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Advancing Sustainable Mobility in the Biosfera Val Müstair

An Evaluation of Sustainable Mobility Solutions for Rural-Peripheral Areas in Switzerland

Author

Cédric Kleeb
Eigenstrasse 24
CH-6260 Reiden
cedric.kleeb@stud.fhgr.ch

Advisor

Frieder Voll
University of Applied Sciences of the Grisons
Commercialstrasse 19
CH-7000 Chur
frieder.voll@fhgr.ch

Co-Advisor

Franziska Peter
Director of Education and Culture at Biosfera Val Müstair
Center da Biosfera
CH-7532 Tschierv
franziska.peter@biosfera.ch

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Abstract

While sustainable transportation initiatives have often been directed at urban areas, rural-peripheral regions like Val Müstair face unique challenges due to their heavy reliance on private car usage, due to the lack of alternatives. The Biosfera Val Müstair, committed to promote sustainability within its park area, recognises the importance of addressing mobility-related issues and aims to enhance accessibility and reduce car dependency without restricting people's mobility. To achieve this, they plan to introduce alternative transportation options between 2025 and 2028.

This research paper focuses on sustainable mobility and its implementation in the Biosfera Val Müstair, a rural-peripheral, sparsely populated region in Switzerland. The Biosfera Val Müstair aims to address emission-related issues and improve the accessibility to mobility and well-being of residents and visitors by improving the access to sustainable mobility while reducing private car usage. Through an inductive, exploratory, qualitative approach, the study analyses prevailing mobility practices, collects suggestions for improvement, and explores factors influencing the acceptance of new mobility solutions. The qualitative data was obtained with semi-structured interviews. Following a qualitative content analysis approach resulted in practical recommendations to the Biosfera management, proposing ridepooling, ridesharing, and integrated mobility concepts as applicable solutions for the region. To ensure success of such projects, stakeholder involvement and collaboration were highlighted, along with the importance of community engagement and pilot projects. It is recommended, to implement not one single concept, but to combine matching offers and create a tailored mobility solution for Val Müstair.

For further studies, the focus should shift towards investigating the application and impact of the proposed mobility initiatives on behaviour changes within the Val Müstair community. Understanding the experiences and opinions of local people after the implementation of these enhancements will be crucial for shaping future adjustments and improving the mobility network in the region. Additionally, the use of quantitative methods alongside qualitative research could provide comprehensive analyses of mobility trends and data, supporting successful mobility planning and implementation in rural-peripheral areas like Val Müstair.

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°C	Degrees Celsius (temperature measurement)
a.m.	Ante Meridiem (before noon)
a.s.l.	Above Sea Level
AG	Aktiengesellschaft (stock corporation)
APA	American Psychological Association
ARE	Bundesamt für Raumentwicklung (Federal Office for Spatial Development)
BBSR	Federal Institute for Research on Building, Urban Affairs and Spatial Development
Bipar	Berlin Institut für Partizipation
BMBF	Bundesministerium für Bildung und Forschung (Federal Ministry of Education and Research)
BUND	Bund für Umwelt und Natur Deutschland (Friends of the Earth Germany)
CE	Common Era
CO_2	Carbon Dioxide
EAER	Eidgenössisches Departement für auswärtige Angelegenheiten (Swiss Federal Department of Foreign Affairs)
FEDRO	Federal Roads Office (Bundesamt für Strassen ASTRA)
FHGR	Fachhochschule Graubünden (University of Applied Sciences of the Grisons)
FOEN	Federal Office for the Environment (Bundesamt für Umwelt BAFU)
FOT	Federal Office of Transport (Bundesamt für Verkehr BAV)
FSO	Federal Statistical Office (Bundesamt für Statistik BFS)
GA	Generalabonnement (GA Travelcard)
GHG	Greenhouse Gas
IPCC	Intergovernmental Panel on Climate Change
Km/h	Kilometres per Hour (speed measurement)
Km^2	Square kilometres (area measurement)

n.d.	No Date
NABU	Naturschutzbund Deutschland (Nature and Biodiversity Conservation Union)
Nr	Nummer (number)
p.m.	Post Meridiem (post noon)
PBG	Personenbeförderungsgesetz (Passenger Transport Act)
RhB	Rhätische Bahn (Rhaetian Railway)
SBB	Schweizerische Bundesbahnen (Swiss Federal Railways)
SBFI	Staatssekretariat für Bildung, Forschung und Innovation (State Secretariat for Education, Research and Innovation)
SFOE	Swiss Federal Office of Energy (Bundesamt für Energie BFE)
STA	Südtiroler Transportstrukturen (South Tyrolean Transport Structures)
TBA GR	Tiefbauamt Graubünden (Civil Engineering Department of Graubünden)
TESSVM	Tourismus Engadin Scuol Samnaun Val Müstair AG
UBA	Umweltbundesamt (Federal Environment Agency)
UBEVM	UNESCO Biosfera Engiadina Val Müstair
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
VÖV	Verband Öffentlicher Verkehr (Association of Public Transport)
VPB	Verordnung über die Personenbeförderung (Regulation on Passenger Transport)
WBF	Eidgenössisches Departement für Wirtschaft, Bildung und Forschung (Swiss Federal Department of Economic Affairs, Education and Research)
WWF	World Wide Fund for Nature

1 Introduction

There is widespread consensus among the scientific community that Earth's climate is changing, primarily due to human activities (Cook et al., 2016; Oreskes, 2004). While a small group of sceptics denies the anthropogenic influence, the majority of scientific research supports the view that human actions play a crucial role in the ongoing global warming and its significant consequences for humanity in the coming decades (Hornsey et al., 2018; Poortinga et al., 2011).

Throughout human history, human activities had a profound impact on the environment, characterised by rapid population growth, urbanization, and industrialization. Excessive consumption and reliance on fossil fuels heavily affected diverse ecosystems, providing human comfort and prosperity for several decades (Fuge, 2013; WWF Switzerland, n.d.). These human-caused emissions of greenhouse gases (GHGs) lead to an atmospheric accumulation of carbon dioxide, nitrous oxide, and methane. According to the 6th global climate report by the Intergovernmental Panel on Climate Change (IPCC, 2023), anthropogenic GHG-emissions have surged since the pre-industrial era. The concentration of CO_2 reached its highest level in the past 800'000 years, and the concentration levels are still rising. It is therefore beyond doubt, that the observed increase in global average surface temperature since 1950 is primarily caused by human activities. Further it affirms that each of the last four decades has been significantly warmer than any preceding decade since 1850. The report unequivocally states, that by emitting GHG into the atmosphere, human influence has led to the warming of the atmosphere, oceans, and continents. Diverse and significant changes are the consequences of the human-induced climate change (IPCC, 2023).

Various consequences, such asglobal rising temperatures, extreme weather events, sea-level rise, changes in precipitation patterns, and biodiversity loss, can be attributed to climate change. In fact, the month of July 2023 is on the verge of being recorded as the worldwide hottest July ever measured, with temperature records tumbling across the world. The North Atlantic has experienced its all-time record surface temperature, a milestone typically reached in September (Copernicus, 2023). These are just two of a meanwhile continuous flood of news regarding global climate and its consequences. The unprecedented changes caused by human-induced climate change disrupt ecosystems, damage infrastructure, threaten biodiversity, and pose severe risks to human well-being, as highlighted by the IPCC in 2023.

A recently published research paper by Meinshausen et al. (2022) says, that only in a scenario with highly ambitious reduction targets there is a possibility of limiting global warming to below 2°C compared to pre-industrial levels. They emphasise the fact, that in order to prevent unrestrained climate change, the anthropogenic GHG-emissions need to be significantly reduced, because an increase in the global average temperature of more than 2°C would drastically intensify the already noticeable impacts mentioned before (Meinshausen et al., 2022).

In order to limit the global rise in temperatures and human-induced climate change, the climate protection treaty of Paris, a legally binding international treaty on climate change, set the goal to “limit global warming to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C

above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change" (UN, 2015, p. 3). It entered into force on November 4th, 2016 (UNFCCC, n.d.). Switzerland also ratified the Paris climate protection treaty, which was signed by 192 countries committed to reduce GHG-emissions up to 50% by 2030 compared to 1990 and to become net-zero by 2050 at the latest (The Federal Council, 2017).

In Switzerland, the average air temperature has already increased by about 2°C compared to 1864, which is approximately twice the global increase of 0.9°C (FOEN, 2023a). Not only are the Swiss heavily affected by some consequences of climate change, but they also contribute disproportionately to it, ranking 13th globally in terms of per capita CO_2-emissions based on consumption (Ritchie et al., 2020). In its long-term climate strategy, Switzerland has also set a goal to emit no more GHGs by 2050 than can be absorbed by natural and technical sinks (FOEN, 2021a). This commitment to carbon neutrality was further emphasised by a recent Swiss popular vote that took place on Sunday, June 18, 2023. Swiss voters approved the government's new climate and innovation law with a majority of 59.1% in favour (The Federal Council, 2023). The law seeks to accelerate Switzerland's transition away from fossil fuels to renewable energies and achieve zero emissions by 2050. This popular vote demonstrates the strong public support for climate action and sustainability measures present in Switzerland.

Although GHG-emissions decreased by 19% in 2020 compared to 1990 levels, the goal of reducing them by 20% by 2020 was not achieved (FOEN, 2022). Even in 2021, they were only 18.2% lower than the emissions in 1990. While emissions from buildings in 2021 were approximately 30% lower than in 1990, the transportation sector showed the most significant lag, with emissions only decreasing by 7% compared to the target. The industrial sector performed relatively well, with emissions decreasing by 21%, aligning closely with the target (FOEN, n.d.).

In 2021, the transportation sector was with 31% the largest emitter of GHGs in Switzerland and is responsible for one-third of the total energy consumption of the country (FOEN, 2021b; FSO, 2022). Additionally, transportation contributes to traffic congestion and accidents, local noise and air pollution, and resulting negative health effects, while also consuming significant resources (Axhausen et al., 2021; Jacobson et al., 2016; Järlskog et al., 2021; Kinable et al., 2016; Szklarek et al., 2022).

In passenger transportation, cars are the largest contributors to CO_2-emissions per kilometre, and road transport alone accounts for 31% of Switzerland's total GHG-emissions, not included rail-, ship- or airline transport (FOEN, n.d.; UBA, 2021). Despite criticism of car-oriented societies dating back to the 1970s, transportation emissions have not been reduced to date (Bubenhofer, 2017). While GHG-emissions per distance travelled have decreased, this effect is outweighed by the increase in kilometres driven, population growth, and the use of increasingly heavier cars, resulting in a net increase in emissions (FOEN, 2018, 2021b). Additionally, factors such as industrialization and the growing spatial separation between work and residence have promoted long-distance travel in Switzerland. As a result of mass motorization, the settlement area has expanded widely rather than along public transport axes, further promoting motorised private transport (Bubenhofer, 2017). Results from the *Mircocensus Mobility and Transportation* show, that the average daily

distance travelled by a Swiss individual has increased by approximately 18% between 1994 and 2015, whereas in the time until 2021, the increase was erased mainly by the consequences of the pandemic. The same effect was observable looking at the average travel time per day, which peaked in 2005 and since then decreased again to the same level of 1994, mainly due to faster modes of transportation (Muralti et al., 2023).

1.1 Problem Statement

Non-urban areas have the highest car usage rates, with the longest distances travelled per person per day. This is due to factors such as poorer accessibility to services, limited job opportunities, and inadequate public transport connections compared to urban areas (Muralti et al., 2023). However, most findings on climate-friendly mobility focus on urban areas, with limited research available for non-urban areas (Marx Gómez et al., 2021, 2021; Zhao & Yu, 2020). Due to the different circumstances, measures developed for cities are not equally applicable in non-urban areas, as they may not achieve the same effectiveness, economic viability, or acceptance (BUND, 2015). Thus, there is a lack of studies, concrete solutions, and recommendations specifically addressing climate-friendly mobility in non-urban areas.

In recent years, sustainable mobility has emerged as a crucial topic for researchers, policymakers, and communities worldwide. The need to address environmental concerns, reduce carbon emissions, and enhance the quality of life has led to a renewed focus on developing sustainable transportation solutions. While urban areas have often been at the forefront of such initiatives, rural regions also play a vital role in achieving sustainable mobility goals.

1.2 Role of Biosfera Val Müstair

The overall goal of this research is to contribute to the promotion of sustainable mobility within the region of Val Müstair, a valley located in the easternmost tip of Switzerland which in 2010 got labelled “Park of National Importance” and renamed to Biosfera Val Müstair. Being an institution and platform that initiates and supports various projects in the areas of nature, society, and economy, with the overarching goal of fostering sustainability within the park perimeter, the Biosfera Val Müstair is the selected partner to achieve this goal.

As the collaboration with the Biosfera Val Müstair is of essential importance to understand the aim and structure of this thesis, an initial kick-off interview with a representative of the Nature Park was done. While a deeper analysis of all conducted interviews will follow in the analysis part in Section 4, this section already outlines the general objectives of the Biosfera Val Müstair in relation to sustainability and mobility, as well as the specific expectations and hopes from the collaboration with the master thesis. This was done with a first analysis of the kick-off interview with Franziska Peter (2023), co-advisor of this thesis and representative of the Biosfera Val Müstair. Based on this, the aim of the research will be formulated at the end of the next subsection.

According to Peter (2023), the Biosfera Val Müstair's primary purpose is to promote sustainability within its park perimeter. As a model region, their main task is to advance sustainability in the valley. They are

committed to continuously improve their operations and implement projects and initiatives to become more sustainable according to the three dimensions of sustainability, namely ecology, society, and economy. As a primarily publicly funded organization, the Biosfera Val Müstair operates within multi-year programmes, outlining their activities and associated budgets. Within these programmes, the Biosfera Val Müstair has the flexibility to determine their focus areas, aligning them with their sustainability objectives.

Peter (2023) explained, that during the program period of 2016-2019, the Biosfera dedicated a project to mobility, however, from 2020-2024, the explicit focus on mobility was not included in their programmes. This change was prompted by the realization that their scope for action in the realm of mobility was restricted. Therefore, they decided to integrate mobility-related projects under different thematic titles such as tourism, education, and awareness. This approach allowed to maintain activity in addressing mobility while navigating limitations and ensuring their efforts remain effective.

Seeing the mobility patterns in the valley, the Biosfera recognises the high importance of automobiles for the people (Peter, 2023). The main challenge lies in providing viable alternatives for individuals who are unable or unwilling to use private cars. This issue particularly affects certain age groups, such as those under 18 years old, individuals with advanced age or disabilities, and tourists who arrive without a car. The Biosfera Val Müstair aims to address these challenges by encouraging sustainable transportation options and promoting the well-being of both residents and visitors within the valley.

Regarding the Biosfera's goals, Peter (2023) expresses the desire for the master thesis to contribute individual puzzle pieces to the overall goal of sustainable mobility. She emphasises that these are dynamic fields, with evolving possibilities and emerging opportunities. In this context she mentioned especially the process of digitalization, offering always new opportunities that could be implemented. The Biosfera is currently working on a development plan for the period 2025-2028, and highly motivated to shift the individual's mobility in the valley from motorised private transport towards sustainable alternatives. This is also in line with the Biosfera's Charta 2021-2030, which goes by the slogan 'Dare more sustainability' (German: 'Mehr Nachhaltigkeit wagen'; Feichtinger et al., 2020). Peter (2023) emphasises that the management is trying to get a step closer to this goal with the development plan 2025-2028.

1.3 Research Aim

In collaboration with the park management, mainly represented by Franziska Peter, this thesis aims to analyse the current state of mobility in the valley and provide the management with the necessary information about the interest groups and stakeholders present, investigating their mobility usage patterns, opinions, motivations and requirements concerning their mobility and regarding new means of mobility which could be possibly introduced.

To contribute to these formulated goals of the Biosfera, first of all a literature review, a general overview of the current state of knowledge in science regarding the topics of sustainable mobility in rural regions, will be done. Then, based on the information gathered in the kick-off interviews with a representative of the Biosfera

and other key interest groups, a comprehensive understanding of mobility in the valley, along with the demands and visions of its residents, will emerge. In the next phase, this knowledge will be utilised to explore alternative mobility solutions through desk research.

The findings are going to be translated into recommendations for the management of the Biosfera, to provide a basis for decision-making for the project phase 2025-2028 to take another step towards sustainable mobility in Val Müstair. Furthermore, the work will in the future hopefully serve as a knowledge base for other researchers when it comes to the needs and attitudes of people in rural areas about mobility and alternatives to the motorised private transport. Pursuing this aim, the thesis will also be submitted to the database of the research commission of the Swiss National Park, of which the Biosfera Val Müstair is being a part.

Overall, this master thesis seeks to shed light on the potential of sustainable mobility solutions in rural areas like Val Müstair, where the unique characteristics and challenges require tailored approaches. By understanding the context-specific factors and leveraging local resources, it is possible to create a mobility framework that ensures both environmental sustainability and the well-being of the community.

2 Literature Review

As the topic of this research is sustainable mobility in a peripheral area, the following literature review first delves into the characteristics of Val Müstair. Secondly, the concepts of sustainability and sustainable mobility will be examined. After that, the prevailing mobility modes in Switzerland, as well as the general factors driving the choice of mode of transportation and the distinct mobility challenges in rural areas like Val Müstair will be presented. The section concludes by identifying research gaps in sustainable rural mobility, setting the stage for the research objectives and questions this thesis intends to address.

2.1 Val Müstair

Being the main focus of this study, this section explores the geography, cultural heritage, economic structure, and sociodemographic changes in Val Müstair, shedding light on its distinctive character and evolving trends.

2.1.1 Geography and Settlement Structure

Val Müstair is located in the southeastern part of Switzerland, in the Canton of Graubünden, bordering Italy. Specifically, it lies in the Alps, to the east of the Swiss National Park. It is a remote valley stretching approximately seventeen kilometres, starting from the Ofenpass, and ending at the Italian border, where it joins the Val Venosta in South Tyrol, Italy. The valley is also noted for its easternmost point which represents the eastern extremity of Switzerland. It consists of several villages including Tschierv, Fuldera, Lü, Valchava, Santa Maria Val Müstair and the principal town Müstair. The once independent entities merged in 2009 into a single political commune, becoming the municipality of Val Müstair (Cumün da Val Müstair, n.d.–a).

As part of the expansion of the Swiss National Park, which was already named the first high-alpine UNESCO Biosphere Reserve in Switzerland in 1979, Val Müstair was added in 2010 as a maintenance and development zone and got named Nature Park Biosfera Val Müstair. With the inclusion of parts of the Scuol municipality, the expanded Biosphere Reserve was definitively granted the label in 2017 and forms today the UNESCO Biosfera Engiadina Val Müstair, as illustrated in Figure 1 (UBEVM & TESSVM, n.d.–h).

Nature parks like the Biosfera are characterised by particularly high natural and cultural value with intact landscapes and only minor impairments due to infrastructures and uses, and an immense biodiversity worthy of protection (FOEN, 2023b). This commitment also brings with it certain objectives. For regional nature parks, these are the conservation and enhancement of biodiversity and landscape, awareness-raising and environmental education, and the strengthening of the sustainable economy, including mobility (FOEN, 2014). The current mobility patterns in the Nature Park Biosfera Val Müstair as well as the shift towards a more sustainable mobility will be the focus of this thesis.

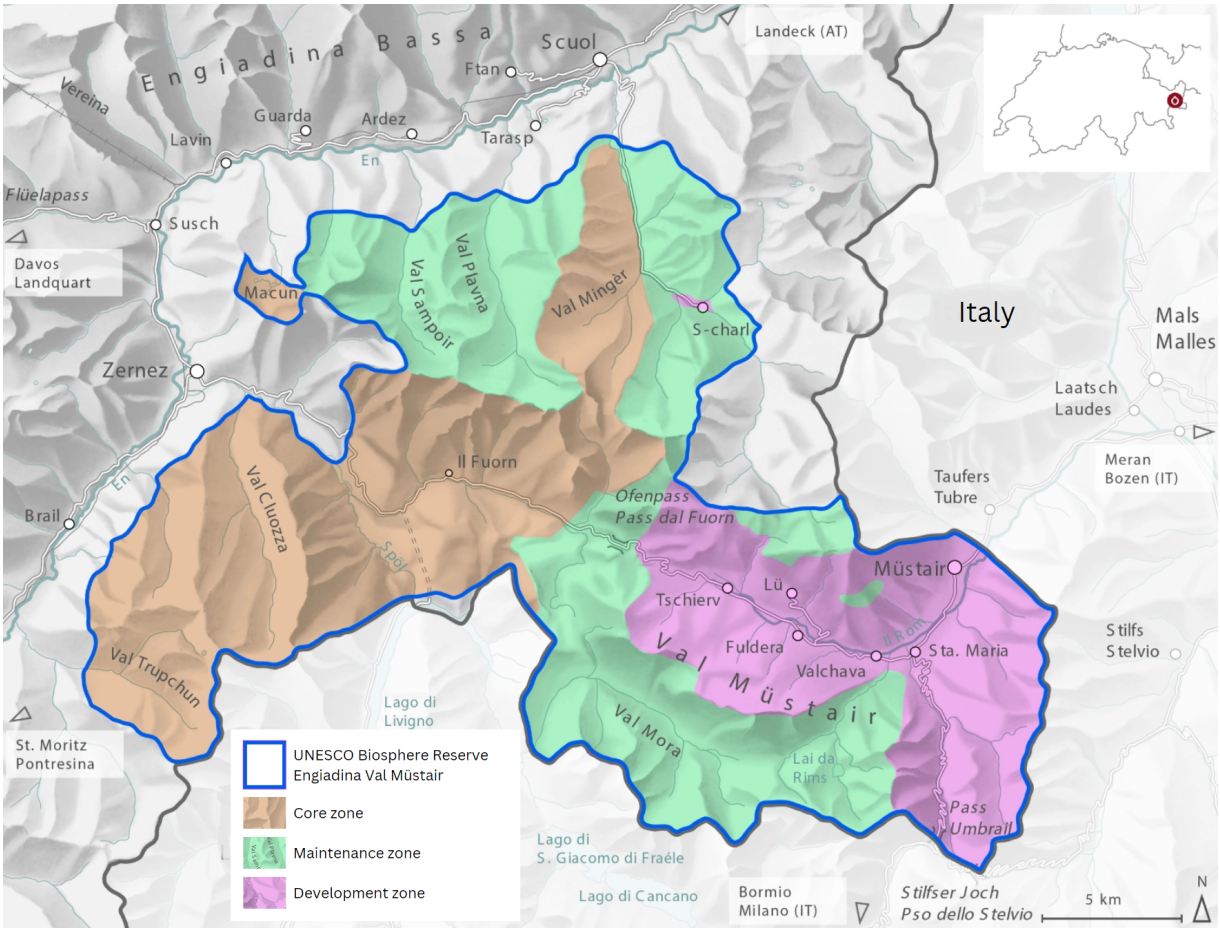


Figure 1: Map of the different zones of UNESCO Biosphere Reserve Engiadina Val Müstair. Own illustration based on UBEVM and TESSVM (n.d.–h)

In order to find a definition of peripheral space that is valid for this thesis, a brief excursion into transport and economic geography will follow. According to Bathelt and Glückler (2018), the dual definition of rural or peripheral and complementary urban space is outdated. It said that urban space is an industrial and service-oriented location with a high density while the countryside is less densely populated and has an agrarian economy. Today, this boundary is fluid, as sub-regions have individual population and economic structures due to natural geographic and socio-economic conditions (Hesse & Nuhn, 2006). Not only is the boundary between rural and urban regions fluid, but new sub-categories have also been elaborated. Additionally, definitions of peripheral spaces differ among countries. Because of this, the Federal Statistical Office of Switzerland, is being consulted for the most accurate definition of spatial type for the region of Val Müstair.

Whereas, according to the Statistical Atlas of Switzerland, until 2012 only two typologies for geographical regions, namely urban and rural areas, were distinguished, since 2012 a total of three spatial distinctions regarding the urban/rural typology have been used by the Federal Statistical Office, namely urban, intermediate, and rural areas. According to this scheme of distinction, the region of the municipality and Nature Park Val Müstair belongs to the rural areas (FSO, 2012). Further, the same federal office distinguishes also among different municipality types, going into further detail. Here, urban, intermediate, and rural municipalities can each be further divided into three sub-categories. For the rural municipalities, this results in the fine subdivision into rural central, rural centrally located and rural peripheral municipalities.

According to this categorisation, the municipality of Val Müstair is a rural peripheral municipality (FSO, 2012; Kohler et al., 2017). Throughout several publications of the Federal Statistical Office an even more detailed classification of regions is being done by differentiating rural peripheral areas into moderately and sparsely populated. The criteria for the different spatial types of rural areas can be seen in Table 1.

Table 1: Definition of rural areas. Own illustration based on Marconi and Schad (2016)

Spatial type	Characterization	Criteria
Peri-urban rural area	Good public transport (PT) and motorised private transport (MPT) accessibility	PT and MPT travel times to the nearest agglomeration centre are less than 20 minutes.
	Moderate PT and good MPT accessibility	PT travel time to the nearest agglomeration centre is between 20 and 60 minutes, and MPT travel time is less than 20 minutes.
	Moderate PT and MPT accessibility	The municipality is located within the biogeographical region “Mittelland”.
Rural-peripheral area	Moderately populated	MPT travel time to the nearest agglomeration centre is more than 20 minutes.
		Population density is greater than 10 inhabitants per square kilometre.
		The municipality is not located within the biogeographical region “Mittelland”.
	Sparsely populated	MPT travel time to the nearest agglomeration centre is more than 20 minutes.
		Population density is less than 10 inhabitants per square kilometre.
		The municipality is not located within the biogeographical region “Mittelland”.
Alpine tourism municipalities	Outside agglomerations	The municipality is located within the biogeographical region “Alps”.
		The number of overnight stays is more than 90’000 per year.
		The proportion of (full-time equivalent) jobs in tourism sector is more than 20%.

According to the definition from the Federal Office for Spatial Development (ARE) and Marconi and Schad (2016), the criteria for a municipality to be classified as a sparsely populated, rural-peripheral area are threefold. Firstly, the travel time by motorised private transport to the nearest urban centre should exceed 20 minutes. In the case of Val Müstair, the next urban centre in Switzerland is Zernez in the Engadine valley, and requires a car drive of at least 30 minutes (from Tschierv), according to Google Maps (Google, n.d.). The second criterion is regarding the population density and sets the limit to ten inhabitants per square kilometre. This reflects the low density of residents within the municipality and the wide spacing between settlements, which is also the case for Val Müstair with a population density of 7.7 inhabitants per square kilometre. Finally, the municipality should not be located within the biogeographical region of ‘Mittelland’, as these cannot classify as rural-peripheral areas. Applying this definition, the municipality of Val Müstair is classified as a rural-peripheral and sparsely populated area, which can be seen in Figure 2. The characteristics of mobility in such rural-peripheral areas that are sparsely populated will be examined in Section 2.3 of this thesis.

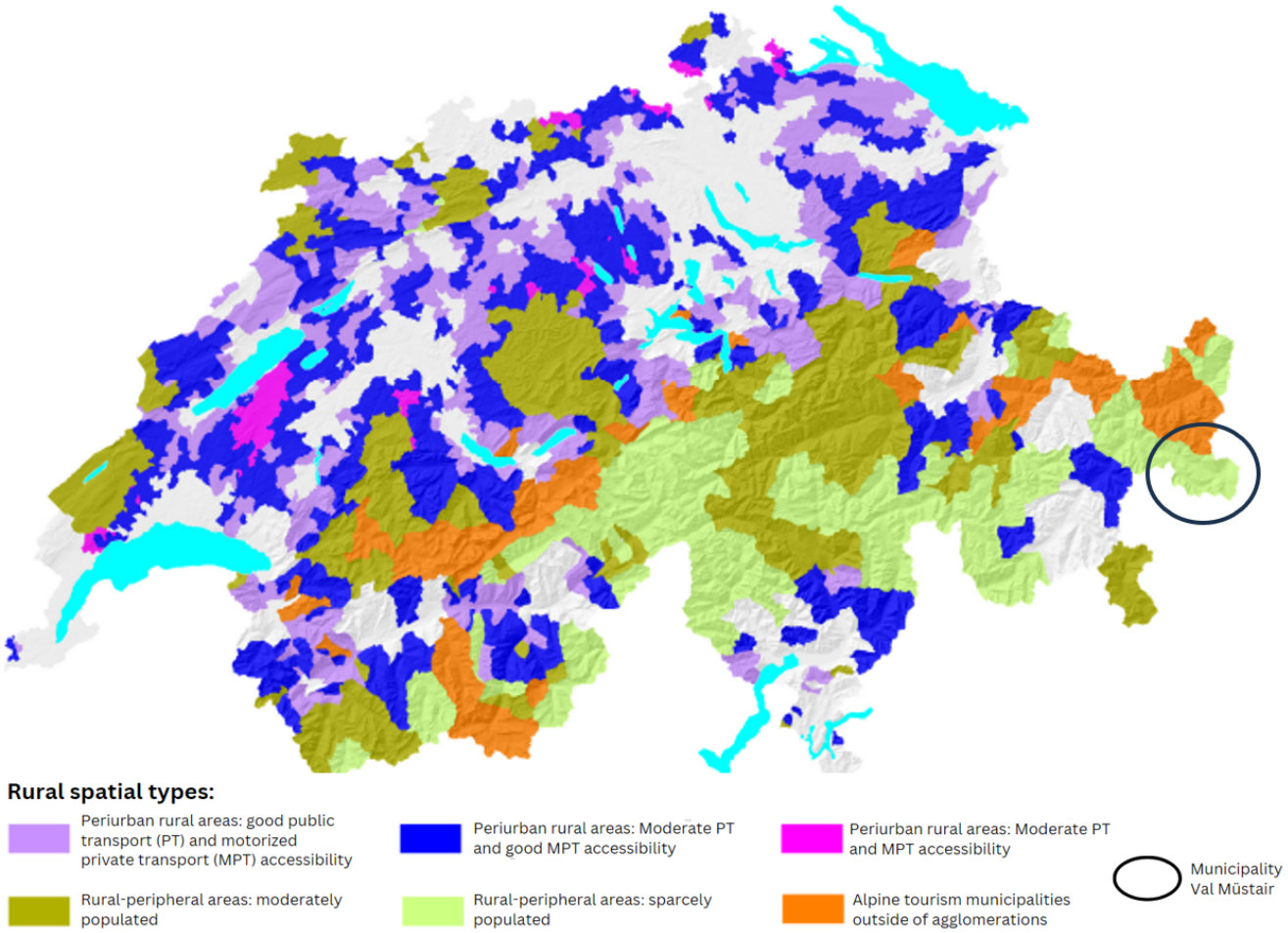


Figure 2: Rural spatial types in Switzerland. Own illustration based on Marconi and Schad (2016).

2.1.2 Social and Cultural Structure

According to Kohler et al., rural peripheral municipalities like Val Müstair are above all typically characterised by a low population density, a decentralised settlement structure, poorer accessibility and greater distances (2017). As of recent data, the valley has a population of approximately 1’440, scattered across a municipal area of 199 square kilometres, leading to a relatively low population density of about 7.7 inhabitants per square kilometre (TESSVM, 2021). This is a strong indicator for the valley's rural character.

In terms of demographic composition, Val Müstair has witnessed slight fluctuations over the years. But while population numbers in many rural areas in Switzerland have been declining due to urban migration and many other factors, Val Müstair has somewhat retained its population. This could be attributed to the economic diversification in the region, from agriculture and farming to tourism and industry (Manatschal et al., 2014).

A defining element of the social structure in Val Müstair is the retention of the Romansh language, the fourth official language of Switzerland. Specifically, the locals in Val Müstair speak a dialect of Romansh known as ‘Jauer’, while writing in ‘Vallader’, the Romansh from the Lower Engadine (Manatschal et al., 2014). It is also characterised by a rich cultural heritage, dating back to the early Middle Ages. The most significant historical monument is the Benedictine Convent of Saint John, a UNESCO World Heritage site (Cumün da Val Müstair,

n.d.–d). This monastery is renowned for housing the world's largest and best-preserved collection of early medieval frescoes, which dates back to around 800 CE (Larcher Gasperi & Lezzi, 2023).

Moreover, Val Müstair's cultural landscape is marked by the preservation of ancient agricultural practices, like the use of traditional watering canals for agricultural fields, known as 'Auals' (Manatschal et al., 2014; TESSVM, n.d.). Also, handicrafts play a significant role. The region is home to the 'Manufactura Tessanda', a hand-weaving mill that continues the tradition of producing textiles of outstanding quality, keeping alive a craft that traces its origins back to 830 CE, as evidenced by archaeological findings in the region. Lastly, numerous local museums offer insights into the historical, social, and cultural evolution of the region, contributing to the rich tapestry of Val Müstair's cultural heritage (Manatschal et al., 2014).

2.1.3 Economic Structure

Not only in terms of culture, but also when it comes to the economy, Val Müstair is a very diverse region characterised by its agricultural heritage, a growing tourism sector, and a small but for the valley important industrial and services base. A significant aspect shaping the economic activities in this region is the emphasis on sustainable practices and organic production.

Agriculture has historically been a significant aspect of Val Müstair's economy, with the focus predominantly on livestock farming, dairy production, and to a lesser extent, grain cultivation (Manatschal et al., 2014). In line with global sustainability trends and local cultural values, the agricultural sector remarkably shifted towards organic farming methodologies. Today, around 80% of the local farming entities in Val Müstair have transitioned to organic farming, embodying the community's commitment to sustainable agriculture (Cumün da Val Müstair, n.d.–b; Schnapp, 2022).

Tourism is another pillar of Val Müstair's economy, with a marked increase in tourist activity since the 1960s (Grimm, 2013; Manatschal et al., 2014). The recognition of Val Müstair as a UNESCO Biosphere Reserve has significantly augmented its appeal as an ecotourism destination. The natural assets of the region, including the Rombach River and its proximity to the Swiss National Park, combined with cultural landmarks such as the Monastery of Saint John, attract many visitors throughout the year. Winter tourism has also been facilitated by the development of areas like Minschuns for snow sports (Cumün da Val Müstair, n.d.–d; Larcher Gasperi & Lezzi, 2023; UBEVM & TESSVM, n.d.–i).

Beyond agriculture and tourism, the local industry and services sectors play an indispensable role in the valley's economy. In addition to traditional crafts like Switzerland’s oldest hand-weaving mill in Santa Maria and the significant furniture industry, various industrial and service businesses settled in the valley since the 1970s (Grimm, 2013; UBEVM & TESSVM, n.d.–g). This led to a vast increase in commuters from the Vinschgau region in South Tyrol. With a population of approximately 1’500 residents, the daily around 450 commuters from Italy represent a substantial portion of the workforce in the valley.

2.1.4 Sociodemographic changes

The rural-peripheral areas of Switzerland, including Val Müstair, have witnessed significant changes and trends in recent decades, backed by official statistics. While there is currently no detailed investigation specifically focusing on the sociodemographic changes in Val Müstair, the following literature review carried out for rural-peripheral areas in Switzerland can serve as a foundation for understanding the situation in Val Müstair. Therefore, this analysis will mainly consider trends relevant to rural and rural-peripheral areas, while excluding those solely related to alpine tourism regions or peri-urban areas.

A major trend is the expansion of cities and urban areas, resulting in the loss of 430 municipalities covering 4,761 km^2 between 1980 and 2010 and in a decrease of the proportion of rural areas in Switzerland in terms of spatial occupation from 89% to 77%. It is worth noting that the majority of the rural areas, accounting for over 80% in 2010, are peri-urban communities located near agglomerations or individual cities, while only a small portion of 18% falls within the rural-peripheral category like Val Müstair. In terms of population, the share living in rural-peripheral areas has been continuously declining, as urbanization has increased from 61% in 1980 to 74% in 2010. Despite this shift, many rural areas in Switzerland have experienced a growth in population, unlike several European countries. Since 2000, the overall rural population has grown by 7%, primarily driven by the peri-urban regions (Bertschy et al., 2012).

Due to a structurally given, limited supply of jobs and the further relocation of these to more urban areas, many people living in the countryside have to commute to work or school (Ahrend & Herget, 2012; Maier, 2008; Marconi & Käser, 2008). Because of the long distances there or to the next public transport station, many must use their own cars to go to work, school, utilities and leisure activities due to the lack of alternatives (Clotteau, 2014). This was also shown in a study by Maeder (2022), who examined mobility use in the Entlebuch region, a rural-peripheral area in the canton of Lucerne.

Although the rural areas continue to maintain relatively good access to basic services compared to urban areas, the quality of service provision has diminished over time (Bertschy et al., 2012; Hesse & Nuhn, 2006). Additionally, the distances to these facilities have increased, making it more challenging for residents to access them. One popular example for this trend is the diminishing numbers of post offices, which particularly affected rural-peripheral areas. In numbers this means, that between 2000 and 2021, the number of post offices in Switzerland had decreased from 3’383 to 2’056 (Mariani, 2016; UPU, 2021).

However, the lower economic dynamism in rural areas, characterised by a smaller proportion of highly productive industries, has resulted in fewer new job opportunities in new enterprises compared to urban regions. Interestingly, the unemployment rate in the rural-peripheral areas is lower than the Swiss average, with only 2.1 individuals per 100 being unemployed in the peripherally rural areas compared to 4.3 individuals in urban areas (Bertschy et al., 2012). This indicates a relatively stable employment situation in the rural regions.

Furthermore, there has been a strengthening of interconnections between rural and urban areas, with an increasing number of employed individuals commuting from their place of residence to their workplace (Ahrend & Herget, 2012; Marconi & Käser, 2008). This trend highlights the importance of the rural areas as

recreational spaces for urban residents, with a significant number of leisure trips to the peripherally rural regions and alpine tourism centres. Moreover, over 80% of second homes in rural areas are owned by individuals residing in urban areas, increasing the mobility needs between urban and rural-peripheral areas even more (Bertschy et al., 2012).

In terms of land use, rural areas naturally have a lower proportion of settlement areas compared to urban regions. However, the rural areas require larger land for transportation infrastructure, while industrial and commercial zones are below average. Over time, settlement areas in rural regions have increased 1.5 times more than the number of jobs and population, reflecting a less intensive use of land compared to urban areas where densification has occurred (Bertschy et al., 2012).

In the context of peripheral rural areas specifically, there is a notable emigration of residents to other regions. The alpine regions are particularly affected by this trend (Maier, 2008). Furthermore, these peripheral regions are experiencing an increasing ageing population, with a higher proportion of individuals over 64 years of age. Additionally, there has been a loss of jobs in the industrial and service sectors in rural-peripheral areas between 1995 and 2008, although some regions, such as the Jura, have seen job growth (Bertschy et al., 2012).

2.2 Sustainable Mobility

Sustainability, as a concept, has a rich historical background, with its origins dating back to antiquity. Throughout the centuries, the idea of sustainability has evolved, culminating in the three pillars of ecology, economy, and social considerations that form the foundation of modern sustainability discourse. This section briefly delves into the history of sustainability, tracing its development and the emergence of the three-pillar model. It specifically examines the role of mobility in achieving comprehensive sustainability goals, exploring how mobility must align with these pillars to contribute to a more sustainable future for Val Müstair.

2.2.1 Sustainability in General

The origins of sustainable thinking go back to antiquity. The principle of sustainability was first called for in 1713 in a writing by Hans-Carl von Carlowitz, though at that time in connection with agriculture. In his paper *Sylvicultura oeconomica,* he criticised the devastating condition of forests as a result of overexploitation and the resulting lack of wood. In the book, he therefore called for a change in forest management and wood-saving measures: "Only as much wood should be felled as could grow back through planned reforestation" (Michelsen & Adomssent, 2014).

Centuries passed before society and economy began to deal directly with the issue of sustainability and environmental protection. It was not until the 1970s that a new movement began to take shape. The UN Conference on the Environment in Stockholm in 1972 and the oil crisis of 1973/74 contributed significantly to this (Michelsen & Adomssent, 2014; Purvis et al., 2018; Schlör et al., 2012).

Today's generally accepted definition of the term of ‘Sustainable development’ goes back to the Brundtland Report of 1987: "Sustainable development is development that meets the needs of the present without

compromising the ability of future generations to meet their own needs" (Brundtland, 1987; Michelsen & Adomssent, 2014; Purvis et al., 2018). Thinking of sustainability in the three dimensions of ecology, economy and social became common worldwide after the Earth Summit in Rio de Janeiro in 1992 and is increasingly being followed also in business (Purvis et al., 2018; Scott, 1998). The three pillars are explained in more detail:

The ecological pillar is most strongly oriented towards the original idea and includes the long-term preservation of the ecological system as a natural capital stock as well as the careful use of resources. One of the most important goals is climate protection. The main approaches are, on the one hand, the reduction of GHG-emissions. On the other hand, it is about the preservation and targeted promotion of those natural components that absorb the most significant GHG, carbon dioxide. Further goals of the ecological dimension are preservation of biodiversity, increased use of renewable resources and reduction of environmental damage caused by pollutants and waste (Pufé, 2012; Rogall & Gapp-Schmeling, 2021).

In the economic dimension, sustainability means the maintenance of prosperity and the development and performance of the economy, always under the premise, that the material prosperity of a country is not satisfied by loading depts on a next generation (Francis, 2013; Schuster, 2013).

In principle, a life should be made possible in which everyone can develop freely, and which is characterised by solidarity and well-being. In the social dimension, the health and security of every individual should be guaranteed. Men and women should be treated equally, minorities protected, and human rights accepted. The demand for equitable life chances also includes access to education and culture (Rogall & Gapp-Schmeling, 2021).

In order to achieve true sustainable development in no matter what field of study, not only a part of the dimensions should be considered. Rather, all dimensions should be considered equally in a holistic approach (Cuello Nieto, 1997; Purvis et al., 2018).

2.2.2 Mobility and its Role in Sustainability

In accordance with the three pillars of sustainability described before, sustainable mobility is in the following analysed along this three-dimensional approach:

Applying the definition of Rogall and Gapp-Schmeling (2021) social sustainability, socially sustainable mobility implies equal opportunities for all to participate in the transport system, regardless of age, gender, nationality, health status and financial situation. It also includes equal access for the public to all means of transport. Another important point to make when it comes to socially just mobility is the full inclusion, integration and participation of the potential user groups as well as the local inhabitants in the decision-making process (Baranek et al., 2005; Da Kirsch-Soriano Silva & Stoik, 2016). Specifically for Switzerland, the Federal Office of Transport states with regard to socially sustainable mobility that it is indispensable to "provide access to mobility for all population groups and parts of the country" (FOT et al., n.d.).

A transport service is economically sustainable if it is not only affordable for the users but that the implementation and maintenance of the service does not exceed the financial limits also of the providing authorities (Cervero, 2013). This can only be achieved if the project or initiative is adapted to the prevailing needs. Thus it should not be wasting unnecessary financial resources or the other extreme of having too little capacity which in turn requires an in-depth analysis of the needs of future users (FOT et al., n.d.).

The ecological impact of mobility is enormous, which makes it all the more important to reduce it (Cervero, 2013; FSO, 2020; Marx Gómez et al., 2021, 2021). Even though the individual means of transport have become much cleaner and quieter than in the past, motorised mobility continues to cause many negative environmental impacts through the emission of GHG, air pollutants and noise, as well as increased land use and resource consumption (van Wee, 2014). In Switzerland, the transport sector is responsible for around one-third of the total energy consumption and causes about 31% of its CO_2-emissions (FOEN, 2021b; FSO, 2022). Several other negative impacts can be found in literature, be it the abrasion of the rubber tyres causing micro-plastic pollution, energy- and resource intense infrastructure maintenance, snow clearance and the intensive use of salt in winter to defrost roads, disturbance of wildlife and numerous others (Jacobson et al., 2016; Järlskog et al., 2021; Kinable et al., 2016; Szklarek et al., 2022).

Analogously to the holistic approach emphasised by Cuello Nieto and Purvis et al., the assessment of sustainable mobility must transcend singular dimensions and encompass all three pillars of sustainability, along with considering the specific local context. By taking a comprehensive view of sustainable mobility in the context of Val Müstair, strategies that align with the region's unique characteristics can be developed, leading to a more balanced and lasting approach towards mobility and sustainability.

2.3 Mobility in Switzerland and Val Müstair

In order to find the current knowledge about mobility in Val Müstair, first the mobility patterns in Switzerland have to be analysed, always with a specific focus on the rural-peripheral areas, as which also Val Müstair was classified in Section 2.1.1. Secondly, the factors influencing the choices individuals make in their quest for efficient, sustainable, and convenient mobility will be presented. This will be done by looking at the interplay of supply-side factors, demand-side preferences, and spatial arrangements. Then the specific needs and challenges of rural-peripheral areas regarding mobility will be discussed. Finally, the spotlight shifts to the case of Val Müstair, exploring its present mobility connections and offerings, while also delving into a brief historical overview of mobility in this captivating region.

2.3.1 Modes of Mobility in Switzerland

In this section, the diverse aspects of mobility in Switzerland are explored, with particular attention to its rural-peripheral regions. The analysis sheds light on the overall mobility patterns in Switzerland, including the prevalence of motorised private transport, public transport usage, and slow traffic. The *Microcensus on Mobility* by Muralti et al. (2023) issued by the Federal Statistical Office (FSO) provides insight about the mobility patterns in Switzerland in general with data from 2021, while the publication about mobility in rural-peripheral

areas in Switzerland by Marconi and Schad (2016), published by the Federal Office for Spatial Development, breaks down the mobility patterns into regional differences with data from 1994-2010. In the following the results of these two studies will be used to get a grasp at how mobility in Switzerland looks like and where the differences lie when looking at its rural-peripheral areas.

On average in 2021, the Swiss population travelled 30 km per day and spends 80 minutes in traffic each day, of which 6 minutes are waiting and transfer times (Muralti et al., 2023). Looking at all reasons for mobility together in Figure 3, cars and other motorised private means of transport such as motor bikes are used for 20.8 km of the average 30 km per day (69%), followed by public transport (16%) and slow traffic (German: 'Langsamverkehr') with roughly 10%. It further shows that the main reason to travel by car are leisure puroposes with 43% share. However, the share of leisure was largest in pedestrian travel, where this purpose accounted for almost two-thirds (64%) of the kilometres covered. Work-related travel took up particularly high proportions with motorised two-wheelers and rail (37% and 35% respectively), whereas educational travel was done predominantly with public road transport (16%). The mobility purposes of accessing shopping and service facilities had relatively large distance shares with passenger cars (17% and 7% respectively), compared to other modes of transport (Muralti et al., 2023).

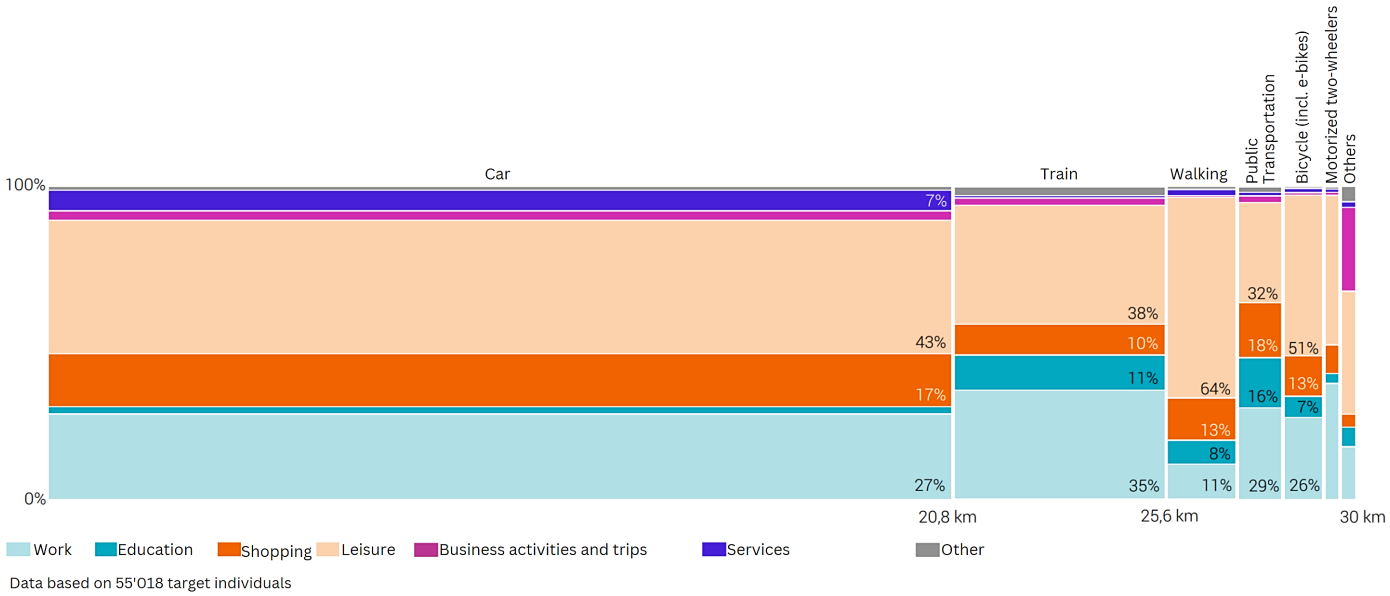


Figure 3: Average daily distance per person according to purpose of mobility and mode of transport (within Switzerland, 2021). Own illustration based on Muralti et al. (2023).

Having established the broader context of mobility in Switzerland and knowing that Val Müstair is the main focus of this thesis, it is essential to also turn the attention to rural-peripheral areas of the country. There has been a noticeable increase in daily distances travelled by rural-peripheral populations since 1994. The reasons for this are the longer distances to essential services, educational and leisure facilities as well as limited local job opportunities. Another interesting fact is that the especially the road network in rural areas experiences an increasing traffic from urban populations, not least because urban residents frequently utilise secondary homes for leisure purposes in rural areas (Marconi & Schad, 2016).

After some general facts about mobility in the country of Switzerland as well as in its rural areas, the three different types of transportation, namely motorised private transport, public transport, and slow, will be explained and analysed in more detail in the following, using data from the previously mentioned studies. First among their significance in the entire country, followed by the analysis of their meaning in rural-peripheral areas like Val Müstair.

Motorised Private Transport

Motorised private transport is a group of transportation methods that includes cars, motorcycles, and small motorcycles, while the overall share is dominated by car usage. In Switzerland, over two-thirds (69%) of all distances are covered by cars, with the majority of this being accounted for by leisure (43%), work-related travel (27%) and shopping trips (17%), while trips for business, educational or other reasons are responsible for less than 5% (Muralti et al., 2023).

83% of individuals aged 18 and above in Switzerland possessed 2021 a driving license for passenger cars. This value has increased by 7% since 1994. The main reason for this increase is the significant rise in driving license ownership among individuals aged 65 and above, which has increased from 44% to 74%, especially among women. Conversely, the trend among young adults aged 18 to 24 has been different for a long time. Between 1994 and 2010, the ownership of driving licenses in this age group decreased from 71% to 59%. However, since then, the trend has reversed, and the proportion of 18 to 24-year-olds with driving licenses was 66% in 2021 (Muralti et al., 2023).

The majority of households in Switzerland have at least one car available all the time or by arrangement (78%), while almost one-third of households owns two or more cars. Cars therefore account for the majority of motorised private transport in Switzerland, whereas a motor bike is available in 12% of the households. Among those who own at least one car, 91% have a parking space at home, and 73% have a parking space available at their place of work, with a little more than half of the parking spaces at workplaces being free of charge (51%). The average occupancy of a car is 1.53 people. When considering work-related travel only, the occupancy rate is even lower at 1.09 people, while it rises to 1.89 people when considering only leisure travel (Muralti et al., 2023).

Regarding the reasons for choosing motorised private transportation which are listed in Table 2, nearly 38% justified their choice because it was the easiest or most convenient solution. Travel time was mentioned by 17% while the lack of alternatives was cited by 16% of the cases. Another significant factor for choosing cars was the need for luggage transport (12%) (Muralti et al., 2023).

Table 2: Reasons of transportation mode choice in 2021. Own table based on Muralti et al. (2023).

	Motorised private transportation: Car, motorised two-wheelers	Public transport: railway, bus, tram	Pedestrian and bicycle traffic (Slow traffic)
Simplest/most convenient solution	37.9	36.6	17.7
Travel time	16.7	8.5	6.5
No other possibility/lack of alternatives	16.2	19.9	3.2

Luggage transport/bulky items	12.3	0.6	*
For weather reasons	4.0	3.3	1.7
Travel enjoyment/travel comfort	3.0	4.6	4.2
Travel costs	1.2	2.8	0.6
Out of habit	2.1	5.0	3.9
Walk	*	*	30.2
For health reasons	*	*	13.0
For environmental reasons	*	3.6	1.7
Subscription ownership	*	5.0	*
No parking space at the destination/ parking space hard to find	*	4.0	*
Because the distance was so short	*	*	13.4
Covid-19	1.1	*	0.5
Other reasons	5.5	6.1	3.5

* Does not apply, because term is not applicable.

Note: Answers to the question: "Why did you primarily choose this instead of another means of transport?" (open-ended question). Frequency of the mentioned reasons for stages with the respective means of transport, in % (multiple mentions possible).

Looking at the households in rural-peripheral areas, the share of individuals in possession of a driving license increased from 73% in 1994 to 82% in 2010, while the proportion of households without a car has reduced from 23% in 1994 to 15% in 2010. Meanwhile, the share of households with one car fell from 55% to 47%, with a simultaneously increasing proportion of households with two or more cars from 22% to 37%, indicating an increase of more than half (Marconi & Schad, 2016). All in all, it can be concluded, that in the entire country and especially in rural-peripheral areas, the motorised private transport plays the most important role.

Public Transport

Public transport refers to a group of transportation services, which can be used by all individuals based on predetermined transportation regulations. Public passenger transport includes services operated by trains, trams, buses, ships, and cable cars, according to predefined schedules. The federal government holds the exclusive right to transport passengers and grants concessions to transportation companies for commercial passenger transport. The laws governing passenger transport, including obligations of companies and the transportation contract, are regulated by the *Passenger Transport Act* (PBG) and the *Regulation on Passenger Transport* (VPB) (PBG, 2009/01.01.2022; VPB, 2009/01.01.2021). The public transport sector includes local-, regional- and long-distance transport as well as tourist transport, with each category serving specific purposes and operated either by public authorities or on a commercial basis (FOT, n.d.; VÖV, n.d.).

Looking at the share of mobility in Switzerland done with public transport, the second most used after cars is the railway. Along with buses and trams, almost one quarter of all distances are covered by public transport. Although trains are used the most in terms of distance for leisure travel (38%), it is primarily the preferred mode of transport for work-related (35%) and educational (11%) travel (see Figure 3). Looking at public road transport like buses and trams, one sees that the shares here are slightly different, with 32% for leisure and 29% for work, while 18% and 16% are for shopping and educational reasons respectively. However, public transport is generally never the only mode of transport for a route but is almost always used in combination

with slow traffic like walking or cycling and sometimes with private motorised transportation (Muralti et al., 2023).

When analysing the most common reasons for using public transport, almost the same reasons as for motorised private transport were mentioned. While the argument of the easiest or most convenient solution had a nearly equal share of 37%, the lack of alternatives followed with 20%, and travel time accounted for just over 8%. Other reasons of some significance for choosing public transport were possession of a subscription pass (5%), the enjoyment of the journey (5%), and simply habit (5%) or the consideration of environmental protection (4%) (Muralti et al., 2023).

In Switzerland, the ownership of public transport subscriptions like the GA Travelcard or the Half Fare Travel Card (Halbtax) is widespread. Accordingly, 93% off all kilometres travelled in public transport were covered by people who had some form of subscription (Muralti et al., 2023). Apart from the pricing policy, several factors can make public transport more attractive, including more frequent connections, higher comfort, better timetable coordination when changing, faster connections, and direct connections without transfers (Amstutz, 2022; EAER, n.d.; Meyer, 2020).

Table 3: Daily distance by mode of transport and spatial type (within Switzerland, in km, 2010). Own illustration based on Marconi and Schad (2016).

	Spatial type				
	Urban area	**Peri-urban rural areas**	**Rural-peripheral**	**Rural-peripheral, sparsely populated areas**	**Total in Switzerland**
Daily distance slow traffic	2.9	2.5	2.6	2.7	2.8
Daily distance motorised private transport	22.2	30.9	29.9	28.9	24.4
Daily distance public transport	9.1	7.2	7.0	4.7	8.6
Daily distance other means of transport	0.8	1.1	1.3	0.4	0.9
Daily distance	35.1	41.7	40.8	36.6	36.7

When looking at data from the rural-peripheral, sparsely populated areas in Table 3, the average daily distance travelled using public transport accounts to only 4.7 km, while in urban areas it lies at 9.1 km and the average in Switzerland is at 8.6 km. One reason for this could lie in the accessibility of households by public transport. While in urban areas 69% of households are very well to moderately accessible, this proportion in rural-peripheral, sparsely populated regions is just 5%. Here, 24% have low accessibility and 71% are marginally or not at all accessible (Marconi & Schad, 2016).

Slow Traffic

The Federal Road Office FEDRO (n.d.) defines slow traffic as movement on foot, on wheels or rollers, powered mainly by human muscle power. This includes bicycles (including e-bikes), pedestrian traffic, skateboards, rollerblades, scooters, and similar (Muralti et al., 2023). With slow traffic, only 9% of the distances are covered. It is especially relevant for educational trips and leisure traffic. In order to describe the mobility behaviour of a population, the number of completed stages can also be considered as a measurement and

is defined as follows: “The stage represents the smallest unit. It has a minimum length of 25 meters and is covered using a single mode of transportation, including pedestrian traffic. When there is a change in the mode of transportation, a new stage begins” (Muralti et al., 2023, p. 23). Although the proportion of distances is small, Figure 4 shows that half of the stages (48%) are covered by slow traffic, as it is often relevant for going, returning, or switching between modes of transportation. The stage share of slow traffic is thus significantly higher than of private motorised transportation (38%) or public transport (12%) (Muralti et al., 2023).

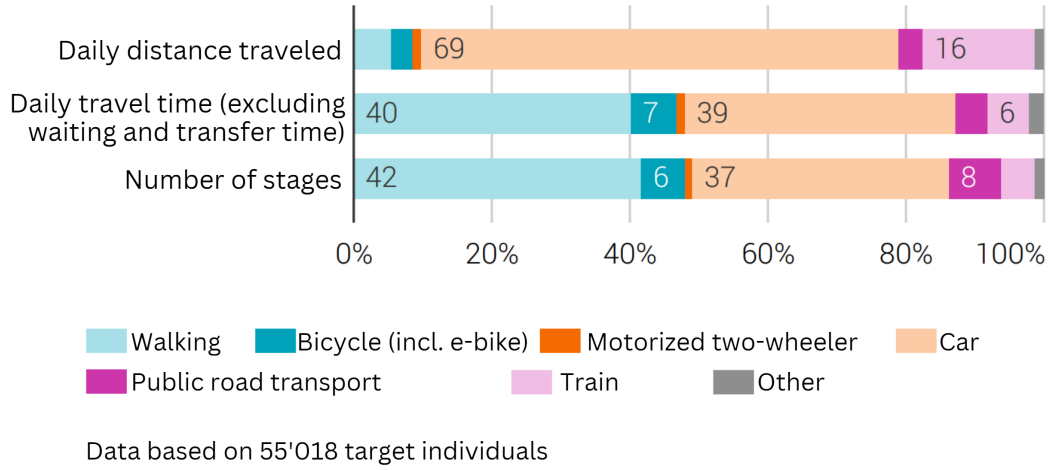


Figure 4: Used means of transport per distance, travel time and stages (within Switzerland, in percentage, 2021). Own illustration based on Muralti et al. (2023)

While in 2000 over 70% of households owned a bicycle, this figure had dropped to around 61% by 2021. However, the proportion of households owning an e-bike increased significantly to 20% in 2021 compared to 7% in 2015. The differences appear when looking at the usage. Figure 5 shows, that while the non-motorised bicycle is mainly used for leisure traffic (53%), followed by work (24%), the slow e-bike (maximum 25 km/h) is used 57% for leisure activities and 24% to go into work, whereas for the fast e-bike (maximum 45 km/h) the numbers are striking. 65% use it to go into work, while leisure activities is more than two-thirds lower than the other two types (Muralti et al., 2023).

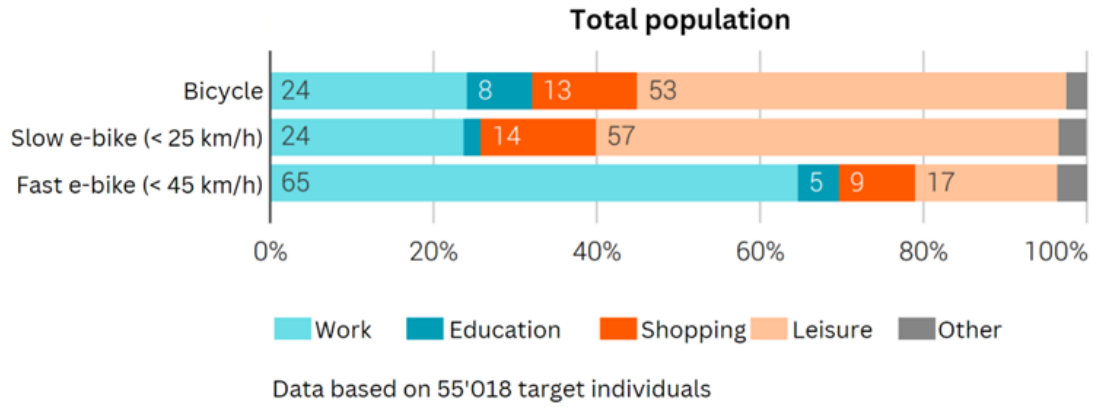


Figure 5: Usage of bicycle and e-bike by mobility purpose (shares of the daily distance travelled within Switzerland, in percentage, 2021). Own illustration based on Muralti et al. (2023)

Parking facilities for bicycles are somewhat less developed than for cars. The proportion of households with a bicycle that have a bicycle parking space available is only about 79%, of which 73% are in lockable rooms and only 30% are easily accessible. At the destination of the individuals' bicycle trips, a parking space is available in 82% of cases (Muralti et al., 2023).

30% of the surveyed trips were walks or respondents chose to go by foot to combine it with another mobility purpose. Following that, with a share of 18%, the argument was that walking or using a bicycle or e-bike represented the easiest or most convenient solution. 13% of the respondents justified their choice based on the short distance, while another 13% cited to do it for health reasons (Muralti et al., 2023).

Table 3 shows, that the average daily distance using slow traffic is lower in all types of rural-peripheral, sparsely populated areas (2.7 km) compared to urban areas (2.9 km). The average total daily distance is almost the same in rural-peripheral, sparsely populated areas with a total of 36.6 km per day in 2010, compared to 35.1 km in urban areas and 36.7 km overall in Switzerland. A small difference, whereas overall 28.9 km are made using motorised private transport and only 4.7 km using public transport, the lowest share of all spatial types (Marconi & Schad, 2016).

2.3.2 Choice of Mode of Transport

When studying the Microcensus on mobility in Switzerland, it becomes apparent that mobility behaviour is among others influenced by various aspects such as age, gender, income, travel distance or comfort (Muralti et al., 2023). Understanding these factors is of upmost importance when expanding or improving existing and introducing new mobility options. In order to provide the Biosfera with a comprehensive overview of the factors influencing the choice of mode of transport, this sub-section summarises the knowledge from the literature. These factors can be broadly categorised into three groups: supply-side factors, demand-side factors, and spatial integration.

Supply-side factors

The first and probably most intuitive factor is provided by the supply side of the mobility offers. The quality of mobility supply can be narrowed further down into duration, cost, and comfort. Duration considers the travel time involved, accounting for factors like distance, traffic delays, transfer times, and waiting periods (Ding & Zhang, 2016; Hurtubia et al., 2010). Travelers assign a monetary value, known as the "value of time", to measure the significance of travel time in their mode selection (Atasoy et al., 2013; Fosgerau et al., 2010; Hurtubia et al., 2010; Tveter, 2022; Wardman et al., 2016). Costs, while important, generally carry less weight than duration, as users tend to underestimate actual expenses and may perceive fixed costs as sunk costs (Santos et al., 2013; van Dijk et al., 2020). Comfort also plays a role, with users willing to choose more expensive or slower modes if they offer a more enjoyable experience. Factors associated with comfort, such as convenience, seating availability, and the transport of bulky goods, influence mode choice decisions (Espino et al., 2006; Vredin Johansson et al., 2006).

Demand-side factors

As previously mentioned, the choice of means of transport is not solely determined by the quality of the offer. The willingness of people to use certain means of transport is central. Therefore, demand factors must also be taken into account. These can be split up into three subcategories, namely external conditions, available resources, and individual preferences.

External conditions encompass factors such as the purpose of the trip, destination, and time constraints. The purpose of the trip determines specific requirements and considerations. For instance, a trip for shopping may require the ability to transport goods, while commuting to work may prioritise efficiency and reliability. The destination also plays a role, as some modes of transport may offer better access or connectivity to certain locations (Ding & Zhang, 2016; Witchayaphong et al., 2020). Time constraints, including the desired arrival time or time-sensitive appointments, can affect mode selection, with individuals opting for faster or more direct options (Ding & Zhang, 2016; Muralti et al., 2023).

Available resources, including time, budget, equipment, and competencies, significantly impact the choice of means of transport. Time availability influences the feasibility of using certain modes, as individuals with limited time may opt for faster options (Beirão & Sarsfield Cabral, 2007; Tveter, 2022). Budget considerations encompass the financial resources required for vehicle, maintenance, fuel, or public transport fares (Santos et al., 2013; Witchayaphong et al., 2020). Equipment, such as owning a bicycle or having access to a public transport subscription, can shape mode choice based on availability and convenience (Witchayaphong et al., 2020). Competencies, such as possessing a driver's license or familiarity with public transport systems, also influence the practicality of using different modes (Muralti et al., 2023).

Individual preferences add a subjective element to transport mode selection. Habits, routines, lifestyle, and personal values play a role in shaping these preferences. For example, individuals may have established habits and routines that lead them to choose a specific mode of transport based on familiarity or comfort. Lifestyle choices and values related to environmental sustainability or social factors can also influence mode preferences. Some individuals may prioritise walking, cycling, or public transport due to their perceived benefits in terms of health, environmental impact, or community engagement. On the other hand, others may have preferences driven by factors such as convenience, speed, or personal status associated with car ownership (van Acker et al., 2016).

Spatial Arrangement

Although the choice of mode of transport is primarily driven by supply and demand, the interaction between space and transportation plays a crucial role, particularly in mountainous and remote areas like Val Müstair.

In areas with diverse terrain and limited local infrastructure and needed facilities, individuals often need to travel beyond their immediate surroundings to fulfil various needs. Work, shopping, leisure, social interactions, and emotional needs cannot all be fulfilled simultaneously and in the same location, resulting in the necessity for movement and mobility (Ahrend & Herget, 2012; Marconi & Schad, 2016; Schuler et al., 2004). Therefore, the spatial arrangement and distribution of these activities can significantly influence the demand

for mobility and choice of transport modes, but as these often are given circumstances, they are difficult to influence (Harding et al., 2012; Witchayaphong et al., 2020).

The physical characteristics of a space, including its layout and topography, form the basis for the transportation infrastructure. Different modes of transport thrive under different spatial conditions. For instance, sparsely populated regions may favour car usage due to efficiency and availability of road networks, while densely populated areas may be more beneficial to public transport due to job density and population concentration. The quality and efficiency of the transport options heavily depend on the regional context, and any changes in the spatial structure can significantly impact the performance and effectiveness of different modes of transport (Anh Hong Nguyen et al., 2017; Rodríguez & Joo, 2004).

By considering these factors, policymakers and transportation planners can develop strategies and solutions that align with the diverse needs and priorities of individuals when it comes to transportation. When looking at mobility in Switzerland, all reasons to decide for one or another mode of transportation can be traced back to the three factor groups of supply, demand, and spatial conditions.

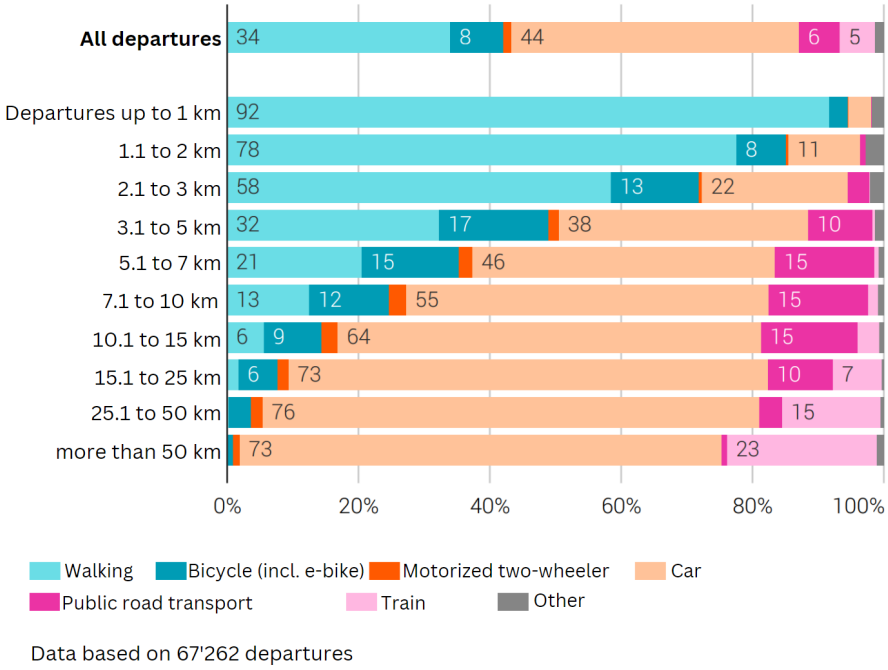


Figure 6: Main means of transport used by distance of departure (within Switzerland, in percentage, 2021). Own illustration based on Muralti et al. (2023)

When looking at the data from the mobility Microcensus by Muralti et al. (2023) illustrated in Figure 6, a factor that is particularly relevant for the choice of transport for instance, is the length of a departure. A departure (German: 'Ausgang') is a unit of measurement referring to a sequence of paths that begins and ends back at home. The distances covered on foot account for 92% of departures under one kilometre, while the train is mostly used for distances over ten kilometres. Bicycles, e-bikes, buses, and trams are mainly used for departure lengths up to 10 km. Cars are used for almost all distances.

It also appears that the chosen mean of transport was usually the "simplest and most convenient solution", had the "shortest travel time", or was "the only option". Private motorised transport is also chosen for

transporting luggage or for weather and precipitation reasons, whereas public transport is chosen when a subscription is owned or when there is no parking space available at the destination or if it is difficult to find. Non-motorised transport is most often chosen for walks (recreation), for health reasons, or "because the distance was so short" (Muralti et al., 2023).

2.3.3 Mobility Challenges and Needs in Rural Areas

The context of rural-peripheral areas brings certain key characteristics with it, namely decentralised settlement structure as well as a functional spatial separation of different activities such as leisure, work or accessing services (Ahrend & Herget, 2012). This generally leads to increasing number of journeys and of kilometres travelled per person (Marconi & Schad, 2016; Schuler et al., 2004). The consequences are higher costs and environmental pollution (Maier, 2008). This process is also amplified by a decline in the supply of services, job loss and population emigration (Franzen et al., 2008; Maier, 2008; Marconi & Käser, 2008) .

Due to a structurally given, limited supply of jobs and the further relocation of these to more urban areas, many people living in the countryside have to commute to work or school (Ahrend & Herget, 2012; Maier, 2008; Marconi & Käser, 2008). Because of the long distances there or to the next public transport station, many must use their own cars to go to work, school, utilities and leisure activities due to the lack of alternatives (Clotteau, 2014). This was also shown in a study by Maeder (2022), who examined mobility use in the Entlebuch region, a rural-peripheral area in the canton of Lucerne.

Additionally, not only residents of rural-peripheral areas access the mobility infrastructure in these regions. Despite only a quarter of the Swiss population residing in rural areas, one-third of the total traffic on the Swiss road network is generated in these regions. This is primarily due to the use of second homes for leisure purposes, with urban residents accounting for 75% of ownership. Therefore, the importance of transportation infrastructure within rural areas is evident, as the overall traffic volume within the rural areas exceeds that between rural and urban areas (Marconi & Schad, 2016).

In general, transport mode choice in rural areas is influenced by factors such as population density and access to public transport. According to Bubenhofer et al. (2018), population and employment densities positively correlate with a higher share of public transport and a smaller share of private motor vehicles. Conversely, areas with poor public transport connectivity tend to have a higher number of private vehicles, resulting in a modal split in which rural areas are more car-dependent compared to urban areas. As shown in Section 2.3.1, over the past years a steady increase of driving license ownership and households owning at least one car can be observed in rural areas. Interestingly, rural communities closer to urban areas have a lower share of public transport use for travel within the urban area compared to rural-peripheral communities, despite having better public transport accessibility (Marconi & Schad, 2016).

Overall, a trend towards increased public transport usage for leisure purposes has been observed in all types of areas, including rural areas, from 2005 to 2015 (ARE, 2018). However, the challenges of limited public transport accessibility and longer distances to services contribute to a higher reliance on private vehicles and a larger number of car ownership in rural areas (Bubenhofer et al., 2018). The longer distances to public

transport services are also shown in the study by Marconi and Schad (2016). They show that a vast majority of households have either marginally or not at all access to public transport, leading to significantly lower usage compared to more urban regions. Similarly, the use of slow traffic methods such as walking or cycling is also marginally less in rural areas compared to urban ones (see Section 2.3.1).

The provision of efficient public transport and addressing the specific mobility needs and challenges in rural-peripheral areas, including Val Müstair, are essential for enhancing accessibility, reducing car dependency, and promoting sustainable transportation solutions (Maeder, 2022; Clotteau, 2014). Here, the federal government has a responsibility to support rural areas within its competencies, ensuring adequate public transport connections to maintain sufficient connectivity between neighbouring rural areas (The Federal Council, 2015; Marconi & Schad, 2016).

2.3.4 The Case of Val Müstair

After having presented Val Müstair in terms of spatial location, social-, cultural and economic structure as well as the current sociodemographic changes during the previous sections, now the focus will be laid on the mobility connections and offers present in the region. In addition, a brief overview of the history of mobility in Val Müstair will be done.

The expansion of the road infrastructure, which was especially challenging over the Ofenpass at 2149 meters a.s.l. (swisstopo, n.d.), began in the second half of the 19th century. Prior to that, the road was just a simple mule track, over which a postman travelled three times a week from Zernez to Müstair, taking one or two passengers with him. Especially the winter season posed problems to the travellers, and many responsibles for the snow removal on the roads fell victim to storms and avalanches (Manatschal et al., 2014).

Thanks to a decision by the people of the canton of Grisons in 1860, which aimed to connect all main valleys and important mountain passes with modern roads within twelve years, the construction of a proper road began 1870 and lasted until 1872. The road was built from Zernez to the national border in Müstair over a length of 40 kilometres (Manatschal et al., 2014).

Motorised Private Transport

Nowadays, the valley is well connected when looking at the road infrastructure, with the main road Nr. 28 connecting the Engadine via the Ofen- and Umbrailpass and the Vinschgau in direction of South Tyrol (both Italy) (Cumün da Val Müstair, n.d.–c; swisstopo, n.d.; Grimm, 2013). Being a destination located in the Alps at an altitude between 1’247 (Müstair) and 1’660 meters a.s.l. (Tschierv) with summer and winter tourism present, seasonal differences play a crucial role when talking about mobility (swisstopo, n.d.). Therefore, tourism leads to significant seasonal variations, for instance the in winter closed Umbrailpass (Solèr et al., 2014; UBEVM & TESSVM, n.d.–a).

During the highly frequented times, the road network in Val Müstair is regularly at its limits, with the village centre of Santa Maria as the bottleneck of the valley, leading especially in summer to traffic congestions and chaotic situations (Sviamaint Santa Maria, 2022). Figure 7 shows data from the traffic counting station in Valchava, located between the Ofenpass and Santa Maria. In 2022 almost 840’000 vehicles passed by, with

peak days seeing up to 5'000 cars. As the graph illustrates, this number has steadily increased, as it was at nearly 780'000 in 2012 and at only 670'000 in 2000. This means an increase of around 25% between 2000 and 2022 in cars driving through Val Müstair (TBA GR, 2010, 2022).

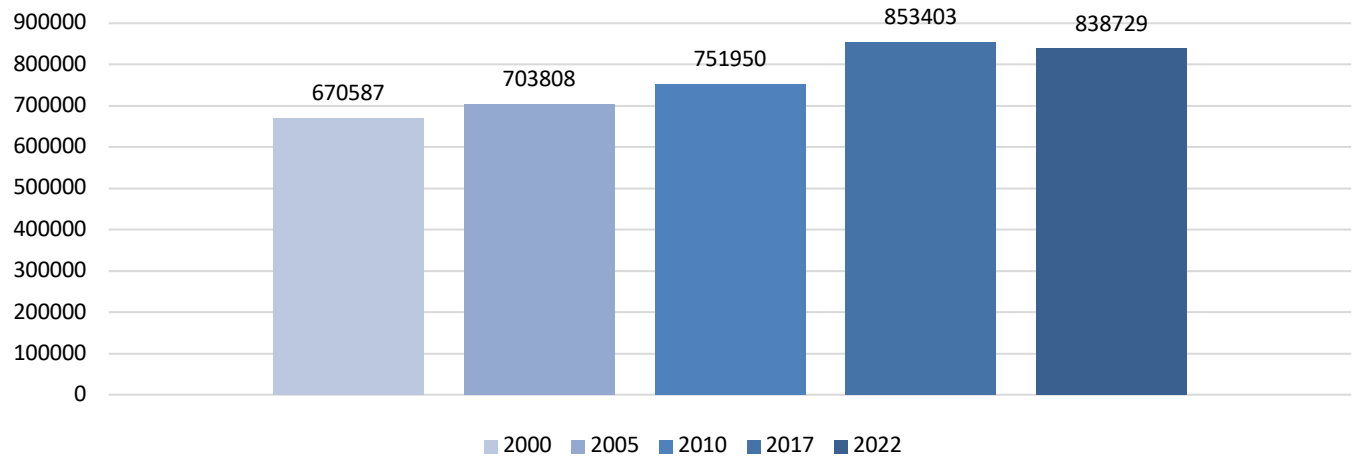


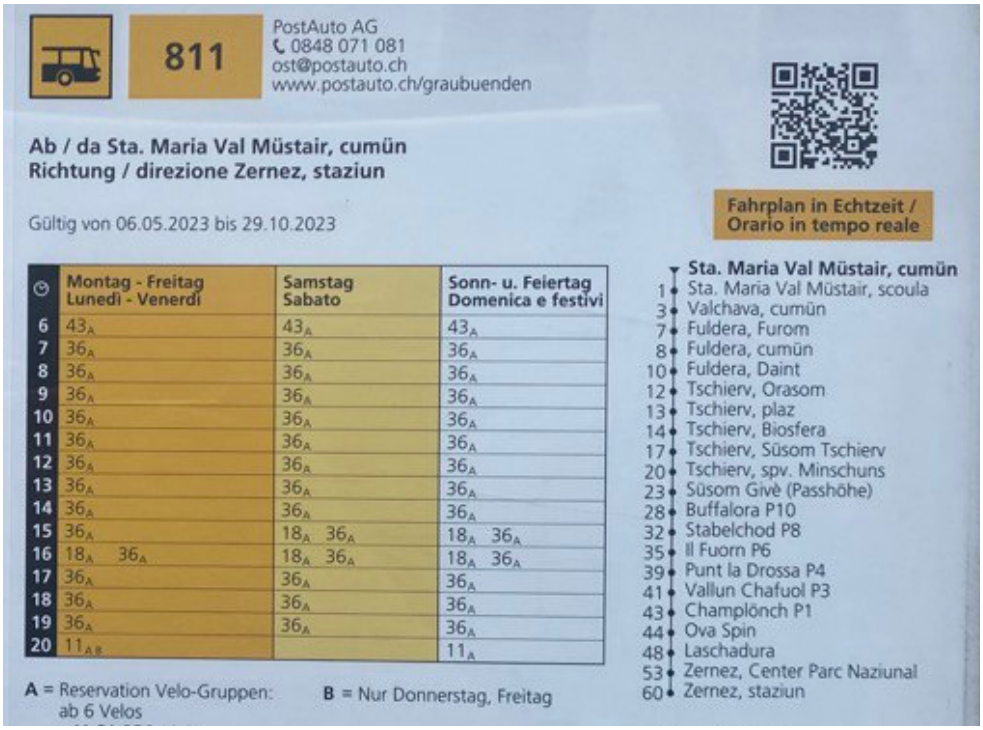
Figure 7: Total traffic volume per year measured in Valchava between 2000 and 2022. Own graph with data from TBA GR (2010, 2022)

A bypass road, intended to alleviate traffic in the town centre of Santa Maria, has been a topic for decades. In the years 1997 and 2013, the local population expressed their approval for the project at popular votes (Südostschweiz, 2013; Sviamaint Santa Maria, 2022). However, the implementation has been further delayed due to various rejections from the Federal Commission for Nature and Cultural Heritage and the Federal Commission for Monument Preservation (TBA GR, 2023).

Public Transport

Based on the new road over the Ofenpass built in the 19th century, also the first public transport connection was established in 1922, transporting around 4'000 passengers in the first year of operations. This number increased steadily to 5'700 in 1923 and even 6'300 in 1924. With the help of snowploughs, in 1933/34 the buses started operating over the Ofenpass also during the winter period. After the second World War, joint operations with Italian bus services were established during the summer months, extending the reach of the public transport network (Manatschal et al., 2014).

Until today, post buses operated by the Swiss PostAuto AG connect the villages in Val Müstair to the next centres in Zernez and Mals, with connections to the respective regional railway companies. In Zernez there are trains of the Rhaetian Railway (RhB), which is connected to the Swiss railway network with good connections towards Chur and Zurich, while since 2005, Mals is connected with Merano in South Tyrol thanks to the reopening of the Vinschgau Railway (Cumün da Val Müstair, n.d.–c; STA, n.d.; Suedtirol.com, n.d.; UBEVM & TESSVM, n.d.–a). Since the reopening, the post buses offer regular bus services from Zernez to Müstair, crossing the border and reaching the final station in Mals (Manatschal et al., 2014). During summer, these buses operate hourly in both directions, and every two hours during winter, while there are no connections between 8 p.m. and 7 a.m. (Cumün da Val Müstair, n.d.–c; SBB, n.d.–a).



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PostAuto AG
0848 071 081
ost@postauto.ch
www.postauto.ch/graubuenden

Ab / da Sta. Maria Val Müstair, cumün
Richtung / direzione Zernez, staziun

Gültig von 06.05.2023 bis 29.10.2023

Fahrplan in Echtzeit / Orario in tempo reale

	Montag - Freitag Lunedì - Venerdì	Samstag Sabato	Sonn- u. Feiertag Domenica e festivi
6	43_A	43_A	43_A
7	36_A	36_A	36_A
8	36_A	36_A	36_A
9	36_A	36_A	36_A
10	36_A	36_A	36_A
11	36_A	36_A	36_A
12	36_A	36_A	36_A
13	36_A	36_A	36_A
14	36_A	36_A	36_A
15	36_A	18_A 36_A	18_A 36_A
16	18_A 36_A	18_A 36_A	18_A 36_A
17	36_A	36_A	36_A
18	36_A	36_A	36_A
19	36_A	36_A	36_A
20	11_{AB}		11_A

Sta. Maria Val Müstair, cumün
1 Sta. Maria Val Müstair, scoula
3 Valchava, cumün
7 Fuldera, Furom
8 Fuldera, cumün
10 Fuldera, Daint
12 Tschierv, Orasom
13 Tschierv, plaz
14 Tschierv, Biosfera
17 Tschierv, Süsom Tschierv
20 Tschierv, spv. Minschuns
23 Süsom Givè (Passhöhe)
28 Buffalora P10
32 Stabelchod P8
35 Il Fuorn P6
39 Punt la Drossa P4
41 Vallun Chafuol P3
43 Champlönch P1
44 Ova Spin
48 Laschadura
53 Zernez, Center Parc Naziunal
60 Zernez, staziun

A = Reservation Velo-Gruppen: ab 6 Velos
B = Nur Donnerstag, Freitag

Figure 8: Bus summer schedule in Santa Maria Val Müstair, at the bus stop cumün in direction of Zernez (own image, June 2023)

Another bus connection away from the main valley operates during the summer season, approximately from mid-June to early September, daily from Val Müstair via the Stelviopass to Veltin, Bormio and Tirano (Italy). From early September to mid-October, the bus runs on a reduced schedule, only on Wednesdays and during weekends (Bus Val Müstair, n.d.; PostAuto, 2023b). For a better overview of the public transport situation in the valley, please refer to Appendix A, where the official route network of PostAuto for the Zernez/Val Müstair region is provided.

Mobility Offers for Tourists

There are several offers in Val Müstair aiming to shift the mobility patterns especially of guests towards public transport. On the one hand, there is a service that takes care of all the luggage transport for tourists arriving on holidays by public transport. In cooperation with the Swiss public transport company (SBB), the luggage is collected from the guests' homes and delivered directly to the holiday flat or hotel (SBB, n.d.–b; UBEVM & TESSVM, n.d.–e). When booking for a minimum of 3 nights at one of the participating establishments in Val Müstair, guests have the opportunity to take advantage of the Grün & gratis offer. This provides them with a free ticket for their arrival and departure using public transport. This offer is available from August to October (UBEVM & TESSVM, n.d.–f). Additionally, all guests in the valley, regardless of the number of nights booked, receive the Guest Card covered by the tourist tax. This card grants them free access to public transport during their stay, as well as additional discounts (UBEVM & TESSVM, n.d.–d).

In winter, a free sports bus runs between Müstair and Minschuns, where the only winter sports area in the valley is located (Sportanlagen AG Val Müstair, n.d.). Another transportation option in summer and winter is the on-demand shuttle and taxi service offered by the company Romex Transport. It offers transportation of guests, sports equipment and luggage into, out of and within Val Müstair (Romex Transport, n.d.).

Other Alternative Mobility Options

Various hotels in the valley in collaboration with the Biosfera Val Müstair offer the possibility to rent electric bicycles. If the battery would run out on the way, there are four public e-bike charging stations in the valley. The aim of the e-bike is to promote it as an attractive and climate-friendly alternative to the car, not only during holidays, but also in everyday life. Because it plays an important role in the sustainability of riding an e-bike, the electricity used for charging e-bikes comes in Val Müstair entirely from renewable energy sources (UBEVM & TESSVM, n.d.–c). Since 2019, guests and locals have the possibility to rent a car at the regional park office. At the same time, the electric rental vehicle serves as business car for the park employees, ensuring the minimum utilization (UBEVM & TESSVM, n.d.–b).

Another offer to nudge people from taking their own car to using public transports is the “Kulturbus”. The culture bus, operated by the previously mentioned Romex Transport company, was initiated by the Biosfera together with some of the local cultural institutions. The aim is that during the week, when there is no public transport connection after 7 p.m., people interested in culture are transported to evening events and back home (UBEVM & TESSVM, n.d.–a).

In conclusion, the analysis of mobility in Switzerland in patterns in rural-peripheral areas, including the case of Val Müstair, reveals specific challenges and characteristics related to decentralised settlement structures, limited job opportunities, longer distances to services, and a higher reliance on private vehicles. These factors contribute to increased traffic volume, higher costs, and environmental impacts. While efforts have been made to enhance public transport infrastructure and promote sustainable mobility options, there remains a research gap in understanding the effectiveness and efficiency of existing measures, as well as identifying innovative solutions tailored to the special needs of rural-peripheral areas. Addressing this research gap is crucial for developing strategies that improve accessibility, reduce car dependency, and promote sustainable transportation systems in these regions. The subsequent sections will delve into the research methodology and findings that aim to contribute to filling this research gap.

2.4 Research Gap, and Objectives, Question

The analysis of the region and municipality Val Müstair has shown, that it is a remote valley on the border to Italy. As seen in Section 2.1.1, with its low population density and decentralised settlement structure, it classifies as a rural-peripheral, sparsely populated region. The valley’s character is shaped by its rich cultural and economic landscape, a mainly organic agriculture, and a small tourism branch. Nevertheless, as many regions in rural-peripheral areas, also Val Müstair is undergoing several sociodemographic changes. These are for instance the continuous migration from rural areas towards peri-urban and urban regions, the resulting ageing of the local population, and the decline in the quality and accessibility of basic services such as healthcare or education. While the number of local residents keeps declining, rural areas are increasingly valued as recreational spaces for urban residents. Combined with a growing interconnection between rural and urban areas, there is a rising demand for transportation infrastructure, also in Val Müstair.

Further, the literature review reveals that Switzerland has a well-developed transportation system but faces challenges of high motorization and car dependency, especially in rural-peripheral areas like Val Müstair. In this specific case, this subsequently causes a continuous increase of the traffic volume, leading to high noise and emission loads, as well as causing for the local population burdensome congestions during peak tourist seasons. Knowing about these mobility problems, the Nature Park Biosfera Val Müstair is keen to change the mobility in the valley towards more sustainable patterns.

During a first energy and mobility project in the period of 2016-2019, the Biosfera management already initiated the process of putting sustainable mobility offers in place, which resulted in the realization of a few measures such as luggage transport services, free public transport offers for tourists, electric bicycles, and on-demand shuttle services (see Section 2.3.4). Nevertheless, according to the management, there is still a high potential regarding this (Peter, 2023). In the process of 2016-2019, they formulated the following goals regarding future mobility in the valley:

- New mobility offer(s) enabling inhabitants to travel without depending on private motorised vehicles within the valley and to close centres during nighttime, when the scheduled public transport is no longer operating.
- Create incentives for tourists as well as locals to use the public transport and shared mobility offers more frequently.
- Especially include individuals who lack access to or permission to use a car, such as youth (under 18 years) and the elderly generation.
- No potentially competitive offers to existing services such as PostAuto and the Romex cab service.
- If possible, reduce general volume of traffic in the valley by promoting different alternative mobility offers to the nowadays usual motorised private transport.

While these goals, in line with the Charta 2021-2030 going by the slogan “Dare more sustainability” (Feichtinger et al., 2020), articulate the commitment to non-competitive mobility offers, preserving existing services like PostAuto and the cab service, it also expresses a desire to reduce the overall volume of traffic in the valley. To do so, the Biosfera is in need of an analysis about the current mobility patterns of people in the valley, their attitude about already existing mobility offers as well as their requirements and opinions about potential new mobility offers in the valley. While existing literature investigates other rural-peripheral areas and their mobility patterns, a lack of knowledge about the specifics in Val Müstair persists.

Especially in the local context, closing this gap with this research is of upmost importance for the Biosfera, enabling them to implement the right measures based on a deeper understanding of the current mobility and the opinion of the interest groups in the valley. In order to make this contribution, the previously mentioned goals form 2016-2019 were considered and further developed in the course of the initial in-depth interview with a representative of the Biosfera Val Müstair, Franziska Peter (2023), in order to find the potential contribution of this master thesis, as well the appropriate research design in order to fulfil this.

As a result, the research objectives of this master thesis are:

- To provide an overview of literature regarding 1) the geographical area of research Val Müstair (Spatial location, settlement-, social- and economic structure), 2) the concept of sustainable mobility and 3) mobility in rural-peripheral areas (needs, challenges, and the case of Val Müstair).
- To conduct an expert interview with a representative of the Biosfera Val Müstair and find the expectations, hopes and requirements for this empirical work. As they know the valley and its stakeholders best, potential interview partners representing an interest group will be asked and interviewed.
- To carry out a secondary analysis, based on the evaluation of the information collected in the interviews to gain insight about:
    - Prevailing mobility practices among different interest groups in Val Müstair
    - Expectations, desires, ideas, and concerns regarding new mobility options
    - Factors influencing the introduction and acceptance of new mobility offers
- To determine which alternative mobility solutions align with the empirically identified requirements of the region and have the highest potential for acceptance among the involved interest groups. This will be accomplished by conducting a literature review of different alternatives and studying best practices from other rural areas facing similar initial conditions.
- To elaborate recommendations for the management of the Biosfera based on these findings.

Based on these objectives the following research question was developed:

What are the prevailing mobility practices, experiences, and preferences among different interest groups in Val Müstair, and what are the factors influencing their acceptance of alternative, sustainable transportation options? What could be suitable mobility concepts for Val Müstair?

3 Research Design

3.1 Research Approach

In this study, a strong focus was placed on employing a qualitative approach to investigate the research topic, as it required a contextual understanding of the individuals involved. Unlike quantitative methods that gather data from a larger number of participants but offer limited depth, qualitative interviews were chosen to provide a more comprehensive and in-depth exploration of the subject (Bryman & Bell, 2011; Veal, 2017).

The primary goal of the research was to gain subjective opinions and viewpoints from various interest groups, with the aim of developing ideas for the future that cannot be quantitatively measured. Qualitative interviews were considered particularly valuable for allowing interviewees to express their thoughts and perspectives in descriptive terms, rather than relying solely on qualitative data (Bryman & Bell, 2015).

Furthermore, conducting qualitative interviews involves establishing a relationship, and demonstrating sensitivity and enthusiasm towards the main topic to gain cognitive access to rich research data (Saunders et al., 2019). As I chose this topic voluntarily and with a high level of self-interest, these two factors were present throughout the interview process. This commitment contributed to a fruitful and engaging exchange of information and insights with the interview partners. The research approach was object-oriented, focusing on interpreting and describing phenomena, which aligned with the literature's recommendation for a qualitative approach (Fredebeul-Krein, 2012a).

3.1.1 Inductive Approach

This thesis follows an inductive research approach, which involves generating theory about a relatively unexplored topic through research data and aiming to establish generalizations. This approach is commonly associated with qualitative research (Bryman & Bell, 2015).

For this study, I adopted the inductive approach to develop a theory concerning the requirements, needs, expectations, and fears of stakeholders in relation to sustainable mobility within the Biosfera Val Müstair. The process involved analysing data from expert interviews, leading to a comprehensive understanding of mobility in the valley. From this understanding, a theory was formulated, which was then applied to the broader population and other stakeholders. This application of the theory to the larger context demonstrates the inductive nature of the research process (Fredebeul-Krein, 2012b).

3.1.2 Exploratory Research

In exploratory research, the primary objective is to generate novel knowledge and gain initial insights into a relatively unexplored research area (Bryman & Bell, 2015). The focus is on exploration rather than having preconceived theories or hypotheses at the outset. The exploratory approach aims for inductiveness and can employ both quantitative and qualitative methods, but qualitative methods are better suited for investigating contexts with limited existing research (Fredebeul-Krein, 2012a).

This master thesis adopts an exploratory research design as it seeks to understand the expectations of interest groups regarding sustainable mobility alternatives in Val Müstair, a field with little existing knowledge. Thus, no specific hypotheses were formulated to keep the research open-ended and allow for the discovery of new insights.

3.2 Data Collection

In order to conduct and develop this research paper, various methods were selected, which depend on each other throughout the research process. Exploratory research can be conducted in three principal steps: reviewing existing literature, interviewing experts and focusing on groups in the field (Bryman & Bell, 2015). For this research paper, a combination of reviewing literature, hence secondary data, and interviews, as primary data, were used. In this section, these two data collection methods will be thoroughly analysed.

3.2.1 Literature Review

To get an overview on the topic and existing literature I first applied the method of reviewing and collecting existing data on the subject, known as secondary data collection. Secondary data refers to information that has been previously gathered by other researchers, often in the form of high-quality datasets from extensive investigations. It serves as a foundational element in academic research papers. Additionally, secondary data encompasses collected information that was initially obtained for other purposes but can also provide a valuable basis for exploring other research topics (Bryman & Bell, 2015; Jennings, 2010; Veal, 2018).

The process of reviewing secondary data involves extensive time and effort as it requires searching through various academic and scientific sources, including raw data and published summaries (Saunders et al., 2019). In this research, secondary data was collected from diverse sources such as academic articles, journals, newspapers, databases, websites, government statistics, reports, and organizational websites. To access relevant information, a wide range of tools like Google Scholar, the author's FHGR university library account and the school-internal RecherchierBar were utilised. The source management tool Citavi was used on one hand for the organisation of sources and, on the other hand, also for research using the program’s internet search tool, which accesses many knowledge databases.

It is important to note that secondary data should not be limited to theoretical literature alone but can also include empirical studies, practical observations, recent reports, media sources, and documents (Saunders et al., 2019). Once the secondary data is obtained, it can be further analysed and synthesised to offer additional interpretations, knowledge, and conclusions related to the selected topic. The purpose of summarizing findings from existing literature is to provide an overview of the current information and understanding within a specific field (Jennings, 2010; Rowley & Slack, 2004). As a result, the literature review section of this paper was structured into three main sections.

For the introduction as well as the theoretical background the method of literature review was used to gain fundamental knowledge regarding the topic as well as to be able to define specific terms. Moreover, by scanning already existing literature, the knowledge gap could be identified and confirmed, which led to the

research problem and research question (see Chapter 2.4). Döring and Bortz (2016) emphasise the importance of an extensive literature review as the fundament of each scientific research, so that the researcher is aware of the current state of research and can systematically derive the research questions or the research objectives. Bryman and Bell (2015) agree and further add that the researcher can learn from mistakes made by other researchers, receive valuable theoretical and methodological input, and find support in interpreting his own results by reviewing existing literature.

This paper sought to identify the existing literature about the Val Müstair, sustainability in general and the role of mobility in this concept. In addition, an overview of the current situation of mobility in Switzerland was gained, as well as literature about mobility in rural areas by a systematic review of the existing literature. The purpose of a systematic literature is to show which findings, models and theories have already been discovered in academic research and to show different sides about the best ways of doing things (Bryman & Bell, 2015). This helped to define terms like sustainable mobility and rural areas as well as putting the researched area Val Müstair in a bigger context and to identify what is already known in literature about sustainable mobility in rural areas and ways to empower the shift towards it (Bryman & Bell, 2015).

The reference manager Citavi and its plug-in in Microsoft Word played a crucial role in organizing the references and maintaining them in the correct APA format, facilitating an efficient writing process. The iterative nature of the literature review allows for adjusting topics throughout the writing process, because it does not require a strictly chronological order (Bryman & Bell, 2015). The three sections of the literature review provided a solid theoretical framework to introduce the research gap and the corresponding research question.

3.2.2 Semi-Structured Interviews

As the collection of secondary data has been explained in detail before, this section covers the collection of primary data. For this research paper, it was gathered with the use of semi-structured interviews to answer the research question in a proper way. Saunders et al. (2019) state, that for research based on a qualitative, inductive and exploratory design, it is best to use semi-structured interviews, which was the case in this research project.

According to Bryman and Bell (2015), this type of interviews usually covers a list of questions, which will be developed before the actual interviews and will cover specific topics based on the research objectives. The list of questions will figure as interview guide throughout the interview, however, the interviewee will have the freedom and leeway to reply to the questions, as they will not have to follow an exact structure and question schedule. Veal (2018) suggests that these interviews can even be guided by a checklist of topics rather than adhering strictly to a formal questionnaire, offering flexibility and adaptability in the interview process.

For the interviews in this thesis, I applied a mix of the before-mentioned definitions to develop an interview guideline. First I prepared a checklist of topics (see Appendix B) to cover during the interview as proposed by Veal (2018). This list I adapted before each interview such that it matched the respective group of interest represented by the interviewee. I then supplemented each topic of the checklist with possible questions related to the topic, as suggested by Bryman and Bell (2015). This checklist served as a guideline during the

interviews, allowing me to continuously monitor if the intended topics were being addressed by the interviewees' responses and allowing for timely and appropriate follow-up questions to steer the conversation in specific directions when needed.

Overall, semi-structured interviews can be held very flexible, thus further, from the dialogue emerging questions which are not included in the question guideline, can be exchanged as well (Bryman & Bell, 2015). In the interviews conducted for this study, the flexibility of the process was evident, allowing for the exchange of follow-up questions that were not part of the interview guideline. When new insights or points of interest arose during the interview, I had the opportunity to explore them further, making the interview process highly adaptable and dynamic.

When it comes to conducting the interviews, Bryman and Bell (2015) mention several preconditions that have to be fulfilled. The interviewer has to show empathy and understand certain upcoming issues, events, patterns, and different forms of behaviour of the interviewee. Also, the interviewer has to stay casual and neutral throughout the interviews, so as to collect as many honest and serious answers as possible and not to influence the interviewee in any way. Therefore, every interview was conducted differently, and the results varied. Further, I did not interrupt the conversation flow, such that the interviewee felt comfortable during the interview.

As the interview was semi-structured, the interview guidelines were not sent to the participants before the actual appointment, so that all participants had the same terms in order to answer directly and without any preparation to the questions. This research depended on flexible, natural, and honest answers of all interviewees. These were needed as they were used to create the primary data collection.

According to Veal (2018), a semi-structured interview consists of three main characteristics: structure, length and depth. They will be analysed in the following. Firstly, due to the nature of a semi-structure, interviews do not have to follow a strict structure during the interview (Veal, 2018). In line with this definition, the interviews conducted for this research were indeed semi-structured, as I utilised the checklist and accompanying questions to guide the interviewees. However, I remained flexible throughout the interviews as the interviewees sometimes switched between topics or addressed multiple questions simultaneously. This flexibility allowed for a dynamic and organic exchange, while still ensuring the comprehensive exploration of the research subjects. Secondly, the length of a semi-structured interview typically lasts at least 30 minutes but can also last from over an hour to several hours (Veal, 2018). The longest interview for this thesis lasted around one and a half hours, the shortest a little less than 30 minutes. And the last point of Veal (2018), which is also confirmed by Jennings (2010), is that a semi-structured or in-depth interview brings more depth and detail to the answers of the interviewees, as the name already points out. This was exactly what was needed in order to work towards the defined research objectives of this thesis.

3.2.3 Choice of Sample and Field Access

Sampling

The choice of a sample in qualitative research is a critical decision that requires careful consideration to ensure the validity and reliability of the findings. According to literature (Miles et al., 2020), sampling in qualitative research involves two key actions: setting boundaries and creating a frame. These actions sometimes pull in different directions, as researchers need to define specific aspects of the case study within their time and resource limitations while also uncovering, confirming, or qualifying the underlying processes or constructs of the study.

In this thesis, I employed a combination of purposive sampling and the snowball sampling method to find my sample for the interviews. My interest are the opinions of different interest groups regarding mobility in Val Müstair. Purposive sampling, as defined by Jennings (2010) and Veal (2018), is a deliberate approach used in qualitative research. It involves selecting participants based on specific characteristics relevant to the research objectives, utilizing the researcher's knowledge. The Snowball method on the other hand is, when interviewees are “used as source of suggestions for additional contacts” (Veal, 2018, p. 430).

Given my limited familiarity with the valley and its social and economic structure, I collaborated closely with my co-advisor, Franziska Peter, who is a representative of the Biosfera’s department of education and culture. She played a crucial role in the selection process by providing me with valuable information on which interest groups to interview and also connecting me with the necessary individuals representing these groups, which can be recognised as the snowball sampling method according to the definition of Veal (2018). As a result of the kick-off interview with Franziska, the stakeholders and interest groups to be included in the study were defined (Peter, 2023):

- Municipality and municipal council: They are the local governing body and play a significant role in creating the framework and providing resources for the implementation of potential measures.
- Local Tourism Association: They are a crucial stakeholders responsible for shaping and offering tourism-related services in the area.
- Representation of the youth (18-) and the elderly generation (80+): Including their perspective is important to capture their unique insights and experiences and provides a broader understanding of the community’s dynamics and special needs.
- Representative from hospitality, gastronomy and/or businesses: Involving this interest group provides insights into its involvement and impact on the local community as well as on the touristic side.
- Cross-border and general commuters: Including individuals who commute to or from Val Müstair contributes to understanding the requirements of this highly mobile interest group.

While interviewing representatives of the before-named interest groups, some of the interviewees provided me again with additional contacts, which I then subsequently requested for an interview. By leveraging these referrals, I ensured that a diverse range of perspectives from various stakeholders and interest groups was captured, enriching the overall analysis of mobility in Val Müstair.

The choice of these sampling methods aligns with literature, which emphasises the importance of involving key stakeholders in defining the boundaries of the case study, ensuring the robustness and relevance of the sampling process (Miles et al., 2020). The main goal was to capture a diverse range of perspectives from the different interest groups and stakeholders in the valley, thus the interviewees were selected accordingly with the help of the key stakeholder Biosfera, the entity which is going to select and implement the chosen measures in the end of the process. Bryman and Bell (2015) and Miles et al. (2020) agree, that involving relevant stakeholders in the sampling process enhances the validity and credibility of qualitative research.

Literature recognises, that the sampling strategy can evolve during the research process (Veal, 2018). In this thesis, the sampling strategy was initially designed after the first interview with Peter (2023) using the snow-ball method combined with her purposive sampling, which reflects the literature's recommendation to plan the strategy in advance (Miles et al., 2020). However, as I progressed in data collection and analysis, it became apparent that additional perspectives would enrich the study. Therefore I included new interview partners along the process, again taking into account the importance of data saturation and the inclusion of diverse perspectives (Lincoln & Guba, 1985; Miles et al., 2020; Veal, 2018). This resulted in the following additional interview partners:

- Families living in the valley: Incorporating the needs and perspectives of families with children provides insights into their specific requirements and experiences.
- Local Commerce and Hospitality Association: As representing organisation of most of the businesses and accommodation providers it became apparent that it is crucial to include a representative.

Regarding the size of the investigated sample, Veal (2018) suggests that in-depth interviews are typically conducted with a relatively small number of subjects, but in a very detailed way. According to Jennings (2010), empirical materials should be collected until theoretical saturation is achieved, which signifies the point where no new insights are gained and only confirmation of previous theories occurs. In this study, after conducting interviews with several representatives of interest groups in Val Müstair region, a redundancy of information was observed, indicating the attainment of theoretical saturation as described by Jennings (2010). As the Val Müstair valley covers a sparsely populated area with approximately 1'500 residents, a coverage of 10 interviews is considered sufficient, including all important interest groups after Peter (2023).

The following table shows the ten interviewees by their location, name, occupation, and interest group which they represented in this study in chronological order of the interviews:

Datum	Location	Name	Occupation	Interest group
February 28, 2023	Müstair	Peter, Franziska	Director of Education and Culture at Biosfera	Nature Park UNESCO Biosfera Val Müstair
April 19, 2023	Valchava	Schreich, Hans-Peter	Former pastor and historian	Elderly generation
April 20, 2023	Tschengls (IT)	Merz, Karin	Director of Administration at Biosfera	Commuters from outside the valley

May 4, 2023	Santa Maria	Cueni, Tobias	Guest Information Manager at local branch of tourism association TESSVM	Tourism association Engiadina Scuol Samnaun Val Müstair
May 4, 2023	Santa Maria	Binkert Becchetti, Gabriella	Municipal president of Val Müstair	Municipality of Val Müstair
May 5, 2023	Müstair	Ulayayi, Stephanie	Guest information and marketing assistant at Biosfera	Locals, Families, Middle-aged generation
May 14, 2023	Tschierv	Kern, Niklaus	Works in Samedan; Founder and manager of KERN cumpost	Commuter out of the valley
June 2, 2023	Santa Maria	Pinggera, Lenka	Manager of camping ground Pè da Munt in Santa Maria	Hospitality sector
June 6, 2023	Müstair	Scandella, Riet	President of the youth association Giuventüna Müstair	Young generation
June 21, 2023	Santa Maria	Casty-Greiner, Karin	Co-president of Commerce and Hospitality Association Val Müstair; Owner of a painting and plastering company	Local businesses

Table 4: List of interview partners (own table)

With the exception of the kick-off interview with Franziska Peter, all other interviews were conducted between April and June 2023. Due to the fact that the interviewees mostly work and live in Val Müstair region and that the author was not present in that area, the interviews were conducted via several online platforms like Zoom and Microsoft Teams. Two of the interviews were done over the telephone, as these participants were not familiar with online platforms. Therefore, some of the interviews were done “face-to-face” and the others “voice-to-voice”. However, a spontaneous interaction between participants and researcher was covered in all interviews, as all participants had to answer the questions spontaneously without being prejudiced and there was a high level of interactivity (Saunders et al., 2019; Veal, 2018). This had another advantage, namely that interviews could be planned with flexibility because they were not limited by a geographical location, as also described by Saunders et al. (2019).

To be able to ensure an accurate and comprehensive record of the conversations and to reduce the risk of missing or misinterpreting information during data analysis, interviews are often digitally recorded and can include notes or verbatim transcripts (Jennings, 2010; Veal, 2018). This allows the interviewer to focus entirely on the interview and engage fully with the interview partners (Bryman & Bell, 2015). With the explicit permission of all interview participants, the interviews were recorded using the Apple recorder function Voice-Memo. This recording allowed me to transcribe the interviews accurately at a later stage for further analyses. It also provided the opportunity for the interviewer to listen to the interviews in detail, ensuring that no valuable information was missed during the analysis process. Importantly, all interviewees willingly consented to being recorded and agreed to be quoted and included in the subsequent analysis and discussion of the results.

Transcription

To analyse the conducted interviews systematically and scientifically, each spoken interview needed to be transcribed into a written text, as emphasised by Bryman and Bell (2015) as well as Flick (2017). Since all interviews were conducted in Swiss German, they were translated word-for-word into Standard German for

better readability during data analysis. All interviews were transcribed using the MAXQDA 2022 software, a process which was extremely time-consuming. For the sake of compactness and clarity, only the detailed interview with Franziska Peter, head of the department for Education and Culture at the Biosfera, will be included in Appendix C for reference. The transcripts of the other interviews are in possession of the author of this thesis and can be requested and accessed at any time.

Qualitative Data Analysis

After transcribing the interviews, the analysis of the gathered data was done using qualitative content analysis according to Mayring and Fenzl (2022). In contrast to quantitative content analysis, the focus was not on the statistical evaluation of the interviews. Instead, the content of the interviews themselves was the main focus.

The qualitative content analysis was carried out through the content structuring described by the above-mentioned Mayring and Fenzl (2022). The aim of content structuring is to extract and summarise certain themes, content, and aspects from the material. Categories and subcategories are created using theoretical frameworks. All interviews are then coded, and the corresponding text components are extracted and systematically assigned to the categories (Mayring & Fenzl, 2022). By coding and categorizing the transcripts, it became easier to analyse the content systematically. While there are several possible ways of coding, for this research the open coding with inductive and deductive coding was applied (Bryman & Bell, 2015). The categories were initially developed through a deductive process (Mayring & Fenzl, 2022), using the research objectives, theory, and the interview guideline as a template for forming relevant categories. In the following, during the coding process, an inductive approach was applied. With the inductive approach, new categories are formed directly from the textual data without involving pre-existing theory (Mayring & Fenzl, 2022). This led to the formulation of new categories and the elimination of some deductively created categories as well as the merging of certain categories due to their high similarity. Some text components are assigned to multiple categories. This process was repeated several times, while progressing on the research and the content analysis. The resulting main- and sub-categories, are listed in the code system in Appendix D.

For this qualitative content analysis, MAXQDA 2022 software was used. In MAXQDA, individual sentences, lines, and entire text segments can be highlighted and assigned to pre-established codes. After coding, the individual codes can be displayed and paraphrased using a filtering function, allowing for the summarization of respective subcategories (Mayring & Fenzl, 2022). This provides a clear representation of the interview statements regarding the selected topics. This representation served as the basis for the results of this master thesis and was essential for answering the research questions.

3.2.4 Quality Criteria and Ethical Considerations

The trustworthiness and quality of research rely on the methods employed and the level of care in their implementation. Two dimensions commonly considered in this context are validity and reliability (Jennings, 2010). Validity refers to the extent to which research accurately represents the phenomena it claims to reflect. Reliability, on the other hand, pertains to the consistency of research findings if the study were to be replicated later or with a different group of participants.

In qualitative research, Guba and Lincoln (1985) introduced the concepts of trustworthiness and authenticity as alternatives to validity and reliability. According to them, trustworthiness encompasses four components, namely credibility, transferability, dependability, and confirmability:

1) Credibility refers to the trustworthiness and reliability of the main findings in a research study. It involves adhering to good practice guidelines and establishing a clear understanding between the researcher and the interview participants (Veal, 2018). In order for the findings to be credible and usable for further research, they need to be confirmed by the participants through a process called 'respondent validation' (Bryman & Bell, 2015). In this particular study, the interviewees did not wish to review the transcript beforehand but agreed to read the research paper after its submission.

2) Transferability, in quantitative research also known as generalizability, refers to the extent to which research findings can be applied to other contexts (Peräkylä, 2011; Veal, 2018). Qualitative research, characterised by smaller sample sizes and in-depth interviews, focuses on contextual uniqueness rather than broad generalizations (Bryman & Bell, 2015). To ensure a valid interpretation and reasonable judgement of transferability, qualitative researchers employ a "thick description" approach that provides detailed information and interrelation of context and findings (Lincoln & Guba, 1985). In this study, the thick description method was applied, and the results can be transferred to other remote, sparsely populated rural areas in Switzerland on a case-by-case basis, considering the similar preconditions posed by topography and infrastructure, as well as social and economic structure.

3) Dependability, synonymous with reliability, pertains to the consistency and rigor of research procedures throughout the study (Bryman & Bell, 2015). It emphasises the importance of following the same structured approach and maintaining complete records of all steps taken during the research process (Saunders et al., 2019). In this study, all interviews except the initial one with the representative of the Biosfera followed the same structure, including a consistent introduction, and were conducted online or via telephone. The use of recorded interviews generated a large dataset, ensuring a level of dependability in the study.

4) Confirmability relates to the objectivity and neutrality of the collected data, ensuring that the research findings are not influenced by the interviewer's personal biases or prejudices (Bryman & Bell, 2015). In this research study, semi-structured interviews were employed, allowing for individual reactions from interviewees. However, no personal opinions or comments were shared during the interviews. The interviewer only shared personal opinions with the participants after the recording. This approach helped maintain the confirmability of the research findings.

Authenticity, as defined by Lincoln & Guba (1985), encompasses various facets including fairness, ontological authenticity, educative authenticity, analytic authenticity, and tactical authenticity. As the process of qualitative studies is not strictly predefined, a comprehensive description of the research process is recommended (Henderson, 2006; Veal, 2018). To meet this criterion, Section 3 provided an in-depth explanation of the research design.

Ethical considerations and privacy issues are similarly vital in research studies involving interviews and data analysis (Saunders et al., 2019). The author ensured confidential handling of data by obtaining permission to record the interviews, assuring participants that the data would be treated confidentially and used solely for the evaluation of the thesis. The author also confirmed that all recordings would be deleted after finishing the study, and participants agreed to the use of their answers for analysis and the study's outcomes.

3.2.5 Reflection of Methodology and Limitations of the Study

In this section, the limitations encountered during the study are discussed and the chosen methodology and its potential impact on the research outcomes are reflected. Throughout the research process, my positionality played a crucial role. My background, experiences, and perspectives could have influenced the study's design, data collection, analysis, and interpretation. Acknowledging and reflecting on these potential biases is vital for maintaining objectivity.

The study focused on examining peoples' everyday mobility, explicitly excluding GHG-emissions related to air travel, freight transportation, and international tourism. Additionally, the results primarily pertain to the rural-peripheral areas of Switzerland, with potential applicability to other rural and mountainous regions. The measures presented in Section 6 were narrowed down to those feasible and effective in the scope of action of the Biosfera Val Müstair.

One of the limitations is regarding statistical generalization due to the non-representative and small sample size of Val Müstair residents. Drawing statistical conclusions from the data was not the primary aim of this thesis, and to address this, absolute numbers and statistical expressions were avoided in presenting the results (Halkier & Jensen, 2011). The recruitment strategy focused on key interest groups allowed for analytical generalization but not statistical distribution. While the small sample size restricted definitive conclusions about the wider population, the emphasis remained on presenting the findings with caution to prevent any misleading interpretations.

Similarly, qualitative data analysis is inevitably accompanied by subjectivity (Halkier & Jensen, 2011; Mayring & Fenzl, 2022). The process of categorizing and summarizing data inherently involves interpretation of the researcher. To maximise transparency, the coding process was described in detail in Section 3.2.3 and the resulting code system is provided in Appendix D. Additionally, all interview transcripts are in possession of the author and can be requested for consultation at any time. Furthermore, subjectivity arises also from choosing interview partners, which was done in collaboration with the Biosfera. This definitely can lead to a certain degree of subjectivity, but as the thesis was done with the Nature Park and the results are tailored to this institution, this bias cannot be eliminated and thus has to be acknowledged as one of the limitations.

The adoption of semi-structured interviews as data collection method presented both strengths and limitations. The interviews proved to be valuable in uncovering the discursive aspects of mobility practices, opinions, background information about the valley, individual ideas, motivations as well as suggestions (see Section 4). However, it should be acknowledged that this method had inherent drawbacks in capturing the materiality and embodied dimensions of practices. As a consequence, the identified mobility patterns may not

fully represent reality, and some pertinent information might have been overlooked if interviewees omitted certain practices from their responses. Despite these limitations, the semi-structured interviews offered valuable insights into the discursive elements of the study's focus.

4 Analysis of Results

In this section, the answers of the ten interviewees are presented. The answers represent the results of this thesis, as they are based on the research themes described at the beginning of this research paper in Section 2.4. In addition to conducting a detailed analysis of the three main topics (main codes 2 – 4, see Appendix D), a further in-depth analysis will be conducted focusing on the research objectives, preconditions in Val Müstair, and the roles of various stakeholders and interest groups. These aspects should be taken into consideration when discussing the results. Consequently, the structure and sequence of the results analysis are as follows:

- Research objectives and preconditions
- Prevailing mobility practices among different interest groups in Val Müstair
- Expectations, ideas, and concerns regarding new mobility options
- Factors influencing the introduction and acceptance of new mobility offers

4.1 Research Objectives and Preconditions

In order to get to know the role of the Biosfera Val Müstair in this thesis and to explore their expectations and initiatives, the kick-off interview with Franziska Peter (2023) provided valuable insights, which were presented in Section 1.2. For the sake of completeness, in this section also the previously given info will be repeated. In addition to that, the general preconditions in the valley, gained information about the local stakeholders as well as previous initiatives and efforts in terms of mobility in the valley will be presented.

4.1.1 Research Objectives

According to the kick-off interview with Peter (2023), the Biosfera Val Müstair is an organization actively engaged in promoting sustainability within its park area through the implementation and improvement of projects aimed at creating a more sustainable future according to the three pillars of ecology, society and economy. The Biosfera's role is to initiate projects, provide a platform for exchange, and connect people. They do not have the authority to build infrastructure or enact laws, also because they are funded by the canton and the federal government. While infrastructure projects are the responsibility of the municipality, the Biosfera strives to collaborate with all stakeholders and work with the given circumstances to make the best of the given situations.

For the Biosfera, it is crucial to address sustainable mobility in the valley, because it addresses emission-related issues and the well-being of the residents and visitors at the same time. Recognizing this and the needs of individuals who cannot or choose not to drive, such as young people, seniors, and tourists, the Biosfera Val Müstair is committed to providing alternative transportation options, which is planned for the project period 2025-2028. Their main objective is to foster sustainability within the park area with the vision “to expand the mobility offerings in such a way, that it becomes possible to shift mobility away from private cars without the people feeling to be restricted in their mobility” (Peter, 2023).

Regarding the contribution of this thesis to these goals, the Biosfera hopes that it can help understanding the mobility usage patterns in the valley, explore ideas for improvement, and identify successful initiatives of other rural-peripheral regions to reduce their residents' reliance on private motorised transportation. When asked, what interest groups and key stakeholders should not be left out for this analysis, Peter (2023) named the municipality, the local tourism association, the youth and elderly generation, business and gastronomy, as well as cross-border and general commuters.

4.1.2 Preconditions

To fulfil the expectations of the collaborating partner Biosfera Val Müstair, the preconditions given in the valley must be taken into account. This was partially done in the Sections 2.1 and 2.3.4, which provides an analysis of the spatial location, the social, cultural, and economic structure and the sociodemographic changes, as well as existing mobility offers and infrastructure in the valley. In this sub-section, the preconditions mentioned by the interviewees will be presented.

Most of the interviewees appreciated Val Müstair as a rural area nestled in a picturesque valley and offering with its tranquillity and seclusion a unique lifestyle to its residents. Talking about teenage life in a rural area, for Riet Scandella (2023), village life as a teenager meant the freedom to engage in typical rural activities like riding mopeds and tractors at night, allowing him to fully enjoy the rural lifestyle. Nevertheless, also the interviewees see sociodemographic changes happening in the valley, namely a continuous depopulation due to emigration, especially from young people. This in turn leads to an ageing population and poses significant concerns for the valley (Peter, 2023).

Regarding the amount of mobility in the valley, Tobias Cueni (2023) warns, that despite being home to a nature park and bordering a national park, Val Müstair is not a low-traffic area. This, because it serves as a traffic axis, which leads to a significant amount of transit traffic. According to him, this reality challenges the idyllic perception often associated with the region, even within the national park itself, where a major road coming from Zernez cuts through it. Poor air quality caused by vehicle emissions is the consequence, and noise emissions and tyre abrasion were mentioned as well (Cueni, 2023; Peter, 2023). This effect is being amplified due to seasonal changes. The summer season brings various road users, including cyclists, motorcycles, racing cars, tour buses, campervans and other vehicles to the normally quiet valley. Peter (2023) describes this afflux of traffic during high-season as loud, chaotic, and potentially dangerous, resulting in frequent accidents on the mountain passes and traffic congestions in the villages. Furthermore, as mentioned by cross-border commuter Karin Merz (2023), also her group of commuters contributes to the traffic volume in the valley, as they have very limited viable alternatives to travel to or through Val Müstair (Merz, 2023).

Regarding the road situation, Peter (2023) identifies the main road connecting all villages in the valley except for Lü, as a focal point of the mobility, which could be the starting point for mobility alternatives. However, Hans-Peter Schreich-Stuppan (2023) identifies challenges in implementing sustainable mobility habits in this sparsely populated area. With a population of only around 1'400 residents, initiatives like hitchhiking would face obstacles according to his experiences, due to a lack of traffic at some times. A potential challenge when

implementing alternative mobility offers to decrease the reliance on private mobility are mentioned repeatedly. Schreich-Stuppan (2023) detects the resistance to change to alternative mobility solution like the public transport in a sense of inferiority of the valley's residents, due to its remote location and limited amenities like supermarkets, cinemas or indoor swimming pools. Also Merz (2023) recognises a tendency to stick to their established habits among the commuters from the neighbouring South Tyrol. Another constraint are the limited financial resources present in the valley. According to Peter (2023), depopulation and the ageing society have an increasingly negative impact on the financial situation of the municipality. The vast geographical area for which the municipality is responsible of stresses the financial situation even more. Therefore, significant costs arise in proportion to the small population, for example, due to extensive forest areas and their management, which in turn hinders the implementation of initiatives like an electric vehicle sharing concept (Peter, 2023).

4.1.3 Stakeholders

Several interest groups and stakeholders of the valley have been interviewed for this analysis. In this section, important information which was shared about some stakeholders will be presented. As the role of the Biosfera Val Müstair has already been extensively described in the introduction (see Section 1.2), the research gap (Section 2.4), and the preceding subsection on research objectives (Section 4.1.1), I will refrain from providing again the information shared in the interviews about the Nature Park.

Strongly connected and in continuous exchange with the Biosfera is the tourism organization Tourismus Engiadina Scuol Samnaun Val Müstair (TESSVM) and its sub-region branch in Val Müstair. Cueni (2023), head of the guest information in Val Müstair, describes their role as integral in promoting and enhancing the region's tourism offerings, striving to create a memorable and sustainable tourism experience in Val Müstair. Their work encompasses various aspects, including guest information, marketing, collaborations, and cooperation with the Val Müstair Nature Park. Product development is primarily based at the Biosfera, while marketing efforts involve collaboration with the TESSVM and their team in Scuol.

He further emphasises that sustainable mobility is an integral part of the overall guest experience. This commitment to sustainability extends to every guest with the Guest Card or the Grün & gratis offer. These efforts should ensure that sustainable transportation options are accessible to all guests (Cueni, 2023). One of their ongoing endeavours is to improve transport connections within the region. Cueni (2023) and his team biennially submit requests for changes to the PostAuto bus service, seeking to enhance accessibility for residents and visitors. While these requests are often denied, they remain persistent in their efforts to improve the transportation infrastructure.

While the primary focus of the tourism organization are incoming guests, the municipality of Val Müstair aims to provide its residents with a high quality of life and essential services without neglecting tourism, as it is an important economic driver in the valley. Gabriella Binkert (2023), mayor of the municipality Val Müstair, strongly highlighted the significant role, the municipality played in improving public transport in the past 15 years, and states, that the goals in terms of mobility are basically achieved. She envisions future mobility

goals, including private mobility offers like a cable car from Tschierv to Minschuns, bypassing Santa Maria, as well as introducing a parking concept across the valley and promoting e-mobility. The municipality is dedicated to supporting sustainable development in both the economic and ecologic sense despite the limited financial resources available. This is also supported by Peter (2023), acknowledging the crucial role of the municipality in ordering and providing financial support to improve public transport services.

4.1.4 Previous Initiatives and Efforts in Mobility

Through the previous analysis, it has become evident that continuous efforts are being made to enhance the mobility situation in Val Müstair. Several of these initiatives have been mentioned in the interviews. This subsection aims to introduce and discuss these past initiatives and the corresponding comments.

As already seen in literature, Val Müstair experiences an high influx of visitors during the summer season, which in the village of Santa Maria with narrow street sections regularly leads to traffic congestions, creating a burden for residents and posing risks, particularly for children (Binkert, 2023; Peter, 2023; Pinggera, 2023). Often, the congestions are caused by transit traffic, which does not contribute to the local economy, says Casty-Greiner (2023), co-president of the Commerce and Hospitality association Val Müstair and owner of a painting and plastering company. The long-planned bypass aims to address this issue, but there are still hurdles to overcome before its construction (Peter, 2023). Lenka Pinggera (2023), manager of the camping ground in Santa Maria specifies, that even though, the project exists for 30 years and the population already voted twice in favour of it, there is a strong opposition coming from the landscape conservation institution (2023). From the perspective of the Nature Park, Peter (2023) explains that they are keen to find an environmentally friendly and nature-conscious solution, with stakeholders and experts involved in discussions.

Other efforts to improve the mobility network have been more successful. In the past years, the bus connections frequencies kept improving, as Binkert (2023) and Cueni (2023) explain. According to them, the municipality and local tourism have been actively involved in the development of public transport, focusing also on the cross-border mobility for the past 15 years. The results are an hourly schedule during summer months, which should according to her be expanded as of coming winter 2023. Binkert (2023) adds, that despite a lack of financing, also a late bus connection over the Ofenpass from Thursday to Saturday has already been secured. The introduction of these late-night courses and improved hourly connections this summer 2023 will provide new opportunities for residents and visitors, making activities more accessible, such as dining in different villages.

Besides the bus connection through the main valley from Zernez until Mals, there are also special courses: one goes, as explained already in the literature review, up to the Umbrailpass and then to Italy. Another bus goes into the valley called Val Vau. These are partly funded by the municipality, partly by tourism and partly by the canton. Binkert (2023) emphasised that when she started as mayor, there was only one bus per week to the Val Vau. Today its three scheduled connections every week, bringing mainly hikers to the valley.

As in the previous sub-section quickly mentioned, the municipality is currently planning to implement a parking concept for the entire valley to address the current disorderly parking situation (Binkert, 2023; Peter,

2023). Right now, the parking spaces in the entire valley are free of charge. Introducing parking fees could not only help regulate parking and address congestion issues but also serve as an additional source of income for the municipality. This approach would allow revenue generation, even from day visitors who may not make other purchases at the local economy. Typical examples for these visitors are ski tourers and mountain bikers. Another, alternative option could according to the Biosfera be to design the parking fee as a consumption voucher, enabling visitors to use the parking ticket value to make purchases within the valley, promoting local economic activity (Peter, 2023). These projects are still waiting for their realisation.

Besides these successful stories, several initiatives and pilot projects have been implemented in the past, some of which have persisted while others have been phased out or remain as ideas. One phased-out initiative involved free luggage transportation, where luggage could be delivered directly from home to the vacation rental or hotel in the valley (Cueni, 2023). However, this service is now chargeable, with standardised costs across all regions of Switzerland (see Section 2.3.4).

Another pilot-project which was especially appreciated by the camping ground manager Pinggera (2023) was the offer for incoming guests to leave their car keys at the local bike shop for a minimum of seven days. In return, they would receive a free e-bike to explore the area using sustainable transportation. This offer was well-received by guests and considered a fantastic opportunity. Unfortunately, it got phased out by now (Pinggera, 2023).

One project that faced difficulties was the implementation of the Mobility car-sharing. The problem is insufficient demand. Peter (2023) highlights the need for a minimum level of usage and frequency, to ensure the economic viability of such services. The costs associated with providing mobility solutions, including electric cars and post buses, need to be justified by the demand for these services. Without sufficient utilization, it becomes challenging to sustain these initiatives financially (Peter, 2023).

Also, the long-standing taxi service Romex Transport failed due to a lack of minimal usage demand. While its website is still online, thus the literature review mentioned this service (see Section 2.3.4), Cueni (2023) and Binkert (2023) explained that meanwhile it has ceased its operations.

4.2 Prevailing Mobility Practices

The following sub-section provides a comprehensive analysis of the conducted interviews regarding the prevailing mobility practices of the interest groups present in the valley, exploring the familiarity, usage, and experiences of various transportation modes. The analysis follows the four categories of mobility in this thesis, namely motorised private mobility, shared mobility, public transport, and slow traffic options.

4.2.1 Motorised Private Mobility

Cars are the prevailing mode of transport in Val Müstair (Cueni, 2023; Kern, 2023; Peter, 2023; Schreich-Stuppan, 2023). Peter (2023) talks about very rigid mobility patterns among the locals and says that most people own a car and use it regularly, while Schreich-Stuppan (2023) describes the mentality as “completely stuck in car-centric thinking”. He finds it “astonishing, how many cars there are per household”. Kern (2023)

states, that “many people just sit in their cars and drive wherever, even if it is just to have a drink at the nearest restaurant”. He summarises: “The behaviour is extremely car dependent”. Regarding a potential change of this behaviour, Schreich-Stuppan (2023) observes, that it might be very difficult to convince others to adopt more sustainable behaviours rather than private cars.

Still, the reasons for people in the valley to use a car before other means of transport are manyfold and must be understood in order to be able to change something about it. Therefore, the reasons mentioned in the interview for using private cars will be presented in the following.

All in all, the car is considered practical, providing individuals with flexibility and eliminating the need to wait for the next bus connection, while allowing people to travel at their own convenience and according to their own schedule (Casty-Greiner, 2023).

According to Casty-Greiner (2023) this especially applies for people who commute to the valley for work, as they often come from the Engadine and South Tyrol. Some of them live in remote villages in South Tyrol, making it impossible to use some other vehicle than a car to go to work.

This situation also applies to Karin Merz (2023), who lives in Tschengls, a small village in the Vinschgau in Italy. She works for the Nature Park Val Müstair, and thus has to commute every workday. For her, the main argument to use a car is the time savings. For the around thirty kilometres distance from her home to work, she needs 35 minutes by car. With public transport in turn, it takes around two hours for the same journey.

The time factor is also mentioned by Kern (2023), who commutes from Val Müstair to Samedan in the Engadine. His journey doubles if he decides to use public transport instead of the car, for example when his wife needs the car to bring their kids somewhere.

Stephanie Ulayayi (2023), who lives in Val Müstair, says that as soon as she leaves her village, she mostly relies on her own car, except it is occupied by her husband. When staying within the village, she often walks to her destination. She concludes that she relies on her car multiple times a week, while using public transport at most three times within a month. However, not everyone appears to choose walking even for destinations within the same village.

Also regarding the touristic guests in the valley, Cueni (2023) says that guests are just as accustomed to using cars as locals: “It is deeply ingrained in their minds”. Pinggera (2023) recognises that most of the guests of the camping ground arrive with cars, motor bikes, campervans or mobile homes. At the same time, she recognises a trend for arriving by bicycle or public transport. As soon as the guests have arrived, most of them do not move their motorised vehicle during their stay. The reason for this she believes to be in the Guest Card, that every guest receives automatically at its arrival, and which includes free public transport in the valley during their stay. Also Cueni (2023) emphasised the efforts done by the tourism organisation, to change the car-centric behaviour of guests with the introduction of the Guest Card with included public transport.

It also seems, that the car is being appreciated as a provider of freedom. Kern (2023) observed, that especially “the older generation, particularly in mountainous regions like Val Müstair, view their car as a symbol of freedom and essential mobility”, providing a sense of independence. The representative of the interest

group of elderly people, Hans-Peter Schreich-Stuppan (2023), elaborated the relation between the elderly and cars in more detail. According to him, “most people mainly use cars, and they continue to do so until they can no longer. Even in old age. […] After people have to give up their driver’s license due to health or age reasons, they struggle to switch to public transport”. The reason for this are issues which arise with the ticketing system, with boarding buses with high steps or expensive fares. “Instead, they prefer to rely on neighbours for rides or ask to be taken somewhere”. Also Binkert (2023) mentions the problem elderly people face, when they are too old to drive a car, that they lose the ability to be mobile.

Regarding young people in the valley, Ulayayi (2023), who grew up in the valley and raises kids there now, explains that they have a strong inclination towards cars. Once they reach the age of eighteen, they usually obtain their driver's license shortly after and use their first savings to buy a car. Until then, they rely on their parents' car. She estimates that young people aged eighteen and above practically do not use public transport, whereas those under 18, especially students who commute within the valley, heavily rely on buses. Further she observed, including through the behaviour of her own daughter, that this leads to an independence and mobility at an early age: “She independently gets on the bus and goes to her friend’s house in the neighbouring village to play”. Ulayayi contrasts this with her mother's time when such independence was unimaginable. She notes that most young locals continue using cars from the age of eighteen until retirement, only later realizing that public transport could be an option for certain journeys.

Scandella (2023), representative of the young generation in the valley, explains that due to the requirement of obtaining a driver's license at the age of 18, cars are not a choice for the younger generation. Based on his perception and experience, children and adolescents are rarely driven to school by their parents in cars and rely on public transport or other motorised vehicles. While there are occasions where teenagers are transported out of the valley by their parents, if they need to travel frequently or regularly, they generally rely on buses and trains. Within the valley, mobility of adolescents is according to Scandella (2023) characterised by the use of mopeds and tractors as primary motorised modes of transportation. Once individuals turn fourteen, mopeds become the number one means of getting around, especially during the summer. Starting from the age of fifteen, they are allowed to ride their mopeds to school. At the age of sixteen, some young people obtain their roller license.

4.2.2 Shared Mobility

It has become clear in the literature review, that there are no bus connections in the valley before 7 a.m., in winter even before 8 a.m. The question arises, what people do, if they have to go to work early in the morning without relying on a private car. This situation was described by Niklaus Kern (2023), who lives in Tschierv and works in Samedan. Because he has to leave Tschierv between 5 and 6 a.m., he needed to find an alternative to the car. Therefore, shared mobility options like hitchhiking and ridepooling became essential for him. In winter, commuting by hitchhiking soon became common, whereas in summer he goes by e-bike. Challenges of hitchhiking are the mostly cold, windy weather in winter and a general lack of frequently passing vehicles that could pick him up (Kern, 2023). This problem was also encountered by Schreich-Stuppan

(2023), a hitchhiker himself in his earlier days. He explained that the population density was too low in the valley, making it challenging to use hitchhiking as a reliable mobility option.

As ridepooling is often more organised and coordinated than the mostly spontaneous hitchhiking, it offers certain advantages in terms of reliability and planning. Kern (2023) also uses ridepooling to commute, but faced challenges with coordination and communication with the drivers. Ridepooling is also widely spread among the youth. Scandella (2023) explained, that they often form ridepooling arrangements, particularly for social activities such as parties in South Tyrol, but also to travel to Chur or further. While employees mostly arrive in their private car to their work places in Val Müstair, some companies within the valley organise pooled transports to the respective work location, to the Engadine valley for instance (Casty-Greiner, 2023). Also Merz (2023) confirms, that her office often carpools together to go for example for lunch in another village than Tschierv, whenever possible using the electric vehicle of the Biosfera.

4.2.3 Public Transport

Public transport in Val Müstair includes the buses run by PostAuto and the connecting trains in Zernez and Mals. The bus network connects all of the villages in the valley, except for Lü, which is not located on the main road (Cueni, 2023). In addition, in this thesis also the culture bus, hiking bus and ski bus count as public transport. Furthermore, also electric car rental services and taxi companies fall into this category.

In general, it can be assumed, that the public transport is appreciated in the valley, but only rarely used by the locals, as it will become apparent when reading this sub-section. While commuter Kern (2023) is unhappy with the lack of early connections before 7 a.m., Casty-Greiner (2023), Ulayayi (2023) and Schreich-Stuppan (2023) similarly criticise the high costs for using public transport. “In South Tyrol, public transport is still relatively affordable, but here in Switzerland, it is rather expensive, especially If you do not have a general or regional subscription pass”, Casty-Greiner (2023) explains. Ulayayi (2023) further adds, that affordability can be especially for the youth and families of concern, as transportation costs can be high when one does not own a subscription pass like the Half Fare Travelcard (Halbtax) or the GA Travelcard (GA). Also Schreich-Stuppan (2023) shares this opinion, while he makes national as well as local politics responsible for it. He referred to the price increases announced recently before our interview by the Swiss Federal Railways (Alliance SwissPass, 2023). He is particularly bothered by what he considers to be a disproportionate increase in prices in the second class compared to the first class and calls it a “completely wrong set of priorities”. He wishes for public transport to be more attractive, safe, and affordable, particularly for older generations. Instead of increasing prices, he believes the municipality should invest more in improving public transport, despite its financial challenges (Schreich-Stuppan, 2023).

Based on these general observations of the interviewees about public transport in the valley, now their opinions and usage patterns of the specific means of transports will be presented, starting with the statements on the bus network in the valley. As presented in the literature review (see Section 2.3.4), bus connections exist hourly from 7 a.m. to 8 p.m., while the frequency is reduced in winter to one bus every two hours. In Sub-section 4.1.4 about previous initiatives to improve mobility, it has already been explained, that the

municipality and tourism association have successfully improved the bus frequencies as of this winter. From now on, the bus will run hourly all-year round and on weekends, from Thursday to Saturday, there will be late evening connections. It is important to know, that the interviewees, except for Binkert (2023) and Cueni (2023) did not know about this coming improvement at the time they were interviewed. Still, the usage patterns and criticism of public buses will be presented here.

Of all ten interviewees, Schreich-Stuppan (2023) was the only one who uses the bus on a regular basis. On the one hand, he uses it for daily commuting, for example to go and buy groceries in a neighbouring village or to go to Zernez for the choir rehearsals. On the other hand, he and his wife use it for excursions, to the nearby South Tyrol for example. “But we are an exception in terms of this behaviour […] Usually it is just us in the bus, apart from the tourist high season” (Schreich-Stuppan, 2023).

While also positive feedback, for instance to the improved frequencies in summer and the hiking bus towards Tirano was expressed, there is one prevailing point of criticism, namely the limited frequencies and scheduling (Pinggera, 2023). This causes, according to Casty-Greiner (2023) and supported by Ulayayi (2023), a lack of convenience and flexibility when relying completely on the public transport. Therefore, many commuters, like the ones working in the business of her, prefer cars over the bus. Like this, they do not have to wait for a bus after having finished work and can leave whenever they want. She explains: “If the workers work until 5:15 p.m., they miss the bus at 5:10 p.m. Adapting the work schedules to match the bus timings on the other hand is not considered an option (Casty-Greiner, 2023).

Also Kern (2023) states, that if public transport does not improve with increased frequencies, for him as commuter to the Engadine there is no way to rely on the buses to go to work. He emphasises the need for earlier connections, such that he could be in the Engadine by 7 a.m. For young people, Scandella (2023) also identifies an obstacle in the lack of frequent bus schedules and says that as a bus user, you need to follow the schedule closely and adapt your programme to it. Also, the connections to the next public transport service providers should be improved according to him. He mentions the specific example of the connection train in Zernez to go to Chur, to which there is only ten minutes of transfer time. With construction sites on the Ofenpass road from Val Müstair to Zernez, there is, especially now with four construction sites, a high probability of not catching the connecting train (Scandella, 2023).

In general for the youth in the valley, Scandella (2023) explains that if you are under 15 years old, you most certainly take the bus very often, while afterwards, most of the adolescents get the license to ride a moped or tractor. For this purpose, every student in the valley receives a free bus ticket from school. This point was confirmed by Ulayayi (2023), whose daughter also receives the ticket and moves quite freely and independently around the valley. As mopeds are not very suitable for winter conditions, that can also be a reason to take the bus. When young people want to leave the valley, they most likely do this with public transport, except they get a ride by their parents or relatives.

Several interviewees highlight the limitations of public transport particularly in the evenings and during nighttime (Cueni, 2023; Kern, 2023; Scandella, 2023; Ulayayi, 2023). Scandella (2023) stressed the need for

improved late and night connections, enabling the youth to go out of the valley on the weekends and still be able to return home at night.

The culture bus, introduced in 2018, has seen increasing usage before the Covid-19 pandemic. As Peter (2023) specified, the bus was mainly used by tourists visiting cultural events. She added, that there were concerns about the financial viability of the offer, as the operator Romex Transport reported that it is not profitable for them to continue operating it (Peter, 2023). This has in the meantime been confirmed, even though, the website of Romex Transport is still online.

Another mobility offer in the valley is the ski bus, bringing people from Tschierv to the ski resort Minschuns. This offer is only viable during winter season. Kern (2023) as well as Peter (2023) confirmed, that the availability and convenience of the sports buses is highly appreciated by residents and tourists alike. Also Binkert (2023) is proud of this service provided for the guests and hopes, that the need for private cars could potentially be reduced if the ski bus service was expanded. Cueni (2023) adds, that the intentions of the Guest Card aim to make public transport more appealing to guests who were previously heavily reliant on cars during their stay, and to encourage young travellers who already frequently use public transport to leave their cars at home altogether.

Tourists and guests in general benefit not only from the complimentary ski bus service in winter, but also from their Guest Card. It is being provided to all second home owners and guests from their first booked night and grants them the privilege of free rides on public transport throughout the entire valley. Binkert (2023) explains, that its introduction was a lengthy process on which the municipality has been working for years: “I have been writing to Chur and Bern for a long time”. For this recently introduced offering the interviewees had only words of praise. Pinggera (2023), as the host at the campground being at the pulse of the touristic guests in the valley, enthusiastically praises the offering. Before its introduction, many people hesitated to use public transport due to the high costs involved. This was particularly true for foreigners, as Swiss citizens often possess a Half Fare Card or a GA ticket, which provide discounted fares for public transport. Now the guests highly appreciate the offer and use public transport more frequently. In Pinggera’s (2023) words: “Guests really make use of it. In the summer, many families come with their cars and a large tent. These cars simply stay in the parking lot throughout their entire stay”.

Peter (2023) from the Nature Park observes as well, that the introduction of the Guest Card with free public transport from Zernez to Mals and to the Umbrailpass led to a surge in popularity of travling by public transport by locals and tourists alike. The local tourism branch of the TESSVM has conducted a survey about the Guest Card. The main takeaway of the survey is according to Cueni (2023) that the card is that most of the respondents would have taken the same trips even without the Guest Card, indicating that they perceive value in the offering. While it may not significantly increase the overall usage of public transport, it reinforces the commitment to sustainability and enhances the overall guest experience. His conclusion is “that people who use the Guest Card and filled out the survey appreciate public transport” and that guests highly appreciate the Guest Card (Cueni, 2023).

But not only tourists, also the second home owners benefit from the offer and according to Ulayayi (2023), it is well received by them. She recognises many people in this group who genuinely use public transport because of the offering, whereas typically they would be relying on their cars.

Schreich-Stuppan (2023) criticises that the card is accessible to all guests and second home owners but not to the locals. Instead of the Guest Card, the locals receive their annual tax statement. In the past, there used to be discounts on public transport for the locals, but unfortunately, that is no longer the case (Schreich-Stuppan, 2023). Ulayayi (2023) mentions in this context that she could imagine that some locals could be encouraged to purchase such a subscription at a reasonable price

An addition to the Guest Card is the previously mentioned Grün & gratis offer. As previously explained, it is offered to guests who are staying three or more nights in the Nature Park and provides them with free travel within Switzerland (Merz, 2023). The goal is to encourage visitors to use public transport to travel to the Biosfera, make public transport more attractive for guests and provide them with financial relief. According to Casty-Greiner (2023), the offer is well appreciated and highly utilised among guests.

One example of an offering that enables mobility during times without public transport is the car rental service provided by Biosfera (Binkert, 2023; Cueni, 2023; Peter, 2023). The electric car serves as the Biosfera's company vehicle while also being available for rental. This dual purpose allows individuals to access transportation during times when public transport might not be available or convenient (Peter, 2023). While the electric car offered by Biosfera provides an alternative for commuting to work, it may not be the most appealing option for some individuals. Kern (2023) has tried to use the electric car as an alternative for commuting to work, but he encountered several disadvantages. First, the cost of using the car for the entire day can become expensive. Furthermore, there were issues with the car not starting after cold winter nights, forcing him to consider alternative transportation methods like hitchhiking (Kern, 2023). Schreich-Stuppan (2023) asserts, that the rental car service is primarily used by tourists or students for example, but not by locals. These experiences highlight some practical challenges and limitations associated with the use of the electric rental car in certain circumstances.

One final option for maintaining mobility when buses are no longer convenient or available is to utilise taxi services. Scandella (2023) remembers taking taxi services based in South Tyrol to get home from going out with his friends there. Binkert (2023) shares about volunteers who privately organise and drive older residents to their destinations and adds, that “it works very well”. The only local taxi service operated by Romex Transport will cease to exist. This has been confirmed by various interviewees (Cueni, 2023; Peter, 2023; Schreich-Stuppan, 2023)

4.2.4 Slow Traffic

Slow traffic in this thesis entails movement on foot, wheels, or rollers, mainly powered by human muscle power or electrically supported. In the interviews made for the empirical part several modes of transport in this area were mentioned, namely bicycles and e-bikes, walking, kick scooter and wheelchairs. First, our attention will go to the most used slow traffic mean, the bicycle.

Peter (2023) describes the circumstances to cycle in Val Müstair as cumbersome due to significant elevation changes and the cold in winter. Kern (2023) acknowledges this argument but tries to counter, as with the emergence of electric bicycles, “these inclines in the valley are no longer a problem”. Peter (2023) and Kern (2023) see more hurdles for cyclists, for example due to very crowded and thus dangerous roads especially in summer, when cyclists have to share the roads with motorcyclists, race cars, tourist buses, campervans and all other cars. Whereas there is a cycling route designated by SchweizMobil (Nr. 29) traversing the valley, it primarily uses forest roads, as on the main roads, there is no real bicycle lane (Kern, 2023; Peter, 2023). When talking about cycling infrastructure, not only cycling lanes on the main roads, but also a suitable bike shop with spare parts and repair services would be essential. In this context, Kern (2023) expresses his dissatisfaction, that despite there is a bike shop in the valley, it primarily focuses on mountain biking, making it difficult for him to find spare parts for his electric trekking bike.

Regarding the use of bicycles among locals, it seems that only a handful uses it to commute regularly, to work for instance. One of them is Kern (2023), who commutes to Zernez by bicycle. Like this, the journey to work in Samedan takes him about one and a half hours, while it would be one hour by car and two hours by train. He says that locals have a different attitude towards bicycles than him, who grew up in a peri-urban area in St. Gallen, where the cycling infrastructure as well as the mindset of the people was different according to him. Therefore, he suggests great potential for locals to start appreciating cycling as a mean of transport in the valley. In his estimation, any people in the valley have a bike or e-bike, but they “mainly use them for recreational activities rather than daily transportation”. The reason for this he locates in the different mindset regarding mobility, being not very enthusiastic for cycling. He indicates that overall, “switching to bicycles is associated with significant hurdles, especially in terms of breaking established habits” (Kern, 2023).

Kern (2023) states, that cycling in winter for instance is certainly not for everyone, as you have to be committed to ride in all weather conditions, including snow, for which he even has tyres with spikes. In order to shift this mindset, he believes that initiating change should begin with the youth in the valley, which according to Scandella (2023) use the bicycle already regularly to go to school, if they live in the village where the school is located. This would entail stepping out of their comfort zone, as cycling is less convenient compared to driving a car, requiring physical effort and exposing them to various weather conditions (Kern, 2023). But he detects the problem already in school, as there is a lack of awareness for bicycles there. While the police visits occasionally to talk about traffic, it focuses more on pedestrian safety. And when there are bike courses for children, they focus more on skills rather than traffic education. He concludes that children and young adolescents are not sensibilised to cycling, which naturally reduces the likelihood of them to eventually choose a bicycle over a car in the future. But for this, he recognises a requirement for willingness among the entire population, to take a step towards change at the community level (Kern, 2023).

While bicycles are not the preferred mode of transportation for the local residents, they are gaining popularity among tourists who visit the valley (Pinggera, 2023). This applies to both leisure rides and mountain biking. Regarding infrastructure, there is a bike and e-bike rental service available at a newly opened, private sports shop in Müstair, which also offers some kind of “hike-up-ride-down” option (Binkert, 2023; Pinggera, 2023;

Ulayayi, 2023). For this, one hikes up to an alpine hut in Val Mora, where the mountain bikes are already parked and ready to be ridden down. However, Pinggera (2023) and Cueni (2023) similarly contended, that the bike rentals in the valley are quite expensive. Hotels provide e-bike rental services to guests, with prices averaging around 50 CHF per day. There is also the short trip option available for 5 CHF, practical for instance to go to the nearest village for shopping or dining (Cueni, 2023). Additionally, a sports shop in the area offers the same service, but at a higher rate of up to 70 CHF per day, as reported by Pinggera (2023). She misses the “car-keys-for-bike” offer, of which many guests took advantage, but ceased to exist. Merz (2023) concludes regarding the existing bicycle rental options, that the offers are great for tourists, but “as a local or someone working here, it is impractical”.

Various interviewees also discussed the availability of e-bikes for rental at partner establishments, which was previously described in section 2.3.4 as part of the predominantly tourist-oriented offerings (Binkert, 2023; Cueni, 2023; Merz, 2023; Peter, 2023). Peter (2023) explains, that the offer was launched during the project period 2016-2019 of the Biosfera and then maintained for the current phase until 2024. As there is no data available about the usage patterns, she estimates that the e-bikes are primarily used by tourists, as “the local residents tend to have their own if they need one”. Merz (2023) thinks that the offer might appeal to tourists but may not be practical for local residents and those working in the valley. Cueni (2023) attributes this to the pricing structure. At 49 CHF per day, the cost is relatively high, though he appreciates the option of a short, one-hour trip for only 5 CHF. He concludes that it could be intriguing to rent an e-bike for an entire day for a mountain excursion, yet it seems unappealing to use it for a brief journey to a nearby village for shopping or dining, as such a trip would typically last longer than an hour.

Due to the large distances in the valley and between the villages, walking was not really considered a viable option for many of the interviewees. Within the villages, distances are partly covered by foot, for instance the walk to school (Scandella, 2023), to the grocery store (Ulayayi, 2023) or the mass in church (Schreich-Stuppan, 2023). Merz (2023) summarises this behaviour as follows: “When I’m in Val Müstair, I try to cover the distances on foot that are manageable on foot”. Only Schreich-Stuppan (2023) mentions longer distances covered by foot, namely when he goes grocery shopping in the neighbour village. The way there takes him between 45 minutes and one hour and normally, he takes the bus to get back home. He adds that he and his wife “are the exception with this behaviour”.

When discussing slow traffic modes of transportation, walking and biking emerge as the primarily mentioned options. Scandella (2023) additionally points out that students who live and attend school in the same village often use scooters to go to school and Cueni (2023) further introduces an innovative offering from the tourism organization aimed at disabled individuals. This is the JST, an all-terrain wheelchair with electric support available for rental. This service makes it possible for individuals dependent on wheelchairs to participate in hiking experiences they would normally find inaccessible.

4.3 Expectations, Ideas and Concerns Regarding New Mobility Options

After examining the existing mobility options in the valley and the usage behaviours and patterns of the interviewees representing various interest groups, the focus will now shift to their suggestions, ideas, and concerns about improving the mobility system. The visions and expectations shared by the interviewees on improving the valley's mobility system reveal a range of goals and ideas, while some feel like the system is satisfactory, given the preconditions in the valley with low population density and mountainous terrain.

Many share the visualization of a valley with less car-focused traffic. Pinggera (2023) advocates for less dependency on cars and increased reliance on walking, cycling, and public transport. This, she believes, will enable inhabitants to appreciate the valley's natural beauty more. Also Schreich-Stuppan (2023) hopes for a quieter environment in the valley, envisioning a decrease in recreational transit traffic. Peter (2023) shares these perspectives and accentuates her image of a mobility system in the valley that reduces the reliance on private cars, targeting reductions in emissions, noise, and traffic-related issues for an increased well-being of the residents and tourists. Thereby she identifies a key issue, mobility for those who cannot or choose not to use cars, such as the young, the elderly, people with impairments, and car-free tourists.

In contrast, respondents like the municipality’s president Binkert (2023), and Ulayayi (2023), a local resident, believe that the current mobility options are satisfactory, given the valley's context. Statements like “Actually, we have reached our goals […] Creating other offers is difficult, because I believe we are quite well positioned here in the valley” (Binkert, 2023) and “I would say that we have everything we can have […] I think that we are well taken care of for what we have here” (Ulayayi, 2023) show, that not everyone in the valley shares a vision of improved mobility solutions to enhance sustainable transportation. Also, Merz (2023) and Ulayayi (2023) support this point of view, insisting on the limitations due to the valley’s low population.

Upon reviewing the diverse perspectives concerning the future of mobility in the valley provided by the interviewees, many specific propositions for its enhancement could be noted in the analysis process. Consequently, this section will explore these suggestions thematically, starting with ideas related to public transport, followed by a discussion on general incentives and regulations proposed. Subsequently, the domain of car-based private mobility will be examined before finally turning our attention to slow mobility. To keep an overview during this section of the analysis, a mind-map containing the main suggestions for improvement of the current mobility system was illustrated (see Figure 9).

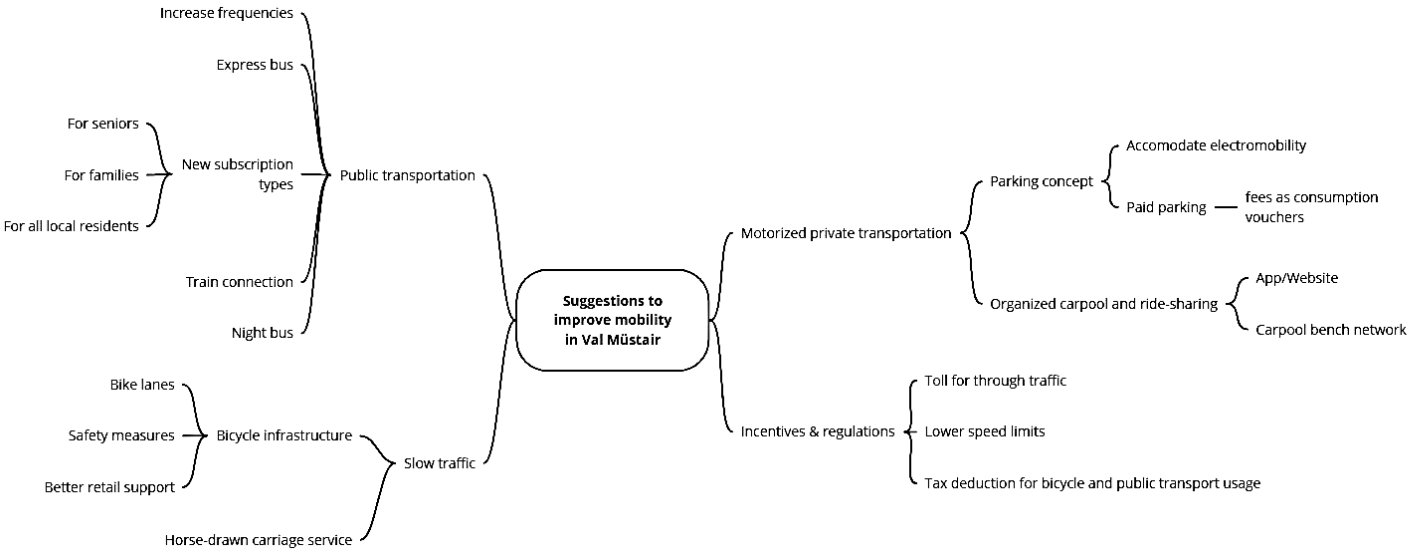

Figure 9: Mind map representing suggestions by interviewees to improve mobility in Val Müstair (own illustration)

4.3.1 Public Transport

Analysing the perspectives of the different interest groups, the necessity for enhanced public transport in terms of frequency and timing emerges as a widespread theme to reduce car dependency. As a commuter from the Vinschgau, Merz (2023) proposes higher bus frequencies during peak hours while raising important questions about defining these peak hours for different commuter categories. She acknowledges the challenge of encouraging cross-border commuters to favour the bus over motorized private transport. However, she underscores the value of increased bus frequencies, particularly during the morning and evening commuter rush. In addition, she is interested in introducing an express bus that would only stop once per village, potentially reducing travel time and serving as an attractive option for local residents and commuters.

Also Kern (2023) would welcome augmented frequencies and earlier connections in the morning and later at night, always emphasizing the need to develop a schedule designed specifically for commuters. Extended operation hours are also supported by Ulayayi (2023) who highlights the need especially for tourists and second home owners, who would like to arrive late or attend events in other villages, always acknowledging the valley's geographical limitations and existing transit infrastructure. Also from the perspective of the younger generation in the valley, an affordable night bus service ideally operating across the border of Italy would be desirable. Scandella (2023) explains, how this would make it easier for young people to move around safely and reduce reliance on taxi services. He highlights the importance of making young people more aware of the existing transportation options, such as the Culture Bus, and suggests its better utilization as a night shuttle.

Overall, the responses highlight the necessity for improving public transport systems to include increased frequency, better timing, improved commuter schedules, and safer, affordable options for the younger population mainly during nighttime. Many interest group representatives agreed that such enhancements could foster a shift away from car dependency. They share a common sentiment regarding the need for more

accessible and economical public transport options in the valley, but they propose different types of subscription offers to achieve this.

But not only existing means of transport in the valley were of interest during the interviews. Both Scandella (2023) and Ulayayi (2023) highlight the desire for a train connection in the valley, though their perspectives differ somewhat. Scandella (2023) simply expresses a wish for a train connection to either South Tyrol or over the pass into the Engadine valley, which would presumably facilitate easier travel and connectivity for local residents and perhaps attract more visitors and commerce to the area. Ulayayi (2023), on the other hand, notes the absence of a railway line and mentions prospective projects to connect Engadine to Vinschgau, which would greatly benefit the local area. However, she expresses doubt about witnessing such infrastructure developments in her lifetime.

For the elderly generation, Schreich-Stuppan (2023) suggests a general subscription for seniors, similar to the subscriptions provided to students in the valley. This proposition is based on the idea that making public transport affordable and accessible to seniors can encourage them to switch from private cars to public transport. He adds another incentive to use public transport, namely to coordinate events, meetings, church services and so on with public transport, as “nowadays, no consideration is given to this”.

Ulayayi (2023) brings up a concept similar to the Guest Card, but accessible for everyone in the valley, a regional network card that functions like the GA travelcard, enabling unlimited travel on public transport networks in the valley. She suggests that this might encourage more residents to utilise public transport. She also identifies potential in a family subscription which could make public transport more attractive for families and incentivise its use for recreational trips and hikes. Similarly, Merz (2023), who lives in the bordering South Tyrol, points out the model of the South Tyrol Pass for public transport, where the costs for the subscription are being reduced, the more kilometres one travels using the pass.

In comparing these ideas, all three parties value making public transport more accessible and cost-effective, though their focus differs. Schreich's proposal concentrates on seniors, Merz's suggestion is distance-based, and Ulayayi's idea looks at a wider demographic including families and second home owners. Evaluating these suggestions, it appears that an integrated system combining elements of these proposals could potentially accommodate a broader spectrum of the population, promoting the use of public transport across different age groups and user profiles.

Apart from the public transport network, there seems also to be a need for taxi offers or similar services. Besides a night bus, Scandella (2023) also suggests an affordable taxi service that crosses borders, to accommodate young people seeking entertainment outside the valley. He notes that current taxi services are expensive and not well-tailored to the needs of young people, while existing transport options like the Culture Bus are underutilised. He further proposes adapting such services to better serve the needs and schedules of young people, providing safe alternatives to potentially dangerous situations like drunk driving. Additionally, he suggests a regular or bookable shuttle service for events or similar occasions of local associations.

Inspired by the success of alpine taxis in South Tyrol, which serve remote hiking destinations, Schreich-Stuppan (2023) suggests implementing a similar service in Val Müstair. This could replace the soon out of operation Romex taxi company, suggesting that it be privately organised with private cars that could fill with hikers and then get the permission to drive up to the mountains. Also Cueni (2023) acknowledges the existence of various transportation options like citizen buses or alpine taxis and identifies them as a viable option to be introduced in the valley.

4.3.2 Incentives and Regulations

While many improvements of the public transport system were proposed and described, also general incentives, regulations and political regimes were brought up to improve mobility in the valley. These are ranging from the introduction of tolls and lower speed limits to parking regulations and financial incentives.

Casty-Greiner (2023) proposes a toll for the valley, which she believes would benefit Val Müstair especially financially and tackle the according to her main problem, the through traffic by travellers: “They come and go, often not even stopping in the valley to spend money”. Schreich-Stuppan (2023) suggests lowering the speed limit throughout the valley and reducing trips to lower noise pollution, particularly where the road passes through the national park before the Ofenpass. He introduces creative concepts, like the use of speed cameras, including fake ones, to reduce speeding and improve safety in the valley, as done in the South Tyrol.

A suggestion regarding a parking system was put on the table by three of the interviewees. Binkert (2023) highlights the need for a comprehensive parking concept due to current disorganization and to better accommodate electromobility. Casty-Greiner (2023) and Peter (2023) emphasise the potential benefits of a paid parking system, and suggests a system where the parking fee could be used as a consumption voucher. This is seen as a way to manage parking and encourage spending within the valley, supporting the local economy and compensating for the negative effects. Peter (2023) formulated it as follows: “So, when guests come and bring negative effects, at least some value is generated”.

In terms of financial incentives, Merz (2023) and Schreich-Stuppan (2023) put forward a few ideas. Merz (2023) proposes an incentive system through withholding tax, whereby using public transport or e-bikes could be tax-deductible. Again she is inspired by her home-region South Tyrol, which uses a practice of financially supporting people who cycle to work. Schreich-Stuppan (2023) criticises car mileage compensation which is being applied by companies and institutions, and argues for a better alignment of meetings with public transport schedules. In his words, drastic incentives and regulations are needed “to get people to switch to public transport […] otherwise everyone will drive forever”. He believes that voluntary action hardly works, and therefore regulations and incentives have to be ordered from political institutions.

Comparatively, all answers share a common thread: the need for regulation and incentives to encourage more sustainable mobility and generate economic benefits for the valley. However, the proposed solutions differ greatly, covering areas such as tolls, speed limits, parking regimes, and tax incentives.

4.3.3 Motorised Private Mobility

In addressing the topic of motorised private mobility and ridepooling, several key opinions and suggestions were brought up from various interviewees. In summarizing and comparing the diverse perspectives provided, it is evident that there is a broad consensus around the need for efficient organization of motorised private mobility solutions. One common theme that emerged is the idea of an organised platform for ridepooling or shared mobility, raised by Casty-Greiner (2023), Scandella (2023) and Kern (2023).

Casty-Greiner (2023) underlined the lack of an exchange platform where ridepooling trips and inquiries could be organised, and thinks, that the Trade and Hospitality Association which she presides, could promote such an offer among its members. Riet Scandella, president of the Youth Association, mentioned existing ridepooling practices through apps and social media platforms in South Tyrol and expressed a desire for a similar system for the valley's residents: "The possibility of organizing oneself within the valley, but really only those from the valley, would probably increase acceptance", he concludes.

Likewise, commuter Niklaus Kern highlighted the need for an online platform to collect ride offers and requests and suggested the creation of a physical entity in the village to serve as an interface: "For example a bench or a board, which points to it and could simultaneously function as a pick-up location". However, he pointed out that such a solution would need to provide to the early morning commute times when public transport is not available. As he is already now sometimes hitchhiking or ridepooling to the Engadine early in the morning, such a platform would "make things much easier and also reduce the waiting time outside and make planning better and more flexible in terms of time".

Cueni (2023) similarly describes the idea of a carpool bench network throughout the valley, which would offer low-threshold access to ridepooling, as "there are no prerequisites for the interested parties, no mobile phone, et cetera, you can just sit on the bench and wait. […] It is good if you can just pick up people, without login, registration, possibly even in connection with the Guest Card". At the same time, he acknowledges this model's challenges, especially given the irregularity of car traffic in the valley, requiring patience for the rideseeker and the exposure to weather, particularly in winter. In this context, Cueni (2023) proposed to connect the carpool bench system with a gastronomy business or a similar establishment. This would allow individuals to wait indoors in a warm and comfortable environment, reducing the discomfort of exposure to harsh winter conditions.

The benefits of such a system also appeal to Peter (2023), who emphasises the underutilisation of private cars. She highlights that a carpool system could especially for cross-border commuters be of great interest. Regarding this, Merz (2023) stresses the fact that commuters from South Tyrol come from very different corners of the region. Therefore, to promote ridepooling among cross-border commuters, she proposes a Park+Ride possibility around Taufers, as "it then goes into the valley and all commuters have to drive through if they go to Val Müstair".

Also Binkert (2023) likes the idea of an organised ridepooling to the Upper Engadine and holds out the prospect that the municipality could potentially support such an initiative: "There would definitely be potential,

and it would also be in our interest, as we would then have less traffic, emissions and noise". She proposes a pilot project in this direction, linking it with existing apps in the region to see its acceptance and effectiveness. The aspect of making better use of existing resources was also mentioned by Casty-Greiner (2023). She suggested a shared platform for businesses to transport goods and products collectively, reducing the number of individual trips.

Overall, while there is consensus on the potential benefits and necessity of ridepooling and shared mobility options, the specifics of implementation vary, with differing suggestions on the structure and execution of such a system. Nonetheless, these discussions reveal a shared vision of a more sustainable, organised, and efficient car-based mobility system in the valley.

4.3.4 Slow Traffic

Regarding suggestions for improvement that are linked to slow traffic, two potential mobility solutions in the valley were mentioned, namely the necessary improvement of the bicycle infrastructure and horse-drawn carriage services.

Concerning bicycle infrastructure, Kern (2023) mentions several barriers for bicycle usage, including the topographical challenges, absence of bike lanes, and traffic safety issues. Despite many valley residents owning bikes or e-bikes, they are primarily used for recreational activities rather than everyday transportation. Furthermore, Kern (2023) points out the lack of local retail support for bicycle parts and accessories, especially for non-mountain bikes, which he thinks to be a part of necessary infrastructure. He believes that significant behavioural and infrastructural changes are required, both at the individual and municipal levels, to promote bicycle usage as a regular mode of transportation.

Meanwhile, Binkert (2023) and Merz (2023) discuss the potential for horse-drawn carriage services as a unique and locally appropriate mobility solution. Binkert (2023) reveals that there is someone in the valley prepared to provide such a service, which could be appealing for tourism. She also suggests that the municipality would be open to providing start-up financing for this venture. Merz (2023) confirms the ongoing discussions around this idea, especially for reaching remote areas like Val Vau, but notes that plans have not yet been concretised.

Concluding, while there is consensus on the need for sustainable mobility, the approach varies, ranging from boosting public transport and shared mobility to less conventional solutions like horse-drawn carriages. Some respondents, however, assert the adequacy of the current system, given the valley's unique characteristics.

4.4 Factors Influencing the Introduction and Acceptance of New Offers

In the last part of the interviews, the respondents were asked to think about enabling factors and factors influencing acceptance among their interest group when it comes to newly introduced mobility offers. This analysis should provide the Biosfera Val Müstair with the necessary knowledge such that an introduction of a new offer can be more successful and embraced by the interest groups, the residents, and touristic visitors.

4.4.1 Enabling Factors

A first critical factor when introducing a new offer is the availability of financial support. The Biosfera financially relies on funding they receive from the cantonal and federal authorities. This allows them according to Peter (2023) some flexibility in setting priorities and starting new initiatives in accordance with their designated project phases. To start new projects, the Biosfera has to incorporate them in a project phase and an according budget, which then will be granted or denied by Cantonal and Federal entities. She concludes, that “we have quite some freedom to set our priorities” (Peter, 2023). At the same time, she acknowledges that there will not be an immense financial support from the municipality side. That the municipality has limited financial capacity is well-known among the interviewees (Binkert, 2023; Peter, 2023; Schreich-Stuppan, 2023). Peter (2023) explains, that the reasons for this are manyfold, namely “outmigration, an ageing population, low tax revenues, a vast municipal area with large forests and protected woodland”. As president of the municipality, Binkert (2023) acknowledges this and confirms, that “the municipality can probably contribute very little financially”. She suggests that the involvement of the private sector or external funding may be necessary for certain projects and holds out the prospect of potential support for offers like the horse-drawn carriage service or an organised ridepooling between the valley and the Upper Engadine.

Stakeholder involvement emerged as another crucial aspect when considering the introduction of new mobility options in Val Müstair. Casty-Greiner (2023) representing the local Industry and Gastronomy Association, highlights the importance of conducting meetings with its members, for instance the general assembly, where generally approximately one third of the members attend. These would serve as a platform to seek feedback, ideas, and concerns from local businesses, enabling them to actively participate in shaping the new mobility options. By involving the stakeholders directly impacted by the transportation choices, the planning process becomes more inclusive and relevant to the community's unique requirements. Similarly, Scandella (2023) advocates for active engagement with young people, who are often key users of alternative transportation methods. He identifies digital communication over social media and community gatherings as effective channels to involve the youth and gather insights into their preferences. This approach not only encourages ownership of the solutions but also ensures that the perspectives of a vital demographic are considered in decision-making.

Binkert (2023) and Schreich-Stuppan (2023) underline the importance to include the local population in the implementation process as well. The approach of Schreich-Stuppan (2023) includes inviting the population to an information event with a “big apéritif. People show up for apéritifs, otherwise not”, while Binkert (2023) would inform people at community meetings, through the local newspaper and by creating and distributing flyers. Such a participation process is according to Ulayayi (2023) already ongoing. Important for such inclusion of the population is for her that information about ongoing goals, plans and potential benefits for the inhabitants is being regularly shared by the initiators. This could be framed as occasional workshops or similar events for participation, which would take place preferably on the weekends, “so people who are not in the valley during the week can participate” (Ulayayi, 2023). This collaborative approach seems to be wished by many interest groups and would thus facilitate a sense of shared responsibility for the region's mobility future

and foster a collective commitment to the new offer. It would promote inclusivity and ensures that new mobility options are tailored to the specific needs and preferences of the community. Thereby also valuable insights about the needs of the residents can be gained, potential challenges identified and consensus around the proposed solutions can be built. As a result, the implementation of new mobility options becomes more seamless and enjoys higher acceptance and support from the community at large.

Also, collaboration with other organizations, businesses or tourism operators can help promote and integrate new mobility options into existing services, enhancing their appeal and reach. Binkert identifies potential partnerships with individuals, who are already equipped, trained and willing to offer some services, such as the farm that could be offering horse-drawn carriage services in the future. She further suggests partnering up with existing platforms, for instance regarding ridepooling, or to develop new solutions in collaboration with private businesses. Like this, the municipality could streamline and expand the availability of these transportation options (Binkert, 2023).

Collaborative partnerships extend beyond the realm of mobility providers. Involving local businesses, such as hospitality and gastronomy, can according to Cueni (2023) play a significant role in promoting sustainable transportation options. He emphasises the importance of incorporating transportation information into guest brochures and itineraries. Also Peter (2023) from the Biosfera identifies advantages in aligning their goals with the municipality's efforts. The Biosfera can use its resources and platform to raise awareness about new mobility options and encourage their adoption within the community and among visitors. Thus, collaborations with private operators, businesses and the tourism sector could offer a unique opportunity to leverage existing resources and expertise.

Effective communication channels are crucial elements in driving the acceptance and adoption of new mobility options in Val Müstair. Interviewees highlighted the significance of clear and accessible communication to inform residents and visitors about the available transportation choices and their benefits. The interest groups utilise diverse channels to engage their respective audiences. Casty-Greiner (2023) explains that the Industry and Gastronomy Association employs its e-mail newsletter as the primary mean of communication, keeping their members up-to-date with relevant information and seeking their input through regular surveys and feedback loops.

Similarly, Binkert (2023) leverages the valley's monthly newspaper "Mas-chalch", as a platform to disseminate information of the municipality about ongoing projects, proposals, and upcoming events. With over thousand subscribers, the newspaper reaches not only residents but also second homeowners and individuals who have moved away from the region. This widespread reach ensures that a broad audience is informed about the latest developments, encouraging engagement and feedback from a diverse community. Scandella (2023) highlights, that effective communication involves engaging and involving young people. This could be done utilizing social media to provide a direct line of communication with the youth, to "push and encourage them to attend" to organizational and community meetings (Scandella, 2023).

In the realm of tourism, Pinggera (2023) states that “information is crucial for guests”. While there are many brochures available for guests at her camping site, many appreciate the direct contact and ask her for information. Similarly, Cueni (2023) emphasises the importance of integrating transportation options into the Guest Card, guest information brochures and other marketing tools. By including details about sustainable mobility choices and their accessibility to various attractions, tourists can make informed decisions and actively opt for eco-friendly transportation during their stay. Cueni (2023) thinks, that utilizing the tourism sector's influence and reach, new mobility options can gain wider visibility and appeal, not only to tourists but also to residents who may become inspired by these sustainable choices. A tool available to the tourism organization is the semi-annual briefing of the hotels in the valley during an information session about recent updates.

Overall, the strategic use of various communication channels, ranging from e-mail newsletters and local newspapers to social media and guest information brochures, could serve as a powerful tool in raising awareness, gathering feedback, and promoting acceptance of new mobility options in Val Müstair. Through effective communication, interest groups can be well-informed, engaged, and actively participate in shaping the future of sustainable transportation in the region.

4.4.2 Factors Influencing Acceptance

The acceptance of a new mobility option is influenced by a combination of factors that play a crucial role in determining its success and uptake within the community. The interviewees shed light on several key aspects than can either encourage or hinder the adoption of a transportation option once it is in place.

The factor mentioned by a majority of the respondents is affordability (Casty-Greiner, 2023; Scandella, 2023; Schreich-Stuppan, 2023). As highlighted by Schreich-Stuppan (2023), it is essential to prioritise competitive pricing and avoid regular tariff increases. This would make a new option economically viable and thus attractive to the local population. He further suggests offering discounts, promotions or rewards when introducing new mobility options, which would positively influence its acceptance and encourage individuals to try it or even make the switch. This point is also highlighted by Merz (2023), who states that financial incentives can indeed have a significant impact on the acceptance.

But a new mobility offer will not be applied solely because of its affordability. It needs to be easily accessible and convenient in its use. Ensuring frequent, reliable and safe options, ideally offering a saving of time, would increase the acceptance according to several interviewees (Casty-Greiner, 2023; Cueni, 2023; Scandella, 2023; Schreich-Stuppan, 2023). Here also the user experience plays an important role. Ensuring a seamless, comfortable, and enjoyable travel experience can enhance satisfaction and encourage repeated usage of the new mobility service (Cueni, 2023).

If the interest groups present in the valley are taken into account during the planning and decision-making process, as described before, they are more likely to use the newly introduced offer. According to Ulayayi (2023), this process is able to build trust and support for the new initiative, fostering acceptance and cooperation. Both Cueni (2023) and Schreich-Stuppan (2023) highlight the importance of promoting the positive

impact of ideally eco-friendly transportation on the environment and the community. Demonstrating how these options contribute to less emissions, noise, pollution, or traffic congestion can resonate with conscious individuals and encourage adoption. Pilot projects, as highlighted by Peter (2023), can be invaluable in gaining data and feedback to fine-tune a new concept. Successful pilot projects can similarly build confidence and enthusiasm, leading to greater acceptance.

In conclusion, the acceptance of a newly introduced mobility option in Val Müstair is influenced by several factors, such as affordability, accessibility, convenience, effective communication, incentives, local engagement, pilot projects, and a seamless user experience. Understanding and addressing these factors holistically can create a favourable environment for the successful implementation and adoption of sustainable transportation alternatives in the region.

5 Discussion of Results

Having presented the results of this research paper, this following section aims to compare and evaluate the responses of all interviewees with the literature previously analysed, in order to answer the first part of the research question: "*What are the prevailing mobility practices, experiences, and preferences among different interest groups in Val Müstair, and what are the factors influencing their acceptance of alternative, sustainable transportation options?*"

To propose feasible and effective mobility concepts for the region Val Müstair in Section 6 and thus provide answers to the second part of the research question "*What could be suitable mobility concepts for Val Müstair*", a careful analysis of relevant criteria is essential. These criteria emerge from a combination of knowledge gained from the literature review and the interviews conducted with representatives from various interest groups within Val Müstair. However, it is imperative to acknowledge the limitations faced by the Biosfera, the organization leading the effort to implement a new mobility offer. Considering these limitations and working within the framework conditions presented in Section 5.1.1, the proposed mobility concepts must align with the Biosfera's possibilities, its scope of action and the preconditions given in the valley.

Following a structure similar to Section 4, the discussion will explore the insights gained from the interview responses and make slight alterations to the section titles to better address the research objectives.

- Research objectives and preconditions
- Prevailing mobility practices
- Collected suggestions for the improvement of the mobility system
- Factors influencing the introduction and acceptance of new mobility offers

By reorganizing the sections and considering the perspectives of the interviewees, this discussion aims to develop a framework with requirements and needs of the Biosfera and the community, to find mobility offers that are suitable.

5.1 Research Objectives and Preconditions

5.1.1 Framework conditions of Biosfera Val Müstair

When it comes to planning and launching a new mobility offer in the valley, the Biosfera Val Müstair faces certain constraints, and these must be thoroughly examined before proceeding with the identification of further criteria emerging from the other interviews. Specifically, any proposed mobility concepts should adhere to the following framework conditions described by Peter (2023). They will help to ensure that the proposed solutions are not only effective but also realistic and feasible within the valley's context and the Biosfera's possibilities and scope of action.

First and foremost, any proposed mobility concept should be non-infrastructure intensive. Given the constraints of the Biosfera, extensive infrastructural changes may not be a viable option. Therefore, the focus

should be on solutions that do not heavily rely on significant developments in infrastructure. Instead, the emphasis should be on creative and innovative approaches that work with the existing landscape and transportation systems and need only small infrastructural changes.

Moreover, legal and institutional framework compatibility is of utmost importance. The Biosfera lacks the authority to change existing laws or regulations, making it crucial to propose mobility concepts that can be implemented within the current legal framework. By working within these limitations, the proposed solutions can avoid unnecessary hurdles and ensure a smooth and efficient implementation process. Also, the institutional framework with the limited scope of action of the Biosfera needs to be taken into account. For instance, to improve the public transport bus connections in the valley, the Biosfera has the ability to submit regular requests to PostAuto along with the municipality and the tourism association. This process is regularly undertaken, and its success is documented in Section 4.2.3. However, due to the involvement of higher-level processes and the Biosfera's legal and institutional limitations, such mobility enhancements may not fall withing the scope of this thesis, even though they would match many of the named criteria and expectations from the Biosfera as well as the interviewed interest groups.

In any proposed mobility concept should also the region's and Biosfera Val Müstair's commitment to tackle environment- and emission-related issues be reflected, while promoting sustainable mobility. Prioritizing environmentally friendly transportation options is vital to reduce the valley's carbon footprint and contribute to the broader efforts of mitigating climate change, while preserving the protected nature in the UNESCO Biosphere reserve and sensibilizing the residents as well as the tourists for the issue.

Another crucial aspect is social sustainability. The community in Val Müstair is diverse, involving individuals with varying mobility needs, including young people, seniors, and tourists. Therefore, the proposed mobility concepts should be inclusive and accessible to all members of the community. Special attention should be given to providing transportation options suitable for individuals who cannot or choose not to drive, ensuring that mobility solutions are available and easily accessible to everyone.

Finally, the Biosfera already faced difficulties in funding mobility initiatives like it was the case with the aimed introduction of the Mobility electric car-sharing concept, as described in Section 4.1.4. This thesis will prevent from proposing financially intensive projects to the Biosfera management. Nevertheless, the Biosfera will need to assess every proposed option for its financial feasibility. By adhering to these critical criteria, this thesis can propose mobility concepts to the Biosfera Val Müstair which comply with the framework conditions described by Peter (2023).

5.1.2 Preconditions Present in Val Müstair

While the Biosfera, as the implementing entity of the planned mobility offer, has its specific requirements outlined before, the interviewed representatives of the interest groups have highlighted certain preconditions that need to be considered in the context of Val Müstair.

According to the interviewees, the Val Müstair community experiences is social and demographic changes. Whereas Manatschal et al. (2014) have found that Val Müstair has retained its population in numbers, Peter

(2023) identifies a continuous emigration, especially among young people, as the most significant change, leading to an ageing population (Peter, 2023). This difference in perception could be from the time difference, as the first study dates back to 2014. Still, Peter (2023) is convinced, that young people leave the valley in search of opportunities elsewhere, posing challenges in maintaining a vibrant community and workforce. With demographic shifts, which are also confirmed by Bertschy et al. (2012), the valley must consider the transportation needs of different age groups, including young people, seniors, and tourists.

Despite being a rural area, Val Müstair valley experiences significant traffic volume, challenging the idyllic perception often associated with the region. The valley serves as a traffic axis, leading to a substantial amount of thorough traffic (Cueni, 2023). The traffic flow results in poor air quality caused by vehicle emissions, noise emissions, and tyre abrasion, which poses environmental and health concerns (Cueni, 2023; Peter, 2023). Peter (2023) further explained, that seasonal changes, contribute to increased traffic and pollution levels, particularly during the summer season when various road users flood the valley,. This often leads to congestions creating a burden for residents and posing risks, especially for children (Binkert, 2023; Peter, 2023; Pinggera, 2023). Accidents on mountain passes and traffic congestions in villages are frequent occurrences during peak tourist periods (Peter, 2023). These results are consistent with literature, which similarly indicates the manyfold negative impacts of a car-centred mobility (Axhausen et al., 2021; FOEN, 2021b; FSO, 2022; Jacobson et al., 2016; Järlskog et al., 2021; Kinable et al., 2016; Szklarek et al., 2022; van Wee, 2014).

As seen in Section 2.3.4 of the Literature Review, there are limited viable alternatives to private cars in the valley, except for people who are very flexible and have enough time to consider alternatives like public transport. This poses according to Merz (2023) meaningful challenges. She adds that interest groups, like cross-border commuters from South Tyrol, have few practical alternatives to travel to or through Val Müstair, except for the public transport. The lack of viable alternatives can contribute to high traffic volumes and hinder sustainable mobility implementation (Merz, 2023).

Implementing sustainable mobility solutions faces various challenges in Val Müstair. Resistance to change among valley residents is one such challenge, as some may be hesitant to adopt alternative mobility solutions like public transport (Schreich-Stuppan, 2023). This topic was also discussed in literature, as van Acker et al. (2016) named habits, routines and lifestyle choices to be influencing transportation mode preferences. Residents may perceive alternative mobility options as inferior due to the valley's remote location and limited amenities (Schreich-Stuppan, 2023). This opinion is consistent with the findings in literature, where Mariani (2016) and UPU (2021) showed the popular example of decreasing post offices in Switzerland, potentially causing this opinion of inferior infrastructure in rural-peripheral areas.

The limited financial resources in the valley as described by interviewees (Binkert, 2023; Peter, 2023) and confirmed by official documents (Cumün da Val Müstair, 2022) add complexity to the pursuit of sustainable mobility goals. With a small population of around 1’400 residents, the municipality faces financial constraints in funding initiatives (Peter, 2023). The municipal finance statistics (Cumün da Val Müstair, 2022) show the continuous trend of depopulation, leading to an ageing society which further intensifies the negative impact on the municipality's finances (Peter, 2023).

In conclusion, Val Müstair faces a combination of challenges related to social and demographic changes, traffic volume and pollution, traffic congestion and accidents, limited viable alternatives, challenges in sustainable mobility implementation, and limited financial resources. Addressing these preconditions is crucial for achieving the research objectives centred on promoting sustainability and expanding mobility offerings to reduce reliance on private cars in the valley. Stakeholders' efforts, such as the Biosfera Val Müstair, TESSVM, and the municipality, play a vital role in tackling these challenges and fostering sustainable mobility in the region.

5.2 Prevailing Mobility Practices

The prevailing mobility practices in Val Müstair valley are characterised by a heavy reliance on motorised private mobility, particularly cars (Cueni, 2023; Kern, 2023; Peter, 2023; Schreich-Stuppan, 2023). Cars are the most common mode of transport among the locals, and this car-centric thinking is deeply ingrained in the mentality of the community (Schreich-Stuppan, 2023). Many residents own a car and use it regularly for various purposes, leading to an extremely car-dependent behaviour in the valley (Kern, 2023). This car-oriented mindset is not limited to the locals, as even tourists and guests visiting the valley tend to rely heavily on cars as their preferred means of transportation (Cueni, 2023; Pinggera, 2023). This is consistent with data found during literature review about the mobility in rural-peripheral areas in Switzerland (Marconi & Schad, 2016). It showed, that in rural-peripheral areas 82% of the people owned a driving license, the proportion of households without a car has decreased to 15% in 2010 and while households with one car have 47% and with two or more cars 37% of the share. Similarly, the measurements of traffic volume in Valchava seen in Section 2.3.4 show between the years 2000 and 2022 a constant increase in cars driving through Val Müstair (TBA GR, 2010, 2022).

The reasons for the prevailing use of cars are diverse and must be understood to consider potential changes in mobility practices. One of the main arguments for using cars is the practicality and flexibility they offer, allowing individuals to travel at their own convenience and according to their schedules (Casty-Greiner, 2023). This again is consistent with numbers found in literature. Marconi and Schad (2016) found that 38% of the car drivers justify their choice of this mode of transport being the easiest or most convenient solution. Especially for commuters who travel from remote villages in South Tyrol or Engadine, cars provide significant time savings compared to public transport (Casty-Greiner, 2023; Kern, 2023; Merz, 2023). In the previously mentioned study, travel time was the reason for 17% of the population to use motorised private transportation (Marconi & Schad, 2016). Another aspect mentioned by Kern (2023) and Schreich-Stuppan (2023) is that the car is perceived as a symbol of freedom and essential mobility, particularly among the older generation in mountainous regions like Val Müstair.

Despite the prevalence of cars, some efforts have been made to promote alternative mobility options. Public transport, such as buses and connecting trains in Mals and Zernez, is available in the valley (Cueni, 2023). Consistent with literature however, the usage of public transport by the locals remains relatively low due to limited frequencies, high costs, and inconvenient schedules (Casty-Greiner, 2023; Kern, 2023; Peter, 2023;

Ulayayi, 2023). Marconi and Schad (2016) found, that there is a significant difference in the average daily distance travelled using public transport between rural- peripheral and urban areas in Switzerland. While, according to the interviews, tourists have shown more interest in using public transport, especially with the introduction of the Guest Card offering free public transport during their stay (Cueni, 2023; Peter, 2023; Pinggera, 2023). The locals do not benefit from the same access to the card, which has led to criticism from some residents (Schreich-Stuppan, 2023).

Among the interviewees, mobility options such as ridepooling and hitchhiking have been utilised from time to time as alternatives to private cars. This was particularly the case for commuters with early morning travel needs, as there do not exist any alternatives using public transport (Kern, 2023; Schreich-Stuppan, 2023). However, their usage is limited, and challenges, such as coordination and weather conditions, have been identified (Kern, 2023; Peter, 2023; Schreich-Stuppan, 2023). There are no current statistics about shared mobility usage in rural-peripheral areas in Switzerland.

Slow traffic options, such as bicycles and e-bikes, are gaining popularity among tourists visiting the valley, but they are not widely used by the local residents for daily transportation (Cueni, 2023; Merz, 2023; Peter, 2023). Literature shows only little information about the usage of slow traffic in rural-peripheral areas. Marconi and Schad (2016) however state, that the daily distance using slow traffic is lower in rural areas compared to urban areas, but the difference is quite small. The lack of proper cycling infrastructure, significant elevation changes, and cold winters have been cited as barriers to wider adoption of cycling as a means of transport among locals (Kern, 2023; Peter, 2023). The factor of spatial arrangement, including infrastructure and spatial preconditions like the mountainous area in Val Müstair, was found as one of the three categories which influence the individual's mobility behaviour. The other two aspects are the supply- and demand-side factors.

In conclusion, the prevailing mobility practices in Val Müstair valley are heavily reliant on motorised private mobility, with cars being the dominant mode of transport. While there have been efforts to promote alternatives such as public transport and shared mobility options, the car-centric mindset remains deeply rooted in the community. Slow traffic options like bicycles and e-bikes are gaining popularity among tourists but are not widely embraced by the local residents. Addressing the challenges and promoting alternative mobility options could be essential in shaping the future of transportation in the valley. This should be done bearing in mind the factors influencing the choice of mode of transport, which were presented in Section 2.3.2.

5.3 Collected Suggestions for Improvement of Mobility System

During the interviews conducted for this study, several suggestions for the improvement of the current system emerged. Although the suggestions in Section 6 will not be solely based on these interview responses, it is essential to briefly analyse them as they might provide valuable insights for the Biosfera management and other readers. These ideas could potentially offer innovative solutions and alternative perspectives that could enhance the overall understanding of the mobility challenges and opportunities in the study area. Thus, acknowledging and briefly examining these unsolicited suggestions may enrich the discussion and contribute to a more comprehensive assessment of the mobility offer in the Biosfera Val Müstair.

As seen in the previous analysis, several interviewees, including Peter (2023), Pinggera (2023) and Schreich-Stuppan (2023), advocate for a reduction in car dependency and an increased focus on sustainable transportation options. On the other hand, Binkert (2023) and Ulayayi (2023) express satisfaction with the current mobility options in the valley, referring to the distinctive context of low population density and mountainous terrain. They believe that the current system is well-positioned to meet the valley's needs.

The main topic of suggestions to reduce car dependency and promote sustainable travel options in the valley was the enhancement of public transport services. Merz (2023) suggests increasing bus frequencies during peak hours and introducing an express bus to cater to commuters. Kern (2023) and Ulayayi (2023) emphasise the need for extended operating hours, particularly for tourists and late-night events. Additionally, Scandella (2023) suggests an affordable night bus service to ensure safe transportation for young people. Ideas to make public transport more accessible and economical for different demographics were mentioned as well. Schreich-Stuppan (2023) proposes a general subscription for seniors to encourage them to use public transport. Ulayayi (2023) suggests a regional network card similar to the GA travelcard for unlimited travel on public transport networks in the valley, while Merz (2023) proposes tax incentives for using public transport or e-bikes.

Interviewees express interest in having a train connection in the valley. Scandella (2023) wishes for a train connection to South Tyrol or the Engadine valley, whereas Ulayayi (2023) similarly mentions potential projects to connect the Engadine with the Vinschgau. While there seems an imminent need to improve public transport, also improved taxi services were a topic. Scandella (2023) proposes an affordable cross-border taxi service for young people seeking entertainment outside the valley and Schreich-Stuppan (2023) suggests a taxi-like service to serve remote hiking destinations.

Likewise, other incentives and regulations to improve mobility were discussed. Casty-Greiner (2023) proposes a toll for the valley to manage through traffic and support the local economy. Schreich-Stuppan (2023) suggests lowering speed limits and using creative solutions like fake speed cameras to improve safety. Peter (2023) suggests implementing a paid parking system with the parking fee acting as a consumption voucher to encourage spending within the valley.

Some interviewees also see the potential benefits of shared mobility and organised ridepooling. Casty-Greiner (2023), Kern (2023) and Scandella (2023) propose an organised platform for ridepooling or shared mobility, aiming to increase ridesharing opportunities. Suggestions are a ridesharing app for the region or a carpool bench network throughout the valley. Binkert (2023) also supports the idea of an organised ridepooling or -sharing system to reduce traffic, emissions, and noise and holds out the prospect that such an initiative could potentially be financially supported by the municipality.

Other interviewees suggest improvements in slow traffic options. Kern (2023) recognises the barriers to bicycle usage, including the topography and lack of bike lanes, and suggests infrastructural changes to promote bicycle usage as a regular mode of transportation. Binkert (2023) and Kern (2023) discuss the potential for horse-drawn carriage services to offer a unique and locally appropriate mobility solution for tourism.

In summary, the interviewees' suggestions and ideas offer a comprehensive overview of various approaches to improve the mobility offer situation in Val Müstair. While there are different opinions on the extent of necessary changes, the overall consensus points towards a desire for sustainable, accessible, and well-organised mobility options that consider the valley's specific context and unique characteristics. Upon comparing these results with the gained knowledge during literature review, some notable patterns emerge.

The suggestions and ideas presented by the interviewees align with the factors influencing the choice of transport mode identified in Section 2.3.2 in the Literature Review. For instance, the interviewees' focus on enhancing public transport, providing incentives and regulations, and promoting shared- and slow mobility options. This reflects the identified demand-side factors discussed in literature, such as external conditions like the purpose of the trip or time constraints, available resources regarding time, budget or equipment, and individual preferences caused by habits and values.

Also, the spatial arrangement aspect was highlighted by some interviewees. The valley's mountainous terrain and limited local infrastructure influence the demand for mobility and the choice of transport modes. Interviewees' suggestions for improving bicycle infrastructure and introducing horse-drawn carriage services take into consideration the spatial characteristics of the valley.

The combination of supply-side and demand-side factors, as well as spatial arrangement, makes the choice of mode of transport a complex decision-making process. The literature review and interview results both indicate that factors like travel time, cost, comfort, purpose of the trip, resources available, and individual preferences all come into play when individuals decide on their mode of transport. This comparison highlights the importance of tailored solutions in the context of Val Müstair's mobility challenges. The valley's characteristics and diverse stakeholder perspectives call for mobility improvements that address the specific needs of the local population, tourists, and various interest groups.

5.4 Factors Influencing the Introduction and Acceptance of New Mobility Offers

One of the most important takeaways from the interview results for Biosfera, which is willing to consider and introduce a new mobility service, is the mentioned factors concerning the adoption and acceptance of such an offering. Therefore, it is essential to extract and prepare these factors from the results in Section 4.4, which will be done in the following. Although it is important to acknowledge their interconnections and the potential for some overlap, the main themes emerging from the interview results can be categorised into the topics of sustainability considerations, practicality, acceptance, and testing and implementation strategy. Therefore, adopting a holistic approach is crucial when introducing a new mobility offer. Such an approach aims to engage and involve a significant portion of the population, sensitizing, encouraging, and enabling them towards more conscious and sustainable mobility behaviours through the implementation of a new service. By considering the interconnectedness of these themes, the goal is to create a comprehensive and inclusive transportation solution that addresses the specific needs and preferences of the community while promoting sustainably responsible mobility choices.

5.4.1 Sustainability Considerations

When exploring factors that could improve the acceptance and adoption of a newly introduced mobility offer, participants highlighted considerations pertaining to all dimensions of sustainability, as evidenced in Section 2.2 of the Literature Review. The three dimensions encompass social, environmental, and economic aspects, indicating the significance of addressing broader implications beyond the immediate transportation benefits to ensure the long-term viability and desirability of the proposed mobility solution.

One of the key criteria highlighted by multiple interviewees is the emphasis on sustainable and environmentally friendly mobility solutions (Cueni, 2023; Kern, 2023; Schreich-Stuppan, 2023). There is a shared vision of reducing car dependency, lowering emissions, and minimizing the impact of transportation on the valley's natural surroundings. Therefore, any new mobility offer should align with these principles and contribute to the overall goal of ecological sustainability, as it is described in Section 2.2.2.

Whereas the ecological dimension was the prevailing topic, several interviewees (Schreich-Stuppan, 2023; Ulayayi, 2023) also stressed the importance of making mobility options accessible and inclusive for all residents and visitors. This includes providing transportation solutions for the elderly, young people, and individuals with disabilities, thus in line with the principle of social sustainability in Section 2.2.2. To ensure inclusivity, new mobility offers should be designed to accommodate various needs, demographics, but also financial situations. This is not only essential in the social dimension but also deeply rooted in economic sustainability.

The issue of affordability was raised by multiple interviewees, suggesting that any new mobility offer should be reasonably priced for both residents and tourists (Cueni, 2023; Merz, 2023). Competitive pricing, avoiding regular tariff increases, and offering financial incentives like discounts or promotions can positively influence adoption and encourage individuals to use the new services (Casty-Greiner, 2023; Merz, 2023; Schreich-Stuppan, 2023).

5.4.2 Practicality and Acceptance

The before-mentioned affordability is likewise a topic for higher acceptance among the residents. Other mentioned factors revolve more around the practicality of new offerings and the need to establish acceptance, aiming to minimise barriers for trying out the offer and ideally integrating it into daily mobility behaviour.

The practicality of the offers, including ease of access, straightforward payment methods, and efficient scheduling or availability, is according to Cueni (2023) and Merz (2023) crucial in promoting their widespread acceptance and usage by all segments of the population. If possible, the implementation should consider integrating different existing and new modes of transportation to create a cohesive and well-connected mobility network that enhances the overall convenience and attractiveness of the sustainable mobility alternatives.

Just as important seems the flexibility and adaptability in new mobility offers. In accordance with the spatial arrangement factor in transport mode choice discussed in Section 2.3.2 of Literature review, the valley's geographical and demographic characteristics require solutions that can adapt to changing needs and seasonal variations. For example, providing flexible transportation options during peak tourist seasons or

adapting schedules to accommodate special events can enhance the effectiveness and acceptance of the mobility system (Kern, 2023; Merz, 2023).

Furthermore, safety and security were mentioned as important criteria by multiple interviewees (Cueni, 2023; Kern, 2023; Scandella, 2023; Schreich-Stuppan, 2023). Implementing measures to ensure the safety of passengers and users, such as well-maintained infrastructure, well-lit waiting areas, and reliable emergency services, can enhance the appeal and trustworthiness of new mobility options.

5.4.3 Testing and Implementation Strategy

The planning and implementation phase of any project is of paramount importance, as it sets the foundation for success and acceptance of new mobility offerings. Participants highlighted the importance of consulting and involving the local community in the decision-making process, with this thesis being the first step of the process (Binkert, 2023; Scandella, 2023). Engaging local stakeholders, including residents, businesses, and authorities, can lead to better-designed solutions that address the specific needs and challenges of the valley. Similarly, a clear and accessible communication is vital to inform residents and visitors about the process, available transportation choices and their benefits. Utilizing diverse, already existing communication channels, such as e-mail newsletters, local newspapers, social media, and guest information brochures, can raise awareness and gather feedback from various segments of the community (Binkert, 2023; Casty-Greiner, 2023; Pinggera, 2023; Scandella, 2023). Ensuring that information reaches both residents and tourists can help build engagement and acceptance of new mobility options (Binkert, 2023; Cueni, 2023; Pinggera, 2023).

Implementing new mobility options in the Val Müstair valley should prioritise stakeholder involvement, collaboration, and partnerships to ensure the success and relevance of the proposed solutions. Engaging directly impacted parties, such as local businesses and young people, during the planning and decision-making process is crucial for creating inclusive and community-driven mobility solutions (Casty-Greiner, 2023; Scandella, 2023). Involving the local population through community meetings and information events fosters a sense of shared responsibility and commitment to the new offer (Binkert, 2023; Schreich-Stuppan, 2023; Ulayayi, 2023).

Furthermore, collaboration with other organizations, businesses, and tourism operators is essential to integrate the new mobility options into existing services and enhance their appeal and reach, which his confirmed by literature (Kim & Hwang, 2019). By leveraging existing partnerships or establishing new ones with private businesses, the availability and efficiency of transportation options can be streamlined and expanded (Binkert, 2023). Additionally, involving the hospitality and gastronomy sector in promoting sustainable transportation options can play a significant role in encouraging acceptance and adoption of such services (Cueni, 2023).

To test the feasibility and acceptance of the proposed solutions, to build up a confidence by doing a pilot project is essential before a complete implementation, as highlighted by Binkert (2023) and Merz (2023). This offers a controlled and localised testing ground for the new mobility options, allowing interest groups to observe and evaluate their impact on a smaller scale. By starting with pilot projects, the community can assess

the practicality and effectiveness of the proposed solutions and make necessary adjustments based on real-world feedback. Moreover, pilot projects can encourage confidence and trust among the local population and businesses by demonstrating tangible benefits and addressing potential concerns, which is also confirmed by literature (Glass, 1997; Thabane et al., 2010). When residents see positive outcomes from the pilot initiatives, they are more likely to embrace and support the wider implementation of the new mobility options (Binkert, 2023; Merz, 2023; Schreich-Stuppan, 2023). Additionally, the confidence gained from successful pilot projects can encourage participation and investment in the broader transportation system. Through this, the implementation of new mobility options in Val Müstair can be approached strategically and inclusively, gaining the support and active involvement of local stakeholders. These measures ensure that the community's requirements and preferences are considered, leading to a more successful implementation of a selected mobility concept (Peter, 2023).

6 Selecting Potential Mobility Concepts for Val Müstair

As a final contribution of this thesis, drawing upon the knowledge and data collected during research so far, alternative mobility concepts will now be selected based on a set of criteria derived from both the Biosfera's requirements and possibilities, as well as insights from various interest groups. Their visions, ideas, criteria, and factors that promote acceptance have been considered as well.

With this approach, it is aimed to identify innovative and sustainable mobility solutions that align with the Biosfera's objectives while addressing the needs and aspirations of different interest groups. By integrating these perspectives, the goal is to pave the way for transformative and forward-thinking approaches to mobility that will benefit both the environment and society as a whole.

In the following section, the expectations of the Biosfera (Section 5.1), as well as the factors influencing the introduction and acceptance derived from the discussion of the results analysis (Section 5.4), will be systematically summarised. In a second step, an overview of existing mobility offers divided in categories is provided, of which then three categories are selected and presented (Section 6.2). After narrowing down the mobility concepts to ridepooling, ridesharing, and integrated mobility, the last Section 6.3 will define these concepts and assess their suitability for the Val Müstair in alignment with Biosfera's objectives and the interest groups' requirements. As a last step, concrete examples of mobility concepts will be provided to the Biosfera Val Müstair.

6.1 Requirements and Influential Factors for Acceptance

This section aims to list requirements for the choice of concepts that will be suggested to the management of the Biosfera Val Müstair.

Table 5: Requirements for choosing suggested mobility concepts (own table).

Topic	Requirement	Detailed
Goals of Biosfera (see Section 4.1.1)	Provide alternatives to private cars	Promote sustainable alternatives to shift mobility patterns away from prevailing private car usage.
	Accessible transportation	Make transportation accessible for individuals who cannot or do not wish to use private cars.
Regulatory compliance (see Section 5.1)	Within scope of work and possibilities of the Biosfera Val Müstair	Must be non-infrastructure intensive and cannot exceed budget reach of Biosfera.
Sustainability considerations (see Sections 2.2.2 and 5.4.1)	Ecological impact	Environmentally friendly option complying to the shared vision of reducing car dependency, lowering emissions, and minimizing impact of transportation on the valley's natural surroundings.
	Social inclusivity	Must be accessible and inclusive for all residents and visitors.
	Economic sustainability	Must be affordable for residents, tourists, the Biosfera and other involved interest groups.

Practicality and acceptance (see Sections 2.3.2 and 5.4.2)	Availability	Efficient scheduling and availability, particularly during times when public transport is not operating.
	Ease of access	Ensuring low-barrier entry, straightforward usage, and easy-to-use payment methods.
	Flexibility and adaptability	Ability to adapt offer to changing needs and seasonal variations.
	Safety and Security	Measures ensuring safety of passengers and users.

To narrow the selection further down, it was necessary to define a geographical perimeter. Therefore, mostly projects in rural areas of Switzerland, as described in Section 2.1.1, were included. This decision was made because existing and established projects in the rural regions are more likely to be applicable in Val Müstair, considering similar conditions and circumstances. Additionally, after this study, the Biosfera aims to implement such a mobility service. Thus, it is advantageous to be able to easily contact or visit similar projects in and assess them on-site, as well as they can draw upon the existing experiences and knowledge.

6.2 Mobility Categories

After the theoretical exploration of the subject and the involved issues, various mobility projects in rural areas of Switzerland were researched. Firstly, an initial overview of the different projects existing in the rural areas of Switzerland was gained through desk research. Afterward, three databases found during this process were included in the selection procedure, as well as suggestions which came directly from the interview partners. They are shortly presented in the following, as the data bases are useful for the Biosfera management to gain further knowledge about existing concepts.

The Coordination Office for Sustainable Mobility (COMO) is the Swiss federal government's central contact point for sustainable mobility. Como is operationally led by the Swiss Federal Office of Energy (SFOE) and is supported by a total of six federal offices (BFOE, 2019). It promotes innovative projects with financial contributions and provides information via a knowledge platform about completed and ongoing projects collected since 2006 (EnergieSchweiz, 2023). It would surely be interesting for the Biosfera to submit its new mobility project to COMO, with the possibility to receiving financial support for the implementation of their project.

Furthermore, the database of the association Mobilservice provides another overview. Mobilservice is a platform for sustainable mobility and mobility management in Switzerland. The association describes itself as a pool of know-how on the internet and as a network for actors in the mobility industry. The Mobilservice database goes back to 2004 and describes over 1'600 initiatives and projects in great detail (Mobilservice, n.d.).

Finally, the Trafikguide platform also made a contribution. Trafikguide is a digital overview of new and existing mobility offers, which are prepared in a current and systematic manner. As visible on the big picture provided by Trafikguide (see Figure 10), they categorise and describe the mobility solutions and make them comparable (Trafiko, n.d.–a).

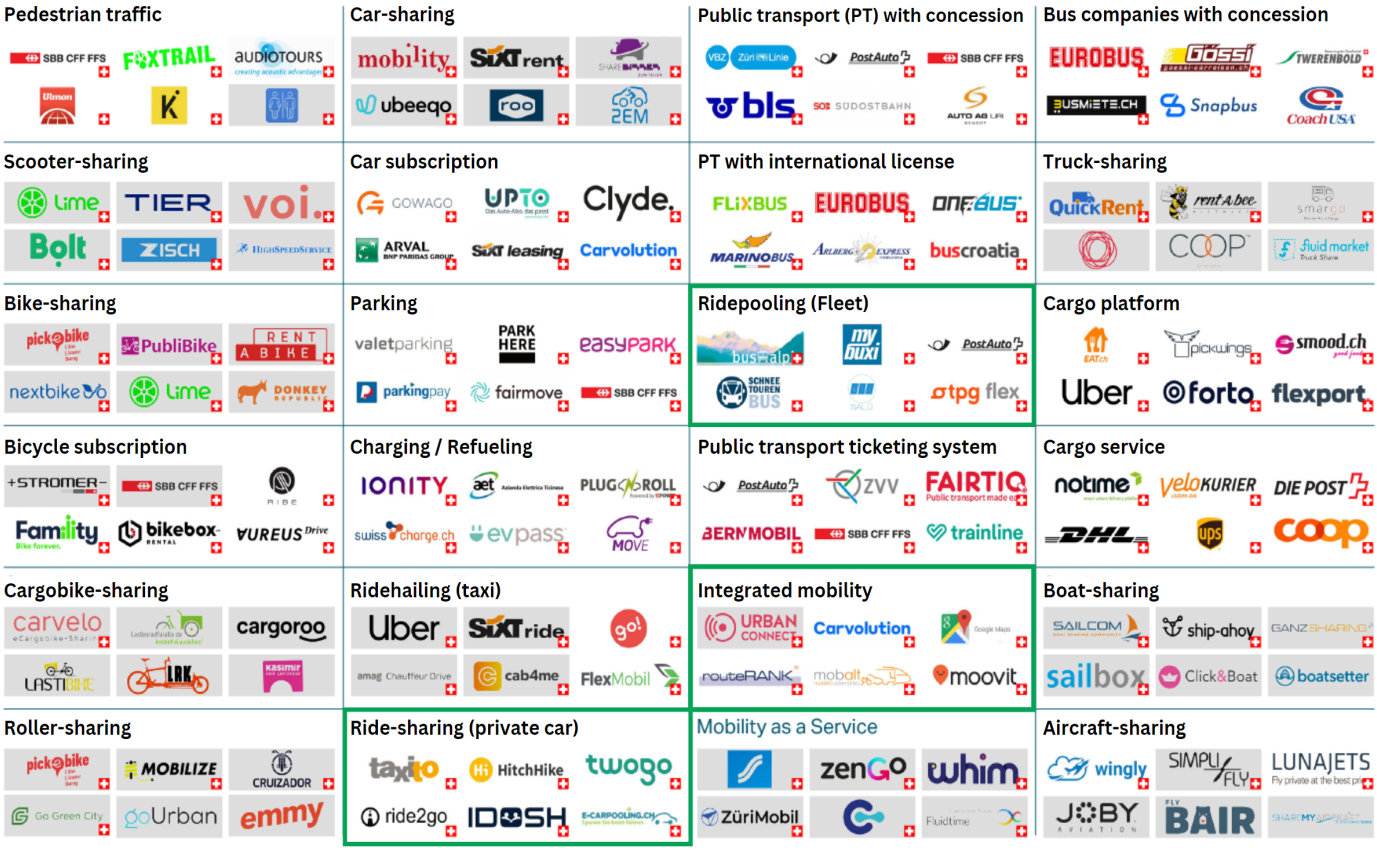

Figure 10: Overview of Trafikguide's categorization of new and existing mobility offers with examples (green frames for categories chosen to further analyse). Offers with a grey background are vehicle sharing offers. The Swiss cross in the bottom right corner identifies offers active in Switzerland. Own illustration based on Trafiko (2023).

In order to further narrow down the choice of mobility options after the desk research in a systematic way, categories encompassing several mobility offers needed to be established. The categorization system provided by Trafikguide (see Figure 10) offers a comprehensive and well-structured classification of over 400 various mobility concepts and offerings. Its incorporation of emerging mobility concepts ensures the system's adaptability to accommodate future trends and technologies, making it an appropriate tool for selecting suitable mobility concepts to propose to the Biosfera. This system supported me in systematically including or excluding specific categories based on the predefined requirements outlined in Section 6.1. Thus, in this section of the thesis, the categorization established by Trafikguide was utilised.

After having conducted the assessment of the categories following the criteria defined in Table 5, it was observed that some of them did not meet the significant requirements. They either went beyond the scope of work and possibilities of the Biosfera, did not comply with the sustainability and practicality considerations or were not applicable to achieve the goals formulated by the Biosfera. As a result, these categories were excluded from the detailed analysis that follows. The list of the excluded categories as well as a justification for each case can be found in Appendix E. In the next sub-section, the categories left from this reduction (see green frames in Figure 10) are explained in detail and assessed according to the criteria of Table 5.

6.3 Suggested Mobility Concepts and Offers

After the reduction of categories, describing the existing mobility concepts and offers, ridepooling, ridesharing and integrated mobility are left for further investigation. First, it is necessary to define each category, to assess in a second step their general applicability (see Appendix F for a systematic table) to the circumstances and prerequisites in Val Müstair, as well as their alignment with the goals of the Biosfera (see Table 5). The applicability of a specific concept adhering to one of these categories has to be analysed in-depth by the Biosfera, as they may not correspond exactly with the definition of the category. Finally, it is needed to find concrete existing examples and best-practices of concepts which are suggested to the Biosfera Val Müstair, with the goal of providing the Biosfera with ideas and inspirations on how to improve the mobility system in the valley according to its needs. To thorough examination of the applicability of each proposed offer in Val Müstair is beyond the scope of this master thesis, as the criteria are so specific and vary for each concept and is left for further investigation and assessment to the Biosfera.

6.3.1 Ridepooling

Ridepooling is a form of on-demand mobility that enables passengers to share rides with others traveling in the same direction, mostly using buses or vans (CleverShuttle, n.d.). It usually operates on a flexible and commercial basis, providing transportation between stops based on passengers' requests. Users can request rides depending on the offer through a mobile app, website or phone service (BBSR, n.d.). The professional driver then collects other passengers heading in the same direction and drops them off at their respective destinations (Gehrig, 2019). This service is often used as alternative to traditional taxi services or public transport (Mobility, 2023).

The inclusion of ridepooling in the assessment for Biosfera Val Müstair is justified by its strong alignment with the region's requirements and goals (see Table 5). Firstly, one of the main objectives of Biosfera is to provide alternatives to private cars, and ridepooling fulfils this by promoting a shared and sustainable transportation option. It encourages multiple passengers to share rides in a single vehicle, reducing reliance on private cars and lowering overall emissions.

Secondly, ridepooling addresses the need for accessible transportation. It offers a cost-effective and inclusive solution for individuals who do not have private cars or prefer not to use them, serving a broad range of residents and visitors. Furthermore, this concept is well-suited to the regulatory compliance within the scope of work and possibilities of Biosfera Val Müstair. It requires, depending on the concept, minimal infrastructure investment, making it financially feasible for the region. Additionally, it can be implemented within the existing transportation framework, complying with regional regulations.

From a sustainability perspective, ridepooling significantly reduces the ecological impact by optimizing vehicle occupancy and lowering emissions per passenger, aligning with Biosfera's vision of sustainable transportation. It also promotes social inclusivity, as it is accessible to various demographics, making it a suitable option for all residents and visitors.

Ridepooling efficiently schedules and offers rides, especially during times when public transport may not be operating at full capacity, enhancing practicability and acceptance. Depending on the platforms, they are designed to provide a user-friendly experience, with straightforward usage and easy-to-use payment methods. Additionally, ridepooling services are flexible and adaptable, ensuring continued availability throughout the year by adjusting their offers to changing needs and seasonal variations. Finally, safety and security measures can be implemented by ridepooling services to ensure the well-being of passengers and users. These measures may include professional drivers and maintaining well-insured vehicles.

Considering these justifications, ridepooling emerges as a highly suitable and beneficial transportation option for Biosfera Val Müstair, contributing to its goals of providing sustainable, accessible, and inclusive transportation while complying with regional requirement. Being rated as applicable in the region of Val Müstair, four selected examples of ridepooling offers are presented in the following:

Bus Alpin

Bus alpin is a Swiss association, which advocates for on-demand bus services to excursion destinations in alpine areas. The collaborative initiative is broadly supported by national stakeholders such as the Swiss Parks Network, of which also the Biosfera is part, Swiss Alpine Club, Swiss Association for Public Transport, PostAuto, and the association Verkehrsclub Schweiz, and has over twenty member regions in Switzerland. The main objective of Bus alpin is to enhance the overall appeal of the member regions by complementing public transport connections, leading to increased local economic benefits, and promoting a shift from private cars to public transport. The organization assists its member regions in various aspects, including the development, operation, marketing, and funding of such public transport services (Verein Bus alpin, 2019). It needs to be clarified, whether the region Val Müstair meets the requirements of Bus alpin listed on their website.

PubliCar

PubliCar is a flexible on-demand bus system operating in Switzerland issued by PostAuto. Its concept offers an alternative to scheduled services in sparsely populated areas, as Val Müstair is. Passengers can decide when they would like to travel and book their journey either by telephone or via the app and pay a small extra fee in addition to the regular public transport fare (PostAuto, 2023a). PubliCar enables different passengers traveling in the same direction to share an on-demand bus. Its functioning can be adapted to the specific local situation, with differences in schedules, stops, seasonality, and pricing (Trafiko, 2020).

Mybuxi

Mybuxi is a ridesharing service that provides on-demand mobility with minibuses for rural areas and is present in four regions of Switzerland. Its goal is to enhance connectivity with the existing public transport network and optimise the utilization of existing modes of transport (Trafiko, 2019). Trips can be ordered through an application or by calling and the payment is made online or directly to the driver. The system pools ride requests to improve the usage of the service and lower costs. Wherever possible, mybuxi uses zero-emission vehicles and cooperates with local electricity providers (mybuxi, 2022).

Citizen Buses

Citizen buses (German: 'Bürgerbusse'), also known as community buses, are small, local, and typically volunteer-run public transport services in rural or low-density areas. These services are often provided in regions where regular public transport options are limited or not economically viable. Citizen buses are designed to address the mobility needs of the local community, providing connections to nearby towns, shopping centres, medical facilities, and other essential services. These buses are usually smaller vehicles, often minibuses, which follow fixed routes and schedules, and passengers can flag them down at designated stops along the route or book a ride in advance.

While citizen buses are an integral part of public transport in Germany and the most used alternative transportation concept, they are still relatively few established in Switzerland (Eidam et al., 2012). However, there are a few regions in Switzerland with community buses, which are listed in the table in Appendix G.

6.3.2 Ridesharing

Ridesharing refers to the common use of a private vehicle by the driver with one or several passengers mostly on a non-commercial basis (Gehrig, 2019). Conditions are that the ride would take place anyway and the driver determines the route (Banerjee & Johari, 2019; Mobility, 2023). It is done either for non-profit purposes where the participants share the costs or as a paid service in which the driver gets compensated (Mitropoulos et al., 2021). Randelhoff (2014) identifies it as a synonym for ridepooling and carpooling, as the driver and car owner decides if the trip will take place, regardless of whether passengers are joining. Shared rides can happen on a spontaneous basis, what is commonly known as hitchhiking, or they are organised through a digital platform like websites, platforms or analog using community boards, newspapers, or public gatherings.

The concept of ridesharing is addressing several requirements and considerations of Biosfera Val Müstair (see Table 5). Firstly, it can contribute to the goal of providing alternatives to private cars, encouraging shared rides, and reducing emissions for the Biosfera's sustainable mobility vision. Secondly, ridesharing offers accessibility, serving individuals without private cars or those who prefer alternative options. It promises to be cost-effective and inclusive, accommodating a diverse range of residents and visitors.

Additionally, ridesharing aligns with sustainability objectives by optimizing vehicle occupancy and reducing ecological impact. Moreover, its practicality and acceptance are notable as digital platforms or analogue ways like community boards can efficiently schedule rides, especially when public transport operates at limited frequency like it is the case in Val Müstair. The user-friendly experience and ease of access further enhance its practicality.

Lastly, when looking at the classic hitchhiking, this type of ridesharing could pose some insecurities about the safety of the passengers. Nevertheless, there are services that can implement safety measures, such as registering drivers and passengers as well as the vehicles. Considering these aspects, the assessment considers ridesharing as potential transportation options for Biosfera Val Müstair. Therefore, different concepts for ridesharing organisation are being presented in the following.

Commuter Benches

These benches are placed in public places or along roads. When a person sits on such a bench, they signal their desire to hitch a ride to the vehicles driving on the road. According to Knobloch (2021), carpool benches provide a simple, low-threshold way for non-urban communities to enhance the mobility of their residents. Her investigation of such a project showed, that through collaboration with citizens this concept is quite accessible and easily understandable.

Nevertheless, also obstacles have been identified: “Fear of not being picked up, uncertainty about riding with strangers, unclear return options, and scepticism about functionality during winter are challenges to be addressed for the success of a carpool bench” (Knobloch, 2021, p. 3). To counteract this, it is advisable to implement measures addressing these issues during the implementation. Numerous municipalities have already introduced or are currently testing the commuter benches concept. For an overview of the projects in Switzerland, initiatives have been listed in Appendix G.

Taxito

Taxito operates similarly to carpool benches and aims to eliminate some of the uncertainties by implementing a modified approach. Users need to go to the nearest Taxito point and enter the desired destination via text message to the displayed number, which then appears on the electronic display. Passing by drivers see the desired destination and can pick up the person if they plan to go in the same direction. For additional safety, users send the car's license plate number to Taxito again via text message. Additionally, a small, symbolic payment is made to the driver via SMS. So far, this system has been established in seven regions all over Switzerland, including the Grisons (Chur – Maladers; Taxito, n.d.).

Ridesharing Platforms

Ridesharing platforms are online platforms or mobile applications that connect drivers with available seats in their vehicles to passengers traveling to the same or similar destinations. These platforms provide a space where drivers can offer empty seats in their cars for a particular journey, and passengers can search and request rides for their desired routes. They offer a convenient and flexible way for travellers to find companions for their trips, and they contribute to more sustainable and efficient transportation options. Additionally, these platforms often incorporate safety features such as user ratings and reviews to build trust and enhance security for both drivers and passengers (Mitropoulos et al., 2021).

There are several platforms that offer such a service. The following examples have been selected with the emphasis on their state of establishment, their existence in Switzerland and if they include the functionality to create a community for a certain geographic region, which was expressed as a desire for higher acceptance by the respondents (Scandella, 2023).

Table 6: List of selected ridesharing platforms (own table).

HitchHike	HitchHike is a digital platform designed to help groups create ridepooling arrangements. It allows businesses, institutions, and regional authorities to personalise ridepooling solutions with the help of HitchHike experts. Users can input their travel preferences, and HitchHike then matches and organises efficient ridepooling options in real-time. Drivers and passengers can communicate directly to finalise the ridepooling details (HitchHike, 2023).
TwoGo	TwoGo acts as a platform provider, facilitating ridepooling opportunities. Drivers and passengers can specify their preferred starting points, destinations, and arrival times for their travel preferences. TwoGo searches for the best carpool group, taking real-time traffic data into consideration. Once a suitable ride is found and confirmed, users are informed via SMS, email, or the app. Information about the travel itinerary, updates, pick-up time, and location are shared. The platform includes an integrated payment function and offers a feature that allows municipalities to create a community for their local area (twogo, n.d.).
BePooler	BePooler for municipalities is a digital solution that allows commuters, businesses, and residents of a community to form carpool groups. Users can offer or search for rides, connect with other ridesharing groups, and share their experiences (BePooler, 2023).
IDOSH	IDOSH is a ridepooling platform that operates through a mobile app. It allows drivers to publish their travel routes, and passengers seeking a ride option can connect with them. Both drivers and passengers are required to create an account and share some personal details. Contact information like email addresses and phone numbers is shared only after the ride request is accepted. The service is entirely cost-free for both drivers and passengers. Furthermore, users are rewarded with 'Coinz' based on the distance they travel, which can be redeemed for discounts or services at partner establishments, like SBB (IDOSH, 2023).
Covoiturage Arc Jurassien	The ridesharing service Covoiturage Arc Jurassien is an online platform and mobile application connecting drivers and passengers interested in sharing rides regionally limited within the Jura Arc region, which includes the cantons Neuchâtel, Jura, Bern, Vaud and crossing the border to the neighbouring communities in France. Users can search for available rides or offer their own, check user profiles, and make seat reservations through the platform. Payment for the journey is arranged directly (Covoiturage Arc Jurassien, 2023) between the driver and the passenger, following a fare estimate provided by the service.
Oberegg Fahr mit	In the regional project 'Oberegg Fahr mit', users can search for ridesharing opportunities or post planned rides with their private vehicles for free through the online platform "Ofami.ch". For both drivers and passengers, a one-time registration is required for safety reasons. (Ofami, 2021)
flinc	Flinc is an app-based ridesharing platform aimed at employees of companies and all other commuters. The main elements of the app include a platform and a system of incentives for ridepooling, which can be customised. Using the app, commuters can establish a long-term ridepooling network. Companies can create and implement individual mobility concepts, track ridepooling for their carbon footprint, provide incentives for forming carpool groups, and optimise their parking spaces based on their design (flinc, n.d.). This could also be applicable on a municipal level in Val Müstair.

6.3.3 Integrated mobility

Integrated mobility refers to the seamless integration of different modes of transportation like public transport, ridesharing and ridepooling into a single system, providing access through a common interface (Wolff & Corwin, 2020). It is a concept that aims to provide users with real-time information about a range of transportation options that can be used interchangeably to create a more efficient and sustainable mobility system and a flawless customer experience (Chowdhury et al., 2018; Matyas, 2020). Key features of integrated mobility may include real-time journey planning and updates, multi-modal ticketing, seamless transfers between different transportation modes, and integration with mobile apps and payment systems (Altay & Okumuş, 2022). The concept also promotes the use of shared mobility services and encourages sustainable transportation choices.

For many routes in rural areas, it is not possible to use only one mode of transportation to get from one point to another, unless one takes the car. Therefore, it is essential that different forms of mobility can be combined easily. This combination of various modes of transport can be facilitated and made easier, for instance, through integrated mobility and mobility hubs. The inclusion of integrated mobility in the assessment stems from its ability to combine the different and newly introduced mobility offers in the valley with the potential to boost them, which would be in the interest of the Biosfera. By providing users with real-time information about various transportation choices, integrated mobility empowers them to make more informed and sustainable transportation decisions.

With integrated mobility, residents, and visitors in Val Müstair can easily access different transportation modes through mobile apps and payment systems, streamlining their travel experience. By facilitating smooth transitions between modes, integrated mobility optimises the use of available transportation resources and ensures efficient mobility even during times when public transport might not be operating, reflecting one of the goals of the Biosfera.

Furthermore, this concept aligns with the Biosfera's vision of more sustainable mobility patterns, as it encourages and promotes the adoption of the in the system included travel options. By offering a wide array of transportation options and making them easily accessible through an integrated system, Val Müstair can enhance its transportation network, improve accessibility, and provide a flawless customer experience for its residents and visitors alike.

While there are many different ways of implementing integrated mobility, the main goal is to bring together disparate mobility modes onto a single digital mobility platform. In Val Müstair, it would make sense to integrate the existing public transport services, e-bike rentals, and newly introduced concepts under a single platform. This way, connections could be compared, and the best and most convenient options could be found, booked, and paid for on the same platform. Such a platform could be integrated in existing websites and systems like the one of the Biosfera, the municipality or the SBB. Since apart from Trafikscreen, no suitable integrated mobility solution was found within the geographically confined area of Switzerland, a project from Germany has also been incorporated into this category:

Trafikscreen

Trafikscreen is a multimodal mobility monitor that provides real-time information about various transportation options. With Trafikscreen, all mobility services within an area are interconnected using open data and displayed in real-time on a departure monitor. This monitor can be integrated into apps, websites, monitors of buildings and businesses, employee intranets, as well as public information panels. This ensures that residents, employees, or public transport users in the area are constantly informed about all current mobility options through a display, enabling them to choose the right mode of transportation for themselves (Mobilservice, 2023; Trafiko, n.d.–b).

GREEN (“Mitfahrtafeln”)

Implemented in cooperation between the German Environmental Foundation and the University of Kassel, this pilot project prioritizes sustainable mobility innovation. It introduces digital mobility platforms in four municipalities in Bavaria and Saxon. These platforms encompass digital mobility boards, an app, and a website, fostering ridesharing and enhancing access to local cultural experiences. The digital mobility boards, so-called “Mitfahrtafeln”, are placed at popular intersections of the participating towns. They are linked to an online application where residents can input one-time or recurring carpooling offers. These offers are not only displayed in an online calendar but also on the local display itself. At the indicated time, those who placed the offers pass by the mobility board and pick up interested carpoolers (bipar, 2023).

Additionally, in collaboration with local cultural sites, the display will facilitate privately organized and event-specific trips, aiming to provide improved access to regional cultural offerings for local residents (bipar, 2023). To foster alternative transportation adoption among residents, the project applies participatory approaches, gentle nudges, and gamification. The University of Kassel assesses these strategies scientifically. The research is still in progress and conclusions will be drawn in spring 2024 (Köbrich Léon & Schobin, 2021). Observing the outcomes of this study may prove important to the Biosfera. Hence, it is recommended to closely monitor the final results of this pilot project.

6.4 Suggested Implementation Strategies

After the Biosfera has selected implementable mobility concepts, it will, upon thorough examination, opt for one or more of them. The representatives of the surveyed interest groups have expressed recommendations and expectations for the specific implementation of these measures (Sections 4.4.2 and 5.3), which are specified here once again.

For the Biosfera in planning, testing, and implementing a new mobility offer, it is vital to engage the local community. Consultation and involvement of residents, businesses, authorities, and the tourism from the beginning are important. Their feedback can shape better solutions tailored specifically to the valley's distinctive requirements. Effective communication is another key for enhanced acceptance. By using diverse channels such as newsletters, social media, and local newspapers, stakeholders, including both residents and visitors, can be kept informed and updated about the new mobility initiatives.

Collaboration with stakeholders, especially those directly impacted by mobility changes like local businesses and the youth, is essential. Actively involving these groups ensures the solutions are community-driven and inclusive. Hosting community sessions and informational events will foster a sense of shared ownership and commitment. Moreover, it would be beneficial to form partnerships with other organizations, businesses, and tourism operators which can allow new mobility solutions to seamlessly integrate with existing services, enhancing their overall appeal.

It is also crucial to recognise the influential role of the hospitality and gastronomy sectors. By promoting sustainable transportation options to visitors and locals, these sectors can significantly accelerate their acceptance. Before a full-scale implementation, the Biosfera should prioritize starting with smaller pilot projects. These allow for the testing and refining of proposed solutions in real-world scenarios. Adjustments can be made based on real-world feedback and highlighting the tangible benefits from these pilot projects can win broader community support for the complete implementation.

In conclusion, by adopting a strategic and inclusive approach that emphasizes community engagement, clear communication, and early testing, the Biosfera can ensure that the community's needs and preferences remain central, leading to a more successful implementation of the selected mobility concept.

7 Conclusion and Outlook

This research paper deals with the shift towards more sustainable mobility the Biosfera Val Müstair. A special focus within this topic lies in supporting the Biosfera in investigating the mobility situation in Val Müstair, a rural-peripheral region in Switzerland, and attaining its sustainability and mobility goals. The Biosfera Val Müstair, an organization committed to promoting sustainability in its park area, recognises the importance of addressing sustainable mobility to tackle emission-related issues and improve the well-being of residents and visitors. As they lack the authority to build infrastructure or enact laws, the Biosfera focuses on initiating projects, facilitating exchange, and connecting stakeholders to work collaboratively.

Their main objective is to expand mobility offerings in a way that reduces private car usage without restricting people's mobility, enhancing accessibility for all population groups, and promoting sustainable transportation in the valley. To achieve this, they plan to introduce alternative transportation options in the project period from 2025 to 2028. They believe understanding mobility usage patterns, exploring improvement ideas, and learning from successful initiatives in other rural-peripheral regions can contribute to their goals. In this context, the contribution of the research thesis is significant, as it shed light on mobility patterns in the valley, offering ideas for improvement, and identifying successful initiatives from other regions that have reduced reliance on private motorised transportation.

This study analysed prevailing mobility practices among different interest groups in Val Müstair, identifying current mobility usage patterns and expectations, desires, and concerns regarding new mobility options. Additionally, factors enabling the implementation and influencing the acceptance of alternative transportation offers were explored. By combining interview data with a literature review, the thesis identified suitable mobility solutions tailored to the region's requirements and preferences.

Prevailing Mobility Practices

The research findings reveal that the prevailing mobility practices in Val Müstair valley are characterised by a strong dependence on motorised private mobility, with cars being the primary mode of transport for both residents and tourists. Despite some efforts to promote alternative options, such as public transport and shared mobility, the car-centric mindset remains deeply ingrained in the community. The practicality, flexibility, and perceived freedom associated with private cars are the main reasons for their widespread use in the valley. Commuters in particular, find cars more convenient and time-saving compared to public transport options. Slow traffic alternatives like bicycles and e-bikes show potential among tourists but are not widely embraced by locals due to infrastructure limitations, challenging terrain and harsh climatic conditions.

Collected Suggestions for the Improvement of the Mobility System

During the interviews, various expectations, desires, and concerns regarding new mobility options emerged from the participants. The focus was on reducing car dependency, promoting sustainable transportation, and enhancing public transport services. Suggestions included increasing bus frequencies, introducing an express bus, extending operating hours, and providing affordable night bus services mainly for young people.

Factors Influencing the Introduction and Acceptance of New Mobility Offers

Affordability was a key consideration for acceptance, and ideas to make mobility options accessible and economical for different demographics were discussed. Participants proposed general subscriptions for seniors, regional network cards similar to GA travel cards, and tax incentives for using public transport or e-bikes. The introduction of improved taxi services or slow traffic options such as bicycle lanes and horse-drawn carriage services was also suggested, as well as online platforms providing the opportunity to connect people in the valley for ridesharing purposes.

Factors influencing the acceptance of new mobility offers were explored, and sustainability considerations were emphasised. Participants highlighted the importance of ecological sustainability, reducing emissions, and ensuring accessibility and inclusivity for all residents and visitors. Practicality and acceptance were crucial factors as well, with suggestions to integrate different transportation modes, offer flexible and adaptable services, and prioritise safety and security.

Suggested Mobility Concepts and Concrete Suggestions

To implement new mobility options successfully, stakeholder involvement and collaboration were deemed essential. Community engagement through meetings and information events, as well as partnerships with local businesses and tourism operators were proposed. To assess the feasibility and build confidence among the community, pilot projects were suggested to ensure a more strategic and inclusive implementation phase. Suggested mobility concepts for the Biosfera Val Müstair were identified based on their alignments with the goals of the Biosfera and the expectations and requirements of the other interest groups investigated. The categories of ridepooling, ridesharing, and integrated mobility resulted as the most applicable concepts for Val Müstair. Ridepooling involves sharing rides with others traveling in the same direction using buses or vans, operated by professional drivers and licenced vehicles. Examples are Bus Alpin, PubliCar, Mybuxi, and the general concept of Citizen Buses. Ridesharing involves private vehicle owners offering the free seats in their car on routes they would drive anyway on a non-profit basis. Practicable concepts of ridesharing like Commuter Benches, Taxito, and various online platforms like HitchHike, TwoGo, BePooler, IDOSH, and Covoiturage Arc Jurassien were presented. Integrated mobility combines different transport modes into a single system with real-time information, enabling users to organise their travels in a seamless way as it integrates all available transportation options under a common platform. A suggested option is Trafikscreen or the pilot project “Mitfahrtafeln” from GREEN.

The information obtained in this thesis offers a deep and diverse insight insight into the attitudes of the interest groups present in Val Müstair. Therefore, this research provides the Biosfera with a detailed understanding of mobility motivations and the prevalence of private motorised traffic for individual mobility. It uncovers the reasons for which residents prefer certain modes of transport, and more importantly, it outlines their suggestions on how to improve the mobility network in Val Müstair. The suggested mobility concepts which were found based on the perspectives of the interviewees should only be implemented after a comprehensive analysis of the feasibility. Financial, organizational, and social aspects all need to be considered, as they

were outside the scope of this master's thesis. It is recommended to approach mobility enhancements holistically, as combining several suggested concepts would probably lead to the best results. One such example could be the introduction of commuter benches paired with the Taxito system to ensure passenger safety. To avoid people having to wait for a ride at a bench, an online system like HitchHike could be added. This platform would allow drivers and passengers to plan their shared rides, either by posting an offer or a ride request. The online service would then match the passenger with the driver, eliminating any waiting time. All of this could be combined through an integrated mobility system like Trafikscreen, thereby simplifying the organization.

However, the most essential aspect is that the chosen solution must be broadly supported by the community. This support can only be achieved through a participatory planning process, allowing everyone to have a say and contribute their insights. A pilot project is recommended to settle any potential doubts and sceptics, to gather additional suggestions for improvement and to increase the potential of adoption of the system by the community.

For further studies of this mobility research, it would be beneficial to focus on the application and impact of the mobility enhancements proposed and the resulting changes in behaviours, rather than just collecting information about the current state of mobility and suggestions for its improvement. Hence, it would be interesting to investigate how the Val Müstair community and other interest groups are affected by and respond to these enhancements, and how they perceive and rate the changes in the mobility landscape. As the success of the mobility enhancements depends on their acceptance and usage by the local population, obtaining insights into the experiences and opinions of the local people after the implementation could shape future adjustments and further improve the mobility network in Val Müstair.

To reach a broader population and to provide a more comprehensive analysis of the effectiveness of the implemented mobility enhancements, the use of quantitative methods would be beneficial. This could help produce extensive statistical analyses of trends in mobility behaviours and other significant data. Therefore, a combination of qualitative and quantitative research methods could reinforce the findings of this study and could also be helpful for Biosfera Val Müstair and other rural-peripheral areas in planning and implementing successful mobility enhancements.

In conclusion, this thesis underscores the urgent need for sustainable mobility solutions in the Biosfera Val Müstair, as echoed by various representatives of interest groups, including commuters, tourism, the Nature Park, and others. By combining the knowledge and participation of the local community, the Biosfera can foster a resilient and future-proof transportation system that complements the region's unique characteristics and contributes to a more healthy and sustainable future for everyone in the valley.

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Appendix A – Route Network of Public Transport in Val Müstair

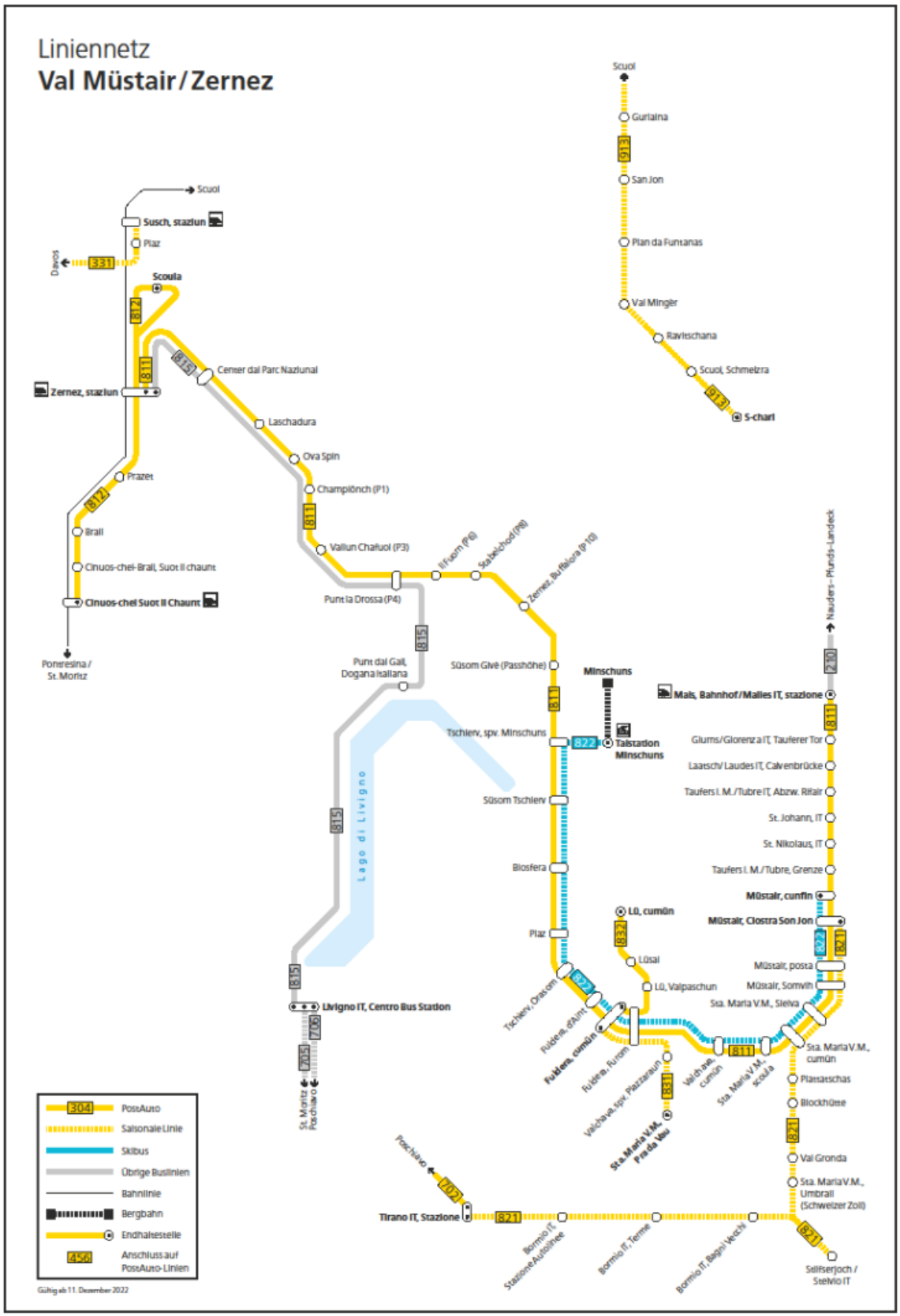

Figure 11: Schematic presentation of public transport network in and around Val Müstair (PostAuto, 2022)

Appendix B – Interview Guideline

Personal information and purpose of the interview

- Short introduction: The interviewer briefly introduced themselves, providing their name, age, study background, and the reason for conducting the interview, which was to gather reliable answers and data for their master thesis.
- Aim of the interview: The main goal of the interview was communicated with the interviewees. It consists of exploring the prevailing mobility practices among interest groups of Val Müstair, collecting suggestions for improvement of the mobility network and finding factors influencing the acceptance of potential new mobility options. Based on this, it is planned to provide the management of the Biosfera Val Müstair with an overview of the status quo of mobility and make suggestions on how the mobility network could be improved
- Ethical formalities:The interviewer obtained the explicit permission from all participants to record the interviews. It was assured that all data collected would be treated with confidentiality and will only be used for the evaluation of this thesis. After submission, all recordings would be deleted. Participants were informed about who would have access to the thesis and how their answers would be used exclusively for the results and discussion in the thesis.
- Length and process formalities: It was communicated that the interview would be conducted in German and last approximately 30 – 60 minutes. After that, the interviewer checked, if the interview partners had any remaining questions before starting the interview.

Themes to ask during the interview

- Personal relation to the region Val Müstair
- Transport behaviour in the Biosfera Val Müstair:
    - Typical modes of transportation
    - Frequency of using different transportation options
    - Travel planning within and to the valley
    - Perception of dis-/advantages of mobility options
    - Challenges or barriers regarding mobility
    - Suggestions to overcome challenges
- Awareness of existing alternative mobility options in the region
- Consideration of alternative transportation modes:
    - Factors influencing decision to consider alternative modes
    - Impressions and experiences with alternative transportation options
    - Alignment of impressions with the interest group’s perspective
- Factors/measures facilitating the acceptance/adoption of alternative mobility options
- Hopes, challenges, and concerns related to transitioning to more sustainable modes of transportation

- Desired involvement of interest group in development and planning process of new mobility offerings

During the interview

- Guide interviewee between different topics and provide transitions
- Double check if the recording is still working

After the interview

- Data storage for further transcription
- Special thank you to interview partner for their time and personal exchange
- Exchange on how to stay in contact in case of back-up questions

Appendix C – Transcript of Interview with Franziska Peter

Interview 1: Franziska Peter, Director of Education and Culture at Biosfera, online, February 28, 2023

CK: Kannst du einen Überblick über die aktuelle Nachhaltigkeitssituation in der Biosphäre Val Müstair geben?

FP: Unser Sinn und Zweck in der Biosfera Val Müstair ist eigentlich, die Nachhaltigkeit in unserem Park-Perimeter zu fördern. Das heisst, wir sind eine Plattform, welche verschiedene Projekte im Bereich Natur, Gesellschaft und Wirtschaft startet und unterstützt.

CK: Also ist die Nachhaltigkeit eigentlich eure Hauptaufgabe?

FP: Einerseits arbeiten wir laufend daran, in unserem Betrieb noch nachhaltiger zu werden. Unsere Hauptaufgabe ist, als Modellregion Val Müstair, die Nachhaltigkeit hier im Tal zu fördern.

CK: Cool. Geschieht das denn eher aus intrinsischer Motivation heraus, oder eher, weil es eure Aufgabe als Teil der Institution UNESCO Biosphäre ist?

FP: Das ist unsere Aufgabe als Naturpark. Das heisst jetzt nicht, dass wir in diesem Bereich super unterwegs sind. Aber wir engagieren uns laufend, dass dies besser wird.

CK: Wo legt ihr eure Schwerpunkte bei den Nachhaltigkeitsanstrengungen?

FP: Nachhaltigkeit wird ja in diesen drei Säulen Wirtschaft, Gesellschaft und Ökologie verstanden. Wir probieren diese drei Bereiche relativ ausgeglichen zu gewichten.

CK: Was ist die Ausgangslage bezüglich dem Mobilitätsverhalten in der Biosfera? Wo liegen Probleme? Gibt es Daten?

FP: Unser Ziel ist es, die Nachhaltigkeit zu fördern. Hauptsächlich sind wir durch Kanton und Bund finanziert und haben da immer mehrjährige Programme, wo wir unsere Aktivitäten und das dazugehörige Budget beschreiben, welches wir dann hoffentlich auch erhalten. Hier sind wir eigentlich sehr frei, wo wir unsere Schwerpunkte setzen möchten. Im Zeitraum 2016-2019 hatten wir ein Projekt, welches sich explizit der Mobilität widmete. Im Zeitraum 2020-2024 hatten wir dieses aber nicht mehr, da wir 2016-2019 gemerkt haben, dass unser Handlungsspielraum im Bereich Mobilität eher eingeschränkt ist, beziehungsweise müssen wir das, was wir machen, irgendwie in Projekte aufteilen. Dabei haben wir gemerkt, dass wir Mobilitätsprojekte noch machen können, aber diese vielleicht mehr unter anderem Titel laufen lassen. Zum Beispiel Tourismus, wenn es ein touristisches Angebot ist, oder Bildung und Sensibilisierung. Dies damit wir trotzdem noch Handlungsmöglichkeiten haben, aber wir sonst zu wenig Spielraum haben, um ein separates Projekt Mobilität zu starten.

CK: Woran liegt das, also wo liegen die Probleme? Sind es zu viele Akteure oder…?

FP: Wir haben eigentlich die Aktivitäten von 2016-2019 auch in der Phase 2020-2024 weitergeführt, jedoch haben wir dann beispielsweise das E-Bike Angebot im Bereich Tourismus oder den Kulturbus im Bereich Kultur weiterlaufen lassen. Jetzt, im Prozess der Planung 2025-2028 ist diese Vorgehensweise noch nicht in Stein gemeisselt. Vielleicht gibt es dann auch wieder ein Projekt mit dem Titel Mobilität. Von der Sache her hat natürlich ein Projekttitel schon einen gewissen Stellenwert, aber schlussendlich können wir die Projekte, welche die nachhaltige Mobilität fördern, meistens unter anderen Titeln umsetzen. Das heisst nicht unbedingt, dass wir jetzt nichts mehr in dem Bereich machen.

CK: Jetzt hast du gerade zwei Beispiele eurer Initiativen im Bereich Mobilität genannt mit dem Kulturbus und den E-Bikes: Wie war da die Akzeptanz und die Reaktion auf die Einführung und wie sieht das Nutzungsverhalten jetzt aus? Werden die E-Bikes zum Beispiel auch von Locals benutzt oder eher von Tourist:innen?

FP: Bei den E-Bikes weiss ich das nicht, da müsste ich meine Kollegin Aline noch fragen. Ich kläre das ab. Meine Vermutung ist, dass die E-Bikes schon hauptsächlich von Tourist:innen benutzt werden, da die hier wohnenden Menschen eher ein eigenes besitzen, falls sie dies brauchen. Den Kulturbus haben wir ungefähr 2018 eingeführt und seither gibt es steigende Nutzungszahlen, hauptsächlich auch von Touristen. Ich glaube bei den Einheimischen bestehen schon sehr starre Mobilitätsmuster, heisst dass die meisten ein Auto besitzen und dieses auch nutzen. Sie überlegen sich oft gar nicht, dass sie das Auto auch mal stehen lassen könnten.

Bezüglich Kulturbus habe ich noch Neuigkeiten. Nachdem du das Proposal erstellt hast, hat mir der Betreiber des Kulturbusses gemeldet, dass sich dieser für ihn nicht mehr lohnt. Das Auftragsvolumen für die Shuttlebus- und Kulturbusfahrten ist schlicht zu klein, um einen Angestellten einzustellen und alleine packt er es nicht, da die Fahrten auch oft am Abend noch stattfinden. Wir sind jetzt dran, eine Nachfolgelösung zu finden. Deshalb ist es wirklich ein super Zeitpunkt für deine Arbeit.

CK: Gibt es noch mehr, was du zur Ausgangslage und Status Quo bezüglich Mobilitätsverhalten sagen kannst?

FP: Im Bereich Mobilität ist im Moment viel Bewegung drin. Im Rahmen der Abklärungen zur Nachfolge eines Kulturbusses habe ich erfahren, dass gerade ein Ausbau der späten Postautoverbindungen zur Diskussion steht, dass diese die ganze Woche von Tschierv und Zernez bis Müstair fahren würde. Plus seit dem Fahrplanwechsel (Dezember 2022) gibt es neu auch eine späte Postautoverbindung von Mals bis Müstair. Möglicherweise sind auch noch weitere Verbesserungen im Kommen.

Sonst noch zu Rahmenbedingungen und Ausgangslage: Wir haben eine Hauptstrasse und eine Dorffraktion, welche nicht an dieser Hauptstrasse liegt. Diese Strasse verbindet das ganze Tal. Mit dem Velo ist es umständlich, da es relativ viele Höhenmeter zu überwinden gibt. Im Winter ist es kalt. Es gibt ein Postauto, welches mehr oder weniger stündlich verkehrt. Für viele Einheimische reicht dies halt nicht. Und so wie ich es von den Gästen wahrnehme, gab es bisher einfach am Abend diese Lücke und dass diese eine Einschränkung sein kann, wenn man zum Beispiel abends in ein anderes Dorf will für das Abendessen. Ein weiteres präsentes Thema ist die Abwanderung, dass vor allem die jungen Menschen gehen. Dies wiederum führt zu einer Überalterung.

CK: Es gibt also auch noch allgemeine, demografische Probleme im Tal, welche noch hinzukommen. **Gibt es denn etwas bezüglich Mobilitätsdaten?**

FP: Es gibt Daten. Da müsste ich meine Kollegin Linda, unsere Wissensmanagerin, konsultieren. Wir vom Naturpark machen einfach ein Monitoring und wollen gewisse Kennzahlen aufnehmen, um den Erfolg unserer Aktionen dann auch einschätzen zu können. Da haben wir auch gewisse Zahlen im Bereich Mobilität, welche wir selber aufnehmen oder nachfragen, zum Beispiel die Postauto-Auslastung. Ich werde abklären, welche Daten wir haben und dir diese dann weiterleiten.

CK: Gibt es bestimmte Perioden/Zeiträume, wo gehäuft Probleme oder Nutzung gibt?

FP: Wir haben etwa 1450 Einwohner, welche wir im Tal haben, plus Touristen. Touristen haben wir im Sommer mehr als im Winter. Der ÖV ist gut im Sinne von stündlich, ungefähr ab 6:30 bis 20:00, danach haben wir Lücken. Und betreffend Saison haben wir im Sommer bezüglich Mobilität ein Problem wegen den Massen. In Santa Maria gibt es eine enge Stelle auf der Kantonsstrasse, kombiniert mit einer Kreuzung, was häufig zu Verstopfungen führt, welche dann Teils sogar erst mithilfe der Polizei entwirrt werden können. Deshalb ist auch schon lange eine Umfahrung in Santa Maria in Planung, um dieses Problem zu lösen. Da gibt es aber natürlich noch viele Hürden und wird deshalb noch ein Weilchen dauern bis zur Umsetzung.

Im Sommer sind es also die Massen, es gibt viel Durchgangsverkehr, welcher ins Südtirol will, und dann haben wir mit dem Ofen-, Umbrail- und Stelviopass auch noch die Rennautos, welche im Sommer einfach die Pässe hochheizen wollen. Im Sommer gibt es viele verschiedene Gruppen auf der Strasse: Fahrradfahrende, Motorräder, Rennautos, Reisecars, Wohnmobile, und alle anderen Autos. Das kann laut, unübersichtlich und gefährlich sein. Auf den Pässen gibt es viele Unfälle, wozu es auch gute Statistiken gibt.

CK: Bezüglich einem Infrastrukturprojekt wie der Umfahrung, wie stellt sich die Biosfera denn dazu?

FP: Wir als Biosfera können Projekte anstossen, eine Austauschplattform bieten, Menschen miteinander vernetzen. Was wir nicht können, ist Infrastruktur bauen oder Gesetze erlassen. Infrastrukturprojekte sind Sache der Gemeinde, hier haben wir in diesem Sinne keine offizielle Haltung. Wir sind mit Bundes- und Kantonsgelder finanziert und können/dürfen diese nicht nutzen, um politisches Lobbying zu betreiben. Wir spielen jetzt aber im Beispiel der Umfahrung eine Rolle, und zwar ist unser Chef David Teil einer Beratungsgruppe, wo Experten, Verbände und andere Stakeholder vertreten sind und die Varianten für die Umfahrung diskutieren. Er bringt da unsere Sicht des Naturparks ein für eine möglichst umwelt- und naturverträgliche Lösung.

Offiziell nehmen wir also keine Position ein, da unser Ziel ist, möglichst mit allen Menschen zusammen zu arbeiten. Wir sind nicht die, die entscheiden, sondern nehmen die Ausgangslage so wie sie ist und machen das Beste daraus.

Aktuell gibt verschiedene grössere Projekte im Tal. Ein Investor möchte eine Hotel- und Ferienwohnungsanlage kombiniert mit einer neuen Zubringerbahn ins Skigebiet realisieren, und eine Hütte soll zu einer SAC-Hütte umgebaut werden. Zu diesen Projekten nehmen wir nicht offiziell Stellung. Im Fall der SAC-Hütte haben wir aber eine Studie mitfinanziert, welche die Auswirkungen der durch den Ausbau der Hütte zunehmenden Menschenmassen im Gebiet untersucht.

CK: Wie sieht es denn im Tal mit der Veloinfrastruktur aus?

FP: Es gibt eine Veloroute von SchweizMobil (Nr. 29) durch das Tal, eher für Tourenvelofahrer, welche in vielen Ortschaften nicht über die Hauptstrassen, sondern hauptsächlich über Forststrassen führt. Velowege gibt es keine.

Ich möchte nochmal auf die Probleme bezüglich Mobilität im Tal zurückkommen. Das Auto ist wichtig. Das Problem stellt sich für all diese, die das Auto nicht nutzen wollen oder können. Dies betrifft bestimmte Altersgruppen wie unter 18-Jährige oder Menschen, die aufgrund fortgeschrittenen Alters oder Beeinträchtigung nicht fahren können, und Touristen, welche ohne Auto anreisen, was wir als Tal auch fördern möchten aus dem Nachhaltigkeitsgedanken heraus. Da liegt eigentlich das Hauptproblem bezüglich Mobilität.

CK: Also sehe ich das richtig: Die Autos sind zwar sehr präsent, jedoch stellen sich den Menschen Probleme, welche dieses nicht nutzen können. Es bräuchte ein Angebot, welche dieses Angebot und die Nachfrage gescheit verbinden würde - Stichwort Shared Mobility.

FP: Genau, das ist sehr spannend. Die Autos, welche Menschen hier besitzen, stehen ja 90% der Zeit und wenn sie fahren, sind sie nur sehr schlecht ausgelastet.

CK: Ok. Kommen wir zu den bereits gestarteten Prozessen und lancierten Angeboten von euch. Du hast bereits den Kulturbus erwähnt oder das Angebot der E-Bikes bei Hotels. Welche Angebote bietet ihr sonst noch an?

FP: Also vom Naturpark aus haben wir ein E-Auto, welches wir einerseits als Geschäftsauto nutzen, andererseits aber auch vermieten. Durch diese kombinierte Nutzung lohnt sich das. Wir brauchen es meist während den Bürozeiten, und am Abend, wenn die Lücke im ÖV besteht, oder am Wochenende steht das Auto zur Verfügung. Da ist jetzt gerade auch etwas im Gange. Ich wurde letztens von Graubünden Ferien kontaktiert. Sie wollen im ganzen Kanton das E-Car-Sharing Angebot fördern, weil die Situation wie auch wir sie bei uns vorfinden, also schlechter ÖV im Berggebiet topographisch bedingt und aufgrund tiefer Nutzungszahlen, gibt es in vielen Regionen im Graubünden. Das könnte spannend sein, wenn im ganzen Kanton mehr solcher Angebote bestehen würden. Sie arbeiten im Projekt mit Mobility zusammen. Jedoch müssten wir, falls wir umsteigen würden auf Mobility, rund doppelt so viel bezahlen, wie wenn wir das Angebot beibehalten, so wie jetzt.

Unser E-Auto ist halt hier in Tschierv stationiert, weil hier auch unser Büro ist und wir das E-Auto ja auch als Geschäftsauto nutzen. Als Standort wäre eigentlich Santa Maria oder Müstair besser geeignet, weil da mehr Leute sind. Im Moment lohnen sich halt mehrere Standorte nicht, weil auch die Nutzung zu tief ist. Letztes Jahr haben wir durch die Vermietung CHF 2000 verdient. Das Mobility-Angebot würde uns jährlich CHF 16'000 kosten. Da siehst du die Herausforderungen, welche sich stellen.

CK: Spannend. Und was kommen dir sonst noch für Prozesse oder Angebote in den Sinn?

FP: Tourismus ist auch ein wichtiges Standbein in der Wirtschaft des Val Müstair. Da gibt es auch verschiedene Aktionen, um den ÖV zu fördern. Seit ca. einem Jahr erhalten Gäste, die im Val Müstair übernachten, sei es in einer Ferienwohnung, Hotel, Lagerhaus, eine Gästekarte. In dieser ist ÖV inklusive, von Zernez bis Mals und ich glaub auch auf den Umbrailpass. Das macht auch das Anreisen mit dem ÖV wieder attraktiver. Das wurde von den Gästen auch gut angenommen. Nur die Betreiber der Unterkünfte stören sich ein wenig, da sie nun mehr Kurtaxen bezahlen müssen. Bei der Einführung von neuen Angeboten besteht halt oft das Huhn-Ei Problem. Die Nachfrage nach Angeboten scheint nicht da zu sein bei den Einheimischen, aber wenn das Angebot nicht passt, dann kann die Nachfrage gar nicht da sein.

Jetzt kommt mir noch etwas in den Sinn. Es gibt den Romex-Transport, welcher unter anderem auch den Kulturbus betrieben hat. Er hat auch noch einen Taxi- und Shuttle-Service angeboten. Aber insgesamt hatte er mit diesen Transportdienstleistungen nie so viel Nachfragen, dass es sich gelohnt hätte, eine neue Stelle zu schaffen. Deshalb möchte er dieses Angebot jetzt reduzieren. Für ihn ist der Versuch gescheitert. Diesen Sommer will er das Angebot noch aufrechterhalten, längerfristig scheint er aber nicht an eine Weiterführung zu denken.

CK: Gut, dann kommen wir langsam zum Thema Vision: **Was sind, abgesehen der Förderung der Nachhaltigkeit in den drei Säulen, die Vision und Ziele der Biosfera, auch bezüglich Nachhaltigkeit?**

FP: Das ist eine gute Frage. Immer nachhaltiger werden. Wenn du auf die Mobilität ansprichst, ist die Vision schon, das Angebot so auszubauen, dass es ohne oder mit wenigen Einschränkungen möglich ist, auf das private Auto zu verzichten. Hier haben wir noch viel Arbeit vor uns.

CK: Gut, ich glaube das können wir so stehen lassen. **Welchen Beitrag kann denn meine Masterarbeit in dieser Problematik leisten? Oder welche Erwartungen und Hoffnungen habt ihr?**

FP: Cool wäre, wenn so einzelne Puzzleteile beigesteuert würden. Nachhaltigkeit und Mobilität sind sehr aktuelle Themen, wo sich sehr viel bewegt und neue Möglichkeiten entstehen. Du hast vorher Car-Sharing und digitale Möglichkeiten angesprochen, die man einfach erst kennen muss, bevor man sie einführen kann und sie dann gar nicht so umständlich und kostenintensiv in der Einführung wären. Wenn wir hier nur schon auf eine Idee gebracht würden, und du dann sogar noch abgeklärt hast, dass danach auch die Nachfrage besteht, das wäre mega cool.

CK: Ich versuche mein Bestes.

FP: Oder auch, um den Druck ein wenig von dir wegzunehmen: Herausfinden, welche Angebote zum Beispiel nicht funktioniert haben, die wir nicht auch noch versuchen müssen, das wäre auch schon etwas.

CK: Cool. Kommen wir zur nächsten Frage. **Warum ist der Biosfera nachhaltige Mobilität so wichtig?**

FP: Uns ist grundsätzlich Nachhaltigkeit wichtig, und Mobilität einfach bezüglich Emissionen ein wichtiger Punkt und Hebel in diesem Bereich. Es sind aber nicht nur die Feinstaub-, Lärm- und Treibhausgaremissionen, sondern auch das Wohlbefinden der Bewohner des Tals, welches durch den vielen Verkehr beeinträchtigt wird. Sei es wegen externen Effekten wie Verstopfung der Strassen, Stau, Unfällen oder sozialen Aspekten.

CK: Was sind denn die grössten Herausforderungen und Hürden?

FP: So wie ich es wahrnehme, ist eine der grössten Hürden, dass zu wenig Menschen im Tal wohnen und von diesen zu wenig den ÖV regelmässig nutzen. Es braucht wie eine minimale Nutzung und Frequenz, damit sich diese Angebote lohnen. Sei es E-Autos, Postautos, usw. Mobility ist eine tolle Sache und funktioniert an vielen Orten, jedoch wenn wir jetzt CHF 2000 mit Autoverleih einnehmen, und das Mobility-Angebot kostet uns CHF 16'000, lohnt es sich schlicht nicht. Auch das Postautoangebot würde sofort weiter ausgebaut, wenn dieses öfters genutzt würde.

Ich habe mir letztens mal das Rufbus Angebot des Naturparks Thal angeschaut und das Verhältnis zwischen Einwohnern im Einzugsgebiet und der getätigten Fahrten des Rufbusses, und dies dann herunter gerechnet auf unser Einzugsgebiet im Val Müstair. Und da kam eine Nutzung von drei Fahrten raus. Da bezahl ich lieber diesen drei Menschen ein Taxi, als ein ganzes System aufzubauen.

CK: Also auch wieder die Kosten-Nutzen Thematik. Da wäre es bestimmt hilfreich, die Nutzungsgruppen zu analysieren, und was bei ihnen die Push-Faktoren zur Nutzung solcher Angebote wären. **Wo liegen denn bei euch die finanziellen Grenzen? Die Umsetzung selbst liegt ja nicht bei euch grundsätzlich?**

FP: Also es gibt gewisse Aspekte, die ganz klar Aufgabe der Gemeinde sind, wie zum Beispiel der Postautokurs. Aber andere Angebote, wie das E-Auto, können wir gut machen. Da ist aber die Gemeinde, welche unter grossem finanziellem Druck steht. Auch wieder wegen der Abwanderung, überalternde Gesellschaft, wenig Steuereinnahmen, riesiges Gemeindegebiet mit grossen Wäldern und Schutzwäldern.

CK: Angewendet auf das Mobilitätsangebot ist folglich bestimmt wichtig, dass dieses niederschwellig umzusetzen ist mit tiefen Startinvestitionen, oder?

FP: Jetzt hole ich ein bisschen aus. Was an der Mobilitätssituation hier auch sehr unelegant ist, ist dass man, um überhaupt ins Val Müstair zu kommen muss man erst etwa eine halbe Stunde durch den Nationalpark fahren. Also das am besten geschützte Gebiet der Schweiz wird durchschnitten durch eine Kantonsstrasse, durch welche Lärmemissionen, Abgase und vieles mehr in dieses Schutzgebiet eingetragen wird. Es gibt diesbezüglich eine jahrhundertealte Idee, einen Tunnel von Scuol ins Südtirol zu bauen und so den Nationalpark zu umfahren. Ein grosser Teil des Verkehrs im Val Müstair besteht ja auch durch Grenzgänger, welche vom Südtirol in die Schweiz fahren, um zu arbeiten, ins Val Müstair oder ins Engadin. Diese fahren alle durch das Tal. Da wäre vielleicht eine Lösung von Car-Sharing im Pendlerverkehr zu prüfen.

CK: Was sind denn die wichtigsten Faktoren, welche die nachhaltige Mobilität fördern könnten?

FP: Ich glaube die Kommunikation, im Sinne von die Denkmuster der Menschen zu brechen und die Leute zu gewinnen. Es muss einfach, günstig und verlässlich sein. Der Mensch ist ein Gewohnheitstier, und da stellt sich die Frage wie man die Leute dazu bringt, etwas Neues zu benutzen, nach jahrelangem Fokus auf den MIV.

Oft geht es auch einfach ums eigene Portemonnaie. Da kann auch ein grosser Hebel sein, wenn etwa das Autofahren teurer oder die Alternativen sehr günstig werden. Da haben wir wie bereits erwähnt als Naturpark keinen grossen Hebel, wir können keine Gesetze erlassen, die das Autofahren teurer machen. Die Hebel die wirklich was bringen sind, wenn es ans Portemonnaie geht oder etwas Verboten wird.

CK: Da sind wir jetzt bei den von aussen gegebenen Rahmenbedingungen, welche sicher stimmen müssen, um etwas zu ändern. **Siehst du denn politische Instrumente, welche bei euch die nachhaltige Mobilität fördern könnten? Beispielsweise eine Durchfahrtsgebühr für die Strasse oder Pässe.**

FP: Gut, dass du das sagst. Das würde natürlich etwas verändern. Ich habe das nicht im Detail untersucht, aber das Stammtischgespräch diesbezüglich ist, dass so eine Massnahme in der Schweiz nicht erlaubt oder extrem schwierig umzusetzen ist. Das ist glaube ich eher unrealistisch, aber es würde natürlich etwas bringen.

Auf Ebene der Gemeinde, diese bestellt die Postautokurse, und muss sich nach einem gewissen Schlüssel auch finanziell daran beteiligen. Das ist einer der Hebel. Und im Moment sind noch alle Parkplätze auf dem Gemeindegebiet noch gratis. Da sind wir politisch bei der Gemeinde dran abzuklären, was hier die Vorgaben sind. Auch wäre dies eine willkommene zusätzliche Einnahmequelle. Das wäre eine Möglichkeit, auch bei Gästen, welche nur für einen Tag kommen und an diesem nichts konsumieren im Tal, auch von ihnen eine gewisse Einnahme zu haben. Wie zum Beispiel Skitourengänger, Biker und so weiter. Eine Alternative wäre, die Parkgebühr gleich als Konsumationsgutschein zu gestalten, dass die Leute die Möglichkeit haben, mit den beispielsweise CHF 5 Parkticket etwas im Tal zu konsumieren. Damit wenn die Gäste schon kommen und negative Effekte mit sich bringen, dass dann wenigstens noch ein wenig Wertschöpfung generiert wird.

CK: Welche Stakeholder und Interessensgruppen sollten auf keinen Fall vergessen gehen und welche wären zusätzlich 'nice to have'?

FP: Da ist sicher die Gemeinde, der Gemeindevorstand. Es ist ja nur eine Gemeinde. Dann der lokale Tourismusverband. Das sind die zwei allerwichtigsten, welche dann schlussendlich auch die Rahmenbedingungen schaffen und die Angebote schlussendlich bereitstellen können und diese nicht nur nutzen. Zusätzlich wäre eine Vertretung der Jungend, eine der älteren Generation, Feriengäste, von Hotel, Gastro und Gewerbe. Grenzgänger und allgemeine Pendler, welche von oder nach Val Müstair pendeln. Wir haben auch noch ein Gesundheitszentrum, das kleinste Spital der Schweiz, welches auch einen Spitex-Dienst anbietet. Die sind auch viel im Tal unterwegs, aber für die Untersuchung wohl eher unwichtig. Und den Naturpark hast du jetzt ja bereits interviewt mit mir.

CK: Gut. Und ermöglichende Faktoren für neue Mobilitätsangebote, kommen dir da neben den vorher genannten noch weitere in den Sinn?

FP: Also wie bereits erwähnt, der Kosten-Nutzen-Faktor. Also die kritische Minimalnutzung, um das Angebot tatsächlich starten zu können im Verhältnis zu den Kosten. Zuverlässigkeit. Beim Beispiel Mitfahrbänke kommt mir auch noch der Punkt Sicherheit in den Sinn, welcher sicher zu jeder Zeit gewährleistet sein muss.

CK: Super besten Dank. Zu diesem Thema werde ich bestimmt auch noch viel Literatur finden. Gut, ich glaube wir haben echt viele Informationen sammeln können und kommen langsam zum Ende. Herzlichen Dank für deine Zeit und Energie. Falls dir noch etwas in den Sinn kommt, jetzt nach dem Interview, lass mir diese Infos gerne noch zukommen.

FP: Ja sehr gerne. Ich schaue, dass das mit Linda noch klappt.

CK: Cool. Herzlichen Dank Franziska, das Interview war sehr spannend.

Appendix D – Code System

Codesystem	**468**
1. Research objectives and preconditions	0
Research objectives Biosfera	10
Things to be aware of	11
Stakeholders	0
Municipality Val Müstair	5
Tourism	5
Previous initiatives and efforts	0
Bypass Sta. Maria	5
Improved public transport	4
Hiking bus	1
Parking situation	2
Guest card Plus	1
Free luggage transport	1
Car-key-for-bike program	1
Car sharing	1
Cab service	1
2. Prevailing mobility practices	0
Modes of transportation	0
Shared mobility	1
Hitch-hiking	6
Car pooling	14
Motorized private mobility	0
Private car	46
Moped	6
Tractor	2
Scooter	1
Public Transportation	0
Buses	38
Kulturbus	5
Hiking bus	3
Ski resort / Ski bus	2
Trains	2
Public Transport overall	6
Public transport included (Guest card)	15
Public transport included (Grün+Gratis)	4
Electric car rental services	7
Taxi	5
Slow traffic	0
Bicycles and e-bikes	14
Bike rental shop	7
E-bikes provided by hotels	6
Walking	5
Kick scooter (Trottinett)	1
JST electric wheelchair	1

Figure 12: Screenshots of final code system in MAXQDA 2022. Showing codes and different levels of sub-codes, as well as the number of coded segments for each code (own image).

Appendix E – Justification for Exclusion of Mobility Categories

	Definition	Reason to exclude	Examples (Trafikguide)
Pedestrian traffic	Offers promoting pedestrian movement through different incentives and experiences.	Pedestrian traffic is not the main focus of this thesis and not in the scope of interest of the Biosfera Val Müstair.	Foxtrail Geocaching Toilet Finder
Scooter-sharing	Shared electric motorised scooters for short-term rental.	Mostly conceptualised for urban areas with a high population density, this type of mobility offer is not of interest for the Val Müstair.	Bolt Scooter TIER E-Scooter Lime Scooter
Bike-sharing	Shared transport service renting bicycles for short-term.	There is already a bike-sharing system available in Val Müstair, offered by partnering hotels. It is used mostly by tourists, while locals mostly possess a bike themselves.	Nextbike Rent a bike Publibike
Bicycle subscription	Subscription for bicycles mostly for medium- to long-term purposes.	Tourists bring their own or can rent a bicycle when on holidays in Val Müstair. E-bike rental already exists. Locals mostly possess one.	Stromer Fleet system Famility BikeBox Rental
Cargo-bike-sharing	Shared cargobikes for transporting goods, people, or large items mostly in urban areas for short-term rental.	Mostly conceptualised for urban areas with a high population density, this type of mobility offer is not of interest for the Val Müstair.	Carvelo2go
Roller-sharing	Shared electric scooters for short-term rental mostly in urban areas.	Mostly conceptualised for urban areas with a high population density, this type of mobility offer is not of interest for the Val Müstair.	Pick-e-Bike Scooter Mobilize Go Green City
Car-sharing	Shared cars for short-term rental. Private or public providers possible.	The Biosfera already intended to introduce the car-sharing system of Mobility, which failed due to high investment costs and low demand.	Mobility-Return Edrive GoMore
Car subscription	Subscription for cars granting access to vehicles for regular use.	Potentially increases use of car instead of decreasing.	SIXT+ Auto Abo Carify Carvolution
Parking	Parking services and infrastructure mostly for private vehicles at public or private parking locations.	The parking situation in Val Müstair is already under revision, thus no further improvement is needed at the moment.	Parkingpay Park4night Parcandi
Charging /Refuelling	Services that either provide charging and refuelling stations or aim to facilitate the search for them.	In combination with the revision of the parking situation, the municipality also aims to improve specifically the e-charging infrastructure throughout the valley.	MOVE IONITY ich-tanke-strom.ch
Ride-hailing (taxi)	On-demand taxi services.	As the local taxi company just recently announced to seize its service, it is not recommended to retry ridehailing in a different form as the demand seems too little to establish such services in Val Müstair. A viable alternative could be ridepooling.	Uber BETAX FahrFlex
Public transport	Public transport services operated under concession of the state.	The bus network is already existing in Val Müstair and operated by PostAuto. As the	PostAuto Rhätische Bahn

with concession		Biosfera in cooperation with the TESSVM and the municipality is requesting improvements on frequency and schedule on a regular basis, there is no need to further suggest any mobility offers of this type.	SBB
Public transport with international license	Public transport services with the authorization to operate internationally.	The bus network operated by PostAuto already crosses the border to Mals in South Tyrol (IT). Due to a low demand caused by low population density, further offers are deemed as not needed, as long the public buses are operating.	FlixBus EUROBUS ONEBUS
Public transport ticketing system	Services offering ticketing systems for accessing various public transport services.	The ticketing system for the existing public transport services is already established. It could be of interest to introduce new types of subscriptions, like passes for families or elderly people covering the entire valley.	FAIRTIQ SBB Mobile SimpleTrain
Mobility as a Service (MaaS)	Integrated platforms providing various mobility services.	Mostly conceptualised for urban and more populated areas, this type of service is not of interest for the Val Müstair.	ZüriMobil zenGo Chipi
Bus companies with concession	Private bus services operated under concession of the state, mostly operating on international routes.	Long distance and international routes are not the focus of this thesis. A public transport bus service exists already.	Twerenbold Gössi EUROBUS
Truck-sharing	Platforms for sharing trucks to transport cargo.	Trucks and cargo are not the focus of this thesis.	Smargo rentAbee QuickRent
Cargo platform	Platforms for handling and sharing of cargo transportation.	Cargo is not the focus of this thesis.	Lieferando SmartBoxBasel Pickwings
Cargo service			Velokurier DHL Die Post
Boat sharing	Platforms for sharing boats for mostly short-term use.	Boats are not the focus of this thesis.	Ship Ahoy SailCom Sailbox
Aircraft sharing	Platforms for sharing aircrafts.	Aircrafts are not the focus of this thesis.	Wingly Simplyfly LunaJets

Appendix F – Justification for Inclusion of Mobility Categories

Topic	Requirement	Ridepooling	Ridesharing	Integrated mobility
Goals of Biosfera	Provide alternatives to private cars	Ridepooling aligns well with this requirement as it promotes a shared and sustainable transportation option. By encouraging multiple passengers to share rides in a single vehicle, ridepooling aims to reduce the reliance on private cars and lower overall emissions.	Ridesharing, by definition, encourages car owners to share rides, thus providing an alternative to exclusive private car usage, contributing to the goal of reduced car dependency.	Integrated mobility aims to offer a comprehensive network of transportation options, promoting sustainable alternatives to private car usage.
	Accessible transportation	Ridepooling can offer accessible transportation to individuals who do not have private cars or prefer not to use them. It provides a cost-effective and inclusive solution that caters to a broad range of residents and visitors.	Ridesharing can be accessible for individuals who prefer not to use public transport or lack access to private cars. It offers a community-based solution that relies on social connections.	Integrated mobility can be inclusive, as it provides various transportation options that cater to different accessibility needs.
Regulatory compliance	Within scope of work and possibilities of the Biosfera Val Müstair	Ridepooling generally requires minimal infrastructure investment, making it within the budget reach of the Biosfera Val Müstair. It can be implemented within the existing transportation framework, complying with regional regulations.	Ridesharing typically does not require extensive infrastructure investments and is within the budget reach of the Biosfera Val Müstair. However, it may involve informal arrangements between drivers and passengers, requiring clear guidelines for regulatory compliance.	Integrated mobility platforms must adhere to regional regulations and align with the Biosfera Val Müstair's budget and scope limitations.
Sustainability considerations	Ecological impact	Ridepooling contributes to reducing the ecological impact by optimizing vehicle occupancy and lowering emissions per passenger, in line with the Biosfera's vision of sustainable transportation.	Ridesharing can help reduce the number of individual cars on the road, potentially lowering emissions. However, its ecological impact may vary depending on the willingness of car owners to share rides.	Integrated mobility encourages shared rides and optimised resource utilization, supporting reduced emissions and ecological impact.
	Social inclusivity	Ridepooling is inclusive and accessible to various demographics, making it a suitable option for all residents and visitors.	Ridesharing's inclusivity depends on the willingness of drivers to offer rides to a diverse group of passengers.	Integrated mobility integrates diverse transportation options, catering to the needs of various demographic groups and enhancing social inclusivity.
	Economic sustainability	Ridepooling can be affordable for passengers, the Biosfera, and other stakeholders,	Ridesharing can be cost-effective for passengers, but its economic sustainability relies on	Integrated mobility can offer cost-effective and affordable transportation options, benefiting both users and the Biosfera Val Müstair.

		as it optimises vehicle usage and generates revenue from multiple passengers.	drivers' willingness to share rides without significant financial incentives.	
Practicality and acceptance	Availability	Ridepooling services can efficiently schedule and offer rides, especially during times when public transport may not be operating at its full capacity.	Ridesharing availability depends on the willingness of individual drivers to offer rides. It may not be as reliable as formal transportation services.	Integrated mobility platforms can efficiently schedule and coordinate multiple transportation modes, ensuring broader availability, especially during times when certain services may have limited coverage.
	Ease of access	Ridepooling platforms are designed to provide a user-friendly experience, with straightforward usage and easy-to-use payment methods.	Ridesharing's accessibility depends on the willingness of drivers and their availability.	Integrated mobility platforms streamline the user experience, offering straightforward booking, payment methods, and centralised information access.
	Flexibility and adaptability	Ridepooling services can adapt their offers to changing needs and seasonal variations, ensuring continued availability throughout the year.	Ridesharing can offer flexible routes and pick-up/drop-off points based on user preferences, but it may not always align with immediate travel needs.	Integrated mobility aims to offer diverse travel choices, allowing users to adapt their travel plans based on changing needs and seasonal variations.
	Safety and Security	Ridepooling services can implement measures to ensure the safety of passengers and users, including vetting drivers and maintaining well-insured vehicles.	Ridesharing safety relies on the trustworthiness and driving skills of individual drivers, potentially posing safety risks when sharing rides with unfamiliar individuals	Integrated mobility can implement safety measures across all integrated transportation modes, ensuring the safety of passengers and users.

Appendix G – Collection of Citizen Bus and Commuter Bench Projects

	Route	Source
Citizen Bus	Walperswil – Epsach – Täuffelen – Aarberg	Gemeinde Walperswil, 2023
	Münsingen – Trimstein – Worb	Berger, 2018; Schlup, 2018
	Höchstetten – Hellsau – Willadingen	Gemeinde Koppigen, 2023
	Lützelflüh – Rüderswil – Zollbrück	SRF, 2017; Stocker-Zaugg, 2019
	Gondiswil – Huttwil – Ufhusen	IGöV Oberaargau, 2023
	Ursenbach – Oeschenbach – Walterswil – Kleindietwil	Gemeindeverwaltung Oeschenbach, n.d.
	Region	**Source**
Commuter Bench Networks	Klöntal	Gemeinde Glarus, 2022
	Simmental – Saanenland	Grubenmann, n.d.
	Küsnacht – Küsnachterberg	Gemeinde Küsnacht, 2019
	Feutersoey – Arnensee	Dorforganisation Gsteig - Feutersoey, 2018
	Masein	Gemeinde Masein, n.d.
	Toggenburg (incl. Commuter App TwoGo)	Tempelmann, 2022; Energietal Toggenburg, 2021
	Grenchen – Bettlach	Nau.ch Lokal, 2022
	Leuggern	Fretz, 2020
	Blauen	Gemeinde Blauen, 2023; Schmid, 2017
	Berg	Adrian Lemmenmeier, 2018
	Wengital – Kaltbrunn	Ortsgemeinde Kaltbrunn, 2020
	Andelfinden – Weinland	Spalinger, 2020

Declaration

I herewith declare that this is my independent work written by me and using only admissible aides and no other sources than those given. I have marked as such, all passages which have been taken literally or analogously from another source. I am aware that if this is not the case, the executive board of the university of applied sciences is entitled to rescind any qualifications awarded or any title bestowed based on this work.

Chur, 11th August 2023

Cédric Kleeb