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Enhancing Sustainable Urban-Rural Integration in Finland

Transportation logistics-based approach

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Abstract

The challenges emerging from the ongoing trend of urbanization suggest the need for ruralization. One approach to enhancing ruralization, along with sustainability, lies within functional transportation logistics. Past research on rural transportation has discussed the potential of the integration of autonomous vehicles and demand-responsive transportation systems. Their possibility was explored in this research through semi-structured interviews with industry experts. The results then concluded that an autonomous demand-responsive transportation system could transform rural areas into more viable places to live. However, due to the level of technology, lack of funding, and absence of large operators, integration of autonomous demand-responsive transportation may not yet be realistic to implement. Whether the current technology could already partly solve the issue was not entirely excluded.

Keywords Ruralization, urbanization, sustainability, demand-responsive transportation,, autonomous vehicles, Finland, rural areas

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Tiivistelmä

Kaupungistumisen tuomat haasteet, viittaavat ruralisaation tarpeeseen. Yksi lähestymistapa ruralisaation kuin myös kestävän kehityksen edistämiselle tiivistyy liikennelogistiikkaan. Aikaisemmat tutkimukset haja-asutusalueiden liikennelogistiikasta ovat avartaneet keskustelua autonomisten ajoneuvojen sekä kutsuohjatun joukkoliikenteen mahdollisuuksista, joita tutkittiin tässä tutkimuksessa asiantuntija haastatteluiden avulla. Tutkimuksesta kävi ilmi, että autonominen kysyntäohjattu kutsuliikennesysteemi voisi edistää haja-asutusalueiden houkuttelevuutta sekä elinvoimaisuutta. Kuitenkin teknologian kypsyys, rahoituksen puute sekä suurten toimijoiden puuttumisen takia autonominen kysyntäohjattu kutsuliikennesysteemi ei välttämättä ole vielä realistista. Kuitenkin sitä mahdollisuutta voisiko jo nykyinen teknologia osittain ratkaista ongelmaa, ei kuitenkaan ole pois suljettu.

Avainsanat Ruralisaatio, urbanisaatio, kestäväkehitys, kysyntäohjattu kutsuliikenne, autonomiset ajoneuvot, Suomi, maaseutu

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Preface and acknowledgements

I want to thank my thesis supervisor, Mikko Pynnönen, for their good advice and guidance.

Mikkeli, 14 April 2024
Elias Salminen

1 Introduction

Rural living tends to be discarded as an alternative living option to the ongoing trend of urbanization. Even though ruralization holds promising possibilities to counter unsustainable aspects of urbanization, challenges emerging from the practical side of the rural living may prompt barriers that prevent the realization of its values. One may even be tempted to wonder whether the current state of rural living is realistic living option. The research around enhancing rural living is nothing new, yet challenges preventing rural living remains the same. In this regard research aiming to enhance rural transportation logistics is welcomed.

1.1 Research Problem

To address the challenges emerging from the ongoing trend of urbanization, it seems logical to discover other alternative options, and of course alternative to urban living is rural living. The question of how rural areas can become more attractive places to live emerges from the logic. One approach is to argue that the lack of ruralization revolves around differences in transportation logistics between rural and urban areas. Then the question of whether unfavourable characteristics of Rural living can be overcome with proper transportation logistics is reasonable. The core reasoning of this thesis is built on that functional transportation logistics could make rural areas more viable places to live. However, how the rural transportation logistics should be restructured is left to the research to solve.

1.2 Research Questions

Based on the research problem identified in the previous section, research questions consist of two questions that revolve around how rural transportation logistics can be improved. The research question are as follows: “How rural transportation logistics in Finland can be restructured to address the current limitations in the transportation of people, goods, and services, making rural living a more viable option for living to people seeking alternatives to urban areas?” and “What innovative transportation logistics strategies or technologies can be introduced to overcome the challenges in rural transportation logistics? The first research question has a wider focus on the research problem and aims to solve the issue in a general level. Meanwhile, the second research questions aim to discover more specific solutions within the first research question.

1.3 Research Objectives

The objective of the research, alongside research questions, is to discover solutions on rural transportation logistics that could make rural living a more viable option to live and then evaluate feasibility of the discovered solutions through the conducted research. Research regarding rural transportation has been conducted for a long time, yet in an area that development may rely on external factors, such as development of technology, there is suspicion that the feasibility changes within time, and hence it is reasonable to conduct.

1.4 Structure of the Thesis

This thesis includes a literature review, methodology, findings, discussions and analysis, and conclusions. The literature review will focus on analyzing the current state of the rural area's transportation logistics. Analyses in literature review will pave the way to formulate the research. The literature review will also consist of a conceptual framework that will clarify the connection of current research and the purpose of this thesis. The methodology part will cover how the research was structured, conducted, and analyzed to serve the purpose of the research questions. The methodology of how participants were chosen are also discussed in the methodology section. Findings will analyze the conducted research. The discussions and analysis part consist of the interpretation of the findings. Last part will be conclusions that briefly explain the main findings of the research, implications for international business, and analysis for further research.

2 Literature Review

The concept of urbanization refers to the movement of people and resources into urban areas (Urbanization, 2023). Likewise, ruralization refers to moving people and resources from urban areas into rural areas (Ruralization, 2023). The purpose of enhancing sustainable urban-rural integration from the transportation logistics context is to opt for a more sustainable approach to what the current trend of urbanization can offer.

The ongoing trend of urbanization in Finland which began in the 1950s and gained momentum in 1990 (Heikkilä & Järvinen, 2002), has scattered how people are distributed between urban and rural areas. However, the trend of urbanization has not only centralized resources and enhanced service accessibility but has also prompted challenges to sustainable ways of life, a phenomenon evident not only within Finland but also globally. With challenges emerging from the urban way of living, the need to explore alternative ways of living has become necessary, with rural living emerging as a viable alternative.

2.1 Urban-Rural Dynamics

Urban and rural areas are vastly different environments, and it is no wonder that either of the living modes can have distinct differences when it comes to their effect on the people living there and the surrounding environment. When the sustainability theme around urban-rural context is narrowed down into smaller aspects, such as mental health, it can be further analyzed to highlight the need for other alternatives to urban living.

It is worth noticing that the absence of comprehensive domestic scholarly research on the correlation of mental health and urban living in Finland limits the validity of data but worldwide data can lay the groundwork to be applied to Finland. A national morbidity survey conducted in the United Kingdom discovered a correlation between high levels of mental health issues and urban living (Paykel et al., 2000). Of course, discoveries in the UK cannot be directly applied to the Finnish context but it brings forth ideas of mental health issues in urban areas.

Although urban areas tend to be associated with health issues more than rural areas, rural areas are not without issues. A study conducted by the National Health Institute in Finland discovered that type 1 diabetes is more common in rural areas compared to urban areas (Rytkönen et al., 2003). However, this observation cannot be exclusively linked to the rural environment as there can be underlying reasons surrounding rural living and not specifically geography.

Another study on well-being among people who move from either an urban area to a rural area or from a rural area to an urban area in Finland

conducted at the University of Oulu found that people who move from rural areas to urban areas have higher levels of dissatisfaction to their life compared to their previous life in rural areas (Lankila et al., 2013). Likewise, in the same study, the researcher also discussed the potential that people tend to move to urban areas after health care services. Although the better quality of life in rural areas may give urban area dissatisfaction to one's life moving to urban areas after health care service refers to impact on one's life that can worsen life quality.

After identifying the downfalls of urban living compared to rural living, while realizing the urbanization trend, opposite to promising ruralization, the question "what prevents ruralization" is imminent. If rural living can offer a more sustainable approach to living compared to urban living, and the promising value of urban living is not realized by the people, there must be barriers preventing it and thus also attributes that could enhance ruralization.

2.2 Transportation Logistics as a Solution

To understand barriers to ruralization, it seems logical to identify the causes of urbanization. Overall, the cause of urbanization can be argued to be due to multiple attributes with job prospects emerging as a prominent factor (Jweihan et al., 2012). In simplicity, economic incentives drive urban living and attract services to urban areas, thus sustaining urban living. Furthermore, encouraging people to move to rural areas requires creating economic opportunities in rural areas.

However, whether economic opportunities exist in the rural areas or whether people living in rural areas have access to economic opportunities elsewhere, is entirely another question. Creating economic incentives in rural living is a complicated task, yet restructuring rural areas' transportation, so that rural areas can be connected to the pool of opportunities elsewhere seems a more realistic solution.

2.3 Rural Transportation Logistics Infrastructure

In this thesis, we can identify transportation logistics systems into three categories: people, goods, and services. In the rural logistics context, solving transportation logistics issues requires restructuring all three categories. The past research on transportation logistics in the rural context has laid the groundwork for the restructuring but due to technological advancements made after the publication of the research, solving the issues in transportation logistics could be now more viable.

In current rural areas transportation in Finland consists of a combination of fixed public transportation and private car ownership, in which public

transportation routes are scares due to economic reasons (Eckhardt, Siirilä & Nykänen, 2018). Both methods of transportation seem to be outdated and do not contribute to the idea of transportation that is sustainable and enhances the viability of rural areas for living.

Unlike in urban areas, establishing functional and economically efficient public transportation in sparsely populated rural areas is more difficult (Velaga et al., 2012). Long distances and sparsely located fixed public transportation routes incentivize people to opt for private car ownership in rural areas. Consumption of fossil fuels, unsustainable manufacturing, and idle usage tend to make private car ownership an unsustainable option (Toon Meelen and Münzel, 2023). Yet discarding private car ownership in sparsely populated rural areas is not a viable option without a solid transportation structure that holds security and ease of use for the community.

According to both domestic and global research, one possibility to enhance sustainable public transportation in rural areas is to implement a demand-responsive transportation system that utilizes transportation more effectively compared to private car ownership (Velaga et al., 2012) (Vilko, Karandassov, & Myller, 2011). In essence, demand-responsive transportation refers to a transportation system in which routes and schedules are adaptive to the passenger's needs (Parragh, Doerner and Hartl, 2011). Unlike conventional public transportation systems, demand-responsive transportation is flexible. By being able to change routes and schedules, demand-responsive transportation offers similar benefits to private car ownership.

When implemented effectively, and in consideration of the community around them, demand-responsive systems could offer solutions to rural transportation logistics. From an urban perspective, rural areas tend to seem like one unified area outside of urban areas, however, rural areas contain a plethora of smaller communities such as villages (Salmivuori, 2022). Given the presence of smaller communities within rural settings and already established functional fixed transportation systems between different urban areas, rural transportation needs primarily revolve around intra-community travel and connectivity to nearby urban areas.

Research on demand-responsive transportation functionality has been conducted for decades and some studies on demand-responsive transportation can be dated even as early as the 1970s (Daganzo, 1978). However, due to technological limitations demand-responsive transportation has not been able to reform transportation structure in the desired way. Fortunately, current technological advancement has made autonomous vehicles a reality. Although autonomous vehicles seem like science fiction, autonomous vehicles already exist in transportation with varying automated functionality (Narayanan, Chaniotakis and Antoniou, 2020). The combination of autonomous vehicles and demand-responsive transportation can offer the possibility to restructure rural areas.

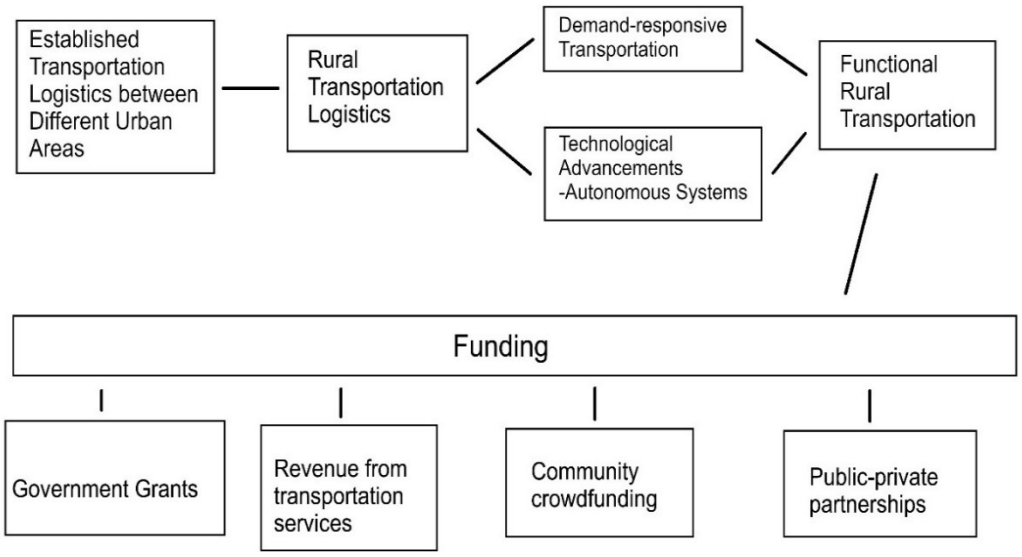

Figure 1: My chart illustrating the synthesis from others' work included in this thesis and acknowledged in the bibliography (Salminen, 2024)

2.3.1 The Logistics of People

In the transportation logistics of people area, to be able to transform transportation logistics into a combination of demand-responsive transportation and an autonomous system boils down to people's willingness. According to a domestic study of a driverless shuttle bus experiment conducted in the University of Southern Finland, people have positive attitudes toward autonomous vehicles, especially after trying autonomous system services (Salonen and Haavisto, 2019). This implies that people are willing to use autonomous transportation systems, but it does not conclude that people are willing to opt for an entire restructuring of transportation systems into autonomous demand-responsive transportation.

Another domestic study concluded that 65% of people in Finland are willing to give up private car ownership if fully automated and available public transportation is good enough (Liljamo et al., 2021). The selected participants in the study were not only from rural areas but also urban areas, which could have affected the validity of the results, but the study also concluded that location did not affect the results. Regarding transforming transportation logistics in rural areas, current studies suggest that people are open to autonomous demand-responsive transportation logistics.

2.3.2 The Logistics of Goods

Rural areas tend to have fewer transportation logistics opportunities than in urban areas, which can be argued to be due to economic reasons (Ministry of Transport and Communications, 2007). Established functional transportation logistics between urban areas do exist, which suggests that the issue within rural transportation logistics lies in the companies' last-mile logistics. As the narrative on demand-responsive transportation tends to focus on the transportation logistics of people, there is no comprehensive study conducted on the possibility of demand-responsive transportation of goods in rural areas that would signal its implications.

2.3.3 The Logistics of Services

Ease of access to services tends to be one of the attributes of urbanization and it must be considered when restructuring rural transportation logistics. In essence, ease of access relates to that people and services have a functional connection. From a rural transportation perspective to combat these issues, implementing autonomous demand-responsive transportation has three choices. The restructuring needs to either facilitate the movement of services to people, people to services, or dissolve a need for transportation.

Unlike in part 2.5.1 which discusses the transportation of people, the Transportation of services, provides more logistical dilemmas, as transportation of services can simultaneously revolve around the movement of goods and people. One solution to facilitating transportation service transportation to people can be mobile services that have been long used in rural areas in Finland in many forms, such as mobile libraries that have been operating since 1961 (Haavisto, 1994). These services can not only offer access to services in sparsely populated rural areas but also utilize the benefits seen in urban areas. However,

As technological innovations can offer better-performing transportation systems, they can also offer alternatives to transportation of people to services or services to people. One example of how technological advancements can contribute to the restructuring of transportation is virtual services that could eliminate the need for physical transportation. Research conducted in Canada found optimistic promises in utilizing virtual healthcare assistance with patients with cardiovascular diseases in rural areas (Buyting et al., 2022). Although the study mentioned that the virtual services required more research, it can still offer a viewpoint on how alternative approaches to issues affect the restructuring of transportation logistics.

2.7 Conceptual Framework

Current research suggests that demand-responsive transportation could restructure rural transportation. However, due to technological limitations before, it has now emerged as a more feasible alternative. With the current technological advancements, it is worth to research whether demand-responsive transportation can be combined with autonomous vehicle transportation systems to restructure rural transportation into functional transportation that creates rural areas into more viable to live. It can be further concluded that the restructuring of rural transportation includes people, goods, and services aspects from which each of these areas are interconnected.

As illustrated below, the independent variable for this thesis is to discover innovative transportation logistics strategies to achieve the dependent variable, viable rural living. The hypothesis then remains from the literature review that a combination of demand-responsive transportation and autonomous vehicles could provide structure for functional transportation in the rural areas. Thus, functional transportation can then reform rural areas into more viable living options.

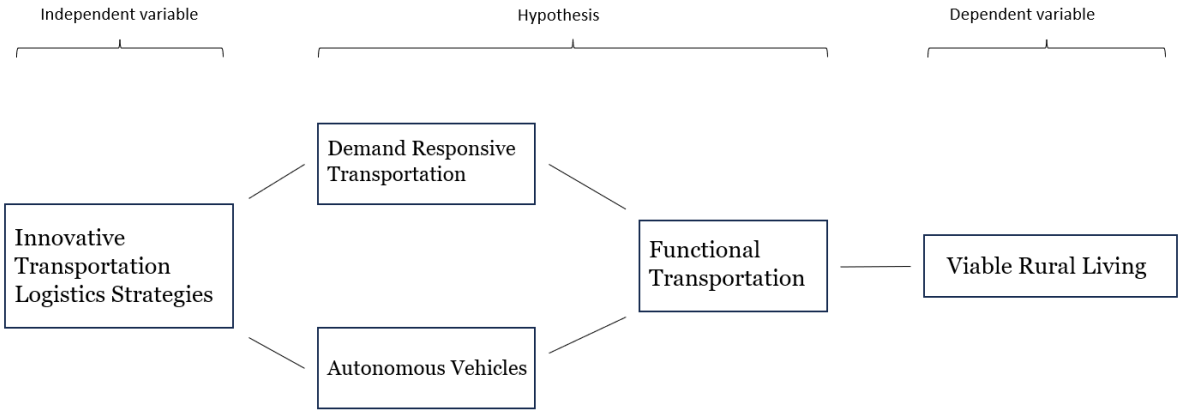

Figure 2: Conceptual framework

3 Methodology

The core purpose of the research in this thesis is to discover how rural transportation can be restructured to increase sustainability. The underlying need for restructuring of the rural area's transportation emerges from the need to discover solutions to urbanization's root issues, as discussed in the previous sections. This thesis aims to conceptualize that one solution to urbanization is ruralisation which requires feasible rural areas transportation. According to the discussions in the literature review, a combination of demand-responsive transportation and autonomous vehicles can offer the possibility for better rural areas transportation (Velaga et al., 2012) (Vilko, Karandassov, & Myller, 2011) (Narayanan, Chaniotakis and Antoniou, 2020). As for the methodology, this thesis aims to conduct research to further investigate the possibilities of demand-responsive transportation and autonomous vehicles, in the Finnish rural transportation context.

3.1 Structure of the Research

The research consisted of semi-structured interviews to collect qualitative data from the experts in the field. This approach was chosen because it creates flexibility towards the research issues, to view the problem from a wider perspective. The interview itself was built upon three different themes that included the overall demand for responsive transportation, overall autonomous vehicle possibilities, and a possible theory on combining both. Each theme included three questions, totalling nine questions that were carefully chosen to be interconnected.

The questions in each theme were structured meaningfully and served the purpose of the whole interview. The purpose of the first question in each theme topic was to elaborate interviewee's personal views towards the theme topics and open the interview to a general level. This was also done, to further analyse later responses to the personal connection to the subject. If later responses to upcoming questions differed between interviewees, one way to discover the reasoning for the phenomenon was to analyse differences within the personal and general level through the first question.

After the general levels were achieved with the first question, the second question's purpose was to research how feasible the concept is to implement in rural areas. In this sense, the second question consisted of the core idea of the research with the aim of understanding on a practical level how realistic each concept is.

However, unlike the first two questions that built general and topic-specific level understanding, the third question's purpose was to go beyond the core idea of the research and ask for further implications of the combination

of demand-responsive transportation and autonomous vehicles to other areas of the research that may not even be covered within this thesis.

Besides the structure of the questions itself, each theme was also carefully chosen and structured in a way that the first and second themes were meant to lead up to the third theme. The first two themes' purpose was to spark ideas for the connection of two separate concepts of demand-responsive transportation and autonomous vehicles that are the core of this thesis. By the time, the interview continued to the third theme, the interviewee had already thought of different concepts and a good foundation to think through the theory of combining both concepts to restructure rural area logistics. Furthermore, not only each of the themes were chosen with the interviewee in mind but also had a practical meaning as it is logical to analyze first individual responses to each concept and then test how interviewees respond when each concept is combined.

3.2 Questions of Each Theme

The first theme was demand responsive transportation and it consisted of three questions. The first question was “What are your thoughts on demand-responsive transportation and its potential use in rural areas in Finland?” The second question was “How realistic do you believe implementing demand-responsive transportation systems would be in rural areas of Finland?” and the third question was “What potential benefits or threats would you identify with the integration of autonomous vehicles in rural transportation logistics in Finland?”

The second theme was autonomous vehicles and it also consisted of three questions. The first question was “What are your thoughts on autonomous vehicles and their potential us in rural areas in Finland?” The second question was “How realistic do you believe implementing autonomous vehicles would be in rural areas of Finland?” Finally, the third question was “What potential benefits or threats would you identify with the integration of autonomous vehicles in rural transportation logistics in Finland?”. The wording of both themes of one and two were almost identical but it was done so that the results from both concepts were logical to compare with one another.

The last theme also referenced as the third theme was called the theory of combination, which in essence was about the possibilities of combination of themes one and two. The first question in the third theme was “Do you believe that the combination of demand-responsive transportation and autonomous vehicle technology could restructure rural logistics to be more viable to live?” The second question was “How realistic do you think it would be to integrate the combination of demand-responsive transportation and autonomous vehicle technology to restructure rural logistics in Finland?” and then the third question was “What potential benefits or threats can you identify

from integrating the combination of demand-responsive transportation and autonomous vehicle technology in rural transportation logistics in Finland?"

3.3 Chosen Participants

The current research discussed in the literature review offers a theoretical aspect to analyze the possibility of demand-responsive transportation and autonomous vehicles possibilities in the rural context. However, as the core challenges of this thesis are not solely theoretical but also practical, as rural areas' logistics involve real-life practices as well as theories for solutions, participants were chosen in practical terms to complete the bigger picture of the rural areas' transportation logistics with theoretical aspects from the literature review.

Each participant for the interview was chosen based on their relevant practical position towards transportation logistics, meaning that each interviewee had real-life experience in the transportation logistics industry and specifically expertise with demand-responsive transportation and autonomous vehicles technologies or their implementation. Although all participants shared similar engineering backgrounds with demand-responsive transportation and autonomous vehicles, they had experiences from the different industries where the demand-responsive transportation and autonomous vehicle technologies were implemented.

Overall, the purpose of the chosen approach on how participants were selected aimed to gain practical insight from experts in demand-responsive transportation and autonomous vehicles, while simultaneously capturing diverse perspectives and patterns from different industries that could be applied to rural transportation logistics.

Informant	Background	Expertise	Sector	Language of interview	Duration of interview	Method
Johanna Taskinen	Transport engineer	Developed DRT service platform	Transportation logistics	Finnish	40 min	Teams
Anonym 1	Electrical Engineer	Worked with sustainable transportation, DRT, and	Transportation logistics	Finnish	-	Email

		MaaS projects				
Anonym 2	Com-puter Software engineer	Devel-oped DRT so-lutions to mobile vehicle devices	Trans-portation logistics	Finnish	-	Email

Figure 3: Table of informants.

3.4 How Data Was Analysed

Collected data from the interviews was analysed with a thematic analysis, to identify patterns within the interview responses. As discussed in the structure of the research part, each theme and question within the interview were structured purposefully to have ease in finding implications of possibilities of utilization of demand-responsive transportation and autonomous vehicles in rural transportation logistics context.

The practical aspect of the collected data analysis process consisted of multiple steps that fulfilled the purpose of understanding the data and discovering patterns. These steps included understanding the data of each response, decoding the data, and eventually discovering patterns. The decoding strategy implemented was first to fully understand each response and then assign for each segment of the response a specific code that represented key concepts or ideas presented by the informants. These segments were chosen to be answers to each question, resulting in nine segments for each response. With three responses, each 9 segments, there were 27 segments that each were compared vertically but also horizontally to other responses.

This chosen method allowed for a systemic decoding approach to discover patterns between responses, while also maintaining flexibility for each response. The codes themselves were not predefined but were developed along with the familiarization of the collected data. Although, results are presented in English, the data from the participants was collected in Finnish and the original questions in Finnish can be found in appendices.

4 Findings

All participants had a positive view of demand-responsive transportation being a solution for rural area logistics. Two out of three participants mentioned demand-responsive transportation as being the only solution. Participants also concluded that demand-responsive transportation can be a cheaper alternative but simultaneously argued that the implementation of demand-responsive transportation would require high costs to set up. Participants showcased scepticism towards how realistic demand-responsive transportation could be to integrate due to these identified high costs to set up. Participants suggested that integration of demand-responsive transportation would require subsidization, which is already the reality for rural area transportation logistics, and or large operator "toimija" or government that would have the resources.

Regarding potential benefits and threats the conducted research indicated that demand-responsive transportation could enhance rural areas vitality and attractiveness. One participant commented in Finnish that "Hyötynä on maaseudun houkuttelevuuden kasvu, sekä yksityisautoilun tarpeen lasku.", translated "the benefits are the increase in the attractiveness of rural areas, as well as the decrease in the need for private car usage." One participant also argued that "liikenneköyhyys" would decrease, referring that more people would have access to transportation opportunities. The possibility that fare tickets in public transportation could increase, regardless of subvention, was also mentioned.

Participants were not certain whether autonomous vehicles could be ready to be implemented into rural areas transportation logistics. Concerns regarding implementing autonomous vehicles into rural areas logistics were focused on weather conditions and the maturity of the technology. However, autonomous vehicles seem to be a promising solution for the future, according to the participants, although not soon. The research also identified that autonomous vehicles could decrease subvention, while increasing the number of vehicles. Possibility of decreasing cost was also mentioned by one of the participants.

Participants seemed to showcase sceptism towards how realistic autonomous vehicles would be to implement not only with their current state but also with more advance technological abilities. One participant noted that when the cost of owning autonomous vehicle and renewable electricity will be enough affordable, autonomous demand responsive transportation will be implemented. Likewise in demand-responsive transportation, participants also concluded that integration of autonomous vehicles would require either larger operator or government subsidisation. One participant suspected that the challenges emerging from creating a profitable business model out of autonomous vehicles would suggest the need for government subsidization. It was also noted that when autonomous demand-responsive vehicles are

possible, they are likely to be first introduced into cities and then into rural areas, where there is a possibility for it to not be profitable and hence operation in cities would cover operations in rural areas.

Regarding benefits and threats, concerns for safety in autonomous vehicles emerged as a pattern among participants. Autonomous vehicles were also identified to have cybersecurity risks. It was noted that autonomous vehicles would not completely obsolete human need, especially in healthcare of the elderly human assistance was needed. For the benefits, autonomous vehicles, were deemed to have less cost and hence be able to offer transportation services in rural areas.

When the theory of combining autonomous vehicles and demand-responsive transportation to restructure rural area's transportation logistics was introduced, participants showcased optimism that autonomous demand-responsive vehicle systems could increase the attractiveness of rural living. However, the research concluded that the unrealistic aspect of Autonomous demand-responsive vehicle system implementation was due to financial and technological issues.

5 Discussion and Analysis

The participants of the conducted research consisted of experts working in the transportation logistical companies. These companies operate in the private sector around transportation logistical issues and can be affected by changes in rural transportation logistics. Regardless of industry, company secrets tend to be a way of maintaining competitive advantage. Hence, it was logical that most of the participant required anonymity for their answers. However, the level of required confidentiality raised questions. One participant stated clearly that their provided information is confidential, which might suggest that the topic might be undergoing a substantial shift that is beyond the findings of the research.

Demand-responsive transportation has been pondered for a long time, as one participant stated that ”...tätä hommaa on synnytetty 80 luvulta lähtien eli 40 vuotta ja jotkut ehkä on luovuttanutkin matkan varrella...” translating “This thing has been tried to birth since 1980s, so 40 years and some may have given up along the way”, which may affect how autonomous demand responsive transportation is viewed. As the pattern of skepticism tends to emerge from the research, it could be suggested that part of the skepticism is due to the everlasting failure of demand-responsive transportation implementation that is ingrained in people within the industry. Hence, it is worth wondering if the underlying barriers preventing solving the issues are due to a mindset that has been fed with impossibility for 40 years.

However, regardless of mental view towards issues, as findings suggest interviewed experts do not believe technology is fully ready, and more importantly lack of funding prevents successful integration. Simultaneously, research suggested that autonomous demand-responsive transportation can lower the costs of transportation but also that the cost of setting up functional autonomous demand-responsive transportation can be too large of a task, both financially and scale-wise for a startup or private sector, which forces government subsidization.

6 Conclusions

Promising solutions that emerged from the synthesis of past research in the literature review were examined by the conducted research. These methods offered wide range of findings that benefits the overall research of the rural area's transportation logistics. However, the findings from the research were not fully able to solve the given issues without concerns.

6.1 Main Findings

The research concluded that functional autonomous demand-responsive transportation system could make rural areas more attractive and viable places to live. However, it was widely illustrated by the interviewed participants that implementation of autonomous demand responsive transportation system is not yet realistic with the current state, due to the current level of technology, lack of required funding and absence of enough large operator to have capacity and resources to establish functional autonomous demand-responsive transportation system.

Although, concerns regarding safety and functionality were raised regarding the current state of technology, the possibility that technology could already partly solve the issues was not entirely excluded. The call for a government subsidization and government steering, seemed congruent among participants. The question then arises whether proper subsidization from government could offer positive results from a small trial experiment.

6.2 Implications for International Business

Integration of a functional autonomous demand-responsive transportation system that transforms rural areas into more viable places to live has no doubt a plethora of different aspects towards international business. Rural areas do not solely exist in Finland, moreover challenges faced by rural areas in Finland regarding transportation can be seen globally. Hence, findings and conclusions within the Finnish rural context can be applied into global context.

Main implication for international business from the global business environment could be as a form of investment opportunity. In a competitive aspect, solution generated in one place could be introduced, and possibly capitalized elsewhere within the global marketplace. If transportation solutions targeted in rural areas in Finland can be beneficial, they can also be exported to be beneficial in other parts of the world.

6.3 Suggestions for Further Research

Researching more advance technological innovations is evident to be able to successfully integrate functional technologies that enhances viability of rural living. Nevertheless, the technological innovations that can be applied to rural areas might emerge as a byproduct from already existing research for other purposes. For these reasons, efforts for enhancing rural transportation could be focused on areas that are specifically beneficial for the rural area transportation logistics restructuring.

Two important rural area transportation logistics specific further research point would be to research how government could be incentivized to invest substantial amounts for building required infrastructure and commit to steering legislation into direction that benefits integration of rural area transportation logistics solutions. These research suggestions could not only solve the issue of lack of funding identified in the research, but also guarantee that the established infrastructure is maintained.

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Appendices

Asked questions in Finnish:

1. Mitä ajatuksia herää kysyntäohjatusta kutsuliikenteestä ja sen mahdollisesta käytöstä maaseutualueilla Suomessa?

2. Kuinka realistisena pidät kysyntäohjautuvan kutsuliikenteen toteuttamista Suomen maaseutualueilla?

3. Mitä mahdollisia hyötyjä tai uhkia tunnistaisit kysyntäohjatun kutsuliikenteen integroinnista maaseudun kuljetuslogistiikkaan Suomessa?

4. Mitä ajatuksia herää autonomisista ajoneuvoista ja niiden mahdollisesta käytöstä maaseutualueilla Suomessa?

5. Kuinka realistisena pidät autonomisten ajoneuvojen toteuttamista Suomen maaseutualueilla?

6. Mitkä mahdolliset hyödyt tai uhat tunnistaisit autonomisten ajoneuvojen integroinnista maaseudun kuljetuslogistiikkaan Suomessa?

7. Uskotko, että kysyntäohjatun kutsuliikenteen ja autonomisten ajoneuvojen yhdistelmä voisi muokata maaseudun logistiikkaa ja siten tehdä siitä elinkelpoisemman asuinalueen?

8. Kuinka realistisena pidät kysyntäohjautuvan kutsuliikenteen ja autonomisten ajoneuvojen teknologian yhdistelmän integroimista maaseudun logistiikan uudelleenjärjestelyyn Suomessa?

9. Mitkä mahdolliset hyödyt tai uhat tunnistat kysyntäohjautuvan kutsuliikenteen ja autonomisten ajoneuvojen teknologian yhdistämisen kautta maaseudun kuljetuslogistiikassa Suomessa?