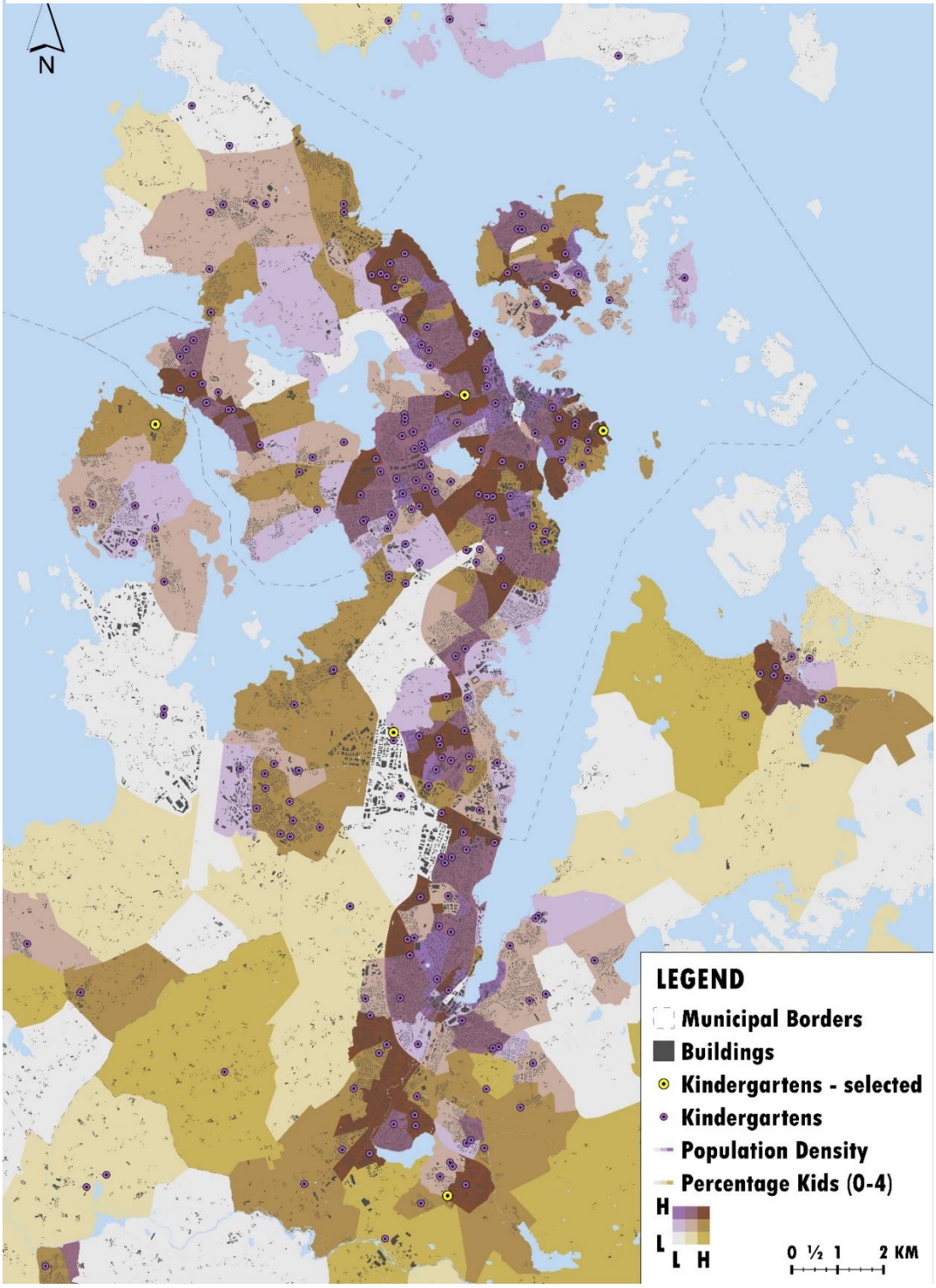
Row	child's age	Who takes the child					Means of transport;By				weather condition		
		Mother	Father	Grand mother	Ground father	Other	walk	bicycle	car	Bus	Sunny	Rainy	Cloudy

In this table, the most critical data for the observer is the gender of parents who bring children and take them from kindergartens and, means of transport they are using. The others are not considered independent variables; they have indirect effects on travel mode preferences. For example, the child's age can affects the travel mode preference of parents; it is supposed that the younger the child, the higher the possibility of using the car is among parents. It is important to mention that child's ages are not precise; they have been recorded based on the guesses of the observer. There is the same assumption for the correlation between the condition of weather and travel mode preferences. This observation tries to figure out whether there is any meaningful correlation between weather conditions and means of transport usage.3.4.1 Selection of kindergartens

For choosing kindergartens to observe, two main criteria are considered: the density of residential buildings and the children's population (0-4 years old). Concerning the density of residential buildings, the city of Stavanger and its surroundings have been divided into five categories with the highest and lowest density level. After this step, the percentage of children's population overlay with the map of the density of residential buildings, and the selection process for kindergartens started. The final criteria for choosing the kindergartens was having one entrance door or at least close doors together to make observation possible. There are 320 kindergartens in the region of Stavanger and with consideration of the mentioned criteria, five kindergartens in the municipalities of Stavanger, Sola, and Sandness have been selected for doing the observation. Map 1 illustrates the location of all kindergartens in the region of Stavanger with population density, percentage of children, and distribution of residential buildings. According to the map, majority of the kindergartens are located in the area with higher density of population and percentage of children. The yellow circles represent the selected kindergarten that are located in different area in terms of density level in residential buildings. In the finding chapter, the detailed information regarding each of these five kindergartens will be discussed.

Perhaps add something on whether the shape of Stavanger (which is quite fragmented) changes anything in the analysis and whether the conclusions may be worth for cities with simpler shapes.

Figure2: The selected kindergartens



Source: Author

Chapter Four

Findings

4. Findings

This chapter presents the analysis results regarding accessibility to kindergartens and observation on the share of parenthood responsibilities in the Stavanger metropolitan area. Also, it presents the facts about travel mode preferences among parents for taking their children to kindergartens. As mentioned in the methodology chapter, the analysis of accessibility is done for all the kindergartens (320) , and the observation is done on five selected kindergartens.

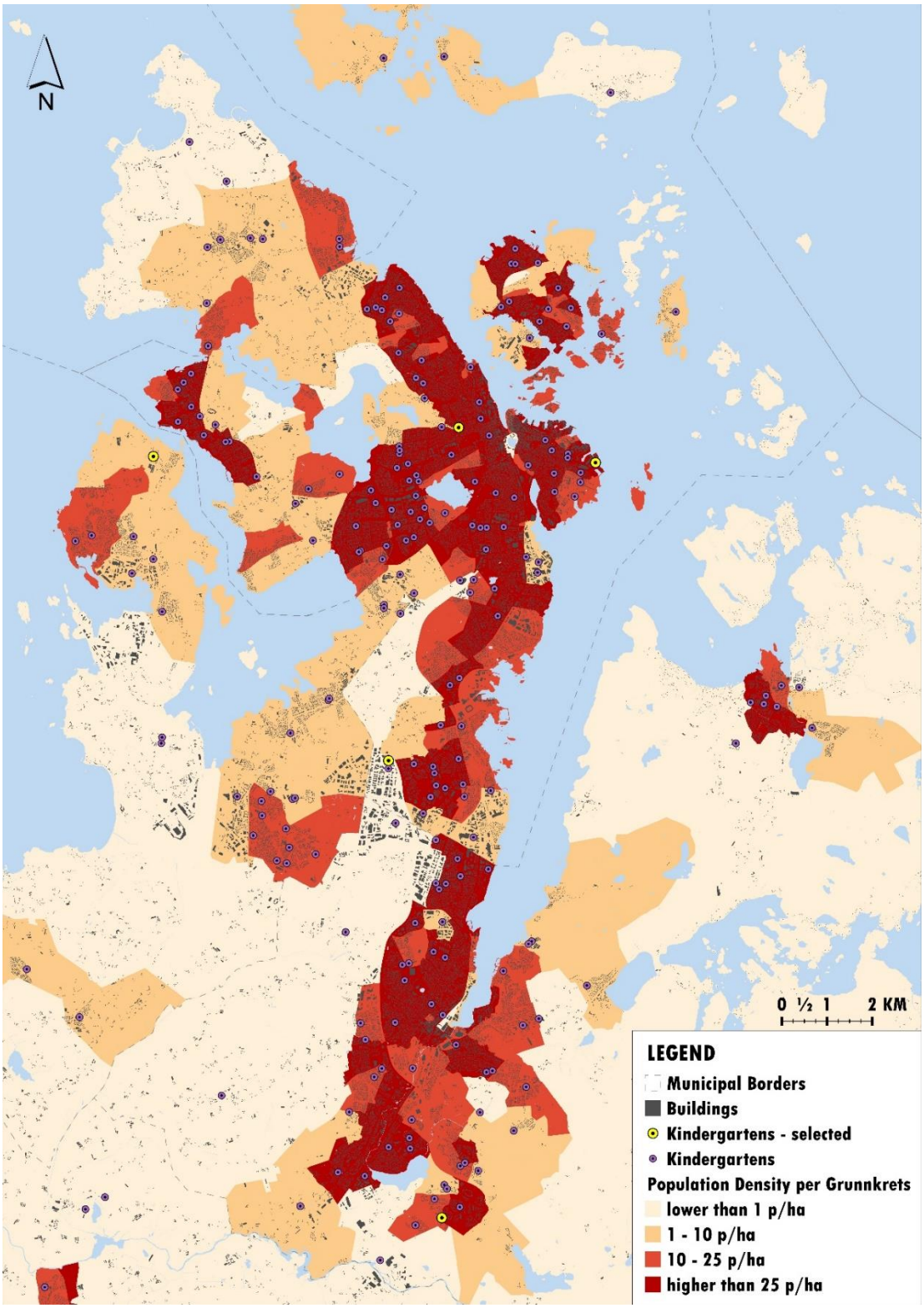
4.1 Condition of accessibility to kindergartens in Stavanger

This section reveals the outcomes of analyses regarding accessibility to kindergartens in the Stavanger metropolitan area. These include a map of the distribution of all kindergartens and population density, a map of the service area for each kindergarten divided by different travel modes, the number of the population who have access to each kindergarten in each service area polygon, and spatial coverage of each service area polygon. Also, the results regarding population provide helpful information for comparing the actual capacity of each kindergarten and the number of children living in each service area. This information reveals whether each kindergarten can cover all the children population in each service area or not. In the following, the detailed results will be discussed with maps and tables.

Figure 3 represents the density of population per grunnkerets [6] and the distribution of kindergartens and buildings in the Stavanger metropolitan area. According to this map, there is a positive correlation between population density and the pattern of distribution of kindergartens. The areas in red color, Figure 3, have the highest level of density in terms of population and building blocks, and as the map shows, most of the kindergartens are located in these areas.

[6] . Basic statistical unit in Norway

Figure 3*:* Population density and distribution of kindergartens in Stavanger MA



Source: Author

Table 6 results from network analyses for all the created service areas showing spatial coverage and servicing a population of 10 minutes away from kindergartens. As there are three different travel modes, including walking, cycling, and E-cycling, the coverage levels are different. In the walking mode, 81.3% of the population have accessibility to the kindergarten with a speed of 5 km/h. Reasonably with other travel modes, the coverage levels are higher since the speed of travel increases and can cover more area and population. For example, 96.3 % of the population by cycling mode, and in E-cycling, 97.4% of all the population have accessibility to kindergartens. The interesting point is that the coverage level (population) for these two travel modes slightly differs. Concerning spatial area coverage, as the travel mode changes and its speed increases, it covers a more extensive area and more residential floor area.

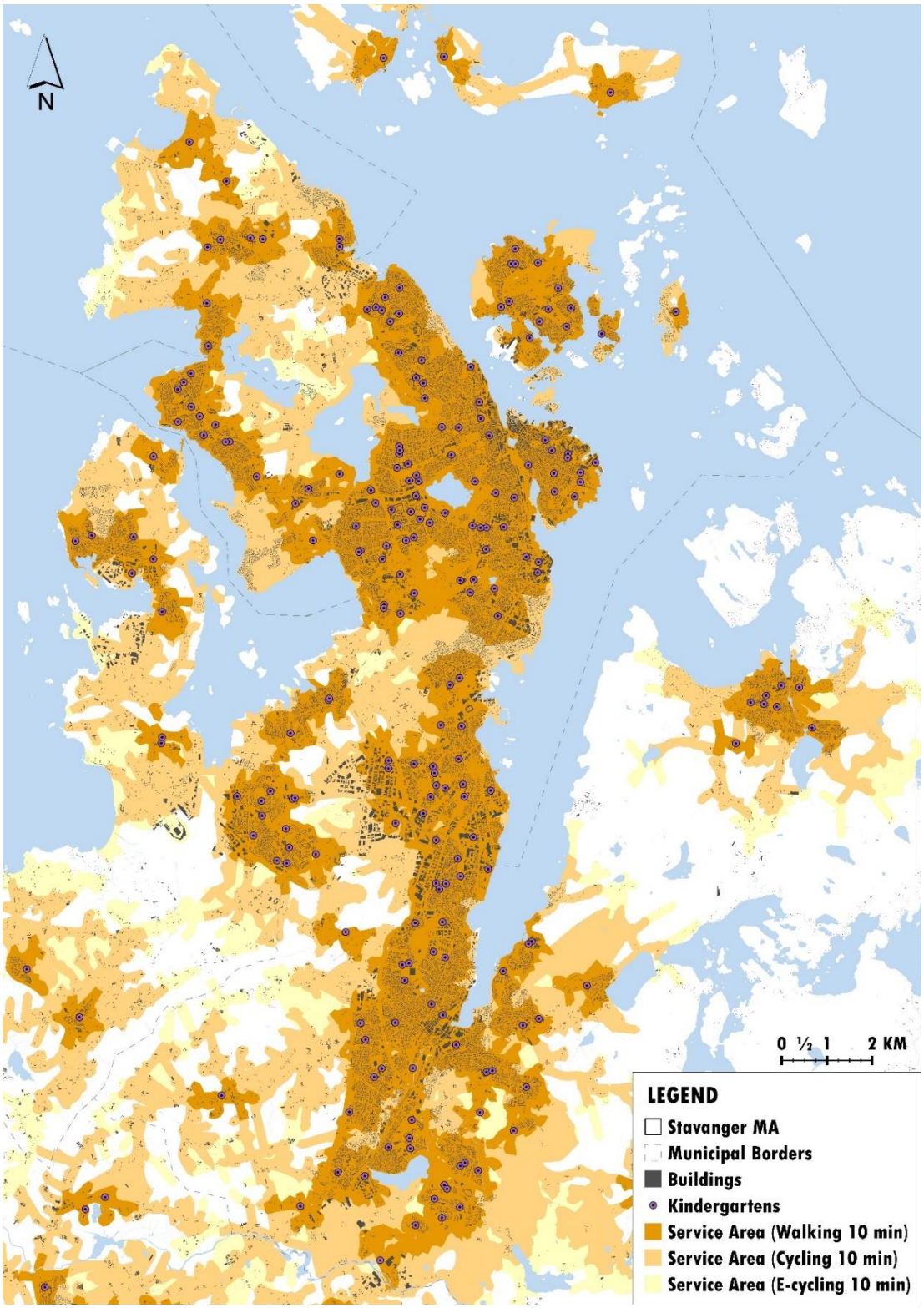
Table 6. . Spatial coverage and serviced population of 10-minute time isochrons away from kindergartens within Stavanger MA.

MOBILITY MODES (10 MINUTES ISOCHRONS)	SPATIAL AREA COVERAGE		RESIDENTIAL FLOOR AREA		POPULATION		CHILDREN (0-4)	
	Area covered (ha)	% of total	Area covered (ha)	% of total	People serviced	% of total	Kids serviced	% of total
Walking (5 km/h)	14 362	5.5%	1 527	80.2%	279 628	81.3%	18 023	82.3%
Cycling (15 km/h)	37 026	14.2%	1 811	95.1%	328 866	95.6%	21 086	96.3%
E-cycling (20 km/h)	46 035	17.6%	1 835	96.4%	333 243	96.9%	21 332	97.4%

Source: Author

Figure 4 illustrates the outcome of network analysis that presents all the service areas divided into three different travel modes and are shown separately with specific colors. As the map shows, many of the polygons for ten minutes walk service area overlap, and it improves accessibility to kindergartens for the children population and their parents. This overlap is more visible in the area with denser building blocks.

Figure4: Service area (10 minutes) for kindergartens for three different travel modes in Stavanger, MA.



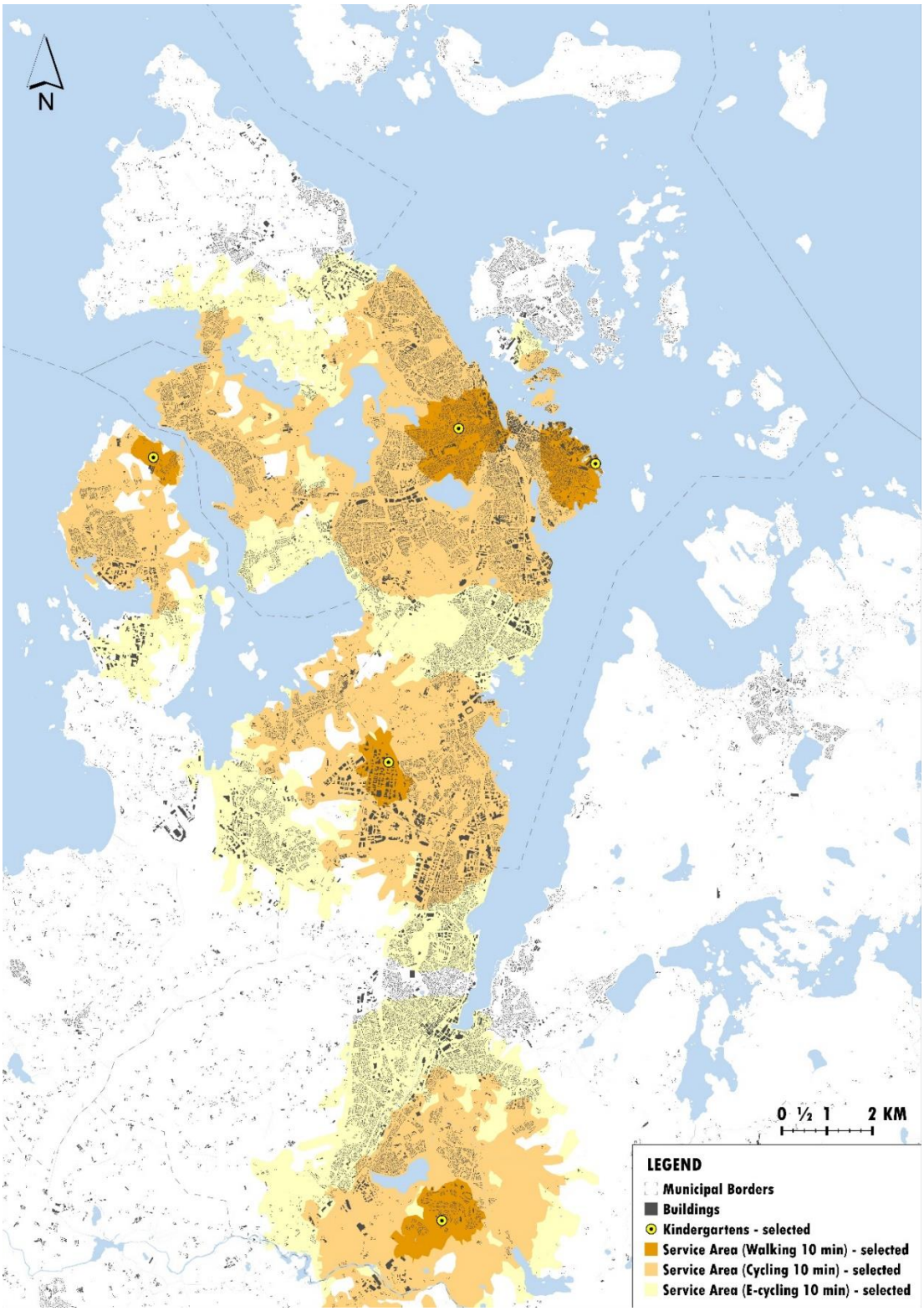
Source: Author

4.2 The results of observations and network analysis on the selected kindergartens

In the introduction chapter, one of the research question was about the share of parenthood responsibilities in taking children to kindergarten and returning them back home.To examine this, five kindergartens have been selected, and the observation process has been done to find out the result. The following part presents the result of observation for each kindergarten. It is essential to mention that the first kindergarten is located in an area with the lowest density in residential building blocks and the following kindergartens have higher density in residential building blocks, respectively.

In addition, the network analysis is done for these five kindergartens to study the coverage level and some built environment parameters that are explained in the methodology chapter. One of the aims of doing this analysis in this section is to figure out the accessibility of population to kindergartens by comparing the present population in each service area polygon and the capacity of each kindergarten.

Figure 5: Service area (10 minutes) for the selected kindergartens for three different travel modes in Stavanger, MA



Source: Author

4.2.1 First kindergarten with the lowest density in residential buildings; “Forus private barnehage”

As mentioned before, the observation was done twice in Sumer 2021 and winter 2022 to find any differences in travel mode preferences because of the weather condition. Furthermore, as it is important to observe both entering and existing of the children the observation took place twice in each day. First in the opening time (7:00 to 7:30 a.m) and then again two or one and half hours before closing time (that was at 16:30 to 17:00).

The first kindergarten is located in the Forus area in the south of Stavanger city, mainly known as an industrial part with numerous companies and offices. Concerning this issue, the density of residential buildings is at the lowest level and it directly affects travel mode preferences by parents. Tables 4 and 5 show the result of observation for this kindergarten. As table 4 shows, the share of mothers is higher than fathers in three observation, except one observation in which the number of fathers who take their children from kindergarten is higher . Moreover, as was expected, since this area has the lowest level in the density of residential buildings almost all the parents prefer to use the car to reach the kindergarten, and there is only one case who uses the bus.

Table 7: The results of observation for “Forus private barnehage”

Total	Mother's share		Father's share		Means of transport								Time	Date
	Quantity	percentage	Quantity	percentage	walk		bicycle		car		bus			
61	32	52%	27	44%	0	0%	0	0%	61	100%	0	0%	Morning	June21 ,2021
42	15	36%	25	60%	0	0%	1	2%	40	95%	1	2%	Afternoon	June21 ,2021
57	29	51%	28	49%	0	0%	0	0%	56	98%	1	2%	Morning	Feb8, 2022
62	38	61%	24	39%	0	0%	4	6%	57	92%	1	2%	Afternoon	Feb8, 2022

Source: Author

Concerning coverage level and serviced population by Forus private kindergarten, the result of analysis shows that according to the capacity of this kindergarten, 90 children, and the number of residents within the first service area polygon (walking) that are 44 , the residets who are living in this polygone have well accessibility by ten minutes walk to the kindergartens. As the travel mode changes, the coverage level increases both in terms of population and the area.

Table 8: Coverage and serviced population of 10-minute time isochrons away from "Forus Private Barnehage"

FORUS PRIVATE BARNEGAGE (10 MINUTES ISOCHRONS)	SPATIAL COVERAGE	KINDERGARTEN CAPACITIES		POPULATION		
	Area covered (ha)	Forus private barnehage	Other kindergartens within range	Residents within range	% of kids (0-4)	Population density within range (POP/ha)
Walking (5 km/h)	84.7	90	0 (1)	44	4.42%	0.52
Cycling (15 km/h)	834.8	90	508 (11)	7 693	6.29%	9.22
E-cycling (20 km/h)	1 558.8	90	1 569 (21)	1 835	6.48%	11.62

Source: Author

The methodology chapter mentioned that it could be a correlation between the density of residential buildings and the travel mode of parents for taking their children to the kindergartens. Table 9 presents the built environment parameters that provide information regarding the density of residential buildings and dwellings, and by comparing this information with the results regarding travel mode, this correlation can be tested. In this regard, gross residential built-up area, floor area ratio for residential use, and dwelling density show a low-density level within service area polygons, specifically, the first polygon for walking. On the other hand, the observation result shows that more than 95 percent of parents use their car to take their children to kindergarten and return them. These data prove a positive correlation between the travel mode of parents and the density of the surrounding area in terms of residential buildings and population. It means in the area with a low level of density, driving by car for reaching the kindergarten is the dominant travel mode.

Table 9: Built environment parameters within 10-mintes time isochrons away from " Forus private barnehage"

Forus private barnegage(10 minutes Isochrons)	Built-up floor area		Residential floor area		Dwellings	
	Gross Floor Built-Up Area (GFA) covered -m2	Floor Area Ratio (FAR)	Gross Residential Built-Up Area (GFAre) covered – m2	Floor Area Ratio for residential use (FARre)	Gross number of dwellings within range	Dwellings density within range (DW/ha)
Walking (5 km/h)	247 812	0.29	2 275 (0.9%)	0.002	14 (3.15)	0.17
Cycling (15 km/h)	2 061 906	0.25	465 912 (22.60%)	0.06	3 109 (2.61)	3.72
E-cycling (20 km/h)	3 396 619	0.21	1 142 990 (33.65%)	0.07	7 414 (2.54)	4.76

Source: Author

4.2.2 Result of observation for the second kindergarten: Læringsverkstedet barnehage Avd Jåsund

This kindergarten is located in the Sola municipality, and in terms of density in residential buildings, it is considered medium to low density. In terms of gender role in escorting children, the share of parents is almost the same, but the number of fathers is slightly higher than mothers. The only exception is seen in the summer observation in the afternoon when the number of mothers (77%) are significantly higher than fathers (23%). As expected, since this neighborhood is not located in an area with dense residential buildings, most parents , more than 70% of them, use their cars to take their children to the kindergarten and bring them back home. After car, walking with 19 %, is standing in the second position for travel mode by parents. But the interesting point is about increase in share of walk in winter in comparison to the summer. According to table 10, the number of parents and their children who chosed walking for home to kindergarten or kindergarten to home trip has been increased in winter; forexample the numbers for the afternoon time in winter is twice of the summer.

Table 10: Results of observation in " Læringsverkstedet barnehage Avd Jåsund"

Total	Mother's share		Father's share		Means of transport								Time	Date
	Quantity	percentage	Quantity	percentage	walk		bicycle		car		bus			
52	25	48%	27	52%	10	19%	1	2%	40	77%	1	2%	Morning	Aug18, 2021
22	17	77%	5	23%	3	14%	0	0%	19	86%	0	0%	Afternoon	Aug18, 2021
51	23	45%	28	55%	11	22%	1	2%	39	76%	0	0%	Morning	Feb 7, 2022
30	14	47%	16	53%	9	30%	0	0%	21	70%	0	0%	Afternoon	Feb 7, 2022

Source: Author

The accessibility to this kindergarten in terms of population coverage is considered a well accessible place for children, especially those living in the first service area polygon. In total, 757 residents live in this polygon, including 13.41% of children between 0 to 4 years old. The number of children is almost equal to the kindergarten capacity that is 109.

Table11: Coverage and serviced population of 10-minute time isochrons away from "Læringsverkstedet barnehage Avd Jåsund".

Læringsverkstedet barnehage Avd Jåsund (10 MINUTES ISOCHRONS)	***SPATIAL COVERAGE***	***KINDERGARTEN CAPACITIES***		***POPULATION***		
	Area covered (ha)	***Læringsvst. barnehage Avd Jåsund***	***Other kindergartens within range***	***Residents within range***	***% of kids (0-4)***	***Population density within range (POP/ha)***
Walking (5 km/h)	*64.2*	*109*	*0 (1)*	*757*	*13.41%*	*11.80*
Cycling (15 km/h)	*461.8*	*109*	*450 (8)*	*7 263*	*7.41%*	*15.73*
E-cycling (20 km/h)	*887.6*	*109*	*624 (13)*	*14 431*	*6.61%*	*16.26*

Source: Author

Regarding the correlation between density level and travel mode, the results do not support a positive correlation between these factors in analyzing this kindergarten since the dominant travel mode by parents is using the car with more than 77%. However, the density level in this polygon is pretty high, reefing to the GFAre that is 82.46%.

Table 12 Built environment parameters within 10-minute time isochrons away from "Læringsverkstedet barnehage Avd Jåsund".

Læringsverkstedet barnehage Avd Jåsund (10 MINUTES ISOCHRONS)	Built-up floor aea		RESIDENTIAL FLOOR AREA		DWELLINGS	
	Gross Floor Built-Up Area (GFA) covered	Floor Area Ratio (FAR)	Gross Residential Built-Up Area (GFAre) covered	Floor Area Ratio for residential use (FARre)	Gross Number of Dwellings	Dwellings Density per hectare (DW/ha)
Walking (5 km/h)	53 364	0.08	44 004 (82.46%)	0.07	345 (2.20)	5.37
Cycling (15 km/h)	567 406	0.12	445 044 (22.60%)	0.10	2 905 (2.52)	6.29
E-cycling (20 km/h)	3 396 619	0.21	1 142 990 (33.65%)	0.07	7 414 (2.54)	4.76

Source: Author

4.2.3 Result of observation for the third kindergarten: Kreativ barnehage Bogafjell

This kindergarten is located in Sandness municipality, and the neighborhood has a medium-density in residential buildings and has between 4 to 8 percent of children under four years old. As table 13 shows, in all observation sessions , the number of mothers is almost twice that of fathers. Among all of these parents, more than 61% of them have used cars for their travel, and the number of parents who chose walking for home – kindergarten or kindergarten – home trip has been incrased from summer to winter.

Table 13: Results of observation in" Kreativ barnehage Bogafjell"

Total	Mother's share		Father's share		Means of transport								Time	Date
	Quantity	percentage	Quantity	percentage	walk		bicycle		car		bus			
69	42	61%	27	39%	7	10%	9	13%	53	77%	0	0	Morning	June22, 2021
43	26	60%	15	35%	8	19%	2	5%	33	77%	0	0	Afternoon	June22, 2021
38	21	55%	15	39%	7	18%	3	8%	27	71%	0	0%	Morning	Feb,10, 2022
33	20	61%	13	39%	8	24%	4	12%	20	61%	0	0%	Afternoon	Feb,10, 2022

Source: Author

For analyzing the accessibility of the population to the kindergarten, besides comparing the capacity of each kindergarten with the number of children living in each service area polygon, there is another valuable data. It is the number of other kindergartens within the range of the kindergarten that has been observed. By knowing the capacity of other kindergartens in each service area polygon, the analysis of accessibility will be more precise since the amount of all actual capacity with the number of children living in each service area will be compared.

Table 14: Coverage and serviced population of 10-minute time isochrons away from "Kreativ barnehage Bogafjell"

Kreativ barnehage Bogafjell (10 MINUTES ISOCHRONS)	*SPATIAL COVERAGE*	*KINDERGARTEN CAPACITIES*		*POPULATION*		
	Area covered (ha)	*Kreativ barnehage Bogafjell*	*Other kindergartens within range*	*Residents within range*	*% of kids (0-4)*	*Population density within range (POP/ha)*
Walking (5 km/h)	*104.0*	*81*	*235 (3)*	*2 092*	*10.37%*	*20.11*
Cycling (15 km/h)	*778.7*	*81*	*563 (9)*	*7 306*	*9.32%*	*9.38*
E-cycling (20 km/h)	*1 337.9*	*81*	*1 032 (14)*	*10 494*	*9.42%*	*7.84*

Source: Author

The results in table 15, especially the GFAre index, present relatively high density in all the service area polygons. Based on the results of table 13 , more than 61 % of the parents are using the car and walking and cycling are second or the third preferences of parents for their travel mode. In this case, there is no positive correlation between a high level of density in residential buildings and more popularity of walking or cycling among parents.

Table 15: Built environment parameters within 10-minute time isochrons away from "Kreativ barnehage Bogafjell"

Kreativ barnehage Bogafjell *(10 minutes isochrons)*	***BUILT-UP FLOOR AREA***		***RESIDENTIAL FLOOR AREA***		***DWELLINGS***	
	Gross Floor Built-Up Area (GFA) covered	*Floor Area Ratio (FAR)*	*Gross Residential Built-Up Area (GFAre) covered*	*Floor Area Ratio for residential use (FARre)*	*Gross Number of Dwellings*	*Dwellings Density per hectare (DW/ha)*
Walking (5 km/h)	*114 364*	*0.11*	*99 798 (87.26%)*	*0.10*	*691 (3.05)*	*6.64*
Cycling (15 km/h)	*426 571*	*0.05*	*341 217 (80.0%)*	*0.04*	*2 715 (2.78)*	*3.49*
E-cycling (20 km/h)	*677 603*	*0.05*	*463 171 (68.35%)*	*0.03*	*3 989 (2.70)*	*2.96*

Source: Author

4.2.4 Result of observation for fourth kindergarten: Kampen barnehage

This kindergarten is located near the city center in Stavanger city with an almost high density of residential buildings. This kindergarten is the smallest one among the other four and has fewer cases for observation. According to table 16, the share of mothers is significantly higher than fathers in all sessions of the observation. Since this place is located close to the residential buildings and has convenient accessibility for the majority of the population, walking is the first choice of half of the observed cases, except for the last observation in winter at afternoon which shows a drop in the numbers. After that, car usage stands as the second most popular choice for parents.

Table 16: Results of observation in" Kampen barnehage"

Total	Mother's share		Father's share		Means of transport								Time	Date
	Quantity	percentage	Quantity	percentage	walk		bicycle		car		bus			
30	21	70%	9	30%	15	50%	4	13%	11	37%	0	0%	Morning	Aug19, 2021
29	17	59%	12	41%	14	48%	5	17%	10	34%	0	0%	Afternoon	Aug19, 2021
30	20	67%	11	37%	15	50%	3	10%	12	40%	0	0%	Morning	Feb9, 2022
29	20	69%	9	31%	8	28%	6	21%	15	52%	0	0%	Afternoon	Feb9, 2022

Source: Author

As mentioned before, the Kampen kindergarten has the lowest capacity among other kindergartens providing services for 43 children. According to the capacity of this kindergarten and other kindergartens lacated in the same sevice area polygons and the number of children, it shows a low level of accessibility for the whole children population. For example, in the first polygon, 6.56% of the population (254 people) are children from 0 to 4 but this kindergarten and the other two kindergartens in the same polygon can provide service for 211 children.

Table 17: Coverage and serviced population of 10-minute time isochrons away from "Kampen barnehage"

Kampen barnehage (10 MINUTES ISOCHRONS)	***SPATIAL COVERAGE***	***KINDERGARTEN CAPACITIES***		***POPULATION***		
	Area covered (ha)	*Kampen barnehage*	*Other kindergartens within range*	*Residents within range*	*% of kids (0-4)*	*Population density within range (POP/ha)*
Walking (5 km/h)	*97.5*	*43*	*168 (2)*	*3 872*	*6.56%*	*39.73*
Cycling (15 km/h)	*901.2*	*43*	*1 427 (23)*	*32 699*	*5.51%*	*36.28*
E-cycling (20 km/h)	*1 436.8*	*43*	*2 466 (41)*	*54 660*	*5.83%*	*38.04*

Source: Author

Based on the data of table 18, the Kampen kindergarten is located in an area with high residential buildings density, referring to the GFAre index. In all the service area polygons this index has relatively high value and the results of observation strongly support a positive correlation between level of density and travel mode choices by parents. Since more than 48% of parents take their children to the kindergarten and also return them back by walk. In this term, the results prove that the denser the neighborhood in terms of residential buildings, the higher the chance of walking or cycling to the kindergarten.

Table 18: Built environment parameters within 10-minute time isochrons away from "Kampen barnehage"

Kampen barnehage (10 MINUTES ISOCHRONS)	***BUILT-UP FLOOR AREA***		***RESIDENTIAL FLOOR AREA***		***DWELLINGS***	
	Gross Floor Built-Up Area (GFA) covered	*Floor Area Ratio (FAR)*	*Gross Residential Built-Up Area (GFAre) covered*	*Floor Area Ratio for residential use (FARre)*	*Gross Number of Dwellings*	*Dwellings density per hectare (DW/ha)*
Walking (5 km/h)	*336 962*	*0.35*	*259 686 (77.07%)*	*0.27*	*1 967 (2.07)*	*20.18*
Cycling (15 km/h)	*3 649 377*	*0.40*	*2 190 174 (60.02%)*	*0.24*	*16 013 (2.20)*	*17.77*
E-cycling (20 km/h)	*5 667 441*	*0.39*	*3 514 429 (68.35%)*	*0.24*	*26 669 (2.21)*	*18.56*

Source: Author

4.2.5 Result of observation for fifth kindergarten: Læringsverkstedet barnehage Avd Lervig Brygge barnehage

The " Brygge" kindergarten is located in a neighborhood almost near the city center of Stavanger with the highest density level in residential buildings. Several medium-rise building blocks surround this kindergarten, and according to the observations, many parents who live in these buildings have brought their children to this kindergarten. Table 19 presents the result of observation and according to it, the number of mothers who have taken the responsibility of taking children to kindergarten is enormously higher than shares of fathers, with more than 60 percent in the summer's observation. But the results during winter observation show equal share of mothers and fathers. As mentioned, there are several residential buildings near Brygge kindergarten, and in most of the observed cases, parents with their children, walked towards the kindergarten. It is worthy to mention that usage of the car by parents in this

kindergarten has the lowest number, except the last observation in winter for afternoon time in which the number of walking and driving car is equal.

Table 19: Result of observation in" Læringsverkstedet barnehage Avd Lervig Brygge"

Total	Mother's share		Father's share		Means of transport								Time	Date
	Quantity	percentage	Quantity	percentage	walk		bicycle		car		bus			
47	31	66%	16	34%	33	70%	5	11%	9	19%	0	0%	Morning	Aug23, 2021
37	23	62%	14	38%	31	84%	0	0%	6	16%	0	0%	Afternoon	Aug23, 2021
42	21	50%	21	50%	32	76%	1	2%	9	21%	0	0%	Morning	Feb11, 2022
23	12	52%	12	52%	12	52%	2	9%	12	52%	0	0%	Afternoon	Feb11, 2022

Source: Author

The last kindergarten observed is located in a neighborhood with the highest level of population density compared to the other kindergartens. This rate is higher in the first service area polygon with 65.16%. Although this kindergarten (100) capacity can not provide service for all the children(278) living in the first service area polygon, the other four kindergartens within this service area can support all the children in terms of accessibility to kindergarten.

Table 20: . Coverage and serviced population of 10-minute time isochrons away from "Læringsverkstedet barnehage Avd Lervig Brygge"

Læringsverkstedet barnehage Avd Lervig Brygge(10 minutes isochrons)	***Spatial coverage***	***Kindergarten capacity***		***population***		
	Area covered (ha)	*Læringsvst. barnehage Avd Lervig Brygge*	*Other kindergartens within range*	*Residents within range*	*% of kids (0-4)*	*Population density within range (POP/ha)*
Walking (5 km/h)	*58.0*	*100*	*326 (4)*	*3 781*	*7.36%*	*65.16*
Cycling (15 km/h)	*357.9*	*100*	*543 (10)*	*18 150*	*5.77%*	*50.71*
E-cycling (20 km/h)	*646.2*	*100*	*946 (17)*	*29 298*	*5.70%*	*45.39*

Source: Author

Considering the gross residential built-up area, the density level in the studied service areas is relatively high, specially in the first service area with 66.16 % and also 37.87 % of dwelling density. According to the observation, 70% of parents in the morning and 84% of them in the afternoon choosed walking as their travel mode and driving by car is standing at the second position. As a result, here there is a positive correlation between the level of density and choose of walking or cycling as travel mode.

Table 21: Built environment parameters within 10-minute time isochrons away from "Læringsverkstedet barnehage Avd Lervig Brygge"

Læringsverkstedet barnehage Avd Lervig Brygge (10 MINUTES ISOCHRONS)	***BUILT-UP FLOOR AREA***		***RESIDENTIAL FLOOR AREA***		***DWELLINGS***	
	Gross Floor Built-Up Area (GFA) covered	*Floor Area Ratio (FAR)*	*Gross Residential Built-Up Area (GFAre) covered*	*Floor Area Ratio for residential use (FARre)*	*Gross Number of Dwellings*	*Dwellings Density per hectare (DW/ha)*
Walking (5 km/h)	*317 951*	*0.55*	*210 349 (66.16%)*	*0.36*	*2 197 (1.76)*	*37.87*
Cycling (15 km/h)	*2 017 879*	*0.56*	*1 057 964 (52.43%)*	*0.30*	*9 902 (1.96)*	*27.67*
E-cycling (20 km/h)	*3 633 578*	*0.56*	*1 814 043 (49.92%)*	*0.28*	*26 669 (2.21)*	*24.20*

Source: Author

4.3 Syhthesis of the results of the analysis

Table 22 shows that the share of mothers in taking children to kindergartens and delivering them is higher than the fathers and consequently respond positively to the sub-reserch question regarding higher share of mothers in taking and bringing back children to the kindergartens. In most cases, the percentages of each gender directly correlate with the density of the observed area in terms of residential buildings. In other words, the area with higher density have more percentages for mothers, and in the less dense area, the number of fathers who take and deliver children from kindergarten is higher than mother's share. The kindergarten in the Forus area, an industrial area with several companies mainly related to the oil and gas industry, is appropriate for this fact.

Table 22: summary of the observations

Total	Mother's share		Father's share		Means of transport								Time
	Quantity	percentage	Quantity	percentage	walk		bicycle		car		bus		
432	249	58%	177	41%	121	28%	27	6%	282	65%	3	1%	Summer2021
395	218	55%	177	45%	102	26%	24	6%	268	68%	2	1%	Winter2022

Source:Author

Furthermore, the observation and network analysis results prove a correlation between the location of kindergartens and the way of commuting for parents and their children in four kindergartens. Most parents prefer to walk to reach the kindergarten in an area with high residential density. The results show a growing trend in walking as the dominant travel mode, followed by the increment in the density of residential buildings.

In reverse, in less dense area, most parents use their cars to take children back home. The most probable reason is that parents drop their children on their way to work and do this task between their home to work and work to home travel. Nevertheless, it is essential to mention that since observation is the only way of collecting data, there is no information regarding types of travel to kindergartens, such as home-kindergarten-home or home- kindergarten-work. Among the collected data, the interesting results are about the usage of bicycles among parents, which has pretty low popularity for reaching the kindergartens, especially in summer time.

In terms of differences in result of observations in summer and winter, the percentage in cases who choosed walking to reach kindergartens dropped slightly in winter and by contrast the number of parents who drive toward kindergartens raised a little in comparison to the summer time. Regarding gender role, mothers have taken more responsibility than fathers for escorting their children to the

kindergarten in both seasons, but it is worthy to mention that the father's share slightly raised from summer to winter time. According to the table using bicycle and bus have the least popularity among parents even in the summer time.

Chapter Five

Discussion and conclusions

5. Discussion

This chapter is devoted to address the research question and sub-research questions that were framed in the introduction chapter. The following parts discuss each question by the provided results in the analysis and observations.

5.1 Distribution of kindergartens and physical accessibility

The main objective of this research is to analyze the accessibility to kindergartens in Stavanger metropolitan area by considering the factor of travel behavior. This research seeks to answer the question of " **How can the distribution of kindergartens in Stavanger, MA, affect families' physical accessibility and travel behavior with preschool children?".**

For responding to this question, five kindergartens have been selected as the case studies for in-depth analyses and performing of the observations. According to the results, four establishments, including Forus, Læringsverkstedet, Kreativ, and Læringsverkstedet (Avd Lervig Brygge), are well accessible for all the children living in areas 10 minutes away. Based on the results in table 23, the mentioned kindergartens have sufficient capacity for the children who live in different service areas around these facilities. As the service area of each kindergarten gets bigger and covers a larger area, it overlaps with other services areas and expand the total capacities of kindergartens. In table 23, in the walking section the capacity of the studied kindergarten has been inserted but in the cycling and e-cycling sections it show the sum of capacities of all the kindergartens that exist in each service area.

On other hand, the Kampen kindergarten, located in a neighborhood with high residential density, seems a little establishment for the size of the population in the vicinity. In all service areas of Kampen kindergarten, the number of existing children exceeds the capacity of the kindergartens, and it shows inconvenient accessibility to kindergartens for this population within 10 minutes by walk or cycling. Referring to the results, building more kindergartens can provide convenient accessibility by walking or cycling to kindergartens for all the children who need this service. Moreover, save the travel time for parents or adults who take the children to the kindergarten and bring them back home.

Table 23: Kindergarten's coverage (physical accessibility) for children population (0-4)

Mobility modes (10 minutes isochron)	Kindergartens									
	Forus		Læringsverkstedet		Kreativ		Kampen		Læringsverkstedet (Avd Lervig Brygge)	
	capacity	Existing population	capacity	Existing population	capacity	Existing population	capacity	Existing population	capacity	Existing population
Walking	90	2	109	102	81+235	217	43+168	254	100+326	278
Cycling	90+508	484	109+450	538	81+563	681	43+1427	1801	100+543	1047
E-cycling	90+1569	119	109+626	955	81+1032	989	43+2460	3186	100+946	1670

Source: author

Considering the effect of the distribution of kindergartens on the travel behavior of parents, table 24 provides a big picture of the existing situation in the studied cases and makes the comparison easier.Also, it offers evidence to address the sub-research question regarding the relation between urban density and the travel behavior of parents. The order of kindergartens in table 21 is based on their location, considering residential building blocks in the area. It means that the first kindergarten (Forus) is located in the least dense area, and the last kindergarten (Læringsverkstedet Avd Lervig Brygge) is located in the densest area.

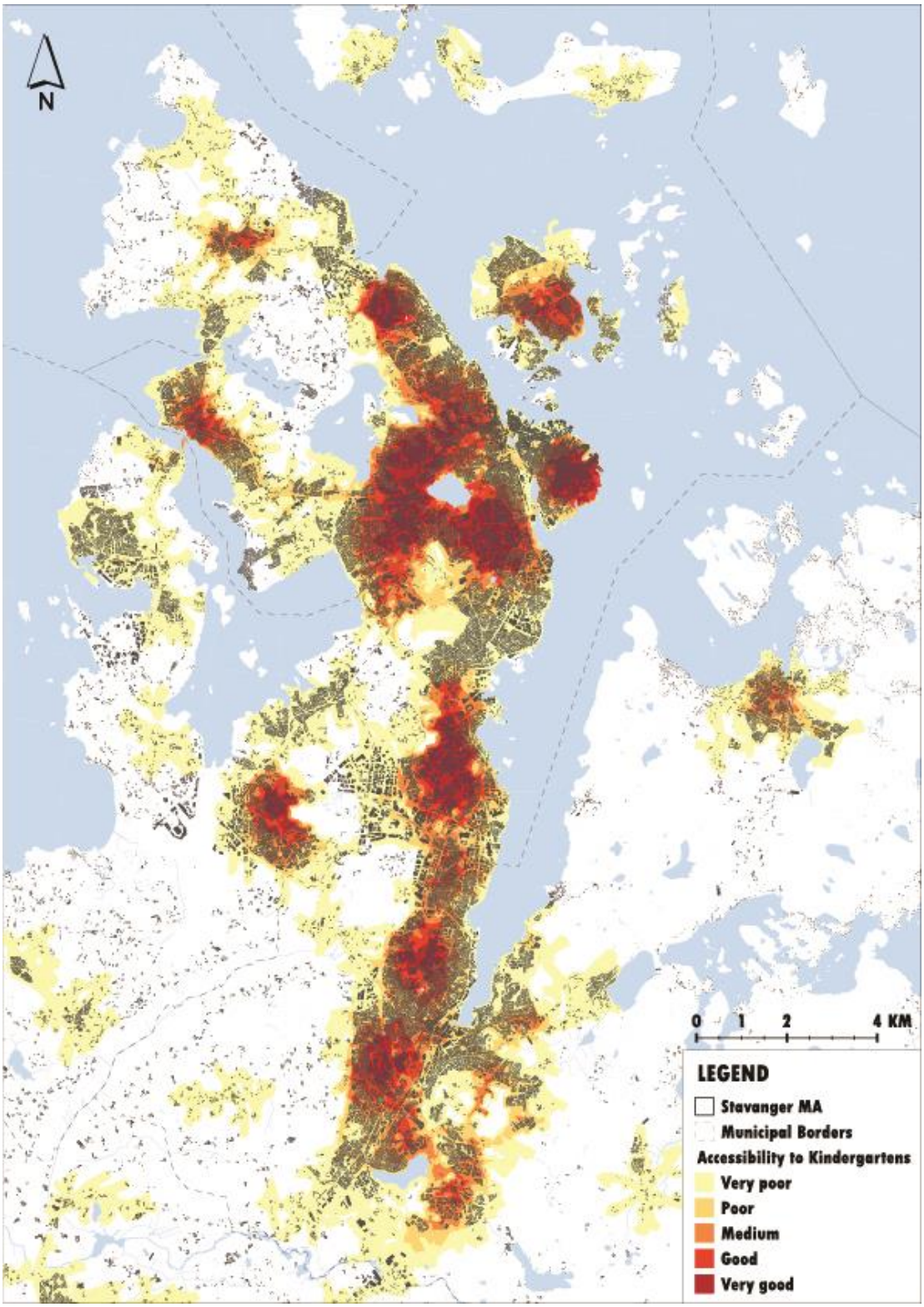
Another feature of the table that is useful for comparison and conclusion is the availability of the results of observations at all times; this is specifically helpful to compare the outcome of summer observations with the ones in the winter time. For instance, the results show that the weather condition has a meaningful effect on the travel behavior of parents. In summer, the number of parents who walk toward the kindergartens increases as the density level in residential buildings gets higher. But in winter, most parents choose the car for their travel mode regardless of the level of density.

Table 24. Result of all observations

Season	Kindergarten	Total	Mother's share Quantity	Mother's share %	Father's share Quantity	Father's share %	Walk	%	Bicycle	%	Car	%	Bus	%	Observation Day	Observation Time
Summer 2021	Forus private barnehage	61	32	52%	27	44%	0	0%	0	0%	60	98%	1	2%	Jun 21th,2021	Morning
		42	15	36%	25	60%	0	0%	1	2%	40	95%	1	2%	Jun 21th,2021	Afternoon
	Læringsverkstedet barnehage Avd Jåsund	52	25	48%	27	52%	10	19%	1	2%	40	77%	1	2%	Aug 18th,2021	Morning
		22	17	77%	5	23%	3	14%	0	0%	19	86%	0	0%	Aug 18th,2021	Afternoon
	Kreative barnehage	69	42	61%	27	39%	7	10%	9	13%	53	77%	0	0%	Jun 22th,2021	Morning
		43	26	60%	15	35%	8	19%	2	5%	33	77%	0	0%	Jun 22th,2021	Afternoon
	Kampen barnehage	30	21	70%	9	30%	15	50%	4	13%	11	37%	0	0%	Aug 19th,2021	Morning
		29	17	59%	12	41%	14	48%	5	17%	10	34%	0	0%	Aug 19th,2021	Afternoon
	Læringsverkstedet barnehage Avd Lervig Brygge	47	31	66%	16	34%	33	70%	5	11%	9	19%	0	0%	Aug 23th,2021	Morning
		37	23	62%	14	38%	31	84%	0	0	6	16%	0	0%	Aug 23th,2021	Afternoon
	Total	**432**	**249**	**58%**	**177**	**41**	**121**	**28%**	**27**	**6%**	**281**	**65%**	**3**	**1%**		
winter 2022	Forus private barnehage	57	29	51%	28	49%	0	0%	0	0%	56	98%	1	2%	Feb 8th,2022	Morning
		62	38	61%	24	39%	0	0%	4	6%	57	92%	1	2%	Feb 8th,2022	Afternoon
	Læringsverkstedet barnehage Avd Jåsund	51	23	45%	28	55%	11	22%	1	2%	39	76%	0	0%	Feb 7th,2022	Morning
		30	14	47%	16	53%	9	30%	0	0%	21	70%	0	0%	Feb 7th,2022	Afternoon
	Kreative barnehage	38	21	55%	15	39%	7	18%	3	8%	27	71%	0	0%	Feb 10th,2022	Morning
		33	20	61%	13	39%	8	24%	4	12%	20	61%	0	0%	Feb 10th,2022	Afternoon
	Kampen barnehage	30	20	67%	11	37%	15	50%	3	10%	12	40%	0	0%	Feb 9th,2022	Morning
		29	20	69%	9	31%	8	28%	6	21%	15	52%	0	0%	Feb 9th,2022	Afternoon
	Læringsverkstedet barnehage Avd Lervig Brygge	42	21	50%	21	50%	32	76%	1	2%	9	21%	0	0%	Feb 11th,2022	Morning
		23	12	52%	12	52%	12	52%	2	9%	12	52%	0	0%	Feb 11th,2022	Afternoon
	Total	**395**	**218**	**55%**	**177**	**45%**	**102**	**26%**	**24**	**6%**	**268**	**68%**	**2**	**1%**		

Source: Author

Figure 6: Condition of accessibility to kindergartens in Stavanger metropolitan area



Source: Author

5.2 Gender role in parenthood responsibility

In the introduction chapter, there was a sub-question regarding gender role in parenthood responsibilities that supported the fact that the share of mothers is higher than fathers. This question was mainly made based on the results of the time use survey in Norway that shows mothers spend more time in parenthood responsibilities than fathers. In this research, the results of the observation support the idea of higher shares of mothers than fathers and show that the number of mothers who take their children to the kindergarten and bring them back home is more than the fathers one. In total, 57% of mothers take their children to the kindergartens and the share of fathers is 41%. Although the differences are not significantly high but shows that still mothers have the dominant responsibility in parenthood responsibility and spend more time than fathers in this task.

5.3 Urban density and accessibility to the kindegartens

Reffering to the research sub-question " How does kindergarten location correlate with urban density **and travel bahaveor of parents**?" the facts show a positive correlation between lacation of the kindergartens and urban density. Based on the results of analyses showing in the figures 3 and 5, most of the kindergartens are located in places with high density in population and residential building blocks and provide sufficient accessibility to these services. Although some exceptions have seen in the study where an area with a high density level does not have enough services for the preschool children's population, the overall assessment confirms a positive correlation.

Furthermore, there is a meaningful correlation between the density of the studied caces and the travel behavior of parents. It means that driving a car is the first priority of travel mode in low dense area and as the density level rises, the travel mode shifts to walking in many observed cases. Table 24 provides strong correlation between density and travel behaviors; the meaningful changes are significant in the sections regarding walking and driving the car. It is important to mention that this correlation is stronger in the summertime, when changes in density level from low to high lead to an increase in the number of parents who walk to reach the kindergartens instead of driving the car. But in wintertime, although the density level still affects the travel behavior of parents, the correlation is not as significant as the summertime.

5.4 Limitation of the research

Regarding the limitations for conducting this research, one of the main issues was accessibility to the children population in each age group. The data for the population is not available in each age group, and it is a combination of five ages in one group. For example, the first age group comprises 0 to 4 years old, and the second group comprises 5 to 9 years old. However, as the attending age to the kindergarten is 0 to 6 years old, it was impossible to consider the population of children ages 5 and 6 because of the unavailability of the data. As a result the analysis for this research is done just by considering the population of children between 0 to 4 years old.

To analyze the condition of accessibility to the kindergartens, having information regarding the residency address of children who attend the kindergartens could help do a precise analysis. However, access to this type of information was almost impossible because of privacy issues and the safety of children.

Due to the pandemic situation of covid-19 and the safety of children, selecting kindergartens faced a challenge and took a longer time than expected. The mentioned situations raised the concern of managers and made them reluctant to permit the researcher to do the observation.

5.5 Suggestions for the future studies and policies

In terms of data collection, using mobile phone data to track case studies' locations can be very helpful and lead to a more precise result. In this case, by knowing the starting point of travel for each individual, the results of the analysis will be more concrete, but as it was mentioned in the previous part, due to the privacy issues of children and their parents, it possibly would be challenging to access this kind of data in Norway.

Moreover, as the results show, driving car is the dominant travel mode in most observed cases, and there can be a correlation between travel mode preferences and the concept of walk appeal. As a suggestion for future studies, considering these two factors and evaluating the quality of pedestrians will be beneficial to find any correlations. Moreover, considering the condition of pedestrians in terms of safety can help in the assessment process

5.6 Conclusions

This study analyzes the condition of accessibility to kindergartens by considering the travel time factor in Stavanger metropolitan area for children and their parents who escort them to the kindergarten. Besides that, it examined two sub-questions regarding gender role in parenthood responsibilities for taking children to the kindergartens and the relation between urban density and travel behavior among parents.

There are 320 kindergartens in this area, and to study the condition of accessibility to these services, the network analysis method in Arc map has been used. In order to examine the main factor of this analysis which was distribution of kindergartens and physical accessibility, the service area technique by considering 10 minutes travel time created different polygons layers for each kindergarten. These polygons are divided by travel mode types, including walking and cycling with normal and E-bike cycles. According to the results, the area with more children has more kindergartens (map2), and the children have convenient accessibility to the kindergartens in the majority of the cases by 10 minutes walk or cycling (map4). It is essential to mention that, to achieve more pricise results, 5 kindergartens have been selected, and in-depth analysis and observation were done on them. The results of network analysis showed that four out of five kindergartens have convenient accessibility and can cover all the children population living 10 minutes away from kindergartens.

Regarding gender role and parenthood responsibility, an in-depth observation was carried out for five selected kindergartens, and the outcomes reveal that the share of mothers taking children to the kindergartens and bringing them back home is higher than the fathers.

Finally, the results showed a car dependency (in any weather condition) attitude towards parents to take children to the kindergartens and bring them back home. This result is aligned with the common trend in travel behavior for care trips in Norway.But, on the other hand, a positive correlation between the density level of the area and the travel mode of parents have been observed. According to this, in the area with denser residential buildings, the number of parents who take their children to the kindergartens by walk is higher than the area with a low-density level.

References

Banister, D. (2008). "The sustainable mobility paradigm." Transport policy 15(2): 73-80.

Chen, Z., Zhou, X., & Yeh, A. G. (2021). Spatial accessibility to kindergartens using a spectrum combinational approach: Case study of Shanghai using cellphone data. *Environment and Planning B: Urban Analytics and City Science*, *48*(6), 1380-1397.

Capasso Da Silva, D., et al. (2020). "Accessibility in practice: 20-minute city as a sustainability planning goal." Sustainability 12(1): 129.

Davoudi, S. and A. Madanipour (2015). Reconsidering localism, Routledge.

Dempsey, N., et al. (2011). "The social dimension of sustainable development: Defining urban social sustainability." Sustainable development 19(5): 289-300.

Ellegård, K. (2018). Time geography in the global context: An anthology, Routledge.

Golob, T. F., et al. (1981). "A utility-theory travel demand model incorporating travel budgets." Transportation Research Part B: Methodological 15(6): 375-389.

Goodwin, P. (1973). Time, distance and cost of travel by different modes. Proceedings of the 5 th University Transport Study Group Annual Conference.

Goodwin, P. (1981). "The usefulness of travel budgets." Transportation Research Part A: General 15(1): 97-106.

Goodwin, P. (2019). "The influence of technologies and lifestyle on the value of time."

Gunn, H. F. (1981). "Travel budgets—a review of evidence and modelling implications." Transportation Research Part A: General 15(1): 7-23.

Handy, S. L. (1992). "Regional versus local accessibility: neo-traditional development and its implications for non-work travel." Built Environment (1978-): 253-267.

Hansen, W. G. (1959). "How accessibility shapes land use." Journal of the American Institute of planners 25(2): 73-76.

Hines, C. (2013). Localization: A global manifesto, Routledge.

Joseph, A. E. and D. R. Phillips (1984). "Accessibility and utilization: geographical perspectives on health care delivery."

Kesarovski,T. and Hernandez, F.(2021). " Time, the other dimension of urban form: Measuring the relationship between urban density and accessibility to grocery shops in the 10-minute city".

Khan, A. A. (1992). "An integrated approach to measuring potential spatial access to health care services." Socio-economic planning sciences 26(4): 275-287.

King, A. C., et al. (2011). "Aging in neighborhoods differing in walkability and income: associations with physical activity and obesity in older adults." Social science & medicine 73(10): 1525-1533.

Lee, J. and H. J. Miller (2018). "Measuring the impacts of new public transit services on space-time accessibility: An analysis of transit system redesign and new bus rapid transit in Columbus, Ohio, USA." Applied geography 93: 47-63.

Levinson, D. M. (2019). The 30-minute city: Designing for access, Network Design Lab.

Litman, T. (2017). Evaluating accessibility for transport planning, Victoria Transport Policy Institute.

Luo, W. and F. Wang (2003). "Measures of spatial accessibility to health care in a GIS environment: synthesis and a case study in the Chicago region." Environment and planning B: planning and design 30(6): 865-884.

Miller, H. J. (1991). "Modelling accessibility using space-time prism concepts within geographical information systems." International Journal of Geographical Information System 5(3): 287-301.

Moreno, C., et al. (2021). "Introducing the "15-Minute City": Sustainability, Resilience and Place Identity in Future Post-Pandemic Cities." Smart Cities 4(1): 93-111.

Pozoukidou, G. and Z. Chatziyiannaki (2021). "15-Minute City: Decomposing the New Urban Planning Eutopia." Sustainability 13(2): 928.

Stanley, J. and J. Stanley (2014). Achieving the 20 minute city for Melbourne: Turning our city upside down.

Tsou, K.-W., et al. (2005). "An accessibility-based integrated measure of relative spatial equity in urban public facilities." Cities 22(6): 424-435.

Wang, S.-I. and C.-L. Yaung (2013). "Vertical equity of healthcare in Taiwan: health services were distributed according to need." International journal for equity in health 12(1): 1-8.

Weng, M., et al. (2019). "The 15-minute walkable neighborhoods: Measurement, social inequalities and implications for building healthy communities in urban China." Journal of Transport & Health 13: 259-273.

Drange, N. and K. Telle (2010). The effect of preschool on the school performance of children from immigrant families. Results from an introduction of free preschool in two districts in Oslo, Discussion Papers.

Duvander, A.-Z. and G. Andersson (2006). "Gender equality and fertility in Sweden: A study on the impact of the father's uptake of parental leave on continued childbearing." Marriage & Family Review 39(1-2): 121-142.

Ellegård, K., et al. (1977). "Activity organization and the generation of daily travel: two future alternatives." Economic geography 53(2): 126-152.

Foltýnová, H. B., et al. (2020). "Sustainable urban mobility: One definition, different stakeholders' opinions." Transportation Research Part D: Transport and Environment 87: 102465.

Hagerstrand, T. (1970). "What about People inRegional Sceience?" Papers and Proceedingsof the Regional Science Association.

Handy, S. (1991). "Neo-traditional development: the debate." Berkeley Planning Journal 6(1).

Horowitz, J. L. (1985). "Travel and location behavior: State of the art and research opportunities." Transportation Research Part A: General 19(5-6): 441-453.

Hupkes, G. (1982). "The law of constant travel time and trip-rates." Futures 14(1): 38-46.

Kim, H., & Wang, F. (2019). Disparity in Spatial Access to Public Daycare and Kindergarten across GIS-Constructed Regions in Seoul, South Korea. *Sustainability*, *11*(19), 5503.

Kitterød, R. H. and M. Rønsen (2013). Does parenthood imply less specialization than before? Tales from the Norwegian time use surveys 1980-2010, Discussion Papers.

Korpi, W. (2000). "Faces of inequality: Gender, class, and patterns of inequalities in different types of welfare states." Social Politics: international studies in gender, state & society 7(2): 127-191.

Lappegård, T. (2010). "Family policies and fertility in Norway." European Journal of Population/Revue européenne de Démographie 26(1): 99-116.

Miller, H. J. (2018). Time geography. Handbook of Behavioral and Cognitive Geography, Edward Elgar Publishing.

Pearson, C. (1990). "The new new towns." Builder, January: 294-301.

Pred, A. (1977). "The choreography of existence: comments on Hägerstrand's time-geography and its usefulness." Economic geography 53(2): 207-221.

Rønsen, M. (2004). "Fertility and family policy in Norway-A reflection on trends and possible connections." Demographic Research 10: 265-286.

Tarwani, A. (2021). A new time-based urban agenda. Exploring the 15-minute city in concepts and practices.

Thrift, N. (1977). An introduction to time-geography, Geo Abstracts, University of East Anglia Norwich, UK.

Vaage, O. F. (2002). "Til alle døgnets tider." Tidsbruk 1971-2000: 1971-2000.

Comber, A., et al. (2008). "Using a GIS-based network analysis to determine urban greenspace accessibility for different ethnic and religious groups." Landscape and urban planning 86(1): 103-114.

Hanson, S. (1990). "Geographic perspectives on the occupational segregation of women." National Geographic Research 6: 376-399.

Hass, K. (2009). "Measuring accessibility of regional parks: A comparison of three GIS techniques."

Talen, E. (2003). "Neighborhoods as service providers: a methodology for evaluating pedestrian access." Environment and planning B: planning and design 30(2): 181-200.

Van Ham, M. and C. H. Mulder (2005). "Geographical access to childcare and mother's labour-force participation." Tijdschrift voor economische en sociale geografie 96(1): 63-74.

Øksenholt, K. V., Tønnesen, A., & Tennøy, A. (2016). Hvordan utforme selvforsynte boligsatellitter med lav bilavhengighet. *TØI rapport*, *1530*, 2016.

Appendix

Table 1: The result of observation for "Forus private barnehage" in the morning, on June 21,2021

Row	child's age	Who take the child					Means of transport;By				weather condition		
		Mother	Father	Grand mother	Ground father	Other	walk	bicycle	car	Bus	Sunny	Rainy	Cloudy
1	8 months	•							•				•
2	12 months		•						•				•
3	3 years	•							•				•
4	9 months		•						•				•
5	2years		•						•				•
6	2years		•						•				•
7	8 months		•						•				•
8	4 years	•							•				•
9	4 years	•							•				•
10	4 years		•						•				•
11	3 years		•						•				•
12	3 years		•						•				•
13	2years		•						•				•
14	1 year		•						•				•
15	4 years	•							•				•
16	3 years	•							•				•
17	2years	•							•				•
18	2years		•						•				•
19	3 years		•						•				•
20	16 months	•							•				•
21	9 months	•							•				•
22	1 year	•							•				•
23	1 year	•							•				•
24	5 years		•						•				•
25	1 year		•						•				•
26	3 years	•							•				•
27	1 year	•							•				•
28	3 years	•							•				•
29	2 years	•							•				•
30	2 years		•						•				•
31	3 years		•						•				•
32	2 years	•							•				•

33	1 year	•							•				•
34	18 monts		•						•				•
35	1 year	•							•				•
36	2 years	•							•				•
37	3 years		•						•				•
38	4 years	•							•				•
39	1 year		•						•				•
40	4 years		•						•				•
41	2 years	•							•				•
42	2 years		•						•				•
43	2 years	•							•				•
44	18 monts		•						•				•
45	1 year		•						•				•
46	4 years		•						•				•
47	3 years		•						•				•
48	4 years		•						•				•
49	3 years	•							•				•
50	2 years	•							•				•
51	4 years	•							•				•
52	1 year	•							•				•
53	2 years		•						•				•
54	3 years	•											•
55	18 monts	•							•				•
56	4 years	•							•				•
57	3 years		•						•				•
58	4 years		•						•				•
59	1 year	•							•				•
60	4 years	•							•				•
61	1 year		•						•				

Table 2: The result of observation in "Forus private barnehage" for the closing time, , on June 21,2021

Row	child's age	Who takes the child					Means of transport; By				weather condition		
		Mother	Father	Grand mother	Ground Father	Other	walk	bicycle	Car	Bus	Sunny	Rainy	Cloudy
1	3 years		•								•		
2	3 years	•							•		•		
3	3 years		•						•		•		
4	4 years		•						•		•		
5	5 years		•						•		•		
6	3 years		•						•		•		
7	4 years	•							•		•		
8	3 years	•							•		•		
9	4 years		•						•		•		
10	3 years	•							•		•		
11	4 years		•						•		•		
12	3years		•						•		•		
13	5 years		•						•		•		
14	3 years		•						•		•		
15	1 year		•						•		•		
16	4 years		•						•		•		
17	3 years	•							•		•		
18	2 years	•							•		•		
19	3 years		•						•		•		
20	2 years		•						•		•		
21	4 years		•						•		•		
22	3 years		•						•		•		
23	1 year		•						•		•		
24	2 years				•				•		•		
25	5 years	•							•		•		
26	3 years		•						•		•		
27	4 years		•						•		•		
28	2 years	•							•		•		

29	4 years				•				•		•		
30	2 years	•							•		•		
31	3 years	•							•		•		
32	3 years	•							•		•		
33	4 years		•						•		•		
34	1 year	•						•			•		
35	2 years	•							•		•		
36	5 years	•							•		•		
37	3 years	•							•		•		
38	2.5 years		•						•		•		
39	4 years		•							•	•		
40	5 years		•						•		•		
41	2 years		•						•		•		
42	4 years		•						•		•		

Table 3: The result of observation in "Forus private barnehage" for the opening time, on Feb 8,2022

Row	child's age	Who take the child					Means of transport;By				weather condition		
		mother	father	grandmother	grandfather	other	walk	bicycle	car	bus	Sunny	Rainy	Cloudy
1	3	•							•				•
2	1		•						•				•
3	2	•							•				•
4	4	•							•				•
5	4	•							•				•
6	5		•						•				•
7	3	•							•				•
8	1		•						•				•
9	3		•						•				•
10	5	•							•				•
11	1	•							•				•
12	4		•						•				•
13	4	•							•				•
14	1		•						•				•
15	5	•							•				•
16	2		•						•				•
17	4		•						•				•
18	2	•							•				•
19	4			•					•				•
20	3	•							•				•
21	2		•						•				•
22	2		•						•				•
23	3		•						•				•
24	3		•						•				•
25	2		•						•				•
26	2		•						•				•
27	3	•	•						•				•
28	4	•								•			•
29	2	•							•				•
30	4		•						•				•
31	2		•						•				•
32	3	•							•				•
33	2		•						•				•
34	4	•							•				•
35	4		•						•				•
36	2		•						•				•
37	3	•							•				•
38	4	•							•				•
39	3	•							•				•
40	3	•							•				•
41	4		•						•				•
42	5	•							•				•
43	4		•						•				•
44	3	•							•				•
45	4		•						•				•
46	4								•				•
47	1	•							•				•
48	2		•						•				•
49	2		•						•				•

50	2	•							•				•
51	3		•						•				•
52	2		•						•				•
53	4	•							•				•
54	4	•							•				•
55	2	•							•				•
56	5	•							•				•
57	4	•							•				•

Table 4: The result of observation in "Forus private barnehage" for the closing time, on Feb 8,2022

Row	child's age	Who take the child					Means of transport;By				weather condition		
		mother	father	grandmother	grandfather	other	walk	bicycle	car	bus	Sunny	Rainy	Cloudy
1	3	•							•				•
2	4	•							•				•
3	5		•						•				•
4	4		•						•				•
5	3	•	•						•				•
6	3	•							•				•
7	5	•							•				•
8	4		•						•				•
9	2	•						•					•
10	5	•							•				•
11	2	•							•				•
12	4	•							•				•
13	4	•							•				•
14	4	•							•				•
15	3			•					•				•
16	4	•						•					•
17	4		•						•				•
18	3	•							•				•
19	3	•							•				•
20	4		•						•				•
21	4		•						•				•
22	3		•						•				•
23	2		•						•				•
24	2		•						•				•
25	4		•						•				•
26	4		•						•				•
27	2		•						•				•
28	1		•						•				•
29	5	•							•				•
30	4	•							•				•
31	1		•						•				•
32	1	•							•				•
33	4		•						•				•
34	1		•						•				•
35	3	•							•				•
36	4	•							•				•
37	3	•							•				•
38	2	•							•				•
39	2	•							•				•

40	2		•						•				•
41	2		•							•			•
42	4	•							•				•
43	3	•						•					•
44	2		•						•				•
45	2		•						•				•
46	1	•	•						•				•
47	3	•							•				•
48	4	•							•				•
49	4		•						•				•
50	4	•							•				•
51	2	•							•				•
52	3	•							•				•
53	2	•							•				•
54	5	•							•				•
55	3	•							•				•
56	1	•							•				•
57	2	•							•				•
58	5	•						•					•
59	2		•						•				•
60	3	•							•				•
61	2		•						•				•
62	2	•							•				•

Table 5: The result of observation in " Læringsverkstedet barnehage Avd Jåsund" for the opening time, on August 18,202

Row		Who take the child	Means of transport;By	Weather condition

	child's age												
		Mother	Father	Grand mother	Ground father	Other	walk	Bicycle	Car	Bus	Sunny	Rainy	Cloudy
1	3 Years		•					•					•
2	1 year	•					•						•
3	2 years		•					•					•
4	3 years	•						•					•
5	2 years	•					•						•
6	1 year	•					•						•
7	3 years	•					•						•
8	3 years	•						•					•
9	2 years		•					•					•
10	3 years		•					•					•
11	2 years		•					•					•
12	4 years		•					•					•
13	2 years		•					•					•
14	4 years	•						•					•
15	1 year	•					•						•
16	4 years	•					•						•
17	3 years		•					•					•
18	4 years	•						•					•
19	3 years		•					•					•
20	2 years		•					•					•
21	3 years		•					•					•
22	4 years	•						•					•
23	2 years		•					•					•
24	2 years	•						•					•
25	3 years		•					•					•
26	4 years		•					•					•
27	2 years		•					•					•
28	5 years	•					•						•
29	3 years	•					•						•
30	3 years		•					•					•
31	4 years	•						•					•
32	4 years	•						•					•
33	2 years		•					•					•
34	3 years	•						•					•
35	2 years	•						•					•
36	3 years	•						•					•
37	3 years		•				•						•

38	1 year		•					•					•
39	2 years	•						•					•
40	2 years	•						•					•
41	3 years		•					•					•
42	2 years	•						•					•
43	3 years	•						•					•
44	3 years		•				•						•
45	3 years		•					•					•
46	2 years		•					•					•
47	3 years		•					•					•
48	4 years		•					•					•
49	2 years		•				•						•
50	3 years		•					•					•
51	3 years	•						•					•
52	2 years	•						•					•

Table 6: The result of observation in " Læringsverkstedet barnehage Avd Jåsund" for the closing time, on August18,2021

Row	Child's age	Who take the child	Means of transport;By	Weather condition

		Mother	Father	Grand mother	Ground father	Other	walk	Bicycle	Car	Bus	Sunny	Rainy	Cloudy
1	4 years	•							•				•
2	3 years		•						•				•
3	4 years	•					•						•
4	2 years		•						•				•
5	3 years	•							•				•
6	4 years	•					•						•
7	3 years	•							•				•
8	3 years	•							•				•
9	2 years	•							•				•
10	1 year	•							•				•
11	3 years		•						•				•
12	1 year	•							•				•
13	4 years	•							•				•
14	3 years		•						•				•
15	4 years	•							•				•
16	2 years	•					•						•
17	3 years	•							•				•
18	4 years		•						•				•
19	5 years	•							•				•
20	2 years	•							•				•
21	3 years	•							•				•
22	2 years	•							•				•

Table 7: The result of observation in " Læringsverkstedet barnehage Avd Jåsund" for the opening time, on February 7,2022

Row	child's age	Who take the child					Means of transport;By				weather condition		
		mother	father	grandmother	grandfather	other	walk	bicycle	car	bus	Sunny	Rainy	Cloudy
1	1		•						•			•	
2	3		•						•			•	
3	1		•						•			•	

4	2		•				•					•	
5	3		•				•					•	
6	4		•						•			•	
7	2		•						•			•	
8	1	•							•			•	
9	4	•							•			•	
10	1	•							•			•	
11	1		•						•			•	
12	3		•				•					•	
13	1		•						•			•	
14	1	•							•			•	
15	2	•							•			•	
16	3	•						•				•	
17	3	•							•			•	
18	2		•						•			•	
19	4		•						•			•	
20	2		•						•			•	
21	1	•							•			•	
22	4	•							•			•	
23	2	•							•			•	
24	1	•							•			•	
25	1		•				•					•	
26	2	•							•			•	
27	1	•							•			•	
28	3	•							•			•	
29	2		•						•			•	
30	1	•					•					•	
31	2		•						•			•	
32	1		•						•			•	
33	2	•					•					•	
34	2	•					•					•	
35	2		•						•			•	
36	2		•				•					•	
37	2	•							•			•	
38	2		•						•			•	
39	2		•						•			•	
40	4	•							•			•	
41	2	•							•			•	
42	2		•				•					•	
43	3		•						•			•	
44	2	•							•			•	
45	4		•						•			•	
46	2		•						•			•	
47	3		•						•			•	
48	2		•						•			•	
49	2	•					•					•	
50	3		•				•					•	
51	2	•							•			•	

Table 8: The result of observation in " Læringsverkstedet barnehage Avd Jåsund" for the closing time, on February 7,2022

Row	child's age	Who take the child					Means of transport;By				weather condition		
		mother	father	grandmother	grandfather	other	walk	bicycle	car	bus	Sunny	Rainy	Cloudy
1	2		•				•						•
2	3		•				•						•

3	3		•						•				•
4	2	•							•				•
5	4	•							•				•
6	2	•					•						•
7	3	•							•				•
8	2	•							•				•
9	2	•							•				•
10	2		•						•				•
11	3		•				•						•
12	2		•				•						•
13	3	•					•						•
14	2		•				•						•
15	4	•							•				•
16	2		•						•				•
17	3		•						•				•
18	1		•						•				•
19	2	•							•				•
20	3	•							•				•
21	5		•						•				•
22	2		•				•						•
23	1	•							•				•
24	3		•						•				•
25	4		•						•				•
26	2	•							•				•
27	1	•							•				•
28	2	•					•						•
29	3		•						•				•
30	1		•						•				•

Table 9: The result of observation in" Kreativ barnehage Bogafjell" for the opening time,on June22,2021

Row	child's age	Who take the child					Means of transport;By				Weather condition		
		Mother	Father	Grand mother	Ground father	Other	walk	Bicycle	Car	Bus	Sunny	Rainy	Cloudy

1	3 years	•							•		•		
2	4 years	•							•		•		
3	4 years	•					•				•		
4	2 years	•					•				•		
5	3 years		•					•			•		
6	4 years	•							•		•		
7	2years	•							•		•		
8	5 years		•						•		•		
9	2 years	•							•		•		
10	3 years	•							•		•		
11	2 years		•						•		•		
12	4 years	•						•			•		
13	3 years	•							•		•		
14	4 years	•							•		•		
15	4 years	•						•			•		
16	4 years	•					•				•		
17	3 years	•							•		•		
18	3 years	•							•		•		
19	4 years	•					•				•		
20	4 years	•							•		•		
21	3 years		•						•		•		
22	3 years		•						•		•		
23	4 years	•							•		•		
24	2 years	•							•		•		
25	2 years	•							•		•		
26	3 years	•							•		•		
27	2 years	•							•		•		
28	1 year	•							•		•		
29	2 years	•							•		•		
30	5 years		•						•		•		
31	4 years		•						•		•		
32	3 years		•						•		•		
33	3 years	•							•		•		
34	2 years	•							•		•		
35	2 years		•						•		•		
36	2 years		•						•		•		
37	4 years		•						•		•		
38	3 years		•						•		•		
39	3 years	•							•		•		
40	3 years	•							•		•		

41	4 years		•						•		•		
42	2 years		•						•		•		
43	2 years		•						•		•		
44	4 years			•			•				•		
45	2 years		•						•		•		
46	5 years			•			•				•		
47	2 years		•						•		•		
48	4 years		•						•		•		
49	3 years	•						•			•		
50	2 years	•							•		•		
51	3 years	•						•			•		
52	4 years		•						•		•		
53	4 years	•							•		•		
54	4 years	•							•		•		
55	4 years	•							•		•		
56	2 years	•							•		•		
57	4 years		•						•		•		
58	5 years	•							•		•		
59	2 years	•							•		•		
60	3 years	•							•		•		
61	5 years	•							•		•		
62	4 years		•						•		•		
63	3 years	•							•		•		
64	3 years	•							•		•		
65	2 years	•					•				•		
66	3 years	•						•			•		
67	4 years	•						•			•		
68	4 years		•						•		•		
69	4 years		•						•		•		

Table 10: The result of observation in" Kreativ barnehage Bogafjell" for the closinging time, on June 22,2021

Row	child's age	Who take the child					Means of transport;By				Weather condition		
		Mother	Father	Grand mother	Ground father	Other	walk	Bicycle	Car	Bus	Sunny	Rainy	Cloudy
1	3 years	•					•				•		
2	4 years		•						•		•		

3	3 years	•							•		•		
4	3years		•					•			•		
5	3 years			•					•		•		
6	4 years	•							•		•		
7	5 years	•							•		•		
8	2 years	•							•		•		
9	4 years	•							•		•		
10	3 years	•							•		•		
11	4 years	•							•		•		
12	3 years		•					•			•		
13	4 years	•					•				•		
14	1 year	•					•				•		
15	2 years		•						•		•		
16	3 years	•							•		•		
17	2 years	•					•				•		
18	3 years	•					•				•		
19	3 years	•					•				•		
20	4 years	•							•		•		
21	3 years		•						•		•		
22	4 years		•						•		•		
23	4 years	•							•		•		
24	5 years	•							•		•		
25	2 years	•							•		•		
26	3 years	•							•		•		
27	4 years	•							•		•		
28	2 years	•							•		•		
29	4 years		•						•		•		
30	2 years	•					•				•		
31	3 years		•						•		•		
32	2 years		•						•		•		
33	3 years		•						•		•		
34	4 years		•						•		•		
35	2 years	•							•		•		
36	4 years			•			•				•		
37	3 years	•							•		•		
38	4 years	•							•		•		
39	2 years		•						•		•		
40	3 years		•						•		•		
41	4 years		•						•		•		
42	4 years	•							•		•		
43	4 years		•						•		•		

Table11: The result of observation in" Kreativ barnehage Bogafjell" for the opening time, on February 10,2022

Row	child's age	Who take the child					Means of transport;By				weather condition		
		mother	father	grandmother	grandfather	other	walk	bicycle	car	bus	Sunny	Rainy	Cloudy
1	4	•							•				•
2	3	•							•				•
3	4	•					•						•
4	2		•						•				•
5	2		•						•				•
6	3	•							•				•
7	2	•							•				•
8	5		•						•				•
9	3		•						•				•
10	5		•						•				•
11	2		•						•				•
12	4		•						•				•
13	2		•						•				•
14	2	•							•				•
15	4	•							•				•
16	5	•							•				•
17	4		•						•				•
18	3		•						•				•
19	3	•					•						•
20	4	•							•				•
21	3	•					•						•
22	2	•							•				•
23	4								•				•
24	2		•						•				•
25	3		•						•				•
26	3	•						•					•
27	5	•					•						•
28	2		•						•				•
29	4	•					•						•
30	3	•							•				•
31	1	•							•				•
32	4		•						•				•
33	3	•					•						•
34	4	•						•					•
35	2	•						•					•
36	4												•
37	1	•							•				•
38	3		•				•						•

Table 4: The result of observation in" Kreativ barnehage Bogafjell" for the closingtime, on February 10,2022

Row	child's age	Who take the child					Means of transport;By				weather condition		
		mother	father	grandmother	grandfather	other	walk	bicycle	car	bus	Sunny	Rainy	Cloudy
1	3	•							•		•		
2	4	•					•						
3	3	•							•				
4	5		•					•					
5	2	•					•						
6	3		•						•				
7	2		•						•				

8	4	•							•				
9	3	•							•				
10	2		•						•				
11	4		•				•						
12	2		•				•						
13	3	•							•				
14	2	•							•				
15	1		•						•				
16	5		•						•				
17	3		•						•				
18	4	•							•				
19	2	•					•						
20	4	•						•					
21	3	•							•				
22	5	•					•						
23	3	•					•						
24	2	•							•				
25	3		•						•				
26	3	•							•				
27	4		•					•					
28	2		•					•					
29	3	•							•				
30	5	•					•						
31	4		•						•				
32	2	•							•				
33	3	•							•				

Table 13: The result of observation in" Kampen barnehage" for the opening time, on August 19,2021

Row	child's age	Who take the child					Means of transport;By				Weather condition		
		Mother	Father	Grand mother	Ground father	Other	walk	Bicycle	Car	Bus	Sunny	Rainy	Cloudy
1	2 years						•				•		
2	4 years		•								•		
3	1 year										•		

4	5 years		•								•		
5	2 years										•		
6	3 years										•		
7	2 years										•		
8	3 years										•		
9	3 years										•		
10	2 years										•		
11	4 years						•				•		
12	3 years						•				•		
13	2 years						•				•		
14	3 years		•								•		
15	3 years		•				•				•		
16	2 years		•				•				•		
17	4 years		•				•				•		
18	4 years										•		
19	4 years		•				•				•		
20	4 years										•		
21	2 years										•		
22	3 years		•				•				•		
23	4 years		•				•				•		
24	1 year		•				•				•		
25	4 years		•				•				•		
26	1 year		•				•				•		
27	3 years										•		
28	1 year										•		
29	4 years		•				•				•		
30	3 years		•				•				•		

Table 15: The result of observation in" Kampen barnehage" for the closing time, on August 19,2021

Row	child's age	Who take the child					Means of transport;By				Weather condition		
		Mother	Father	Grand mother	Ground father	Other	walk	Bicycle	Car	Bus	Sunny	Rainy	Cloudy
1	3 years	•							•		•		
2	2 years	•					•				•		
3	3 years		•						•		•		

4	1 year		•				•				•		
5	2 years	•					•				•		
6	3 years	•					•				•		
7	4 years	•					•				•		
8	3 years	•					•				•		
9	3 years		•				•				•		
10	4 years		•					•			•		
11	4 years		•						•		•		
12	3 years	•					•				•		
13	4 years	•							•		•		
14	4 years	•					•				•		
15	2 years	•					•				•		
16	2 years	•					•				•		
17	4 years	•					•				•		
18	4 years		•				•				•		
19	3 years		•				•				•		
20	4 years	•						•			•		
21	3 years	•						•			•		
22	4 years	•							•		•		
23	3 years	•							•		•		
24	3 years	•							•				
25	2 years		•					•					
26	3 years		•					•					
27	4 years		•						•				
28	2 years		•						•				
29	1 year		•						•				

Table 15: The result of observation in" Kampen barnehage" for the opening time, on February 9,2022

Row	child's age	Who take the child					Means of transport;By				weather condition		
		mother	father	grandmother	grandfather	other	walk	bicycle	car	bus	Sunny	Rainy	Cloudy
1	5	•					•						•
2	4	•					•						•

3	3		•				•						•
4	4		•						•				•
5	2	•							•				•
6	4		•						•				•
7	5	•					•						•
8	3	•					•						•
9	2	•							•				•
10	1	•							•				•
11	5	•					•						•
12	4		•						•				•
13	4	•					•						•
14	3	•					•						•
15	2	•					•						•
16	2		•						•				•
17	2		•				•						•
18	3		•						•				•
19	4		•						•				•
20	2	•						•					•
21	4	•							•				•
22	4	•						•					•
23	4		•						•				•
24	5		•						•				•
25	2	•					•						•
26	3	•						•					•
27	3	•					•						•
28	1	•					•						•
29	4	•	•				•						•
30	2	•					•						•

Table 16: The result of observation in" Kampen barnehage" for the closing time, on February 9,2022

Row	child's age	Who take the child					Means of transport;By				weather condition		
		mother	father	grandmother	grandfather	other	walk	bicycle	car	bus	Sunny	Rainy	Cloudy
1	2	•					•						•
2	1	•					•						•
3	3		•				•						•
4	2	•							•				•
5	4		•						•				•
6	4	•							•				•

7	5	•					•						•
8	4			•					•				•
9	3		•					•					•
10	4	•							•				•
11	3	•						•					•
12	3		•						•				•
13	4	•						•					•
14	3		•					•					•
15	2	•							•				•
16	3			•					•				•
17	4			•					•				•
18	3	•					•						•
19	3	•					•						•
20	4	•							•				•
21	3		•					•					•
22	5	•						•					•
23	4	•					•						•
24	5		•						•				•
25	4	•					•						•
26	5		•						•				•
27	2	•							•				•
28	4		•						•				•
29	4	•							•				•

Table 17: The result of observation in" Læringsverkstedet barnehage Avd Lervig Brygge" for the opening time, on August,23,2021

Row	child's age	Who take the child					Means of transport;By				Weather condition		
		Mother	Father	Grand mother	Ground father	Other	walk	Bicycle	Car	Bus	Sunny	Rainy	Cloudy
1	3 years	•					•						

2	4 years	•					•						
3	3 years	•							•				
4	4 years		•						•				
5	4 years		•				•						
6	3 years		•				•						
7	2 years	•					•						
8	3 years			•					•				
9	4 years	•						•					
10	3 years	•							•				
11	4 years		•					•					
12	4 years	•					•						
13	3 years	•					•						
14	2 years	•					•						
15	1 year	•					•						
16	4 years		•				•						
17	5 years	•					•						
18	2 years		•				•						
19	5 years	•					•						
20	3 years	•					•						
21	4 years	•					•						
22	1 year	•					•						
23	3 years	•						•					
24	2 years		•				•						
25	4 years				•		•						
26	4 years	•					•						
27	3 years	•						•					
28	3 years		•				•						
29	4 years	•					•						
30	3 years		•					•					
31	4 years	•					•						
32	2 years		•				•						
33	3 years	•					•						
34	4 years		•					•					
35	3 years		•				•						
36	2 years	•					•						
37	3 years	•						•					
38	2 years	•					•						
39	4 years	•						•					
40	4 years	•					•						
41	3 years	•						•					
42	3 years		•					•					

43	3 years		•				•						
44	4 years	•					•						
45	4 years	•					•						
46	2 years	•					•						
47	3 years		•				•						

Table 18: The result of observation in" Læringsverkstedet barnehage Avd Lervig Brygge" for the closing time,on August 23.2021

Row	child's age	Who take the child					Means of transport;By				Weather condition		
		Mother	Father	Grand mother	Ground father	Other	walk	Bicycle	Car	Bus	Sunny	Rainy	Cloudy
1	3 years	•					•						•
2	4 years	•					•						•
3	3 years	•					•						•
4	3 years		•				•						•
5	4 years	•					•						•
6	4 years	•					•						•
7	3 years	•					•						•
8	2 years	•					•						•
9	4 years	•							•				•
10	3 years		•				•						•
11	4 years		•				•						•
12	3 years	•					•						•
13	3 years	•							•				•
14	5 years	•					•						•
15	3 years		•				•						•
16	2 years		•				•						•
17	3 years		•				•						•
18	4 years		•				•						•
19	4 years		•						•				•
20	3 years	•					•						•
21	4 years		•				•						•
22	3 years	•					•						•
23	4 years	•					•						•
24	2 years	•					•						•
25	5 years	•					•						•
26	4 years	•					•						•
27	5 years		•				•						•
28	3 years		•				•						•

29	4 years		•				•						•
30	2 years	•					•						•
31	4 years		•				•						•
32	3 years				•		•						•
33	4 years			•			•						•
34	3 years						•						•
35	2 years								•				•
36	3 years		•				•						•
37	2 years	•					•						•

Table 19: The result of observation in" Læringsverkstedet barnehage Avd Lervig Brygge" for the opening time, on February11,2022

Row	child's	Who take the child					Means of transport;By				weather condition		
	age	mother	father	grandmother	grandfather	other	walk	bicycle	car	bus	Sunny	Rainy	Cloudy
1	3	•					•						•
2	1		•				•						
3	4		•						•				
4	4	•					•						
5	3	•					•						
6	3	•					•						
7	3		•				•						
8	4		•				•						
9	3		•				•						
10	2	•					•						
11	4		•						•				
12	5		•				•						
13	4	•							•				
14	4		•						•				
15	2		•						•				
16	3		•						•				
17	5	•					•						
18	3	•					•						
19	2		•				•						
20	2		•				•						
21	2	•					•						
22	4	•							•				
23	5	•					•						
24	4	•					•						
25	3	•							•				
26	3		•				•						
27	5	•					•						
28	4	•					•						
29	5		•				•						
30	2		•				•						
31	5	•					•						
32	2		•				•						
33	2		•				•						
34	5		•				•						

35	2		•						•				
36	4		•					•					
37	5	•					•						
38	4		•				•						
39	2	•					•						
40	4	•					•						
41	3	•					•						
42	4	•					•						

Table 20: The result of observation in" Læringsverkstedet barnehage Avd Lervig Brygge" for the closing time, on February11,2022

Row	child's age	Who take the child					Means of transport;By				weather condition		
		mother	father	grandmother	grandfather	other	walk	bicycle	car	bus	Sunny	Rainy	Cloudy
1	3		•				•						•
2	2	•	•				•						
3	2		•				•						
4	2	•					•						
5	3		•					•					
6	4		•						•				
7	3	•							•				
8	5		•				•						
9	2	•							•				
10	3	•					•						
11	3		•						•				
12	4	•					•						
13	2	•					•						
14	5		•						•				
15	3	•							•				
16	4		•					•					
17	5	•					•						
18	3	•							•				
19	3		•				•						
20	2	•							•				
21	4	•							•				
22	3		•				•						
23	4		•						•				