Group Part

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Business Model Innovation in Micromobility: Analysis and future directions - a Literature Review and Business Model Analysis

(Group title: Business Model Innovation in Micromobility: Analysis and Future Directions)

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Abstract:

Micromobility is revolutionising urban transportation, addressing challenges such as congestion, emissions and limited accessibility. Central to this transformation is business model innovation, which enables operators to adapt to evolving user needs, regulatory landscapes and environmental priorities. This thesis explores the use of models like subscription services and mid-term rentals, demonstrating their potential to stabilise revenue streams and foster customer loyalty. By leveraging advanced technologies such as AI, IoT and predictive analytics, operators can optimise operations and reduce costs. The study underscores the importance of aligning innovative business strategies with sustainability and multimodal integration, positioning micromobility as a cornerstone of future urban mobility.

Keywords:
Micromobility, Business Model Innovation, E-Mobility, Mobility as a Service (MaaS), Business Model Patterns, Urban Mobility

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List of Abbreviations

AI	Artificial Intelligence
B2B	Business to Business
BCG	Boston Consulting Group
BMC	Business Model Canvas
BMI	Business Model Innovation
C**AC**	Customer Acquisition Cost
CO_2	Carbon Dioxide
CSR	Corporate Social Responsibility
EU	European Union
GDP	Gross Domestic Product
IoT	Internet of Things
KPI	Key Performance Indicator
MaaS	Mobility as a Service
OEM	Original Equipment Manufacturer
PESTEL	Political, Economic, Social, Technological, Environmental and Legal
R&D	Research and Development
ROI	Return on Investment
SaaS	Software as a Service
SEaaS	Software-Enabled as a Service
SME	Small and Medium-sized Enterprises
UN	United Nations
US	United States

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1. Introduction

"Innovation is the ability to see change as an opportunity, not a threat." This insight from Steve Jobs highlights the transformative potential of business model innovation in addressing the challenges of modern urban mobility (Gallo, 2010). Urban mobility is at a critical juncture, as cities and their inhabitants grapple with the twin pressures of rapid urbanization and escalating environmental concerns. In this context, micromobility has emerged as a viable and forward-thinking solution, offering flexible and sustainable alternatives to traditional modes of transport (Curtis & Mont, 2020). This study explores how innovative business models can rise to these challenges, drive sustainable growth, and reimagine the future of urban transportation systems (Teece, 2010)

Transportation is a major contributor to global CO_2 emissions, accounting for about 23% of energy-related emissions worldwide, with road transport representing nearly 75% of that figure (Creutzig et al., 2015). The traditional reliance on private vehicles has become unsustainable and inefficient in densely populated cities (Banister, 2008). Private cars contribute to urban sprawl, congestion and environmental degradation, underscoring the need for innovative urban mobility solutions that align with sustainability goals and adapt to changing urban dynamics (Bertolini, 2017). Consequently, the concept of sustainable mobility is gaining prominence, advocating for transportation systems that meet economic, social and environmental needs while minimizing negative impacts (Holden et al., 2020).

In response to the call for sustainable mobility, micromobility has emerged as a promising alternative to conventional transportation modes (Shaheen & Cohen, 2019). McKinsey defines micromobility as "the use of very lightweight vehicles such as scooters, bicycles, or electric scooters offered to the public for shared use, either through dock-based or free-floating systems"

(McKinsey & Company, 2024). In this thesis, the term *micromobility* will specifically refer to passenger transportation, excluding all forms of freight logistics. The focus is, therefore, on vehicles such as electric scooters (e-scooters), electric bicycles (e-bikes), and electric mopeds (e-mopeds), which provide flexible, low-emission mobility solutions ideally suited to high-density urban environments where conventional transportation methods often fall short (Nikitas et al., 2020). These vehicles help reduce traffic congestion and carbon emissions and improve the accessibility and integration of urban transportation networks (Reck & Axhausen, 2021).

Micromobility services often operate on-demand and are app-based, aligning with the concept of MaaS. It is a user-centric, flexible and sustainable model that integrates various forms of transport services into a single, accessible, on-demand platform (Sochor et al., 2018). By offering convenient and affordable options, micromobility contributes to reducing urban congestion and emissions by providing viable alternatives to car usage for short trips—many of which are less than five kilometres (Reid, 2020; Nikitas et al., 2020). This shift addresses a significant portion of urban travel and holds substantial potential for replacing car usage in cities.

The micromobility sector witnessed significant growth at the end of the 2010s, propelled by companies like Lime, Bird and Spin. These pioneers introduced dockless e-scooters and e-bike services that are accessible via smartphone applications (Smith & Schwieterman, 2018). By eliminating the need for fixed docking stations, they lowered barriers to entry and expanded accessibility (Hollingsworth et al., 2019). Leveraging GPS technology and mobile payments, the dockless model streamlined the user experience, contributing to rapid adoption rates (Shah et al., 2020). By 2019, the global micromobility market exceeded $300 billion and is projected to reach $500 billion by 2030, driven by rising consumer demand and widespread adoption by cities worldwide (McKinsey & Company, 2019; tim, 2020). This growth underscores the sector's potential to significantly contribute to sustainable transportation goals (Hensher, 2020).

1.1 Objectives and Contribution of the Study

Despite the promising potential of micromobility to address urban transportation challenges, the industry faces significant obstacles that hinder its sustainable growth and integration into city mobility systems (Gössling, 2020). Key challenges include operational inefficiencies stemming from complex fleet management, regulatory fragmentation across different jurisdictions, infrastructural limitations and difficulties in achieving profitability while fulfilling social and environmental goals (Reck & Axhausen, 2021). Current business models, predominantly based on pay-per-use schemes, lead to inconsistent revenue streams and complicate the building of long-term customer loyalty (Cohen & Kietzmann, 2019). High operational costs for maintenance, redistribution and regulatory compliance further strain profitability (Sipe & Powell, 2020). Additionally, regulatory inconsistencies create barriers to scalability and innovation, as operators must navigate varying policies related to vehicle deployment, parking regulations and safety standards (Bai & Jiao, 2020). These challenges underscore the need for innovative approaches to business models that can adapt to the dynamic and complex environment of urban mobility (Teece, 2010).

In light of these challenges, this study aims to investigate how micromobility companies can utilize BMI´s to overcome existing obstacles and capitalize on emerging opportunities to achieve sustainable growth and profitability. By conducting an in-depth analysis of industry dynamics, technological advancements, regulatory frameworks and consumer behaviour, the study seeks to provide actionable insights for developing robust and sustainable business models in the micromobility sector. In doing so, it analyses the role of BMI to understand how they can foster competitive advantages and address industry-specific challenges (Foss & Saebi, 2017). Furthermore, the study assesses the influence of technological advancements such as artificial

intelligence, Internet and battery innovations on operational efficiency as well as service quality (Pagani & Pardo, 2017).

Another focus is the examination of the interplay between regulatory frameworks, infrastructure availability and the adaptation of business models (Lazarus et al., 2020). Understanding these dynamics is crucial for navigating the complex regulatory landscapes that micromobility companies often face (James et al., 2019). Simultaneously, consumer preferences and behaviours are analysed to identify factors influencing user acceptance of micromobility services. This is essential for developing customer-oriented business models that enhance satisfaction and loyalty (Reck & Axhausen, 2021).

Finally, the study explores strategies for micromobility companies to balance profitability with social and environmental objectives through BMI, ensuring long-term industry viability (Geissdoerfer et al., 2018). By achieving these objectives, the research contributes to closing gaps in understanding the role of BMI in emerging mobility services. It offers practical insights for industry stakeholders, including micromobility companies, policymakers and urban planners, to foster sustainable growth and effectively address pressing urban transportation issues. Ultimately, the study aims to develop robust and adaptable business models in the rapidly evolving micromobility sector that ensure both economic success and social and environmental sustainability.

1.2 Report Structure

This thesis comprises nine chapters that build upon each other to thoroughly explore the research topic—from problem identification to findings and strategic recommendations. Following the introduction, Chapter 2 presents a critical literature review on micromobility, BMI, technological

advancements, regulatory frameworks and consumer behaviour, identifying gaps and establishing the theoretical foundation. Chapter 3 outlines the research methodology, detailing the philosophical approach and methods of data collection and analysis. Employing a mixed-methods approach combining quantitative surveys with qualitative interviews ensures a robust understanding of the research questions, with discussions on ethical considerations and data validity. Chapter 4 provides an in-depth industry analysis of the micromobility sector, including market trends, key players, competitive dynamics and the external environment. Analytical frameworks such as PESTEL are utilized to understand the industry forces shaping micromobility. In Chapter 5, a theoretical framework is developed by integrating concepts from BMI with factors influencing micromobility, serving as a lens to interpret empirical findings. Chapter 6 presents the empirical findings, analysing quantitative data from surveys and qualitative insights from expert interviews to address the research questions. The results highlight key themes relevant to BMI in micromobility. Chapter 7 discusses the empirical findings in the context of the literature review and theoretical framework. It interprets the results, synthesizes insights and discusses implications for theory and practice, addressing study limitations and suggesting areas for further research.

Chapter 8 offers strategic recommendations based on the study's findings, aimed at micromobility companies and policymakers. These focus on enhancing business model effectiveness, promoting sustainability and addressing industry challenges. Finally, Chapter 9 concludes the thesis by summarizing key findings, reflecting on contributions to knowledge and outlining managerial and policy implications. It emphasizes the potential impact of the research on the micromobility industry and suggests avenues for future investigation.

By following this structured approach, the thesis aims to provide a coherent and comprehensive examination of how BMI can enable micromobility companies to overcome challenges and achieve sustainable growth, contributing to the advancement of sustainable urban mobility solutions.

2. Literature Review

Following Hoffmann's (2021) framework, this literature review synthesises the theoretical foundations and empirical evidence surrounding BMI, with particular focus on the St. Gallen Business Model Navigator™ (BMN) and its application in the micromobility sector. The review progressively builds from foundational theories to specific applications, examining how BMI principles intersect with the unique challenges and opportunities in micromobility. The review structure advances through several key stages: First, it establishes the theoretical underpinnings of business models and their innovation, providing essential context for understanding current approaches. Second, it explores the St. Gallen Business Model Navigator™ as a systematic framework for innovation, examining its methodology and practical applications. Finally, it investigates the specific context of the micromobility sector, analysing how BMI principles and patterns manifest in this rapidly evolving industry. This systematic approach enables a comprehensive examination of how theoretical frameworks can inform practical BMI in the micromobility sector. The review critically evaluates existing research while identifying gaps in current understanding, thereby establishing a robust foundation for the thesis's analytical framework and empirical investigation.

2.1. Business Models

A business model represents the fundamental architecture of how an organization creates, delivers and captures value (Teece, 2010). While various definitions exist in academic literature, there is growing consensus that business models serve as a holistic description of how a firm conducts its business (Zott, Amit, & Massa, 2011). The concept has evolved significantly since its emergence

in the academic discourse of the 1990s, developing from a simple representation of business logic to a complex framework encompassing multiple dimensions of business operations.

2.1.1. Functions and Value Creation

Business models serve three essential categories of functions that are fundamental to organisational success and sustainability (Chesbrough & Rosenbloom, 2002). From a strategic perspective, they play a crucial role in articulating the organisation's value proposition, enabling precise identification of target market segments, establishing clear value chain structures, and specifying revenue generation mechanisms. These strategic functions provide the foundational framework that guides an organisation's long-term direction and competitive positioning.

At the operational level, business models are practical frameworks guiding day-to-day organisational activities. They inform decisions about resource allocation, helping organisations optimise the distribution of their human, financial, and technological resources. Additionally, they provide the blueprint for establishing effective organisational structures and defining the key processes necessary to deliver customer value. These operational functions translate strategic objectives into actionable plans and executable processes.

The economic functions of business models focus on ensuring financial viability and sustainability. They facilitate the estimation of cost structures and profit potential, helping organisations understand and optimise their financial performance. Through clearly defined value capture mechanisms and revenue models, business models enable organisations to monetise their value propositions effectively while maintaining sustainable operations.

2.1.2. Key Components of Business Models

Understanding modern business models requires a systematic examination of their constituent elements. The framework developed by Osterwalder and Pigneur (2010) provides a comprehensive architecture comprising nine interconnected building blocks that collectively describe an enterprise's business logic. At its core, this framework begins with customer segments, identifying distinct groups of people or organisations that the enterprise aims to serve. These segments are intrinsically linked to value propositions, which encompass the specific combinations of products and services designed to create value for each identified customer group.

The delivery of these value propositions is facilitated through carefully designed channels, representing the organisation's communication and distribution pathways. These channels are complemented by customer relationships, which define how the company establishes and maintains connections throughout the customer journey. The framework also addresses the critical aspect of revenue streams, detailing the various mechanisms through which the company monetises its value propositions across different customer segments.

Supporting these customer-facing elements are key resources encompassing the crucial physical, intellectual, human, and financial assets required for operational success. These resources enable key activities, representing the critical processes and operations that ensure effective business model functioning. The integration of real-time fleet management, as highlighted by Jorge and Correia (2013), demonstrates how operational efficiencies can be achieved by leveraging technology. Their analysis of car-sharing services emphasises the importance of dynamic allocation and cost-reduction mechanisms. The framework is further strengthened by key partnerships, defining networks of suppliers, collaborators, and strategic partners that enhance operational efficiency and effectiveness. Finally, the cost structure delineates all expenses

associated with operating the business model, including fixed costs, variable costs, and potential economies of scale.

3. Methodology and Research Design

This chapter is dedicated to detailing the research methodology chosen to conduct the thesis. It explains the chosen methods, ethical considerations, and the design of both surveys and interviews. This approach ensures a comprehensive understanding of the sector, combining quantitative data with qualitative perspectives to inform the analysis and recommendations.

3.1 Research Philosophy and Paradigm

The central aspects of the following explanations include the selection and justification of the applied research paradigm. Research paradigms form a conceptual foundation based on premises that explain how reality is perceived and studied (Sarantakos, 2013). A paradigm generally consists of four essential elements: ontology, epistemology, axiology and methodology (Kivunja & Kuyini, 2017). Ontological and epistemological considerations play a central role in the planning and implementing scientific studies (Corbetta, 2003). Ontological questions deal with the nature and structure of reality. They are intended to help researchers define assumptions and beliefs (Saunders, Lewis & Thornhill, 2019), whereas epistemological questions concern the foundations and acquisition of knowledge (Kivunja & Kuyini, 2017). These paradigm components are often reflected in the prevailing research approaches, especially in the paradigms of positivism and interpretivism (Sekaran, 2020).

In this thesis, a mixed-methods methodology based on both positivist and critical realist paradigms is chosen. The positivist approach is used for surveys based on an objectivist view of the world (Corbetta, 2003). Critical realism is the paradigm for qualitative interviews, which enables a differentiated view and allows the linking of objective and subjective elements of reality (Maxwell, 2012).

The framework of a positivist paradigm is used. This approach supports using quantitative and qualitative methods to analyse variable relationships (Sarantakos, 2013). Reality is perceived as objective, and the objectivist knowledge acquisition model assumes that science provides an increasingly objective approach to reality (Kivunja & Kuyini, 2017). Positivists emphasise what is recognised as valid and legitimate knowledge by observing social phenomena (Saunders et al., 2019). The findings from positivist studies are strongly interested in generalisations and aim to identify cause-effect relationships, which are supported by observation and experimentation (Sekaran & Bougie, 2020).

On the other hand, critical realism forms a bridge between objectively measurable variables and the understanding of subjective structures influenced by social interactions. In contrast to pure positivism, critical realism allows for a retroductive analysis of phenomena, whereby underlying mechanisms can be identified to explain observed phenomena (Danermark et al., 2002). A mixed methods approach is encouraged, using quantitative methods for pattern recognition and qualitative approaches to capture deeper structural mechanisms (Sayer, 2000). The aim is to investigate social phenomena without postulating an objective truth, focussing on the structural conditions and interactions that shape and influence social events (Sayer, 2000).

3.2 Research Approach - Methodological Choice and Research Strategy

The quantitative component of this work comprises a survey of voluntary participants on sustainability and micromobility. In addition, qualitative interviews were conducted with industry experts, researchers and consultants. After collecting the data from the survey and interviews, a comprehensive analysis is carried out, followed by a presentation of the results. In addition to collecting primary data, secondary literature is also used to integrate existing findings into the study. The research strategy thus combines elements of field research and literature work.

The online survey was published from November 10 to November 24, 2024, using 'Microsoft Forms', whereby participants could complete the questionnaire at any time. The average completion time is around 20 minutes. The results were anonymised and made available for analysis. In total, 217 questionnaires were completed in full and used for analysis. The question development was based on extensive literature research and proven questionnaires from the relevant literature. The survey serves to answer the formulated hypotheses and is based on a quantitative research approach.

The interviews took place from November 10 to November 30, 2024, using 'Microsoft Teams' and were conducted in a semi-structured format with standardised questions. The interview lasted 25 to 35 minutes, and the transcripts were partly anonymised. A total of 10 interviews were conducted, the questions of which were derived from the previous research. The interviews supported answering the hypotheses and represented the qualitative part of the research.

Due to the collegial network at NOVA SBE, the survey was also published in internal WhatsApp groups to encourage a high level of participation. As sustainability is highly relevant for the target group, an additional incentive was not necessary. The survey results were coded for evaluation in Python to analyse the data comprehensively.

3.2.1 Ethical Consideration

Ethical considerations and compliance with data protection guidelines have priority in this study. The contact details of all group members are provided for any queries. No personal questions were asked, and all data will be stored securely in a password-protected location to which only the authors have access. A minimum participation of 200 respondents was targeted with a margin of error of ±10%.

The interviewees were recruited partly through private contacts and partly on their own initiative, with no conflicts of interest. This is a purely scientific collaboration without any professional or contractual obligations. The results are based on a neutral and objective analysis that is beneficial to both parties.

3.3 Questionnaire Development

The questionnaire for this research is designed to understand consumer preferences, perceptions and behaviours in the micromobility sector. It ensures collecting relevant and robust data to address the research questions effectively.

The primary objective was to gather insights into how consumer segments engage with micromobility, their motivations and the barriers they face. The questionnaire also evaluates preferences regarding technological features, service quality and sustainability, which are critical factors shaping the market's competitive landscape. A questionnaire was chosen for its efficiency in collecting large-scale, quantifiable data, complementing interviews that address company- or industry-specific issues while focusing on customer-specific insights. The questionnaire is clustered into five different areas. It begins with demographic questions to segment data and

explores how sociodemographic aspects influence usage patterns. User behaviour is assessed, including frequency of use, preferred modes (e.g. e-scooters or e-bikes) and purposes (e.g. commuting or leisure). Travel distance is considered, capped at 4 km, with walking times included to address limitations in spatial cognition, making distances more relatable. Motivations and barriers are explored, focusing on cost, convenience, environmental awareness and safety. Likert-scale questions measure preferences for features like GPS tracking and fleet availability. Sustainability and innovation are addressed, examining attitudes toward environmentally friendly practices and advanced technologies such as battery-swapping.

The questionnaire balances closed-ended questions for statistical analysis and open-ended ones for richer insights. A pre-test with 15 participants refined question phrasing and structure. Designed for simplicity, the estimated completion time was less than twenty minutes to encourage participation. Ethical considerations were addressed with clear explanations of the study's purpose, voluntary participation and confidentiality assurances. Data will be analysed using a mixed-methods approach: statistical analysis for quantitative responses and thematic coding for qualitative insights. This comprehensive approach aims to uncover the factors influencing micromobility adaption and usage, providing valuable insights into the industry's growth and competitive landscape.

3.4 Interview Development

Expert interviews were conducted to gain deep insights into the micromobility sector, focussing on current business models and the innovations shaping them. Micromobility is a rapidly growing segment of urban mobility, intersecting economic, social and environmental dimensions. (Source)

The study aimed to understand how companies adapt to technological advancements, regulatory frameworks and strategic partnerships.

While surveys provided quantitative customer data, the interviews offered qualitative depth. They uncovered connections, challenges and success factors directly from industry practitioners. This approach validated findings from literature and surveys and generated new insights that extended beyond the existing knowledge base.

A systematic approach was adopted for selecting interviewees, involving stakeholders in diverse roles. Consultants and founders provided direct insights into business strategies and operational challenges. Researchers, academics, and urban planners offered theoretical perspectives on regulatory frameworks, infrastructure developments, trends, and benchmarking best practices, ensuring that both overarching patterns and subtle nuances were identified. The interview guide was designed to align with research objectives while allowing flexibility. A semi-structured approach encouraged open-ended responses, facilitating an in-depth analysis of expert perspectives.

The questions were categorised into four core themes from the research goals. First, the interviews examined the current state of the micromobility industry, focusing on key developments, challenges and opportunities. Second, they explored innovations in business models, particularly the role of internal processes, organisational strategies and customer feedback in fostering or hindering innovation. Third, the discussion centred on technological advancements such as IoT, AI and electrification, investigating their integration into operational processes and the practical challenges associated with implementation. Finally, the interviews addressed the role of collaborations and partnerships, emphasising the interactions between companies, regulatory authorities and other stakeholders, including the opportunities and conflicts arising from such relationships. Additionally, experts were asked to anticipate future developments in the

micromobility sector, such as how the industry might evolve over the next five to ten years. This aimed to identify emerging trends and societal changes that could influence innovation and growth significantly.

The interviews were conducted online via Microsoft Teams, chosen for its efficiency and flexibility in accommodating experts' diverse schedules. Participants received a detailed briefing document beforehand, outlining objectives and topics to set clear expectations and foster productive dialogue. Adhering to ethical standards, informed consent was obtained for recording and data processing. Sessions were recorded and transcribed, with detailed notes taken to enhance the richness of collected data. These qualitative insights formed a central pillar of the research methodology, complementing the literature review and survey findings.

Experts' personal experiences and professional perspectives enriched the understanding of innovation processes in micromobility. They bridged the gap between theoretical frameworks and real-world applications. Concrete examples of successful BMI were shared, detailing their conceptualisation and implementation. Regulatory hurdles, technological limitations and organisational challenges were explored in depth.

Integrating these qualitative insights with other research findings provided a comprehensive view of the innovation dynamics within micromobility. This methodological rigour bolstered the study's credibility, ensuring the findings were relevant and beneficial to academic and industry audiences.

4. Industry Analysis: The Micromobility Market

This section analyses the micromobility industry by providing an overview of the industry, the influence COVID-19 has had on the industry, the maturity of the market, the roles of key stakeholders, and the challenges that affect the industry. Examining the industry in that order will provide comprehensive insights into the status quo of the micromobility industry, what key trends are prevalent and what challenges companies need to overcome.

4.4. Key Stakeholders in the Micromobility Ecosystem

After outlining the industry's current state, this section analyses the key stakeholders within the micromobility ecosystem. It highlights their roles, relationships, and contributions, emphasizing the interconnected dynamics that drive the industry. Due to page constraints, financial aspects of asset acquisition and ownership are excluded, along with investor considerations not reflected in Figure 2.

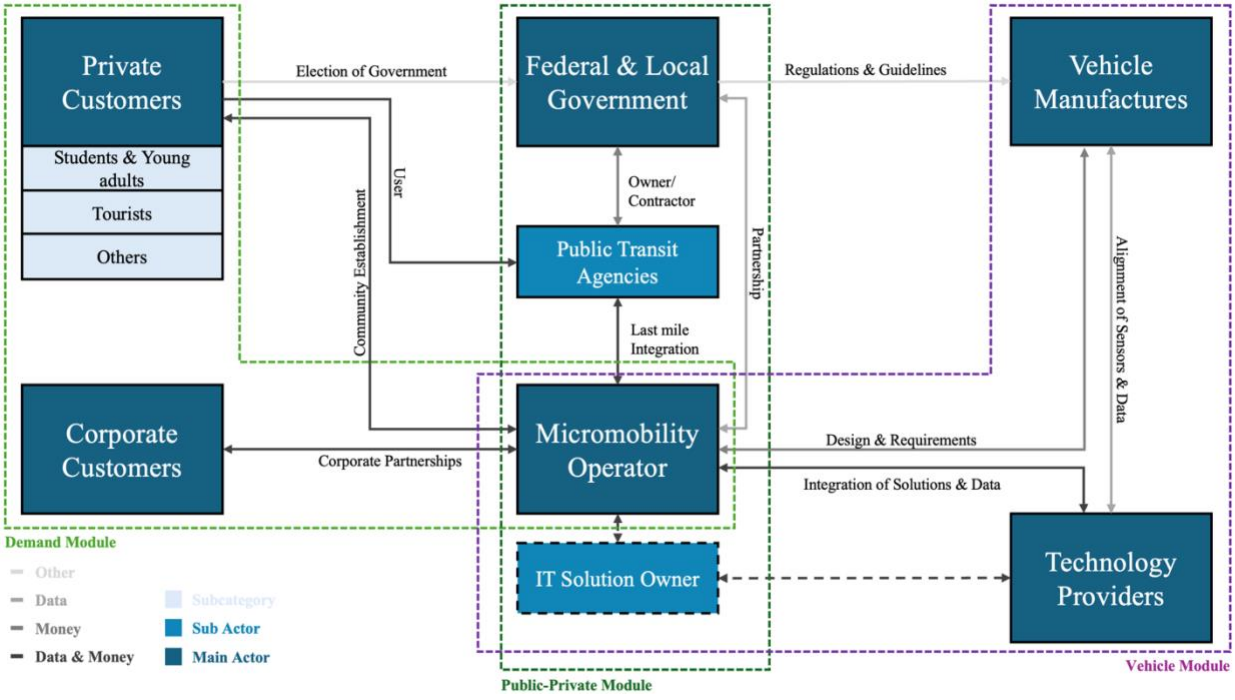

Figure 1:Micromobility's Operating Model (Internal Analysis 2024)

The figure above outlines three key modules encompassing micromobility's operating model: the demand module, the public-private module, and the vehicle module. Within each module, all respective stakeholders and their relationship with each other will be analysed. Moreover, the flow of money and data will also be a key component in this section, as it measures the connectedness of the eight stakeholders. However, since micromobility operators are at the centre of this blueprint for micromobility, it is worthwhile to introduce them here first before going into the details of the modules. These operators of micromobility, include prominent names such as Lime, Bird, Tier-Dott. and Voi, who act as service providers, managing fleets and ensuring their accessibility through app-based platforms. These companies are responsible for catering to consumer demand while adhering to city regulations. They also drive market expansion by forging public-private partnerships, which enable integrated multimodal solutions, such as combining micromobility with public transit for first- and last-mile connectivity (Smith et al. 2021). Additionally, operators invest heavily in vehicle maintenance and innovations to reduce operational costs, reflecting their central role in making micromobility scalable and sustainable. While many of them have different business models, which will be mentioned in later parts, the above-mentioned activities describe the role central they play within this industry. Furthermore, they area also the only stakeholder, who is connected to all other stakeholders in this industry, thereby underlining the importance of micromobility operators.

4.4.1 Micromobility Operating Model – Demand Module

Understanding and effectively addressing demand is essential for the success of micromobility, as it directly influences the types of services offered. Therefore, it is important that the micromobility operator is aligned with the needs and wants of its private and corporate customers.

Private customers are the most important stakeholder among the two customer types, as private customers typically make up the bulk of revenue, however here, there is a need to further segment since the micromobility market serves a diverse range of consumer segments, each with unique behaviours and motivations and, most importantly, usages of micromobility solutions.

Students and young adults are the largest demographic group, often aged between 18-30. They form the backbone of micromobility ridership. Students value affordability, accessibility and eco-friendly transportation. For example, university campuses frequently serve as testing grounds for micromobility services due to high-density populations and short-distance travel needs. Lime, for instance, offers student discounts and strategically placed fleets near universities to capture this market (Global Infrastructure Hub 2023). Young adults in urban areas also adopt micromobility as an alternative to car ownership, aligning with their preferences for flexible and sustainable transport options. This group prioritizes app-based convenience and integration with other platforms like navigation tools and fitness tracking (Sarker et al. 2024).

Tourists represent an opportunistic segment that uses micromobility for short-term, leisure-based exploration. Operators like Lime and Voi often target tourist hotspots, offering localized maps and guided routes through their apps. For example, Barcelona has seen significant uptake in micromobility usage by visitors, given its walkable neighbourhoods and bike-friendly infrastructure. Tourists are price-sensitive and value easy onboarding processes, such as seamless app registration and payment systems. This customer segment values reliability, speed and

integration with existing transportation networks. Partnerships with transit agencies have enhanced adoption among tourists (Jażdżewska-Gutta, Szmelter-Jarosz, and Borkowski 2023).

Corporate partnerships have also become a strategic avenue for operators to tap into commuting and business travel markets. Lime and Bird have launched corporate micromobility programs offering subscription services or fleet rentals for employee use. For instance, Google and Amazon have partnered with Lime to provide their employees with discounted or free rides, reducing car dependency and improving workplace sustainability metrics. These partnerships also contribute to CSR initiatives, showcasing companies' commitment to green transportation (Lime 2024).

Micromobility operators thus offer a variety of solutions to their two customer groups and adapt to each of their specific needs. In return, micromobility operators can gather customer data and use it either for internal purposes or later sell/repurpose it for additional value. Moreover, micromobility receives financial payments from these customer groups, which can come in various forms, either as one-time payments, subscriptions, or set prices in the case of corporate partnerships (Dr. Harald and Zauner 2024). Furthermore, micromobility operators aim to build a community with their customers and create a sense of loyalty and partnership.

4.4.2 Micromobility Operating Model – Public-Private Module

Public-private collaboration is essential for navigating complex regulatory landscapes and facilitating the implementation of large-scale projects that deliver public benefits. The transportation sector is particularly heavily regulated to mitigate user risks, and many transport operators maintain licensing agreements with public agencies that dictate how services, such as ticketing, can be managed. Compliance with these agreements often requires significant resource

allocation from public and private entities. Hence, it is important for the three stakeholders to be in alignment (Dr. Harald and Zauner, 2024).

Local and state governments are among the most influential stakeholders in the micromobility industry, as they determine regulations allowing the use of such operators. They can also develop infrastructure projects that make e-bikes and e-scooters more appealing, as mentioned before, by constructing bike lanes in Paris and temporary solutions such as pop-up lanes in Berlin. However, municipal authorities are doing much more than determining infrastructure. They are refining regulatory frameworks to balance innovation with safety and financial stability. Revenue-sharing models, vehicle caps and geofencing requirements reflect an ongoing effort to align public and private sector interests (ITF 2021). However, a hindrance to the sustained development of such efforts is the inherent instability that elected officials and offices provide. This makes developing long-term projects, such as extensive infrastructural redesigns, difficult. Nonetheless, close cooperation between local governments and micromobility operators is necessary and important. As indicated in a report by the National League of Cities, "Whether the goal is continuing the clean air levels achieved due to COVID-19, offering efficient single-occupancy transportation options, or simply creating more mobility options that do not contribute to congestion, cities are beginning to utilize micromobility to create more equitable transit systems strategically." (Rivett, Lee, and Rainwater 2020).

Furthermore, partnerships with public transit agencies are increasingly integrated into micromobility, thus providing urban transportation networks a "first-mile/last-mile" solution. By collaborating with micromobility operators, they aim to enhance accessibility and reduce reliance on private vehicles. For example, cities like Hamburg and Singapore have implemented integrated ticketing systems that combine micromobility services with public transportation, allowing users to switch seamlessly between e-scooters, buses and subways. Such initiatives not only boost

ridership but also contribute to the overall sustainability goals of urban centres. Cities like Paris and Berlin have integrated e-scooters and bikes with public transit apps, enabling seamless multimodal journeys. For example, Tier Mobility's partnership with Hamburg's HVV transit network allows commuters to rent e-scooters directly through the HVV app, complementing bus and train services. Such collaborations reduce congestion, promote sustainable travel and attract commuters who prefer unified payment systems (ITF 2021).

Public-private partnerships form a central element of the micromobility operating model. The successful development and implementation of micromobility solutions greatly benefit from active participation by public entities. Public organizations will likely face significant challenges without the technological expertise, innovation, and investments that private enterprises can provide. A key aspect of such collaboration is the standardization of data exchange formats, which involves establishing common data structures and protocols for sharing transportation-related information. Standardized and consistently formatted data enables micromobility providers to access and utilize information more effectively. This, in turn, fosters interoperability between different transportation systems and services (Proff et al. 2023).

4.4.3 Micromobility Operating Model – Vehicle Module

The vehicle module connects all stakeholders, crucial to developing and integrating micromobility vehicles within its ecosystem. Vehicle manufacturers, technology providers, and micromobility operators work hand-in-hand to integrate a hardware solution into the mobile application.

Vehicle manufacturers design and produce micromobility vehicles such as e-scooters, e-bikes and other lightweight transportation options. One of the most prominent players in this sector is Segway-Ninebot, which supplies many familiar names such as Lime, Bird and Bolt. While there

are also other competitors in the market, such as Xiaomi, who also supplies Bird, Segway-Ninebot is the market leader in the European and American markets (Levy Electric 2024). These vehicle manufacturers have often partnered up with micromobility companies such as Lime, Bird and Tier-Dott to the extent that they have played a crucial role in designing the e-scooters we know today. Bird is producing its own e-scooters to gain greater leverage and control over the supply chain, which only underscores these two stakeholders' close relationship (Levy Electric 2024). Hence, there is an evident connectedness between micromobility operators and vehicle manufacturers. Additionally, since factors such as vehicle lifetime and purchasing costs play a huge role for micromobility operators, the importance of vehicle manufacturers as a stakeholder is high.

Closely linked with vehicle manufacturers are technology providers that enable many of these big micromobility companies. These technology providers often serve as the backbone of micromobility operations. Companies like Wunder Mobility and Vulog develop fleet management software that powers micromobility services. This integrates real-time vehicle tracking, predictive maintenance, and route optimisation, all of which have to be integrated with the hardware provided by vehicle manufacturers. Hence, there is a flow of data between vehicle manufacturers and technology providers, enabling such solutions to be integrated. For micromobility companies, the tools are crucial for maximising fleet utilisation and minimising downtime, and therefore also for a company's profitability. Additionally, sensory data gathered is crucial for micromobility operators regarding value creation for other stakeholders (Micromobility Landscape 2024).

Furthermore, as consumer expectations evolve, technology providers must integrate advanced features like GPS, navigation, and app-based user interfaces. Companies like IoT Venture specialise in embedding connectivity solutions directly into micromobility vehicles, further enhancing user experience and operator efficiency (IoT Ventures 2024). Thus highlighting the interconnectedness between vehicle manufacturers, technology providers and micromobility

operators. However, in some cases, micromobility operators do not own the technology platform on which the micromobility app operates. In these cases, an IT solution owner manages the back end of the technology platform, as highlighted in Figure 2. Here, the IT Solution owner would act as an intermediary between micromobility providers and technology providers, as the IT solution owner would integrate technological features into the platform. There is a distinction between IT solution owners and technology providers in the sense of ownership.

4.5 PESTEL Analysis of the Micromobility Industry

The micromobility industry operates within a complex ecosystem where various external factors significantly influence its development, operations, and long-term viability. This analysis applies the PESTEL framework, originally described by Johnson, Scholes, and Whittington (2017), to the micromobility industry, examining the intricate relationships between political, economic, social, technological, environmental, and legal factors shaping the sector's evolution and prospects.

4.5.1 Political Factors

The political ecosystem fundamentally influences the micromobility industry's development through diverse regulatory frameworks and governance mechanisms. Municipal authorities globally have implemented heterogeneous requirements regarding vehicle specifications, operational zones, and safety protocols, precipitating significant compliance challenges for operators pursuing multi-market expansion strategies. Within the European context, notable disparities exist; Paris mandates stringent velocity restrictions of 20 km/h and designated parking protocols, while Berlin permits increased velocities of 25 km/h with more flexible parking parameters (Cohen & Shaheen, 2022). This regulatory fragmentation introduces operational complexities and elevated compliance expenditures, diminishing operators' capacity to achieve economies of scale.

Governmental entities at national and municipal levels function as critical determinants in micromobility initiative outcomes through their influence on urban planning paradigms and transportation policy frameworks. Facilitative governmental policies, encompassing sustainable transport subsidies and infrastructure investment, demonstrate significant positive correlations with adoption metrics. Metropolitan regions such as Amsterdam and Copenhagen exemplify how

prioritization of micromobility-conducive infrastructure yields enhanced utilization rates and reduced urban congestion (Shaheen et al., 2024).

Political instability and regulatory ambiguity present substantial impediments to market development. Emerging markets frequently exhibit unclear legislative requirements, inconsistent enforcement protocols, or institutional inefficiencies, potentially deterring capital investment and impeding service deployment. Furthermore, geopolitical tensions and trade policies impact the supply chain resilience of micromobility vehicles and their components. These tensions can manifest in tariff implications for battery imports or restrictions on critical raw materials such as lithium.

Municipal approaches to public-private partnership frameworks demonstrate significant variation. While certain governmental entities collaborate with operators to achieve shared mobility objectives, others implement restrictive permitting systems that constrain market competition. Implementing limited permit frameworks in municipalities such as San Francisco creates substantial barriers to entry for smaller operational entities, facilitating market concentration among established operators (International Transport Forum, 2023).

Regulatory oversight has intensified in response to public safety and equity considerations. Governmental bodies are implementing mandatory safety protocols, including protective equipment requirements and enhanced visibility measures while imposing accessibility mandates to ensure service availability across demographic segments. Additionally, political discourse surrounding sustainability and climate mitigation has positioned micromobility as a central component of urban environmental initiatives, incentivizing municipalities to adopt growth-promoting policies (EU Commission, 2023).

The influence of policy advocacy mechanisms warrants significant consideration. Major operational entities frequently engage in policy dialogue to influence regulatory frameworks,

advocating for standardized protocols to reduce operational complexity across jurisdictions. The European Commission's de Report emphasizes the imperative for harmonized regulations to enhance competitiveness and innovation within the EU directly impacting the sector's growth trajectory (European Commission, 2023).

4.5.2. Economic Factors

The economic viability of micromobility operations remains a critical challenge within the industry that has yet to be adequately solved. Operators face substantial operational costs associated with fleet management, maintenance, charging infrastructure, and fleet rebalancing across service areas. The industry's financial structure is significantly strained by the upfront capital expenditure required for fleet acquisition and expansion (McKinsey, 2023). Seasonal fluctuations in demand compromise revenue stability, while persistent price sensitivity among users limits operators' ability to adjust pricing to cover operational costs effectively, with operational costs consuming 60-75% of revenue in mature markets.

The competitive landscape has intensified as the number of operators in significant markets grows, leading to aggressive price competition that further erodes profit margins (Deloitte, 2023). This intensifying market pressure has triggered a wave of consolidation within the industry as companies seek economies of scale and operational efficiencies to maintain viability. The result has been a notable reshaping of the market landscape, with several prominent operators pursuing strategic mergers, such as Tier & Dott, or ultimately ceasing operations. This trend underscores the challenging economics of micromobility services and highlights the ongoing need for BMI to achieve sustainable operations in this rapidly evolving sector.

4.5.3. Social Factors

Social dynamics and safety considerations significantly influence adoption patterns and the long-term viability of micromobility services. The International Transport Forum (2023) reports increased accident rates in areas lacking adequate infrastructure, mainly where unsafe practices such as sidewalk riding and traffic rule violations are prevalent. Improperly parked vehicles create accessibility barriers, particularly for disabled persons navigating obstructions on sidewalks. These challenges are especially acute in dense urban areas, where space constraints exacerbate user conflicts and create infrastructure bottlenecks requiring intervention to improve operational efficiency (Schwinger, Tanriverdi, & Jarke, 2022).

Timić et al. (2020) research indicates that cities with strong community engagement and clear usage guidelines typically show 30-40% higher adoption rates than those without such measures. This finding underscores the importance of transparent communication and community engagement, particularly in areas where micromobility systems are perceived as disruptive (Marques & Coelho, 2022). Various interventions have proven effective in addressing safety concerns and improving public acceptance. Geofencing can restrict unsafe behaviours in high-risk areas, while designated parking zones can reduce sidewalk clutter and conflicts with pedestrians (Schwinger, Tanriverdi, & Jarke, 2022). These measures enhance public trust and improve operational efficiency by minimising disruptions caused by improper micromobility use.

Infrastructure development plays a crucial role in supporting micromobility integration. Dedicated lanes, clear signage, and safe parking facilities reduce safety risks while integrating micromobility systems into existing transport networks (Timić, Glavić, & Milenković, 2020). By combining these safety interventions with broader urban mobility planning, cities can ensure the long-term acceptance and success of micromobility services. The implementation of dedicated infrastructure,

enforcement of regulations, and the use of advanced technologies create safer environments for micromobility users while reducing public apprehension (International Transport Forum, 2023; Marques & Coelho, 2022; Konovalova, Kotenkova, & Senin, 2022).

4.5.4. Technological Factors

Technological innovations have fundamentally transformed the operational paradigm and user interface dynamics within the micromobility sector. The implementation of IoT infrastructure has proven instrumental in facilitating real-time vehicle monitoring systems, enabling both predictive maintenance protocols and sophisticated fleet management strategies. Such technological integration encompasses GPS tracking mechanisms and geofencing capabilities, facilitating regulatory compliance through automated speed modulation and operational zone restrictions (Cohen & Shaheen, 2022). Concurrent advancements in battery technology, particularly the development of solid-state configurations, have yielded significant improvements in vehicle range capabilities, safety parameters, and charging efficiency, thus addressing prevalent concerns regarding extended journey feasibility (McKinsey, 2023). Implementing battery recycling protocols and secondary application initiatives further enhances the environmental sustainability metrics of these technological developments (Shaheen et al., 2024).

Emergent technologies, particularly in autonomous micromobility systems, are increasingly shaping industry trajectories. Experimental implementations of self-parking mechanisms and automated fleet redistribution systems demonstrate potential for operational cost reduction and service reliability enhancement. Additionally, mobile applications' sophistication and integration with MaaS frameworks have facilitated substantial improvements in user interface efficiency, enabling streamlined booking processes, payment systems, and real-time route optimisation

algorithms. Furthermore, operators increasingly leverage AI capabilities and big data analytics methodologies to optimise demand prediction models, resource allocation strategies, and service customisation parameters. Thus, technological innovation is established as a fundamental driver of sector evolution (Deloitte, 2023).

4.5.4. Environmental Factors

Environmental considerations constitute a fundamental paradigm within the micromobility sector, simultaneously driving adoption patterns and eliciting critical examination. These mobility services contribute substantially to mitigating urban carbon emissions and ameliorating congestion by providing alternative transport modalities for short-distance urban journeys. Quantitative analyses suggest that a modal shift of merely 10% from automotive to micromobility transport in urban environments could precipitate a reduction in CO2 emissions of approximately 4 million metric tons per annum (International Transport Forum, 2023). However, comprehensive lifecycle emissions analyses, encompassing manufacturing processes, distribution networks, and end-of-life disposal protocols, remain significant challenges within the sector. Implementing enhanced recyclability protocols for vehicle components, particularly regarding battery systems, is imperative for mitigating these environmental impacts (McKinsey, 2023).

The sustainability paradigm extends beyond operational considerations to encompass infrastructure development and waste management protocols. Metropolitan regions such as Copenhagen and Amsterdam demonstrate the efficacy of targeted infrastructure investments, including dedicated micromobility corridors and intelligent parking systems, in facilitating adoption while minimising urban space utilisation conflicts (Shaheen et al., 2024). Furthermore, operators are increasingly pursuing strategic partnerships with renewable energy providers to implement sustainable charging infrastructures, diminishing their environmental impact. Managing end-of-life vehicles and battery

systems through circular economy frameworks has emerged as a critical focus area, contributing to waste minimisation and enhanced resource utilisation efficiency (Deloitte, 2023).

4.5.5. Legal Factors

The micromobility sector operates within a complex legislative framework characterised by multifaceted regulatory requirements that present operational challenges and strategic imperatives. Data protection legislation, particularly the General Data Protection Regulation in the EU and the California Consumer Privacy Act imposes stringent protocols regarding the management and security of user-specific data, encompassing geolocation metrics and financial transaction information. Operating entities must implement comprehensive cybersecurity infrastructures to mitigate potential data breaches, which carry substantial financial penalties and reputational implications (Cohen & Shaheen, 2022). Furthermore, the heterogeneous nature of insurance requirements and liability frameworks across jurisdictional boundaries significantly amplifies the complexity of international operational scaling (McKinsey, 2023).

Municipal permitting architectures and licensing frameworks exhibit substantial variability in their implementation, with certain jurisdictions imposing significant monetary obligations and operational constraints. Notable European metropolitan areas, specifically Paris and Berlin, have implemented divergent regulatory parameters encompassing velocity limitations and designated parking protocols, necessitating substantial compliance-related expenditures for operational entities (EU Commission, 2023). Labour legislation further impacts operational dynamics, particularly in jurisdictions where fleet maintenance and charging personnel may be subject to employment classification modifications, potentially necessitating structural alterations to established cost models (Deloitte, 2023).

Determining legal liability in micromobility-related incidents still needs to be more adequately defined within existing jurisprudential frameworks, prompting regulatory bodies to implement increasingly stringent safety protocols regarding vehicle design specifications and operational parameters. Furthermore, governmental entities are progressively mandating accessibility requirements to ensure service inclusivity for individuals with physical disabilities, introducing additional regulatory compliance considerations. The effective navigation of these juridical complexities represents a critical determinant of operational scalability and sustainable growth trajectories within this dynamic sector (International Transport Forum, 2023).

5. Analysis of BMI in Micromobility

As mentioned, the micromobility industry is a fiercely competitive and complex landscape, thus making BMI an important aspect of a company's competitiveness. This section looks deeper into the BM of a leading company in the micromobility industry by analysing its current business model and identifying the innovations already implemented. Furthermore, this section also emphasises the importance of BMI in relation to the industry stage as analysed by the industry life cycle. Lastly, it also analyses the extent to which industry peers have different approaches and how aspects of the BMC differ.

Therefore, by providing the status quo and examining the applied business model patterns according to BMN of various companies, this analysis creates a basis for future innovation to improve a company's competitive position within the micromobility industry. It also analyses the extent to which industry peers have different approaches and how aspects of the BMC differ.

5.1 Business Model Canvas – Lime as an Industry Benchmark

Operating in over 200 cities in nearly 30 countries, Lime is one of the sector's largest and most recognised players. Its extensive global footprint provides valuable insight into how companies scale their operations while navigating various regulatory and market challenges, emphasising the importance of an adaptable framework to meet different local needs (Causeartist 2023). Moreover, due to the company's size and prominence as a brand, there is abundant comprehensive information about Lime's strategies and performance. Hence making it an ideal candidate for an in-depth analysis. As a global brand, Lime has often been reported in industry reports, academic studies, and media publications, providing a strong foundation for detailed analysis. This wealth of data is crucial for a sound examination of the business model and innovations (IFB, University of St.

Gallen 2023). The BMC is used to analyse Lime's current business model. This framework delineates nine interrelated components that illustrate how the company creates, delivers, and captures value. It enables a structured and comprehensive evaluation of Lime's operations and strategies that have led to Lime's success (Osterwalder and Pigneur 2010).

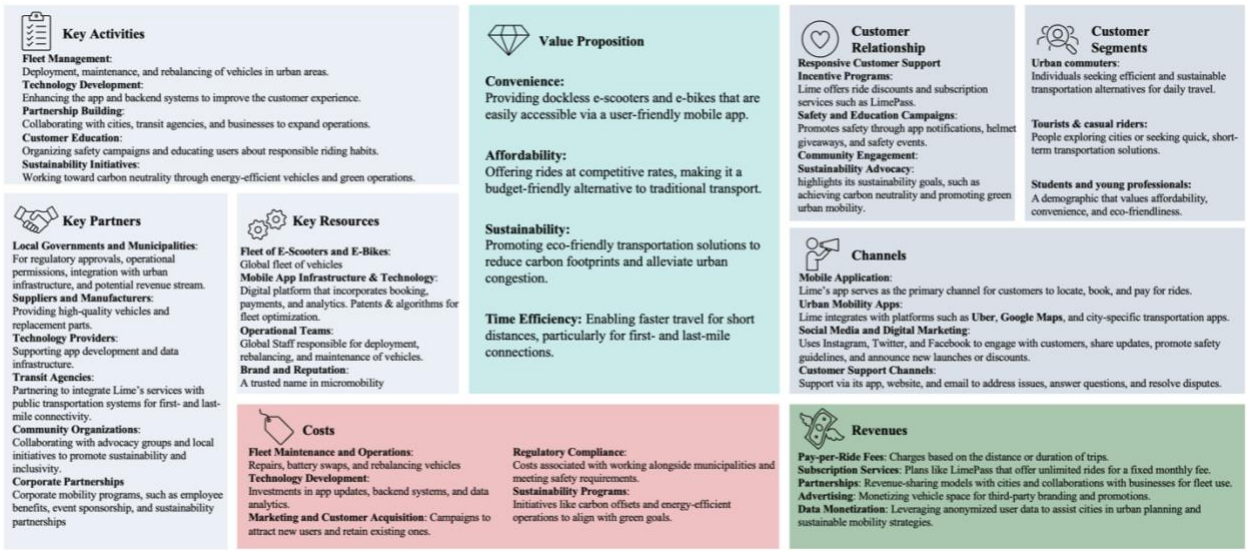

Figure 2: Business Model Canvas – Lime (Internal Analysis, 2024)

Lime targets a diverse customer base, including urban commuters seeking efficient and sustainable transportation alternatives, tourists and casual riders exploring cities, and students and young professionals prioritising affordability and convenience. The company also collaborates with universities and corporations to provide tailored fleet solutions, extending its services to business partners. Additionally, Lime has introduced adaptive mobility solutions to serve accessibility-focused riders, demonstrating its commitment to inclusivity (Global Infrastructure Hub 2023).

At the centre of Lime's value proposition is providing e-scooters and e-bikes that offer convenient, affordable and environmentally friendly transport options. The aim is to tackle urban mobility challenges by reducing congestion and emissions. The mobile application is designed to facilitate seamless access to its fleet and create possible integration with public transport systems, thereby

making Lime as convenient and time efficient as possible. Additionally, the company has continuously made improvements concerning sustainability. It has committed itself to using renewable energy to power its vehicles (Trahant 2024). Furthermore, Lime's sustainability approach has led to pioneering battery swap technology, which its Vice President and Head of Sustainability, Andrew Savage, says "[…] with the swappable battery model. I think hands down, that was the most important decision the company has made to date. It has yielded ridership, it has yielded sustainability benefits, it has yielded unit economics and lifespan improvements. All the things that came with that investment were mission-critical and became business-critical in the long run.", thus emphasising the impact it has had on its value proposition (Myrtetus 2023).

Lime has established a multi-faceted system to engage customers at various levels and build a sustainable relationship with them. The central interface is the company's mobile application, enabling users to locate vehicles, book journeys and pay the corresponding fees. These core functionalities are enhanced by partnerships with established platforms such as Uber and Google Maps, which ensure greater visibility and seamless integration into existing urban mobility systems (Martin 2019). At the same time, the Lime vehicles physically present in urban areas act as mobile advertising spaces that raise awareness of the brand and its offerings. This strategy is supported by digital marketing and activities on social media platforms, through which the company regularly provides information on new offers, safety measures and promotions (Micromobility Biz 2023).

Another key part of Lime's customer retention strategy is its support services. In-app support helps customers quickly and easily, while subscription models such as LimePass, which allows unlimited journeys for a flat monthly fee, provide an additional incentive for regular users.

As an Industry leader, Lime's commitment to safety is relevant to the entire industry's success. Here, Lime invests in safety innovations in technology, hardware, and operations (Lime 2020). Additionally, it invests in educational initiatives for safe use and community programmes, such as

free rides for system-relevant occupational groups. Moreover, it also invests in rider education by offering courses and quizzes within its app. These measures emphasise the company's social and environmental responsibility and contribute to anchoring its values (Better Bike Share, 2023).

The company's revenue streams include charges per ride and subscription models. Charges per ride are likely to make up the bulk of generated revenue; however, as Lime does not publically disclose this data, it is hard to measure the breakdown in revenue streams accurately. In addition, Lime is continuously investigating alternative revenue models, such as monetising mobility data through collaborations with cities and research institutions or advertising opportunities on the vehicle fleet (Financial Times, 2022). These models are underpinned by the efficient management of the vehicle fleet, the continuous development of the technological infrastructure and the establishment and maintenance of strategic partnerships.

Lime's cost structure reflects a key operational priority. The most significant expenses include fleet maintenance and management, technological development, marketing activities and regulatory compliance. A growing proportion of costs are attributable to sustainability initiatives such as CO_2 offsetting and energy-efficient operations. This underlines Lime's long-term commitment to environmentally friendly mobility and its continuous focus on ecological goals (Lime, 2020)

Lastly, the company cooperates with local authorities to facilitate compliance with regulatory requirements and ensure long-term acceptance in cities. At the same time, alliances with manufacturers contribute to providing high-quality vehicles, while technological partnerships strengthen the digital infrastructure. MaaS also enables the seamless integration of Lime into existing urban mobility systems, further increasing the service's attractiveness and accessibility (Micromobility Biz, 2023).

5.2. Application of BMI to the Micromobility Industry

As section 2.2.1, 'Foundations and Mechanisms of BMI' mentions, BMI's comprehensive approach gains importance as organisations face increasing pressure to adapt to rapidly evolving market conditions and technological advancements (Porter & Heppelmann, 2014). Within these evolving conditions, BMI can help companies seize new opportunities, or "white space," in three distinct ways (Johnson 2010).

First, BMI supports the development of new value propositions that address unmet customer needs or "jobs-to-be-done" within existing markets. Second, it facilitates targeting new customer segments traditionally underserved or overlooked by current value propositions. Third, BMI allows companies to enter entirely new industries or market territories, often described as "new terrain." (Johnson 2010).

These approaches present unique managerial challenges and opportunities that require strategic consideration. Shifts in the basis of competition influence the extent to which BMI is necessary (Moore 1996). At different stages of market development, companies must innovate along varying dimensions to remain competitive and responsive to market demands, as illustrated in Figure 4.

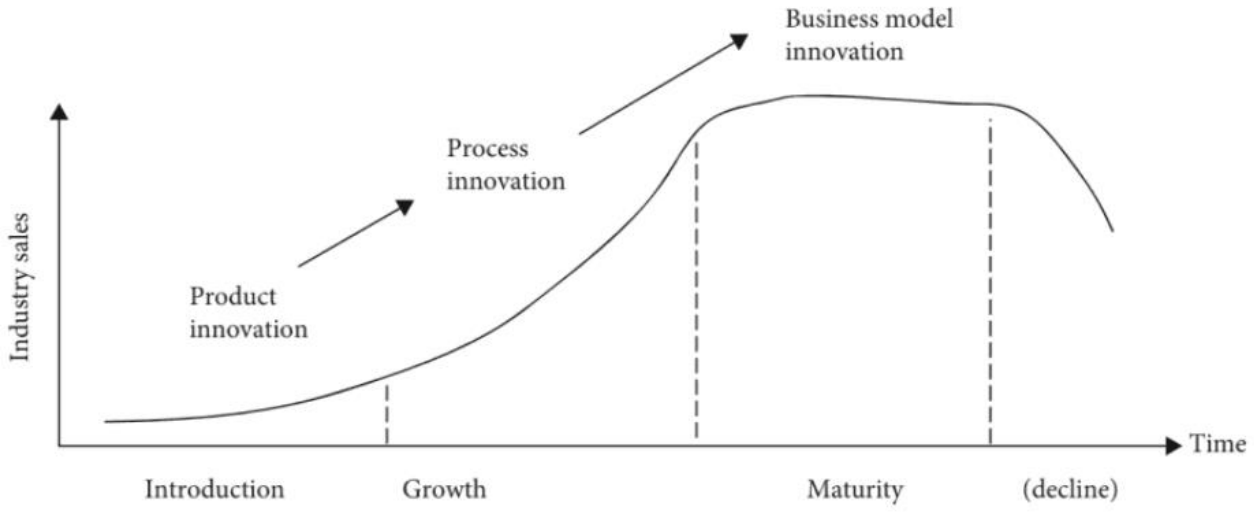

Figure 3: Industry Life Cycle and Business Model Innovation (Dodgson, Gann, and Phillips, 2013)

In the introduction stage, innovation focuses on product features and functionality to address customers' unmet needs. As markets progress to the growth stage, the basis of competition shifts to process-oriented innovations as customers demand higher quality and reliability, and there is an increased need to scale operations (Dodgson, Gann, and Phillips 2013). However, as mentioned in Chapter 4, the micromobility industry is currently in the maturity stage of the industry life cycle. At the maturity stage, markets become commoditised, and innovation emphasises customisation, convenience, and cost reduction to maintain competitiveness. BMI becomes particularly critical at this stage, as it allows companies to develop entirely new value propositions beyond what traditional product or process innovations can achieve, offering tailored solutions or significant cost advantages.

Thus, the micromobility industry provides an exemplary context for applying and further developing the business model patterns described in section 5.2.2. 'The St. Gallen Business Model Navigator Framework', in order to address the unique challenges described by the six dimensions of the PESTEL analysis.

5.3 Business Model Innovation – the Industry Status Quo

Examining the industry's current state of innovation allows for identifying critical innovations required for the sector's continued maturity. Therefore, the following will analyse Lime's approach to BMI, the patterns it adopted per the St. Gallen Business Model Navigator, and how it differs from its peers.

A total of 8 recurring business model patterns can be observed in Lime's operations. One key pattern is the Pay-Per-Use model, which serves as Lime's core revenue mechanism. Users are charged per ride based on the duration or distance, aligning with the demand for cost-effective

short-distance transportation. This model offers simplicity for users but poses challenges in ensuring profitability, given Lime's high operational and maintenance costs.

Another pattern is Freemium, in which the basic version of an offering is free in the hope that it will persuade the user/customer to pay the full price later (Business Model Navigator 2024). This is reflected in Lime's promotional strategies, such as offering free or discounted rides to attract new users. This model is primarily used to incentivise the initial use of the app and attract new users via competitive pricing. While effective in driving initial adoption, this approach increases the financial strain on Lime's already cost-intensive business, as this practice drives up the customer acquisition cost (CAC) and is not a sustainable business practice. The freemium business model often poses a risk to the company, as the percentage of paying customers is usually not high enough to subsidise all the free users and make a profit (Henriksson and Rama 2016).

Additionally, Lime leverages the pattern of sensor-as-a-service, which refers to using sensor data to create new offerings. It is important to note here that it is not the sensor that generates revenue but the data analysis that the sensor creates. Furthermore, Lime uses the pattern of Leverage Customer Data in combination with Sensor-as-a-Service, as value is created by using collected data from sensors in a beneficial way for internal and external stakeholders. Here, revenue is generated by selling this data directly to others or leveraging it for their own purposes (Business Model Navigator 2024). The sensors embedded in Lime's vehicles gather information on customer usage and vehicle performance. This data helps inform Lime's operational decisions, thus increasing its operational efficiency. It also offers value for urban planning and traffic management, showcasing an additional layer of utility derived from its micromobility offerings.

The Customer Loyalty and Subscription patterns are closely interconnected. Increased loyalty makes customers more likely to subscribe, as they are more willing to commit long-term. Conversely, subscriptions encourage more prolonged engagement with the company, further

strengthening customer loyalty. Hence, it is logical that the company engages in both patterns through offerings like LimePass, which provides unlimited rides for a fixed fee, and community-building efforts, which foster a loyal user base. This approach enhances customer retention while promoting long-term engagement with Lime's services.

The rent-instead-of-buy pattern describes the essence of Lime's approach. This pattern lowers the capital typically needed to gain access to the product. The company benefits from higher profits on each product, as it is paid for the duration of the rental period. Both parties gain from higher efficiency in product utilisation, as non-usage times are reduced for each product (Business Model Navigator 2024). In the case of Lime, it offers users temporary access to e-scooters rather than requiring ownership, thereby lowering the barriers to entry for customers while ensuring flexibility in usage. Customers can use the provided micromobility solutions for short-term use without purchasing a micromobility solution. Lime can repeat this process with multiple customers, thus maximising usage times and revenue from each product.

Lastly, Lime strives to achieve the pattern of Guaranteed Availability, which ensures consistent access to services, by maintaining a consistent presence of operational vehicles in target areas. This pattern underscores Lime's commitment to reliability, a critical factor in building user trust and ensuring repeat usage.

Bird, a competitor in the micromobility space, adopts a contrasting BMI approach. Bird predominantly relies on the pattern of Franchising, where local entrepreneurs manage fleet operations under the Bird Platform. This model shifts operational responsibilities towards franchisees while maintaining a centralised platform and brand control. Within this model, Bird allows independent operators to purchase scooters from the company and use its technology and branding to manage fleets (The Drive 2019). This approach enables Bird to scale with lower direct

operational costs but introduces challenges in maintaining brand consistency and operational quality.

Despite their differing operational models—Lime's direct management and Bird's franchise approach—their Value Proposition to the customer remains broadly similar. Both companies aim to provide affordable, accessible, sustainable, short-distance transportation solutions. Reviewing their offerings reveals no significant differences in core customer-facing services, such as ride pricing, vehicle availability, or user experience through their respective apps. However, Lime's greater control over operations allows for a more uniform service quality, while Bird's decentralised model can lead to regional variations.

Additional deviations in business models within the micromobility industry exist beyond Lime and Bird. Other European operators, such as Tier-Dott and Voi, have prioritised sustainability and technology integration. Tier-Dott partnered with public transit systems, such as Berlin's BVG network, to allow users to combine micromobility with other modes of transportation. This multimodal strategy aligns with European cities' regulatory priorities, particularly in reducing emissions and traffic congestion (Tier 2023). Voi, similarly, has embraced technology and regulatory compliance, using AI to optimise fleet distribution and predict user demand. By working closely with municipal authorities, Voi has co-developed regulations that facilitate its market access in cities like Stockholm and Oslo, strengthening its competitive position in these regions (Voi 2022).

These variations in operating/business models highlight the diversity of approaches in the industry, reflecting different priorities and strategic goals. However, the lack of diversity in offerings indicates a lack of BMI, which is necessary to differentiate oneself in a competitive market.

6. Empirical Findings

The section below displays the empirical findings from the questionnaire and the interviews. The questionnaire in its entirety can be found in the appendix of this thesis. Moreover, the data collected from the questionnaire was analysed using the statistical software Python.

6.2. Survey Analysis

This section provides a detailed analysis of the survey results using descriptive statistics, correlation methods and regression models. It explores demographic characteristics, transportation habits, satisfaction levels and challenges faced by users of micromobility services. The analysis aims to uncover patterns and relationships that inform user preferences and highlight areas for improvement.

6.2.1. Descriptive Statistics

The first step is to divide the survey data into different categories: demographics, transportation habits, satisfaction levels and price preferences. These descriptive insights establish the foundation for understanding user behaviour and the factors influencing their choices.

Demographic Overview of Respondents

The survey received 217 valid responses, offering valuable insights into the participants' demographic characteristics.

	Gender	Age	Country	City	Employment Status	Annual Income (gross) Bracket
unique	*4*	*6*	*25*	*52*	*6*	*6*
top	*Male*	*25-34*	*Germany*	*Munich*	*Student*	*Less than €20,000*
freq	*90*	*78*	*102*	*60*	*70*	*66*

Table 1: Descriptive statistics of demographics (internal analysis, 2024)

In terms of gender, most respondents identified as male. The age distribution revealed that the 25–34-year age group was the most represented, comprising 35.9% of respondents. Other age groups were also present, reflecting a diverse sample.

Geographically, many respondents resided in Germany, with 47.0% of participants identifying the country as their primary location. Munich emerged as the most frequently cited city in Germany, accounting for more than ¼ of all responses. While less represented individually, other cities contributed to a wide range of perspectives across urban and suburban environments.

Regarding employment status, students formed the largest group, representing 1/3 of the participants. The reported annual income levels varied significantly, with nearly 30% of respondents indicating a gross annual income of less than €20.000,00. However, a substantial portion of respondents fell within the €40.000,00 to €60.000,00 bracket, suggesting a well-distributed economic representation within the sample.

The demographic data demonstrate a diverse sample, concentrating on younger, urban-dwelling individuals. This composition is particularly relevant for a study on micromobility, as these groups are often among the primary users of such services. However, the findings should be interpreted with an understanding of the potential biases inherent in such a demographic profile.

Transportation Habits of Respondents

The survey explored transportation habits for short distances (1–2 km, 2–3 km and 3–4 km).

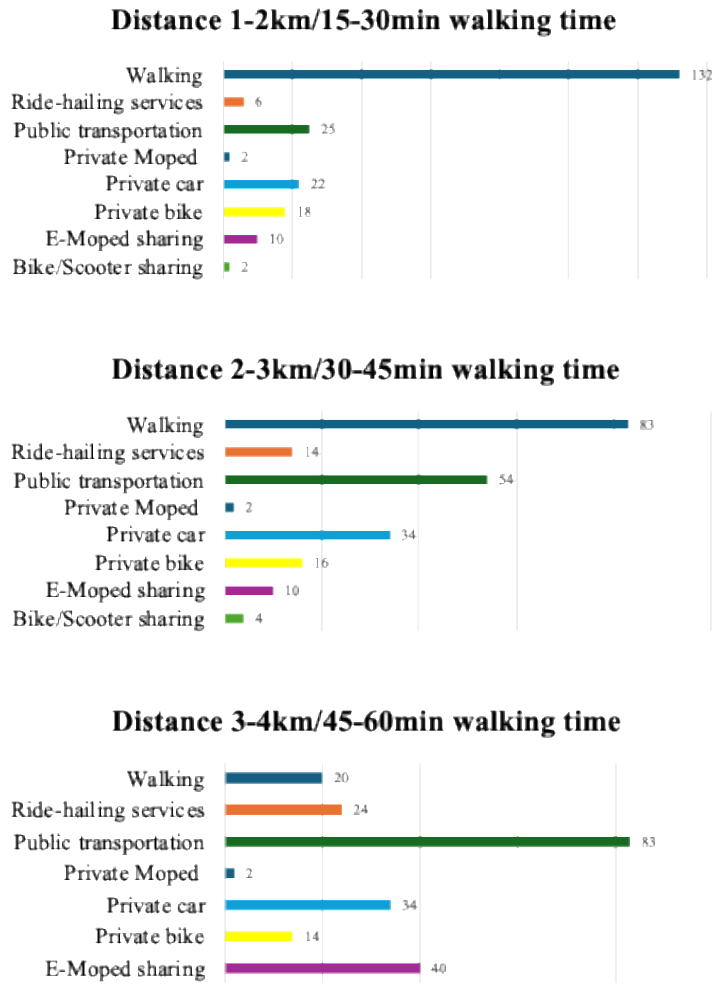

Figure 4:Transportation habits depending on distance (internal analysis, 2024)

The survey explored transportation habits for short distances (1–2 km, 2–3 km and 3–4 km). Walking was the most popular mode for trips within one to two km, but its usage declined sharply for longer distances. Public transportation became the preferred mode for trips beyond three km, with 83 out of 217 relying on it for three to four-km journeys.

Micromobility options such as bike and scooter sharing, e-moped sharing and ride-hailing services were supplementary, with adoption ranging between 19% and 33% depending on distance. Private

bikes showed steady usage across all distances, indicating a preference for ownership among some respondents.

Satisfaction with Micromobility Services

Participants rated their satisfaction with current micromobility services on a scale from 1 (very dissatisfied) to 5 (very satisfied). The mean satisfaction score was 2.93. This indicates moderate satisfaction levels overall. However, the variance was 0.89, reflecting some dispersion in responses.

Regarding frequency, 70 respondents rated their satisfaction as 2 and 72 respondents rated it as 3, forming the majority. Few participants rated their satisfaction at the extremes, with only 9 giving a score of 1 and 7 giving a score of 5.

Willingness to Pay and Subscription Preferences for Micromobility Services

The survey assessed respondents' willingness to pay for short-term micromobility rentals, subscriptions and midterm renting options, shedding light on the pricing strategies that could enhance adoption.

For short-term rentals, such as 15-minute rides, 47% of respondents indicated a willingness to pay between €3 and €5, while 28% preferred a lower range of €2 to €3. A minority (15%) stated they would not use these services, often citing cost concerns or infrequent usage needs. The data reflect the critical role of affordability in driving adoption, particularly among younger or cost-conscious users. When considering monthly subscriptions (e.g., unlimited rides), 45% of respondents expressed interest, provided the cost was below €40. A further 35% were open to subscribing, contingent on the price or features offered, while 20 % explicitly rejected the idea due to limited perceived utility. This means 80 % of respondents are interested in such a possible construct. The

mean willingness to pay for a subscription was €36,50, with a median of €30,00, suggesting a preference for economically accessible plans.

Midterm rentals (e.g., 1–3 months for e-mopeds) garnered moderate interest, with 38% of respondents expressing a willingness to explore such plans. A further 25% were undecided, highlighting a potential but underexplored market. Most preferred rental costs are below €70,00 per month, with only a tiny proportion open to paying over €100,00. These findings align with the affordability expectations observed in other pricing models.

Reasons for Using Micromobility Services

The survey provides insights into the factors influencing transportation choices and the primary motivations for using micromobility services.

	1st	2nd	3rd	4th	5th	6th	Average Rank
Convenience (availability, parking)	50	30	15	10	3	1	1.98
Speed	30	40	20	10	5	4	2.38
Cost	15	20	40	20	10	4	3.02
Comfort	10	10	15	30	20	5	3.61
Environmental impact	3	5	5	15	40	41	4.90
Safety	1	4	4	14	21	50	5.13

Table 2: Importance of factors influencing transportation choices (internal analysis, 2024)

Respondents ranked six key factors based on their importance, 1st being most important and the 6th being least important. Convenience, which encompasses availability and ease of parking, had an average rank of 1.98 and was most frequently selected as the top priority. With an average rank of 2.38, speed was the second-most important factor, reflecting the value users place on minimising travel time. Cost ranked third with an average score of 3.02. Comfort ranked fourth (3.61), suggesting users prioritise functional considerations over luxury. As mentioned, environmental

impact ranked fifth (4.90), highlighting that while sustainability is valued, it is often secondary to immediate practical concerns.

When asked about their reasons for using micromobility services, respondents emphasised time efficiency and convenience as their primary motivators, citing them 154 and 151 times, respectively. The flexibility and accessibility of these services were also emphasised, especially for short distances in urban areas. Respondents also highlighted the enjoyment aspect of e-scooters and e-bikes, with “fun to use” being chosen a total of 102 times when asked about the reason for choosing micromobility solutions. Environmental friendliness was mentioned 63 times, demonstrating a comparable lack of importance of respondents on this topic.

Challenges with Micromobility Services

The survey identified several challenges associated with micromobility services, highlighting areas for potential improvement. The most frequently cited issue was the availability of vehicles, reported by 156 respondents, followed closely by difficulties in parking or returning vehicles, which 144 respondents highlighted. These issues directly impact the convenience and accessibility of micromobility solutions. Cost was another notable barrier identified by 95 respondents, underscoring the importance of affordability in driving adoption. Safety concerns, including inadequate safety features, were mentioned by 46 respondents, while 40 highlighted poor customer service as an area for improvement.

Desired Improvements and Potential Offerings in Micromobility Services

Many participants expressed dissatisfaction with current pricing structures. Suggestions included more affordable pricing tiers, student discounts, and loyalty programs for frequent users. Another significant improvement mentioned was the expansion of service coverage. Participants

highlighted the need for greater availability in suburban and less densely populated areas, which are often underserved by existing micromobility networks. Improved safety measures were also a recurring theme, with respondents calling for enhanced infrastructure such as dedicated lanes, improved lighting and the inclusion of helmets with rentals.

Respondents also expressed concerns about vehicle parking and management. Many proposed solutions to mitigate clutter caused by parked e-scooters and e-bikes, such as designated parking zones and stricter parking rule enforcement. Additionally, several participants noted a desire for better vehicle maintenance to ensure reliability and safety during use.

Respondents suggested a range of ideas when asked about potential products or services that could encourage more frequent use of micromobility. Subscription models with flexible features, such as combined micromobility and public transportation passes, were widely recommended. Other suggestions included integrating technology to enhance the user experience, such as apps with route optimization and gamified rewards for sustainable travel behaviour.

6.2.2. Correlation Analysis

This subsection delves into the relationships between key variables to understand their influence on satisfaction, willingness to pay and subscription. It provides insights into user behaviour and the factors shaping their engagement with micromobility services.

Satisfaction and Income

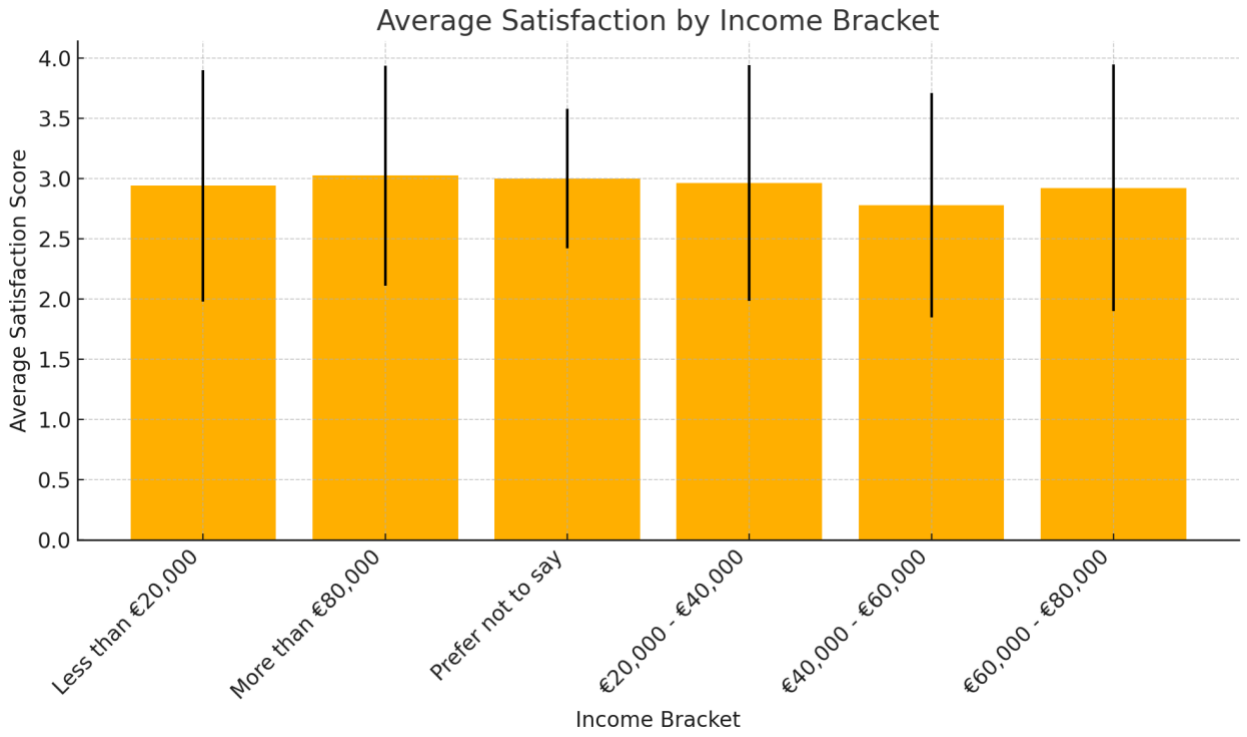

Figure 5: Average Satisfaction by income Bracket (Internal analysis, 2024)

The analysis of satisfaction scores across income brackets suggests only minimal differences in satisfaction levels among income groups. As shown in the figure, average satisfaction scores range from 2.78 to 3.02, with the highest score reported by individuals earning more than €80.000,00 and the lowest by those earning between €40.000,00 and €60.000,00. However, these differences are minor, and the overlapping error bars indicate that the variations may not be statistically significant. The relatively consistent standard deviations across income brackets, ranging from 0.58 to 0.98, further highlight the lack of substantial variability in satisfaction by income.

Satisfaction and Willingness to Pay for Short-Term Rentals and Subscriptions

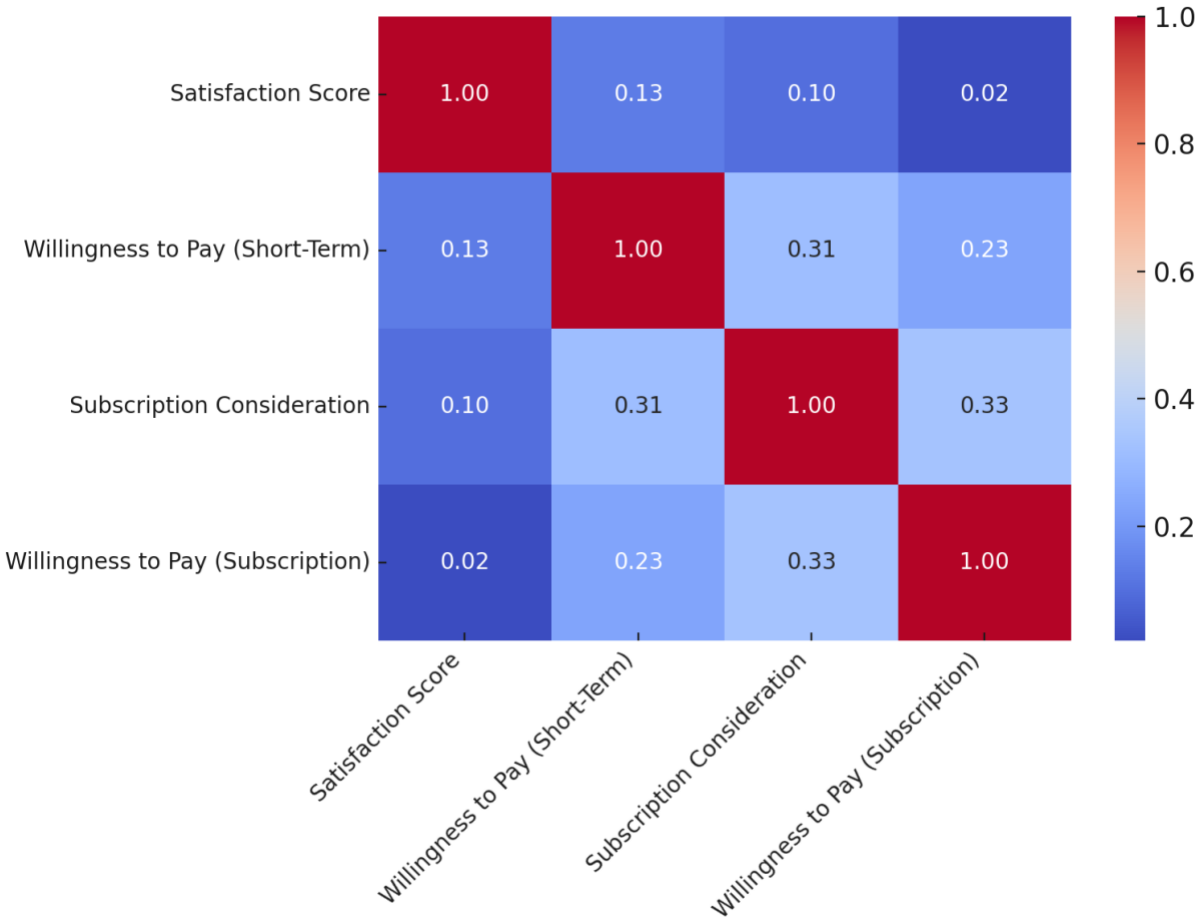

Figure 6: Correlation Matrix of Satisfaction and Willingness to Pay for Short-Term Rentals and Subscriptions (Internal analysis, 2024)

The correlation coefficient between satisfaction and willingness to pay for short-term rentals is 0.127. Similarly, the correlation between satisfaction and willingness to pay for subscriptions is 0.019, indicating an almost negligible relationship. Furthermore, the correlation coefficient between satisfaction and a user's consideration of subscribing is slightly higher at 0.099 but remains weak.

Correlation Between Individual Challenges and Satisfaction Levels

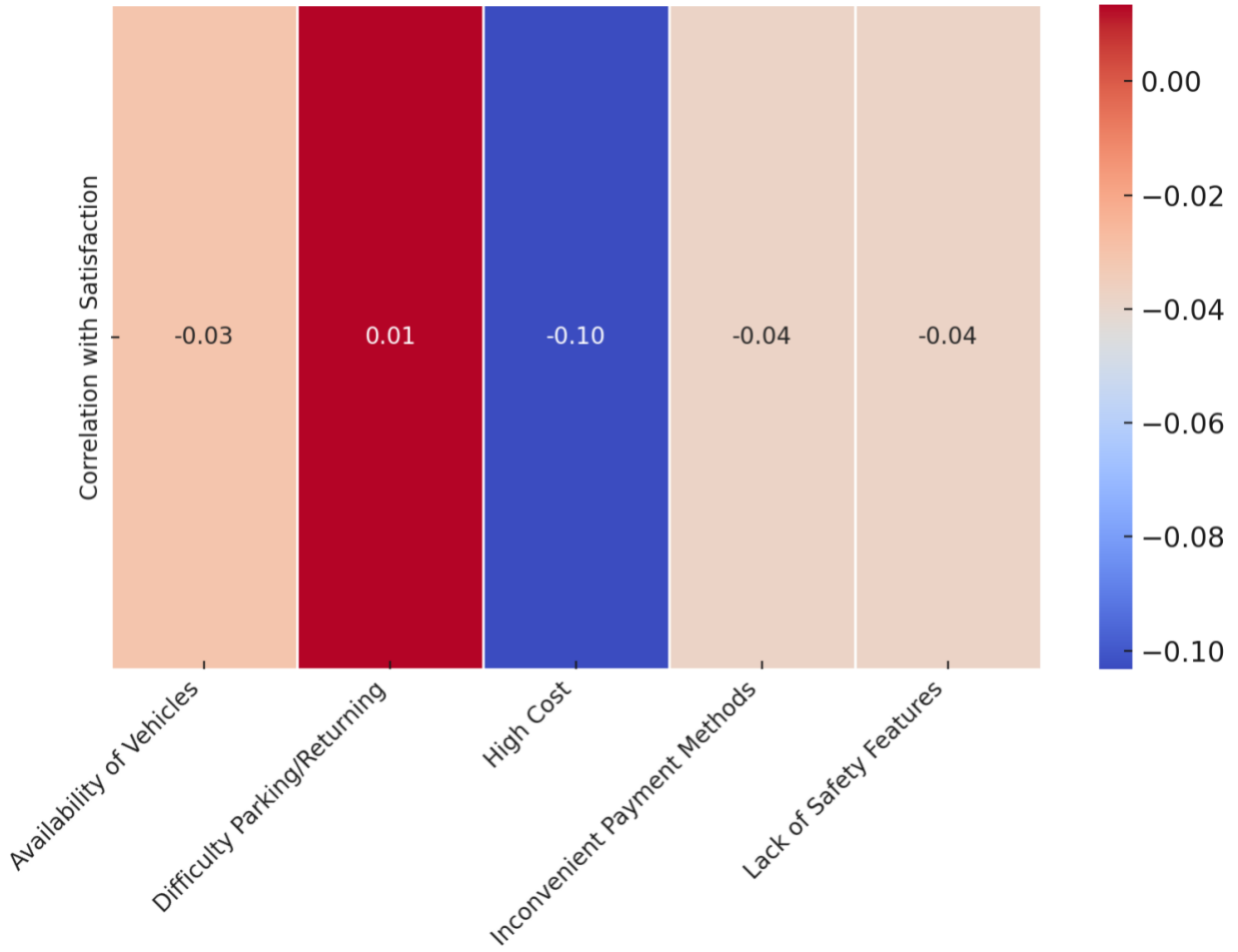

Figure 7: Correlation between Satisfaction and different Challenges (Internal Analysis, 2024)

The analysis reveals that most challenges have negligible correlations with satisfaction levels. Among the challenges analyzed, "High Cost" demonstrated the strongest negative correlation (-0.103). This aligns with prior findings that affordability is a key concern for many users.

Other challenges, such as "Availability of Vehicles" (-0.030), "Difficulty Parking/Returning" (0.013), "Inconvenient Payment Methods" (-0.038) and "Lack of Safety Features" (-0.038), exhibited correlations near zero. These results indicate that these challenges, while important in shaping specific aspects of user experience, do not strongly influence overall satisfaction scores.

6.2.3 Regression Analysis

This section examines the factors influencing user satisfaction, subscription likelihood and willingness to pay for micromobility services through three distinct regression models. Each model analyses a specific outcome of interest, integrating operational challenges, demographic variables and satisfaction levels to provide a comprehensive understanding of user behaviour and preferences.

Satisfaction Model

The model incorporates operational challenges, such as “Difficulty Parking/Returning” and “High Cost,” along with demographic variables, including income and gender, to assess their relative influence. The results identified “Difficulty Parking/Returning” as a statistically significant positive predictor of satisfaction ($p = 0.003$). Other challenges, such as “High Cost” and “Availability of Vehicles,” did not show significant relationships, indicating their limited direct impact on user evaluations. Similarly, demographic variables, such as income, employment and gender, were not significant. The model’s goodness-of-fit, with an R2 of 0.178 and an adjusted R2 of 0.103, indicates that the predictors explain approximately 10.3% of the variation in satisfaction. Diagnostic checks confirmed the model's validity, with no major violations of linearity, homoscedasticity, or normality in the residuals.

Subscription Likelihood Model

The analysis revealed that satisfaction is the most significant predictor of subscription likelihood ($p < 0.01$). This result highlights the critical role of overall user experience in fostering subscriptions, as users who report higher satisfaction are more inclined to subscribe.

The model's goodness-of-fit, with an R^2 of 0.210 and an adjusted R^2 of 0.155, indicates that the predictors explain 15.5% of the variation in subscription likelihood. This relatively higher explanatory power compared to the Satisfaction Model underscores the importance of satisfaction in driving this outcome. Residual diagnostics confirmed the model's validity, showing no significant deviations from linearity or homoscedasticity and approximate normality of residuals.

6.2.4 Summary of Survey Findings

The demographic analysis reveals that the majority of respondents were male, aged 25–34, and predominantly located in Germany, with Munich being the most frequently mentioned city. Students formed a significant proportion of participants, with nearly 30% reporting an annual income below €20,000. This demographic profile highlights younger, urban-dwelling individuals as the primary user group for micromobility services.

Respondents' transportation habits indicate a preference for walking over short distances (1–2 km), while public transportation dominates for trips beyond 3 km. Micromobility options, such as e-scooters, e-bikes, and ride-sharing, served as supplementary solutions, with 19% and 33% adoption rates. Ownership of private bicycles maintained steady usage across all distances, reflecting user preference for personal modes of transport.

Satisfaction levels with micromobility services were moderate, with a mean score of 2.93 on a 5-point scale. The majority of respondents rated their satisfaction as 2 or 3, indicating room for improvement. In terms of pricing, 47% of respondents were willing to pay between €3–5 for short-term rentals, while 80% expressed interest in monthly subscription models, provided the cost remained below €40. Midterm rentals, such as 1–3-month e-moped plans, garnered moderate interest, with most respondents preferring a price point under €70 per month.

When examining factors influencing transportation choices, convenience emerged as the most critical factor, followed by speed and cost. Environmental impact and safety were considered less important, with safety ranking last overall. Key motivations for adopting micromobility services included time efficiency and convenience, while "fun to use" was also cited as a reason by a notable number of respondents.

The analysis also highlighted significant challenges. The most frequently reported issues were vehicle availability (cited by 156 respondents) and parking/return difficulties (144 mentions). High costs and safety concerns were additional barriers to adoption, with respondents emphasising the need for more affordable pricing, expanded service coverage in suburban areas, and improved safety measures such as dedicated infrastructure and helmet availability.

The correlation analysis demonstrated weak relationships between satisfaction and other variables, with high costs showing the strongest negative correlation (-0.103). Other challenges, such as vehicle availability and parking issues, had minimal influence on overall satisfaction scores.

The regression analysis identified satisfaction as the most significant predictor of subscription likelihood, underscoring the importance of enhancing user experience to drive subscriptions. The model explained 10.3% of the variation in subscription likelihood, while operational challenges and demographic variables showed limited predictive power.

In conclusion, the findings emphasise the importance of convenience, affordability, and service availability in driving micromobility adoption. Addressing key challenges, such as vehicle availability, parking infrastructure, and safety features, while enhancing pricing structures and introducing flexible subscription models, can significantly improve user satisfaction and broaden the adoption of micromobility solutions. These insights provide a valuable foundation for informing strategic decisions and operational improvements within the micromobility sector.

7.4 Research Limitations

While this study offers valuable insights into the innovation potential of business models in the micromobility sector, several limitations must be acknowledged. These constraints influence how the findings should be interpreted and, by extension, their applicability in broader contexts. Consequently, it is essential to consider the conclusions drawn here within the framework of these acknowledged shortcomings.

A primary concern relates to the representativeness of the sample. Respondents were primarily recruited through convenience sampling, drawing on networks from NOVA SBE, personal acquaintances, and professional contacts. Although this approach ensured a sufficient sample size, it may not fully encapsulate the wide-ranging demographic, social, and behavioural variances that characterise micromobility users across the globe. The same caveat applies to the selection of industry experts. Despite including a variety of stakeholders, the chosen experts may not reflect regional nuances, sector-specific subtleties, or culturally contingent perspectives.

Another limitation lies in the scope and methodological composition of the data collection. The research established a multifaceted viewpoint by combining quantitative surveys with qualitative interviews. However, the geographic concentration and relatively limited timeframe may restrict the universal applicability of the results. Moreover, the reliance on self-reported data in surveys introduces potential biases, such as social desirability bias, particularly when addressing sensitive topics like sustainability and regulation. The subjective nature of participants' perspectives may have further shaped the findings, possibly skewing interpretations.

The micromobility sector's dynamism compounds these challenges. As a nascent industry subject to rapid technological shifts and evolving regulatory landscapes, the conditions observed during data collection may have already changed. Trends, challenges, and opportunities can emerge or

dissipate quickly, potentially rendering specific insights time-bound and limiting their long-term relevance.

Additionally, the study's broad thematic scope, spanning technological, regulatory, and behavioural dimensions, may have constrained the depth of inquiry in any single area. For instance, although the intersection of micromobility and urban policy or the intricate cost structures underlying innovative business models warrants closer examination, the breadth of this research may have prevented more granular analyses. Similarly, while theoretical frameworks such as the St. Gallen Business Model Navigator™ were integrated with empirical data, emerging topics—like gamification or AI-driven fleet optimisation—could only be partially explored, given their embryonic state in practice and research.

Cultural and ethical considerations introduce another layer of complexity. Without explicitly addressing how regional, societal, or ethical factors influence the acceptance and perception of micromobility services, there is a risk that the generalizability of these findings remains limited. Methodological constraints also played a role: the use of Microsoft Forms and Microsoft Teams for data collection may have unintentionally excluded potential respondents less familiar with digital tools or those lacking reliable internet access.

Future investigations could address these limitations in several ways. Expanding geographic coverage and employing stratified random sampling might ensure a more comprehensive demographic and cultural representation. Longitudinal designs could capture the industry's evolution over time, while narrower inquiries into specific aspects, such as regulatory cost burdens or the scalability of particular technologies, might yield more targeted insights. Furthermore, delving into cultural attitudes and ethical dimensions would enhance understanding of user behaviour and inform more inclusive strategies in diverse markets.

Despite these constraints, the present study furnishes a robust foundational understanding of innovation dynamics within the micromobility sector, both practical and theoretical. Acknowledging these limitations does not detract from the study's contributions; on the contrary, it illuminates pathways for further inquiry, thereby strengthening the potential for future research to refine, validate, and expand upon the knowledge established here

9. Conclusion

The micromobility industry stands at a critical inflexion point, transitioning into a phase marked by market consolidation, stricter regulations, and decelerated growth. Its sustained viability hinges on operators' ability to adapt to evolving user preferences, regulatory environments, and environmental imperatives. This thesis highlights the transformative potential of micromobility as a cornerstone of urban mobility, addressing critical challenges such as congestion, emissions, and accessibility while reshaping urban environments for a more sustainable future.

Affordability, flexibility, and availability remain pivotal to user adoption, as survey findings indicate strong preferences for subscription models priced under €40. These insights underscore the necessity for pricing strategies that balance user affordability with operational sustainability. The research identifies four critical business model innovations to address current industry challenges: a subscription-based revenue model with dynamic pricing to stabilise revenue streams and enhance customer loyalty; an integrated fleet management system to optimise operational efficiency; a multimodal integration platform to connect with existing transport infrastructure seamlessly; and a circular economy business model to ensure long-term sustainability. A practical implementation of these principles is demonstrated in the Breeze concept. This mid-term e-moped rental solution bridges the gap between traditional sharing and ownership models, with 56% of

survey respondents expressing interest in such mid-term rental options. By addressing current gaps in service delivery through these complementary approaches, these innovations align with evolving consumer expectations while fostering long-term engagement and operational viability.

Technological innovation emerges as a critical enabler of operational efficiency and scalability. IoT-enabled fleet management, AI-driven predictive maintenance, and battery-swapping systems offer the potential to optimise vehicle utilisation, reduce downtime, and enhance service reliability. For example, predictive analytics can dynamically allocate fleets to high-demand areas, ensuring services meet user expectations even in densely populated urban centres. These advancements lower operational costs and strengthen the industry's capacity to meet rising consumer demands.

Sustainability remains a defining characteristic of the micromobility sector. Operators must adopt circular economy principles, incorporating modular vehicle designs, optimised recycling processes, and renewable energy sources. Emphasising measurable outcomes, such as reductions in carbon emissions, will attract environmentally conscious consumers and solidify brand loyalty. However, as explored in Chapter 7, the "intention-behavior gap" highlights that sustainability, while appreciated, is often secondary to convenience and cost-effectiveness in user decision-making. Addressing this gap requires embedding sustainability into operational processes rather than treating it as a peripheral narrative.

Infrastructure development and regulatory harmonisation are equally critical. Fragmented regulations across cities inflate operational costs and hinder scalability and user accessibility. As exemplified by Oslo's MaaS platform, standardised frameworks demonstrate how public-private partnerships can integrate micromobility into multimodal transport networks, enhancing user convenience and operational efficiency. Collaborative initiatives, such as data-sharing agreements

and co-developed infrastructure projects, are essential for overcoming regulatory barriers and fostering seamless mobility solutions.

The resilience demonstrated by the micromobility sector during the COVID-19 pandemic underscores its capacity to navigate disruptive challenges. The recovery trajectory, driven by technological advancements, evolving consumer behaviour, and favourable public policies, exemplifies the industry's ability to transform obstacles into opportunities. In the words of Steve Jobs, "Innovation is the ability to see change as an opportunity, not a threat." This ethos encapsulates the journey of micromobility, illustrating how strategic innovation can drive progress for the industry and the urban ecosystems it serves.

Looking ahead, the micromobility sector is well-positioned to act as a catalyst for sustainable urban transformation. By aligning with principles of innovation, fostering collaboration among stakeholders, and anticipating future trends, operators can solidify their role as indispensable components of urban mobility systems. This thesis offers a framework for understanding the intricate dynamics of micromobility. It provides actionable insights for addressing its challenges, enhancing its impact, and ensuring its relevance in an ever-evolving urban landscape. The journey of micromobility is more than an industry narrative; it is a testament to the power of innovation to drive sustainable growth and meaningful change.

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11. Appendix

11.1 Interviews

Andre Miles: Interview Transricpt

Date: 6 Dezember 2024
Participants:
• Leander Christopher Held
• Andrew Miles, Director of Partnerships at Righty

Introduction
Interviewer (Leander): Um, okay, to start, maybe you could briefly introduce yourself and share a bit about your role and responsibilities within your organization or in the whole industry.
Andrew Miles: So my name is Andrew Miles. I'm currently the Director of Partnerships for Righty, a Chicago-based micro-mobility company operating across the US and recently expanding to Canada. At Righty, we deploy micro-mobility solutions as amenities for large commercial real estate, primarily office tech parks, multi-family residential buildings, student housing, corporate campuses, and hospitality sectors.
What that really means is we deploy primarily shared e-bikes and e-scooters in a private setting, where only tenants, employees, or residents of these buildings have access to these dedicated fleets. The usage model is akin to private ownership, but these are shared devices owned by the building and operated by us.
Previously, I've been in the industry for about seven years. My last role was with a white-label software company called Joyride, which deployed software for publicly shared companies worldwide, operating in both public and private schemes but mostly public. Before that, I was a senior operations manager at a US-based operator called Veo during the early days of public scooter sharing (2018–2020). I gained extensive experience launching new markets, deploying new technologies, and leading regional and national teams.

State of the Micromobility Industry
Interviewer: Just a quick intro into the industry. How would you describe the current state of the micromobility industry?
Andrew Miles: The micromobility industry is undergoing significant transformations. Righty operates across the US and has recently expanded into Canada, reflecting a broader North American trend. The shift is towards operational efficiency and centralized control, driven by advancements in AI and the adoption of swappable batteries. There's also a noticeable trend of integrating various vehicle types and improving vehicle quality to enhance user experience and operational sustainability.
Additionally, the market is seeing consolidation as companies strive to achieve scale and profitability amidst tightening venture capital landscapes. The focus is shifting from rapid expansion to sustainable growth, emphasizing durable and efficient fleet management.

Current Business Models in Micromobility

Interviewer: From a perspective of the vehicles, you only have bikes and scooters right now in the fleet?

Andrew Miles: Primarily, yes. We focus on e-bikes and e-scooters, but we also offer regular pedal bikes at some locations based on customer demand. Recently, we've started incorporating cargo e-bikes to cater to specific needs like deliveries and logistics within commercial properties.

Interviewer: Could you also imagine adapting the fleet to include electric mopeds, like Vespas or similar vehicles, or isn't that interesting?

Andrew Miles: Possibly, if the client or commercial property owner requests it. However, in the US market, electric two-wheelers like mopeds aren't as prominent as they are in Europe, particularly in regions like Iberia or Italy where they've been part of the culture for decades. The main challenge is the cost; electric mopeds can be three to five times more expensive than gas-powered ones. Additionally, the infrastructure and regulatory environment in the US aren't as conducive to electric mopeds as they are in Europe. That said, there's potential in student housing or college towns where mopeds have been traditionally popular.

Adapting Business Models to Stay Competitive

Interviewer: Let’s jump into the next section and talk about the current business models. One of our key focus areas is how companies are innovating their business models. Could you share your perspective on how mobility companies are adapting their business models to stay competitive?

Andrew Miles: Sure, I’ll focus on companies like Lime, Bolt, and Tier because they dominate funding and news cycles. These companies have been striving for profitability for years but have often avoided necessary steps like running lean operations and slashing sales and marketing budgets.

They followed Bird's initial blitzkrieg market acquisition model, which focused on rapid scaling and increasing valuation through aggressive unit economics. However, this approach works well in SaaS but not in hardware and operations-heavy businesses like ours.

When the pandemic hit, venture capital dollars dried up, forcing companies to pivot. Some, like Veo and Spin, shifted focus early by emphasizing in-house operations, centralized control, and swappable batteries. These strategies improved operational efficiency, reduced costs, and increased fleet availability, thereby boosting margins. This shift is essential for maintaining competitiveness in a market where funding is increasingly tied to profitability.

Impact of Pricing Models on Customer Retention

Interviewer: Thank you for these deep insights. Regarding your revenue stream, do you use a pay-per-use or subscription-based model?

Andrew Miles: It depends on our customers. Most of our clients offer our service as a free amenity to end-users, such as residents of furnished apartment complexes or employees in office parks. In these cases, the service is included as part of the rental or employment package, and users can access the fleet without direct charges.

However, some property owners choose to charge day or hourly fees via our app, creating a pay-per-use model. This flexibility allows us to cater to different market needs and optimize revenue streams based on the specific requirements of each commercial property.

Role of Strategic Partnerships and Ecosystem Development

Interviewer: Moving on to strategic partnerships and ecosystem development, how are partnerships shaping the future of business models in this sector?

Andrew Miles: Partnerships are crucial for our business model and the future of micromobility. On the backend, we partner with software companies like Zoba or Capture, which provide AI-powered solutions for parking compliance and operational efficiency. These technologies help us manage our fleets more effectively, ensuring vehicles are properly parked and maintained.
On the frontend, we establish local partnerships with businesses like cafes that incentivize rides and build community goodwill. These partnerships enhance the user experience by providing rewards and creating a network of interconnected services that benefit both our users and our partners.
Additionally, strategic collaborations with commercial real estate developers and property managers are essential for integrating micromobility solutions seamlessly into their offerings. These partnerships enable us to provide tailored solutions that meet the specific needs of different commercial environments, thereby enhancing the value we deliver to our clients.

Future Trends and Innovations
Interviewer: What are the most promising trends or innovations in micromobility for the next 5–10 years?
Andrew Miles: Key trends include:
Improved Vehicle Quality and Durability: There's a focus on enhancing the robustness and longevity of micromobility vehicles to reduce operational costs and increase user satisfaction.
Advanced Battery Technologies: Innovations like lithium-air or graphene-based batteries promise longer lifespans and quicker charging times, which are critical for operational efficiency and user convenience.
Diversification of Modal Mixes: Incorporating a variety of vehicle types, such as quad e-peds or electric tuk-tuks, can cater to diverse user needs and expand the market reach.
AI Adoption for Safety Features: Implementing AI for features like speed modulation in pedestrian-heavy areas can enhance safety and compliance with local regulations.
Infrastructure Development: More cities are introducing dedicated cycleways and car-free zones, which facilitate safer and more efficient use of micromobility vehicles.
Integration with Public Transport: Developing infrastructure that supports seamless transitions between micromobility and public transport systems can enhance the overall urban mobility ecosystem.
These trends highlight the importance of technological advancements and strategic infrastructure investments in shaping the future of micromobility.

Conclusion
Interviewer: Perfect, very interesting. Thank you so much for your time and insights.
Andrew Miles: Absolutely. Good luck with your thesis!
Interviewer: Thank you. Have a great day and week ahead. Maybe we'll cross paths again soon.
Andrew Miles: With pleasure. Take care. Bye.
Interviewer: Goodbye.

Pedro Homem de Gouveia: Interview Transcript

Date: 6 Dezember 2024
Participants:
• Leander Christopher Held
• Pedro Homem de Gouveia

Introduction
Leander: Yeah.
Pedro: It has started fine.
Leander: OK, perfect. Great. Now we can start, alright. Yeah, OK, I've already introduced myself.
Pedro: Where are you from? You didn't say.
Leander: I'm from Germany, sorry. Yeah, and yeah, we're in our last semester right now and we're working on our master thesis in the area of business model innovation in the micromobility industry.
Pedro: OK. Yep.
Leander: Yeah, maybe to start, you could also briefly introduce yourself and share a bit about your role and responsibilities within your organization or in the industry. Be nice.
Pedro: Yeah, yeah. So my name is Pedro Homem de Gouveia. I work for Polis. Polis is the leading network of European citizen regions advancing transport innovation, specifically innovations that can make urban, suburban, and rural mobility more sustainable, safe, and equitable. We have around 120 members, which include local and regional governments and transport authorities. We also have a few research non-profits like Nova.
My previous experience includes working for 21 years with the city of Lisbon in various roles. I started as a political advisor, then returned as a public worker where I served as a designer, strategist, trainer, and internal consultant from 2008 to 2019. My focus was on improving pedestrian accessibility by removing barriers from sidewalks to help people with disabilities and pedestrians in general. Additionally, I worked on integrating scooters and other micromobility solutions into the city's infrastructure.
In Lisbon, as in many other cities, micromobility operators entered without a clear regulatory framework. Public authorities can only forbid or authorize based on existing laws, leading to a significant regulatory gap. This resulted in a surge of companies, with up to 12 shared micromobility operators in Lisbon at one point, many of whom left due to intense competition.
At Polis, I work on the European level, interviewing and engaging with both private micromobility operators and public sector regulators. This provides me with a comprehensive perspective on the discussions and decision-making processes at both political and administrative levels.

State of the Micromobility Industry
Leander: Just a quick intro into the industry. How would you describe the current state of the micromobility industry?
Pedro: Well, looking at it, you can clearly see consolidation taking place. There are a few key points:
Venture Capital Withdrawal: Access to venture capital is decreasing as investors pull out of the sector. Many micromobility companies burned through capital in their early years, but now funding is drying up. Additionally, there's uncertainty about how much these companies are profiting from data sales, which the public sector is largely unaware of.

Early Adoption Stagnation: Shared micromobility, particularly shared e-scooters, remains stuck with early adopters—mainly younger individuals and tourists. The adoption curve indicates that if a technology remains in the early adopter phase for too long, it may not achieve widespread usage. There's a slow increase in usage among younger women, but it's still minimal.
Individual Ownership Surge: In countries like France, there's a significant rise in individually owned e-scooters. For example, in 2021, nearly 908,000 e-scooters were sold to individuals, compared to the shared fleet numbers. This surge benefits manufacturers more than shared micromobility operators, raising questions about the long-term impact on the shared sector.
Urban vs. Suburban Deployment: Shared micromobility operators tend to focus on urban centers with high population density. However, suburban areas present challenges due to lower density, requiring more vehicles to achieve the same level of utilization, which is unsustainable. To address this, operators need public compensation or incentives to deploy effectively in these areas, helping users connect to public transit corridors.
Overall, shared micromobility is struggling to transition from early adopters to mainstream users, facing intense competition and operational challenges.

Adapting Business Models to Stay Competitive
Leander: From your perspective, how are micromobility companies adapting their business models to stay competitive?
Pedro: Honestly, I see no significant adaptation. Many companies are not adapting their business models effectively. Here's why:
Lack of Transport Expertise: Most micromobility companies are founded by tech professionals, not transport experts. They focus on creating apps and acquiring users without a deep understanding of transport operations. This leads to inefficient business models that prioritize growth over sustainability.
Operational Inefficiencies: Companies often choose the cheapest vehicles, like e-scooters, which are less durable and require frequent replacements. This increases operational costs and reduces profitability. There's a growing pressure to make these vehicles last longer and be sturdier, but without sufficient capital, it's challenging.
Platform Economy Limitations: In the platform economy, continuous growth is essential. Once growth slows, companies struggle to maintain profitability. Many are unable to innovate their business models to adapt to a non-growing market, leading to stagnation.
Limited Focus on Corporate Mobility: There's a lack of exploration into corporate mobility partnerships. Few companies are targeting corporate clients who could provide steady revenue streams through employee mobility programs. This represents a missed opportunity for diversification and financial stability.
Overall, the lack of adaptation in business models hampers the ability of micromobility companies to stay competitive in a challenging market environment.

Challenges Limiting Business Model Innovation
Leander: What are the biggest regulatory or infrastructural barriers limiting innovation right now?
Pedro: Shared micromobility presents a complex case study with several economic and regulatory challenges:
Cognitive Bias in Regulation: Regulators often focus on new and salient issues, like the safety of e-scooters, while ignoring underlying problems. For example, e-scooters are statistically less dangerous than pedestrians being hit by cars, yet they receive disproportionate regulatory attention.

Regulatory Gaps and Inconsistencies: Local governments have limited authority to regulate micromobility effectively due to overarching federal laws. This leads to inconsistent regulations across cities, making it difficult for operators to navigate and comply uniformly.
Infrastructure Limitations: Cities lack adequate infrastructure to support shared micromobility, such as designated parking areas and charging stations. This results in chaotic parking behavior and operational inefficiencies.
Economic Strain on Public Authorities: Extreme climate events and economic pressures stretch public authorities thin, limiting their ability to invest in and regulate micromobility infrastructure effectively. This leads to reactive rather than proactive regulatory approaches.
These barriers create an environment where innovation is stifled, and shared micromobility operators struggle to operate sustainably.

Role of Strategic Partnerships and Ecosystem Development
Leander: How are partnerships shaping the future of business models in this sector, particularly between different operators and with public transport or other authorities?
Pedro: There are very few successful cases of strategic partnerships in micromobility. Here are some observations:
Mobility as a Service (MaaS): The concept of integrating various transport modes into a single service platform faces significant challenges. Margins are extremely thin, making it difficult to generate sustainable revenue. Additionally, tech companies prefer to maintain direct relationships with users rather than mediate services for other providers, limiting effective partnerships.
Public Transport Integration: True integration with public transport data and ticketing systems is rare. Without partnerships that allow micromobility operators to access and utilize public transport data, seamless user experiences remain elusive. European regulations are pushing towards requiring public transport authorities to make their ticketing apps accessible, which could facilitate better integration in the future.
Non-Competing Partnerships: Successful partnerships tend to occur between non-competing entities. For example, car rental services can partner with micromobility operators without directly competing, allowing both to benefit from each other's customer bases.
Overall, strategic partnerships are essential for creating a cohesive urban mobility ecosystem, but they are currently limited by technical, economic, and regulatory challenges.

Future Trends and Innovations
Leander: What are the most promising trends or innovations you believe will shape the industry over the next few years? Maybe you can name three or four main trends.
Pedro: Here are some key trends:
Climate Change Impact: Extreme weather events like floods and heatwaves will increasingly affect infrastructure and mobility patterns. Governments, already dealing with high debt levels, will face challenges in maintaining and upgrading transport infrastructure, impacting both public and private sectors.
Growth of Inequality: Economic strains and structural changes will exacerbate inequalities, affecting mobility choices. Younger generations face higher job turnover and housing challenges, making traditional car ownership less appealing and increasing reliance on shared micromobility solutions.
Electromobility Revolution: The surge in electric vehicle ownership, including e-scooters and e-bikes, will create new regulatory challenges. Shared micromobility operators must adapt to

accommodate individual ownership trends and integrate with broader electromobility infrastructure.

Sustainability and Greenwashing: As sustainability becomes a more significant concern, companies may engage in greenwashing to appear environmentally friendly without making substantial operational changes. Genuine sustainability efforts will become crucial for long-term success.

These trends highlight the need for micromobility companies to adapt their strategies to address environmental, economic, and social challenges effectively.

Conclusion

Leander: Thank you for the interesting insights. You already answered some questions I wanted to ask later. From your perspective, how are micromobility companies adapting their business models to stay competitive?

Pedro: I see no significant adaptation. Most companies aren't effectively reinventing their business models. They are primarily tech-driven without sufficient transport expertise, leading to operational inefficiencies and unsustainable growth models.

Leander: Absolutely. As we wrap up, what are the most promising trends or innovations you believe will shape the industry over the next few years?

Pedro: The key trends include the impact of climate change on infrastructure, the growth of economic inequalities affecting mobility choices, the ongoing electromobility revolution, and the challenges of genuine sustainability versus greenwashing. These factors will necessitate strategic adaptations and innovations within the micromobility sector.

Leander: Perfect. Great. Thank you for the interesting insights and your expertise. Sorry for being a bit late and running over time.

Pedro: No, it's fine. I hope it was useful.

Leander: Absolutely. Very interesting. Thanks for your expertise and good luck in your studies.

Pedro: Thank you too. Bye bye.

Leander: Goodbye.

Øyvind Kragh Kjos: Interview Transcript

Date: 2 Dezember 2024
Participants:
• Philipp Nicolas Mathias Mennen
• Øyvind Kragh Kjos

Introduction
Philipp: Good. After your confirmation, you just have to put on your camera and microphone again. Yes, perfect. Thank you so much.
Øyvind: Right, so who am I? I've worked previously for three and a half years as the Operations Manager for Void Technology in Norway. The essence of that job was to ensure the right amount of skills were in the right places at the right time to optimize user experience and the cityscape. This involved ensuring everything flowed smoothly and maximizing the number of trips per vehicle per day. Essentially, making sure each scooter was utilized as much as possible, which is a key indicator for profitability per trip.
Before that, as an economist by trade, my first job out of university was quite different—I worked at the National Statistical Institute on national accounts, producing GDP figures. I then followed a more traditional career trajectory, working for the public transport provider of the Oslo region, which covers about 1.5 million people. They have taken significant innovative steps to include micromobility as an extension of traditional public transport, such as buses, trams, trains, boats, and the metro.

State of the Micromobility Industry
Philipp: It's crazy AM.
Øyvind: Yes, seeing it dig further into Oslo makes a lot of sense. Oslo is one of the most mature micromobility markets in the world outside of where it started in California. My perspective in Europe differs from the States primarily because, in the US, micromobility is more leisure-based. It's not as easy to use micromobility for commuting due to larger distances and less developed cycling infrastructure. In contrast, cities like Oslo and Stockholm have more mature markets. For example, in Oslo with around 700,000 inhabitants, we have 8,000 scooters divided among three operators, producing between 40,000 and 60,000 trips per day in high season. This is not necessarily based on the calendar but rather on weather conditions—people use micromobility as long as it's not too cold, snowy, or rainy.
Oslo's geography, with many trips being 2-4 kilometers, is ideal for micromobility. This allows for direct trips without the need for extensive public transport routing, making it a massive market. On certain days with great weather and high demand, we can reach up to 70,000 trips with 8,000 vehicles, a record unmatched by any other city currently.
Philipp: It's crazy, yeah.
Øyvind: Additionally, Norway's young professional population is both willing and able to pay for micromobility services. The city's layout, with short distances between residential and work areas and gradual topography, is perfect for micromobility. Traditional bikes often struggle with uphill climbs, but electric scooters solve that problem, making them a North Star goal for any city aiming to enhance micromobility.
Philipp: But you perfectly described our first question with your introduction. Regarding the state and key trends, what do you think are the key trends in the micromobility sector? In this context,

do you think sustainability and environmental concerns, especially as you mentioned, have influenced the adoption of micromobility solutions?
Øyvind: Definitely, regulation is a major trend. Norway is ahead in Europe with micromobility regulation. Each city needs tailored regulations based on its topography and demand. In smaller cities, overly strict regulations have led operators to pull out due to insufficient room for multiple operators. Effective regulation must align with the business purposes of each city to find the right balance.
Germany, for example, is a significant market with companies like Void Technology operating 10,000 vehicles in Berlin. However, the velocity of the market there isn't as strong as in Oslo, where 30,000 vehicles serve 700,000 people. This high density led to regulatory actions to manage the "tragedy of the commons," addressing issues like parking and congestion.
At the recent Europe Wide Mobility Conference, it was emphasized that micromobility should be viewed as an extension of public transport, providing flexibility during peak hours or disruptions. Micromobility offers a dynamic solution that public transport cannot, such as adding 50 vehicles around a main transport hub instead of additional buses, which face road space limitations.

Impact of Pricing Models on Customer Retention
Philipp: Regarding financial sustainability in the micromobility sector, do you think diversifying revenue streams, such as B2B partnerships or subscription models, is important for financial sustainability?
Øyvind: Absolutely. Diversifying business models is crucial, but it requires sufficient scale to divert from core products. Initially, operators focused on growth, but the macroeconomic shift around 2022—with the war in Ukraine and rising electricity prices—forced companies to prioritize profitability. Investors now demand profitability before funding further expansion.
Most companies have had to slash budgets, reducing marketing and partnership managers to focus on core operations and product development. For example, Poor Technology was planning an IPO in 2022 but had to postpone it until they achieved profitability. Diversifying revenue streams helps hedge against market fluctuations and ensures financial security.

Role of Technology and Data-Driven Approaches
Philipp: We also discussed trends like AI, data analytics, or autonomous vehicles. Do you think these technologies are impacting the business model in the micromobility sector?
Øyvind: AI is primarily used for operational efficiencies, such as identifying correct parking spots through image recognition. However, this remains a challenge due to the variability in street layouts and parking behaviors. Training AI to recognize and enforce proper parking is ongoing, but it hasn't been fully solved yet.
Hardware improvements have plateaued, so the focus is shifting to software enhancements, geolocation accuracy, and machine learning to provide more reliable services. These technological advancements are essential for improving the overall service quality and operational efficiency of micromobility solutions.

Future Business Models and Strategies
Philipp: As we wrap up, do you think there are specific business models or strategies that companies should pay more attention to for long-term success?
Øyvind: Yes, finding the right collaboration and integration with public transport is vital. This allows micromobility operators to tap into a massive user base. For instance, our app in Oslo has 1.2 million users, and all micromobility operators are deeply integrated into it. Users can plan entire

journeys using our app, which directs them to micromobility options when needed. This integration not only broadens the user base but also enhances the overall efficiency and convenience of urban transportation.

Conclusion

Philipp: Thanks for the insightful discussion. Before we end, do you have any final thoughts?

Øyvind: It's essential to focus on collaborations with public transport and leverage technological advancements to enhance service quality. By doing so, micromobility can play a significant role in the future of urban transportation.

Philipp: Thank you for your time and valuable insights. Have a great day and week ahead. Maybe we'll cross paths again soon.

Øyvind: With pleasure. Take care. Bye.

Philipp: Goodbye.

François Hoehlinger: Interview Transcript

Date: 28 November 2024
Participants:
• Leander Christopher Held
• François Hoehlinger

Introduction

Leander: Thank you for joining me today, François. To start, could you briefly introduce yourself and outline your role and responsibilities within the micromobility industry?
François: Certainly. Thank you for having me. My name is François, I'm 35 years old, and I'm French. I have extensive experience in mobility and transportation, beginning my journey at Flix Bus in 2018 as Managing Director. After a brief stint at Easy Park, I returned to France to manage Troopage, a company focused on shared mobility using mopeds. Concurrently, I launched the European-wide network called Inter Mobility, aimed at bringing together experts, CEOs, and journalists to exchange ideas, create reports, and share best practices. Currently, I support several companies on a day-to-day basis and am also studying at ENAU, the French administration school, where I focus on public policies to better integrate mobility and transportation into the European framework.

State of the Micromobility Industry

Leander: How would you describe the current state of the micromobility industry?
François: It's a challenging period. The industry stands at a crossroads between its current state and its potential future. While solutions exist, there's still a significant journey ahead. Regulatory pressures are mounting, and although solutions are present, their implementation is lagging.

Regulatory Changes and Infrastructure Developments

Leander: Considering your experience working with authorities, what are the most significant regulatory changes or infrastructure developments currently shaping the industry?
François: In cities like Paris, there's a shift towards prioritizing pedestrians and self-usage over shared mobility. This has led to a reduction in the number of shared scooters and bikes. For instance, thousands of bikes and hundreds of kick scooters were previously operational, but many kick scooters were removed due to accidents and street congestion. On a broader scale, European regulations are pushing cities to become greener and integrate micromobility into their transportation plans to reduce car dependency. However, there's a lack of a unified, large-scale plan dictating specific numbers of bikes or mopeds for cities. Additionally, regional and city-level policies vary significantly, leading to discrepancies in how micromobility is implemented across different areas.

Current Business Models in Micromobility

Leander: Let's delve into business models. How are micromobility companies adapting their business models to remain competitive?
François: The business model in micromobility is inherently challenging due to high operational costs. Companies must invest in vehicles, batteries, charging infrastructure, maintenance, and insurance. Additionally, city fees per vehicle add to the financial burden. To achieve profitability, companies need high utilization rates—typically around three 15-minute trips per day per vehicle.

Marketing expenditures are also substantial, as companies like Tier, Dott, and Lime focus heavily on brand visibility rather than purely operational efficiency. One potential solution is consolidating operations under a single umbrella to reduce margins by 5-10%.

Impact of Pricing Models on Customer Retention

Leander: How do different pricing models, such as pay-per-use and subscription-based models, impact long-term customer retention?

François: It largely depends on the target demographic. Bike users and moped riders have different needs and behaviors. Key factors influencing customer retention include competitive pricing, excellent customer service, and effective promotions. In France, for example, mobility cards allow employees to use various transportation modes, including mopeds and bikes. When users become frequent riders, they are more inclined to purchase packages that offer better value, such as monthly subscriptions with discounts. This indicates that higher usage rates correlate with a preference for subscription models.

Challenges in Business Model Innovation

Leander: What are the primary obstacles companies face when trying to innovate their business models in the micromobility sector?

François: The main challenge is achieving profitability, which is difficult given the high costs involved. Companies need to find ways to reduce costs across the entire value chain, from vehicle procurement to maintenance and insurance. Additionally, negotiating better terms with suppliers and integrating more advanced software and intelligence into operations can help, but these solutions add complexity. Insurance costs remain a significant expense due to the high incidence of accidents and issues, preventing these costs from decreasing over time.

Regulatory and Infrastructural Barriers to Innovation

Leander: What are the biggest regulatory or infrastructural barriers limiting innovation in micromobility right now?

François: Regulatory barriers are substantial, especially since city authorities often lack the expertise to create effective tenders for micromobility services. This has led to situations where unsuitable companies win contracts, sometimes even those that are already bankrupt. Additionally, infrastructure limitations, such as the lack of in-city charging or battery-swapping facilities, hinder operational efficiency. Improved collaboration and lobbying at both the city and European levels are necessary to address these issues.

Financial Sustainability Strategies

Leander: In an increasingly competitive environment, what strategies do you see micromobility companies using to achieve financial sustainability?

François: Companies can approach financial sustainability by either raising prices to reflect the true cost of services or seeking subsidies from corporations, governments, or regions. Diversifying revenue streams is also crucial. For instance, some companies incorporate advertising into their platforms—like Forest in London, which displays ads when users unlock their bikes. While this can contribute to profitability, its effectiveness may vary. Additionally, focusing on B2B partnerships, although challenging due to low usage rates, can offer alternative revenue sources.

Role of Strategic Partnerships and Ecosystem Development

Leander: How are partnerships shaping the future of business models in the micromobility sector, especially regarding integration with public transportation systems?
François: Consolidation is inevitable as the market cannot sustain an excessive number of players. Collaborating with transport authorities is essential to provide services that cities cannot manage independently. However, these partnerships are complex due to challenges in data exchange and integrating different ecosystems. Moreover, micromobility often competes with other forms of transport for the same user base, making seamless integration difficult.

Future Business Models and Strategies
Leander: Are there specific business models or strategies that you believe companies should pay more attention to?
François: I believe car-sharing systems hold significant promise. Offering memberships or fees for access to a fleet of cars across multiple cities provides on-demand availability. However, micromobility faces a dilemma: it struggles to be both accessible to everyone and financially sustainable. Companies must decide whether to target a profitable, wealthier segment or to attempt serving a broader audience, which often compromises profitability. Focusing on premium offerings, like high-quality bike-sharing services, could be a viable strategy, treating them as a luxury rather than a mass-market solution.

Conclusion
Leander: Thank you for sharing your valuable insights, François. Before we wrap up, do you know other experts in the field who might be open to an interview?
François: I can reach out to some country managers from various sharing companies. Additionally, attending micromobility events is a great way to network with industry leaders and government officials involved in urban mobility planning.
Leander: That's a great suggestion. Thank you again for your time and the informative discussion.
François: My pleasure. Let me know if you need anything else in the future.

Leander Christopher Held: Thank you. Have a great day and week ahead. Maybe we'll cross paths again soon.
François Hoehlinger: With pleasure. Take care. Bye.
Leander Christopher Held: Goodbye.

Leonel Soares: Interview Transcript

Date: 19 November 2024
Participants:
Leander Christopher Held
Leonel Soares, CEO of Boost Logistics

Introduction
Leander: Thank you so much for taking the time to speak with me. Could you start by briefly introducing yourself and your role in the micromobility industry?
Leonel: Of course. I'm the CEO of Boost Logistics, which is part of a larger group based in Lisbon. Our group initially started in the tourism sector, with brands like Urban Trails, Relax Dragon, and Ecolo Tourist, operating in Lisbon and Porto.
Before the pandemic, we decided to branch out into logistics, and that's how Boost Logistics was born. We specialize in fleet management for bicycles, scooters, and mopeds, mostly in the sharing economy. We've partnered with companies like Lime, Bird, and Tier to handle their fleet maintenance and battery swapping.
For example, we've set up battery-swapping stations in partnership with Gulp and Swabi at gas stations across Lisbon. This allows us to collect and swap batteries efficiently without relying on large warehouses.
More recently, we've diversified into last-mile delivery, providing services for companies like DHL and GLS. Additionally, we've started maintaining EV chargers in Portugal and Spain to support the growing demand. My role focuses on leading business development, creating new partnerships, and staying ahead of emerging trends in urban mobility.

State of the Micromobility Industry
Leander: How would you describe the current state of the micromobility industry? What are the key trends and challenges?
Leonel: The industry is facing serious challenges, particularly from municipalities. Many cities have imposed restrictions on the number of vehicles allowed, implemented tendering processes, or, as in Paris and Madrid, outright banned certain types of micromobility vehicles like e-scooters. This makes it increasingly difficult for sharing companies to scale their operations. On top of that, the venture capital market is cautious right now. Investors are holding back, trying to understand the long-term viability of the sector.
That said, there are still opportunities. Companies are starting to explore new avenues, like last-mile logistics, and experimenting with models like "vehicle-as-a-service," where they don't own the batteries, significantly reducing their costs. This is especially important as they try to balance profitability with sustainability.

Innovation in Business Models
Leander: What innovations or changes do you see shaping business models in the micromobility industry?
Leonel: One key innovation would be the standardization of batteries. Currently, each brand—whether Lime, Bird, or Tier—uses its own proprietary battery design, which complicates logistics and maintenance. If we could have a unified battery standard across the EU, companies could adopt

a "battery-as-a-service" model, renting batteries instead of owning them. This would dramatically lower their operational costs and make the industry more sustainable.
Another significant shift is the integration of micromobility into multimodal transport systems. Partnerships with public transportation providers and data-sharing initiatives are essential to offering seamless mobility options for users, making it easier for people to get from point A to point B without relying on private cars.

Financial Sustainability
Leander: Many companies struggle with profitability. How do technology and data-driven approaches, like predictive maintenance, contribute to financial sustainability?
Leonel: Predictive maintenance is already a game-changer. Most companies we work with have advanced algorithms that predict when parts need replacement or when vehicles require servicing. These tools allow them to schedule maintenance efficiently, reducing downtime and operational costs.
At Boost Logistics, we use their systems to optimize our operations. These technologies are incredibly powerful and help us stay efficient, but there's still potential for further improvements in this area.

Role of Partnerships
Leander: How important are external partnerships for the future of micromobility?
Leonel: Partnerships are absolutely critical. The main challenge is moving people from point A to point B without relying on private cars. Achieving this goal requires seamless integration between different modes of transport—trains, buses, scooters, bicycles, etc.
Data sharing is essential in this process. Users need real-time information about where the next bus is, where they can find a scooter, and when the train will arrive. This kind of multimodal system, like what Google Maps offers, is key to enabling a car-free journey.

Future Outlook
Leander: Looking ahead, what trends or innovations do you believe will shape the micromobility industry over the next 5–10 years?
Leonel: I see three major trends:
Urban Mobility Hubs: Cities need to develop dedicated hubs that integrate EV charging stations, battery-swapping infrastructure, and parking spaces for micromobility vehicles like scooters and bicycles. This will improve efficiency and encourage greater adoption.
Drones for Last-Mile Delivery: The use of drones for delivering goods will grow significantly, especially in dense urban areas. While passenger drones are also being explored, they are likely to take longer to become mainstream in Europe.
AI and Data Analytics: Artificial intelligence will play a growing role in optimizing operations, predicting demand, and enhancing fleet management. However, access to data remains a challenge, as companies are often reluctant to share their insights with third parties.

Conclusion
Leander: Thank you for sharing these insights. One final question—do you know other experts in the field who might be open to an interview?
Leonel: I can check with some country managers from sharing companies. Additionally, I recommend attending micromobility events. These gatherings are excellent for networking with industry leaders and even government officials who are involved in urban mobility planning.

Leander: That’s a great suggestion. Thank you again for your time and the valuable insights.
Leonel: My pleasure. Let me know if you need anything else in the future.

Andreas Knie: Interview Transcript

Date: November 15, 2024, 1:11 PM
Participants:
Philipp Nicolas Mathias Mennen
Andreas Knie (Guest)

Introduction
Philipp: Thank you for joining us today. Let's start right away since we have limited time. To begin, I'd like to get an overview of the current state of the micromobility sector. Could you describe where the industry currently stands, and do you think sustainability and environmental factors have influenced the adoption of micromobility solutions?
Andreas: Sure. I can only speak for Germany, where I have the most insight. Micromobility, as we typically define it, includes e-scooters, bicycles, and mopeds. For this discussion, we'll leave out cars since they don't fit the micromobility category.
Starting with mopeds: They've stagnated, both in terms of private sales and rental services. That's unfortunate because traditional mopeds are noisy and polluting, and electric ones could address these issues. However, e-mopeds remain too expensive, limiting their growth in Germany.
As for bicycles, especially in the public sector, cities have invested heavily in bike-sharing systems. For example, Berlin's Nextbike program is performing decently, with usage rates growing at 2–3% annually. However, Nextbike has already been sold multiple times, raising questions about its financial stability.
E-scooters, on the other hand, have expanded significantly, despite challenges. Companies like TIER and others experienced rapid growth due to years of cheap capital but are now facing consolidation. TIER, for example, merged with Dott, though some might argue it looked more like a buyout.
Sustainability definitely plays a role in justifying micromobility projects. These solutions complement public transit networks, particularly for the last mile, and help reduce reliance on private cars. However, the sector's growth is highly dependent on political and regulatory frameworks. Issues like special usage fees or restrictive regulations can stifle innovation.

Adapting Business Models
Philipp: You mentioned stagnation in some areas, especially with e-mopeds and larger e-scooters. One focus of our research is how companies can innovate their business models. Could you share your perspective on how micromobility companies can adapt to remain competitive or re-enter a growth phase?
Andreas: That's a key question. For e-mopeds, I believe the focus should shift away from private sales toward the rental market. The infrastructure for rentals is already established, and public acceptance of shared mobility is high. Companies could partner with firms like Sixt to integrate e-mopeds into their rental platforms.
For smaller e-scooters and e-bikes, companies need to think more politically. Many startups approach the market with a focus on better apps, branding, and marketing—strategies that might work for a while but are unsustainable in the long run. Success in this space heavily depends on **political frameworks**. Cities must actively support micromobility by offering designated parking spaces, reducing regulatory burdens, or even providing subsidies.

Operators need to form partnerships with cities and public transport providers to align with urban mobility goals. For instance, while Paris banned e-scooters, they are already discussing reintroducing them with stricter guidelines. Political alignment is crucial for long-term growth.

Financial Sustainability

Philipp: With capital no longer flowing as freely as before, financial sustainability is more important than ever. Do you think diversifying revenue streams—through B2B partnerships or subscription models, for instance—will play a key role in ensuring the industry's long-term viability?

Andreas: Diversification is essential. The industry initially relied on **network effects**, assuming that larger fleets would lead to profitability. However, this approach often requires excessive capital, and operators have struggled to achieve the desired scale. Instead, companies could explore models with **smaller, strategically placed fleets** to achieve similar economic benefits at a lower cost.

Partnerships are another avenue. Collaborations with public transport providers, sponsorships from retailers, or co-branding opportunities with companies like Lidl or Aldi could help stabilize revenue streams.

I also see potential in **subscription models**. For example, offering a monthly flat rate of €35 for unlimited rides could attract customers who value predictability and convenience. Flat-rate models could also reduce per-trip costs for operators, as users tend to ride less frequently than they anticipate.

Partnerships and Collaboration

Philipp: You've mentioned partnerships several times. Do you think collaborations with companies like Sixt or public transport providers could help the sector become more financially sustainable?

Andreas: Absolutely. Partnering with established players like Sixt makes a lot of sense, especially for e-mopeds and larger e-scooters. Sixt already has the infrastructure, brand recognition, and customer base to support such integrations.

On the public transport side, initiatives like **Jelbi in Berlin** or **Switch in Hamburg** show promise. By bundling micromobility options into public transport networks, cities can encourage multimodal trips and make micromobility a more integrated part of urban mobility. These partnerships require operators to work closely with municipalities, but the benefits—both financial and operational—are well worth the effort.

Future Trends and Innovations

Philipp: Looking ahead, what do you think are the most promising trends and innovations in the micromobility industry over the next 5–10 years? How might advancements in AI and data analysis impact the sector?

Andreas: AI is often overhyped—it's mostly advanced computing rather than true intelligence. However, **predictive analytics** could offer practical benefits. For example, operators could use data to anticipate fleet demand based on weather conditions or time of day, ensuring vehicles are available where and when they're needed.

In the bigger picture, cities need to become more **livable** by reducing car dependency and fostering micromobility. Partnerships with municipalities will remain crucial, as public support can make or break the industry.

While I don't foresee any groundbreaking technological developments, focusing on **battery recyclability** and **sustainable production** will be essential. These "unsexy" but necessary improvements could bolster the industry's reputation and align it with broader sustainability goals. Ultimately, the industry's success will hinge on operators' willingness to engage with local governments and address urban challenges. It's a less glamorous path, but one that offers the best chance for long-term survival.

Philipp: Thank you so much for your insights. One last question: Do you know any other experts in your network who might be open to an interview?
Andreas: I'd recommend Enrico Howe—he's extremely knowledgeable about the sector and has worked with many of the major brands. I'd be happy to connect you.
Philipp: That would be great. Thank you again for your time and expertise!
Andreas: You're welcome. Best of luck with your research.

Sebastiaan Boschmans: Interview Transcript

Date: November 15, 2024, 3:00 PM
Participants:
Leander Christopher Held
Sebastiaan Boschmans

Introduction
Leander: Thank you for taking the time to speak with me today. Could you start by introducing yourself and your role at your organization?
Sebastiaan: Sure, but first, could you give me a bit more context about your project and what you're focusing on?
Leander: Of course. Together with my group, I'm writing my master's thesis here in Lisbon at NOVA SBE. We've decided to focus on business model innovation in the mobility sector. Specifically, we are analyzing current business models in the industry and exploring potential innovations to address existing challenges.
Sebastiaan: Got it. So, my name is Sebastiaan Boschmans, and I'm a senior consultant in the Monitor Deloitte team in Belgium, based in Zaventem. I work in the strategy department, with a focus on public sector projects, particularly mobility-related topics. This includes both passenger and freight transport.
Before joining Deloitte, I worked at Transport & Mobility Leuven, a spin-off of KU Leuven University. There, I focused on topics like the uptake of EVs, urban mobility plans for the European Commission, and emission modeling.
At Deloitte, I've been involved in transport projects for local, Flemish, and EU governments, as well as private sector clients. For instance, we assist operators with tender submissions to help them navigate local regulations and gain competitive advantages. Local insights are key since different cities often have very distinct requirements.
We've also conducted studies on micromobility regulation, such as the "Sweet Spot for Micromobility Regulation" study for Bolt. This explored how cities can regulate micromobility in ways that balance the needs of operators and minimize negative impacts, like scooters cluttering streets or safety concerns from citizens.

Key Trends in Micromobility
Leander: That's fascinating. If possible, could you share the link to the "Sweet Spot" study? It sounds very relevant to our research.
Sebastiaan: Sure, I'll share it in the chat.
Leander: Thank you. To start, what are the key trends or changes driving the mobility industry today?
Sebastiaan: One major trend is the high level of **competition and acquisitions** in the micromobility sector. Initially, when e-scooters were introduced around 2018, it was relatively easy to enter the market. Many operators relied on low-cost Chinese products, and there was little to no regulation.
However, cities are now imposing stricter **regulations**, which has made it more challenging for operators to remain profitable. For example, operators now need to comply with requirements like geofencing or parking rules, where users must take a photo of a correctly parked scooter.

Some operators, like Bolt, use profits from other business units—such as their ride-hailing services—to subsidize their micromobility operations. Others have had to rely on **mergers and acquisitions** to consolidate and survive in an increasingly competitive environment.

Adapting Business Models

Leander: Given these challenges, how are companies adapting their business models to stay competitive?

Sebastiaan: Many operators are focusing on **innovating** to meet city requirements. This includes investing in features like geofencing, safety measures, and parking enforcement technologies. For instance, some services enforce speed limits in pedestrian zones or require users to confirm proper parking with a photo.

On the other hand, operators are also working on building **local insights** to better align with specific city regulations and preferences. However, I haven't observed drastic changes to their fundamental business models—it's more about incremental innovations to ensure compliance and maintain competitiveness.

Another challenge is the **tendering process**, which can be burdensome for companies. Each city has its own unique requirements, and companies must tailor their proposals to win operating licenses.

Data Utilization

Leander: How do companies use data to improve customer engagement and operational processes?

Sebastiaan: Data is critical for both operators and cities. Many tenders now require companies to share usage data with cities. This data helps operators optimize their fleet management, such as repositioning vehicles during peak times or improving battery maintenance.

Weather conditions also play a role. For instance, in Nordic countries, usage drops significantly during the winter months. Operators can use data to adjust fleet sizes dynamically during these periods, which can help reduce costs and street clutter.

Cities also use this data to implement **dynamic fleet caps**, ensuring the number of vehicles on the streets aligns with actual demand.

Financial Sustainability

Leander: Financial sustainability is crucial for long-term success. What strategies do you see micromobility companies using to achieve this?

Sebastiaan: From what I've seen, companies rely heavily on **scaling operations**. Expanding into multiple markets helps them achieve economies of scale, which is essential given the tight profit margins in this sector.

Mergers and acquisitions are also common, as smaller players struggle to survive independently. Companies also invest heavily in **lobbying efforts** to influence city policies in their favor, ensuring they can operate profitably.

Customer-Centric Innovation

Leander: Customer focus is becoming increasingly important in the industry. How do services like dynamic pricing or flexible rental options impact customer satisfaction and adoption?

Sebastiaan: Dynamic pricing can enhance user satisfaction by ensuring availability during peak demand. For example, higher prices during busy times incentivize operators to reposition their vehicles, ensuring users aren't left without options.

However, in such a competitive market, users will often switch to a cheaper service if prices vary too much. That's where **mobility-as-a-service (MaaS)** platforms come in. By bundling multiple operators into one app, cities can improve the user experience while maintaining fair pricing across providers.

Partnerships and Collaboration

Leander: Partnerships seem to be a vital part of the industry's success. How are collaborations shaping the future of micromobility business models?

Sebastiaan: Partnerships are essential, particularly between **micromobility operators and public transportation providers**. First-and-last-mile trips often complement public transit, making micromobility a key driver of public transport usage.

We've also seen **government subsidies** play a role, especially in regions where micromobility alone isn't profitable. For instance, Donkey Republic, an e-bike provider in Belgium, operates across multiple municipalities with government support, making longer-distance trips feasible.

In urban areas like London, partnerships help address gaps in underserved zones. For example, micromobility thrives in central areas (zones 1 and 2), but operators often abandon outer zones due to low profitability. Government collaboration is crucial to filling these gaps.

Future Trends and Disruptions

Leander: Looking ahead, what are the most promising trends or innovations shaping the future of micromobility?

Sebastiaan:

MaaS Integration: Bundling multiple services into a single platform will simplify user experiences and encourage adoption.

Gamification: Incentivizing sustainable choices through challenges or rewards, such as encouraging users to switch from cars to micromobility.

5G and Smart Technologies: Enhanced connectivity will enable innovations like smarter geofencing, better vehicle allocation, and more efficient docking stations.

Road User Charging: Dynamic pricing based on congestion levels could further encourage sustainable mobility choices.

Leander: And what about potential disruptions, like Paris banning e-scooters?

Sebastiaan: Policy disruptions are more likely than technological ones. Operators need to address issues like safety and parking to prevent further bans. For instance, helmets, proper parking, and single-rider enforcement are critical areas for improvement. These innovations could help mitigate public complaints, which often drive restrictive policies.

Closing Remarks

Leander: Thank you so much for your time and insights! One last question: do you know of any experts in your network, perhaps from government agencies or other companies like Bolt, who might be open to an interview?

Sebastiaan: Let me think about it. I'd recommend looking into the Polis network, which connects cities and regions across Europe. Karen Vancluysen, their Deputy General, could be a great contact. You might also want to reach out to Transport for London or check out speakers from the London conference we discussed.

Leander: Perfect, I'll follow up. Thanks again for your time and help! Have a great weekend.

Sebastiaan: You too. Feel free to reach out if you have more questions about the study.

Leander: Will do. Thanks

Daniel Beutler: Interview Transcript

Date: November 18, 2024, 9:03 AM
Participants:
Leander Christopher Held
Daniel Beutler

Introduction

Leander: Good morning! First of all, thank you for taking the time to speak with me. To begin, could you briefly introduce yourself and your background?

Daniel: Of course. My name is Daniel Beutler. I have a background in transportation and logistics. I studied both engineering and business, which gave me a mixed perspective. I spent a long time at Deutsche Bahn, where I was part of the board for Western Europe.

After that, I transitioned into the startup world, working with a company that sold train tickets. This company was acquired by Trainline, the largest platform for train tickets globally. I worked my way up there and served as President when we went public in 2019.

Since then, I've been supporting CEOs with scaling their businesses and have taken on roles like Chairman of the Board at Rail Europe, one of Trainline's competitors, and another London-based company focused on accessibility, called Transreport. That's a brief overview of my career.

Current State of the Micromobility Industry

Leander: Thank you! Let's dive into micromobility. How would you describe the current state of the industry? What trends or changes are shaping it right now?

Daniel: First, let's clarify what you mean by micromobility. It's a term that's interpreted differently by different people. Could you define your scope?

Leander: Of course. We're focusing on small-scale, urban transportation solutions like e-scooters, e-bikes, bicycles, and e-mopeds. These are primarily used for short-distance travel, often referred to as "last mile" mobility.

Daniel: Got it. I think there are two perspectives to consider here—one as a user and the other as someone in the industry.

From a **user's perspective**, I've seen firsthand how micromobility has transformed urban landscapes. For example, when I lived in Paris a few years ago, the city relied heavily on taxis, which were highly regulated and not very user-friendly. Innovations like Uber opened up new mobility options.

Micromobility has followed a similar trajectory. Initially, the market was completely unregulated, leading to oversaturation with thousands of scooters flooding cities. This created problems, such as cluttered streets and congestion. But I believe it was important to let this experimentation happen so we could identify both the benefits and the challenges. Regulation naturally followed, and cities like Paris and London adjusted their policies to strike a balance.

From an **industry perspective**, the big question is how to sell these services and make them sustainable. There's ongoing debate about whether we need "super apps" that integrate all mobility options or if specialized apps focused on specific modes of transport are better. Personally, I lean towards the latter. I think having one app for everything adds unnecessary complexity. Instead, users need apps that work seamlessly within their city, tailored to their specific needs.

Business Model Adaptation

Leander: That's an interesting point about specialized apps. Moving on, how do you see micromobility companies adapting their business models to remain competitive, particularly in areas like customer retention and value proposition?
Daniel: Honestly, I haven't seen dramatic changes in their business models in recent years. Many companies try small adjustments here and there, but the margins in this industry are so slim that it's hard to experiment.
What stands out is the sheer number of players that have already exited the market. This is natural in any unregulated market—first, you see oversaturation, and then the market either self-regulates or governments step in to impose order.
For some companies, the focus isn't on making a profit directly but on gathering data. For example, Chinese-backed companies might view their operations as a way to collect valuable data about user behavior, which can then inform other products or services. In contrast, many European players are under pressure from investors to generate quick returns, often leading to short-term decisions.

Operational Optimization Through Data
Leander: That's a great segue into my next question. How do companies use data to optimize their operations?
Daniel: A good example of this comes from Paris. Imagine the Montmartre area, where people often ride scooters downhill but rarely uphill. Companies observed that vehicles were piling up at the bottom of the hill, leaving none available at the top. To address this, they started using trucks to redistribute the scooters at night.
This kind of operational insight helps companies manage supply and demand. Beyond that, cities can also use this data to understand travel patterns. For example, if you analyze where people are commuting, you can identify where to build new infrastructure like parking or bike lanes. In Hamburg, for instance, they used such data to redesign and expand bike lanes where they were actually needed, rather than following dogmatic approaches to city planning.

Challenges in Business Model Innovation
Leander: What do you think are the biggest obstacles companies face when trying to innovate their business models?
Daniel: There are two major challenges:
Cost Pressures: The margins in this industry are extremely tight, and vehicles often require frequent maintenance. This makes profitability very difficult to achieve.
Regulation: Companies face significant regulatory risks. Governments or cities can suddenly impose new rules or even ban operations, as we've seen in Paris with the recent e-scooter ban. This creates an unstable environment for innovation.
The lack of long-term guarantees, such as multi-year operating agreements, discourages investment in new ideas. This is particularly problematic in Europe, where regulation often stifles innovation rather than fostering it.

Financial Sustainability and Profitability
Leander: Let's talk about financial sustainability. What strategies are companies using to achieve profitability in such a competitive environment?
Daniel: Profitability and sustainability are often treated as two separate goals. In terms of profitability, the focus is on cutting costs, increasing customer numbers, and potentially raising prices. However, sustainability often feels like greenwashing.

Take e-scooters, for example. While they're marketed as eco-friendly, the reality is that their batteries have a limited lifespan, and disposal is a major issue. When you consider the full lifecycle of an electric vehicle—from production to disposal—the carbon footprint can be worse than that of a traditional gasoline-powered vehicle.
That said, there is a positive environmental impact in specific use cases. For instance, replacing polluting mopeds in cities like Paris with electric alternatives can significantly reduce noise, air pollution, and emissions.

Customer-Centric Innovation
Leander: Do you think flexible rental models, such as mid-term subscriptions for e-scooters or e-mopeds, could be a viable business model, similar to what Swapfiets offers for bikes?
Daniel: Absolutely. A subscription model for e-mopeds could make a lot of sense. It combines the convenience of ownership with the flexibility of rental. However, such a model would require support from cities to ensure long-term stability. Without regulatory guarantees, it's hard for companies to invest in such offerings.

Partnerships and Market Consolidation
Leander: What role do partnerships, such as collaborations with public transportation operators, play in shaping the future of the industry?
Daniel: Partnerships will play a significant role. For example, integrating Lime into a city's public transportation app, like Hamburg's HVV app, could enhance accessibility and user experience.
However, I believe the real future lies in market consolidation. Over time, we'll likely see just two or three major players dominating the market, as is common in other industries. This will lead to economies of scale and more streamlined operations.

Closing Remarks
Leander: Thank you so much for your time and insights. This has been incredibly helpful for our research. One last question—do you know anyone in your network who might be open to an interview on this topic?
Daniel: Sure. Let me think about it, and I'll connect you with a few people.
Leander: That would be fantastic. Thank you so much, and have a great day!
Daniel: My pleasure. Good luck with your research!

Sven Becker: InterviewTranscript

Date: November 7, 2024, 5:16 PM
Participants:
Philipp Nicolas Mathias Mennen
Sven Beiker

Introduction
Philipp: So, is everything set up? Can you hear me? You're muted at the moment.
Sven: Ah, yes. That happens automatically when these things start; it mutes everything.
Philipp: Everything's disabled now?
Sven: It seems like it. Are we on Zoom or Teams?
Philipp: Teams, yes. Let's get started. Thanks so much for taking the time to meet today.
Sven: Sure thing. I have time until 5:30, so let's go ahead.

Current State of the Micromobility Industry
Philipp: To start, we'd like to get an overview of the current state of the micromobility industry. Could you describe where the industry stands right now and highlight the key trends?
Sven: Sure. Before diving into trends, I'd ask: what's our scope? Are we looking at this globally or regionally?
Philipp: Europe, if possible.
Sven: That's good to know. I'm based in the US, but I keep a close eye on Europe through publications and frequent travel. While I wouldn't call myself a European micromobility expert, I can certainly share some observations.
If we look historically, micromobility has evolved in phases. It started with bike-sharing, then came electric scooters, and now we see electric mopeds like Emmy or similar services in Germany. These three categories—bicycles (muscle-powered or electric), e-scooters, and mopeds—probably represent about 95% of the micromobility sector today.
From my perspective, it all began with bike-sharing programs. I remember "Call-a-Bike" from Deutsche Bahn in Germany in the late 1990s. Back then, it was quite cumbersome without smartphones, but it was an intriguing offering that I used when I lived in Munich. Programs like these existed even earlier, but the real breakthrough for micromobility came with smartphone apps, which made these services more convenient and accessible.
One ongoing question in the industry is whether to adopt free-floating models or station-based systems, and whether subscriptions should be daily, monthly, or yearly. In my experience, scaling these services is critical for success. Offering micromobility in isolated locations doesn't work unless you dominate the market there.
When comparing bicycles and scooters, I find scooters better suited for sharing. They're smaller, easier to use, and require less maintenance. Bicycles, on the other hand, face issues like flat tires, broken chains, and wear-and-tear on brakes. Scooters, especially those designed for sharing, are often more robust and reliable.
That said, I personally prefer bicycles—it might be due to my last name, *Beiker*!
Another trend I've noticed—though this is more from a US perspective—is a growing focus on profitability. Companies are starting to report positive financial results. I think I recently read that Lime, for instance, had its first profitable quarter.

However, the regulatory environment remains a challenge. Take Paris, for example, which recently voted to ban e-scooters. This highlights the dynamic and often controversial nature of the industry.

Sustainability and Environmental Impact

Philipp: Do you think sustainability and environmental concerns have influenced the adoption of micromobility solutions?

Sven: Yes, in terms of consumer perception. People often feel good about using micromobility, thinking it's a sustainable choice. However, I doubt it's significantly reducing car usage. The distances covered by micromobility are often too short to make a meaningful dent in emissions.

While micromobility might not solve our CO_2 problem, it could alleviate traffic congestion and contribute to more livable urban spaces. It's also encouraging to see a shift in mindset—people are realizing they don't always need a subway or car when they can take a scooter instead.

Pay-Per-Use vs. Subscription Models

Philipp: How do you see pay-per-use and subscription models impacting long-term customer retention?

Sven: Subscription models are great for fostering customer loyalty. For instance, in Göteborg, Sweden, there's a service where you pay a small monthly fee—around €10—and an annual subscription costs only slightly more. This makes it appealing for users to forgo owning a bike.

What would make these models even better is interoperability across cities. Imagine traveling from Munich to London and using the same subscription without needing to download a new app or re-enter your payment details. A system like "roaming" for micromobility would be ideal.

The Role of Partnerships

Philipp: Would partnerships between operators and public transportation providers help with this kind of interoperability?

Sven: Absolutely. Partnerships are crucial. For example, Uber allows you to rent scooters and bikes in multiple cities through one app. If local services, like Munich's MVG or London's bike-sharing system, could collaborate under a single platform, it would enhance convenience for users and boost financial sustainability for operators.

Advice for Success in Micromobility

Philipp: Finally, what advice would you give to companies aiming for long-term success in the micromobility industry? Are there specific business models or strategies they should prioritize?

Sven: I'm not intimately familiar with the unit economics or business models, but one observation is that platforms like Uber have succeeded because they offer multiple services. Uber isn't just about ride-hailing anymore—you can order food, rent a car, or even get a taxi through their app.

Micromobility operators could learn from this. Instead of focusing solely on bike or scooter-sharing, they could expand their offerings. For example, why not integrate other transport or delivery services into their apps?

It's also critical to streamline operations. Managing fleet distribution efficiently—like ensuring scooters aren't all stuck at a stadium after a game—is essential. While this is a known challenge, I'm not sure anyone has fully solved it yet.

Closing Remarks

Philipp: Thank you so much for your insights. You've answered multiple questions with each response, which was incredibly helpful!

Sven: Happy to help. Let me know if you need anything else.
Philipp: Will do. Thanks again!
End of Transcript

Wouter de Wit: Interview Transcript

Date: November 13, 2024, 11:03 AM
Participants:
Leander Christopher Held
Wouter de Wit

Introduction
Leander: Great, we're all set up. First of all, thank you for taking the time to speak with me. As I've mentioned before, we're exploring innovation in micromobility business models as part of our research.
To start, could you briefly introduce yourself and share a bit about your role and responsibilities within your organization?
Wouter: Sure. I work at Deloitte in the Netherlands, although I've also spent time with Deloitte in the UK and Australia. My main focus is supporting clients in the mobility sector across Europe. I've worked with several shared micromobility operators, like Bolt and Dott, as well as automotive clients such as BMW on international projects.

Current State of the Micromobility Industry
Leander: Let's begin by discussing the broader landscape of micromobility. How would you describe the current state of the industry, and what are the key trends or changes driving it today?
Wouter: If we look back, the era of "free money" is clearly over. When micromobility companies first launched, they had easy access to capital, which allowed them to rapidly scale with consumer-focused (B2C) models. Cities were largely unregulated back then, so companies could place their vehicles anywhere, and the most aggressive operators gained market share quickly.
Then two major changes occurred:
Regulatory Oversight – Cities began implementing policies and regulations, often using tender processes to grant operational rights. We conducted a study for Bolt on how different cities regulate micromobility. Essentially, these tenders became a sort of "beauty contest" where companies had to convince cities of their alignment with public goals, such as sustainability and safety. This shifted the business model from being purely B2C to also B2G (business-to-government). Operators needed to focus on winning tenders by meeting city objectives.
Financial Pressures – Rising interest rates and investor skepticism about profitability made it harder for companies to raise funds. This led to a wave of consolidation in the industry. For instance, we've seen bankruptcies, acquisitions, and mergers like the recent Tier-Dott merger.
Today, we're left with fewer operators dominating the market. However, to my knowledge, nearly all of them are still unprofitable.

Business Model Innovation
Leander: One of our key focus areas is understanding how companies are innovating their business models to stay competitive. Could you share your perspective on this?
Wouter: Building on what I mentioned earlier, operators have shifted their focus to developing solutions that cater to cities rather than just end users. Examples include:
Parking Compliance: Implementing geofencing and enforcement tools to ensure vehicles are parked correctly. End users are incentivized to park in designated areas or face penalties, which helps companies showcase high parking compliance to cities.

Safety Features: Innovations like detecting multiple riders on a scooter, preventing drunk driving, and enhancing vehicle safety have become key selling points for tenders.
The goal is to position themselves as partners for cities by addressing urban challenges such as safety, parking, and sustainability.
Additionally, the fear of more bans—like the one in Paris—has driven companies to improve their image and prove their value to cities. Some have even partnered with public transportation providers or subsidized trips to complement public transit. This helps them demonstrate that micromobility replaces car trips and supports public transportation, aligning with city goals.

Challenges and Regulatory Obstacles
Leander: Regulatory restrictions seem to be a big challenge for the industry. What do you see as the primary obstacles companies face when trying to innovate under these constraints?
Wouter: There are two main challenges:
Policy Influence: Companies are investing heavily in public policy teams to lobby governments and demonstrate the benefits of micromobility, aiming to prevent bans and unfavorable regulations.
Vehicle Diversification: Cities are often more receptive to e-bikes than e-scooters. As a result, many operators are increasing the share of e-bikes in their fleets to meet tender requirements and diversify their offerings.
Some companies, like Uber, are also integrating micromobility into broader "mobility as a service" platforms, bundling options like ride-hailing, car-sharing, and e-scooters.

Financial Sustainability and Profitability
Leander: Financial sustainability is crucial for long-term success. What strategies are companies using to achieve profitability in such a competitive environment?
Wouter: The main strategies are:
Selective Market Focus: Companies are becoming more strategic about where they operate, prioritizing markets with high demand, strong customer bases, and favorable relationships with cities.
Operational Efficiency: Streamlining operations by minimizing overhead costs and adopting leaner business models is essential to make the slim profit margins work.
Additionally, consolidation plays a big role. By merging or acquiring competitors, companies can reduce competition and gain economies of scale.

Role of Partnerships
Leander: Do external partnerships play a critical role in ensuring financial sustainability?
Wouter: It's a mixed bag. While partnerships with public transport operators or integration into multi-modal platforms don't always generate significant additional revenue, they can be critical for winning tenders. Cities value micromobility operators that complement public transit systems, so these partnerships can improve an operator's chances of being selected.
For example, some companies have partnered with associations for visually impaired people to address safety concerns and demonstrate social responsibility. While these initiatives don't directly drive profit, they improve a company's reputation and standing with policymakers.

Technology and Data-Driven Innovation
Leander: How do technology and data-driven approaches, like predictive maintenance, help reduce operational costs and improve profitability?

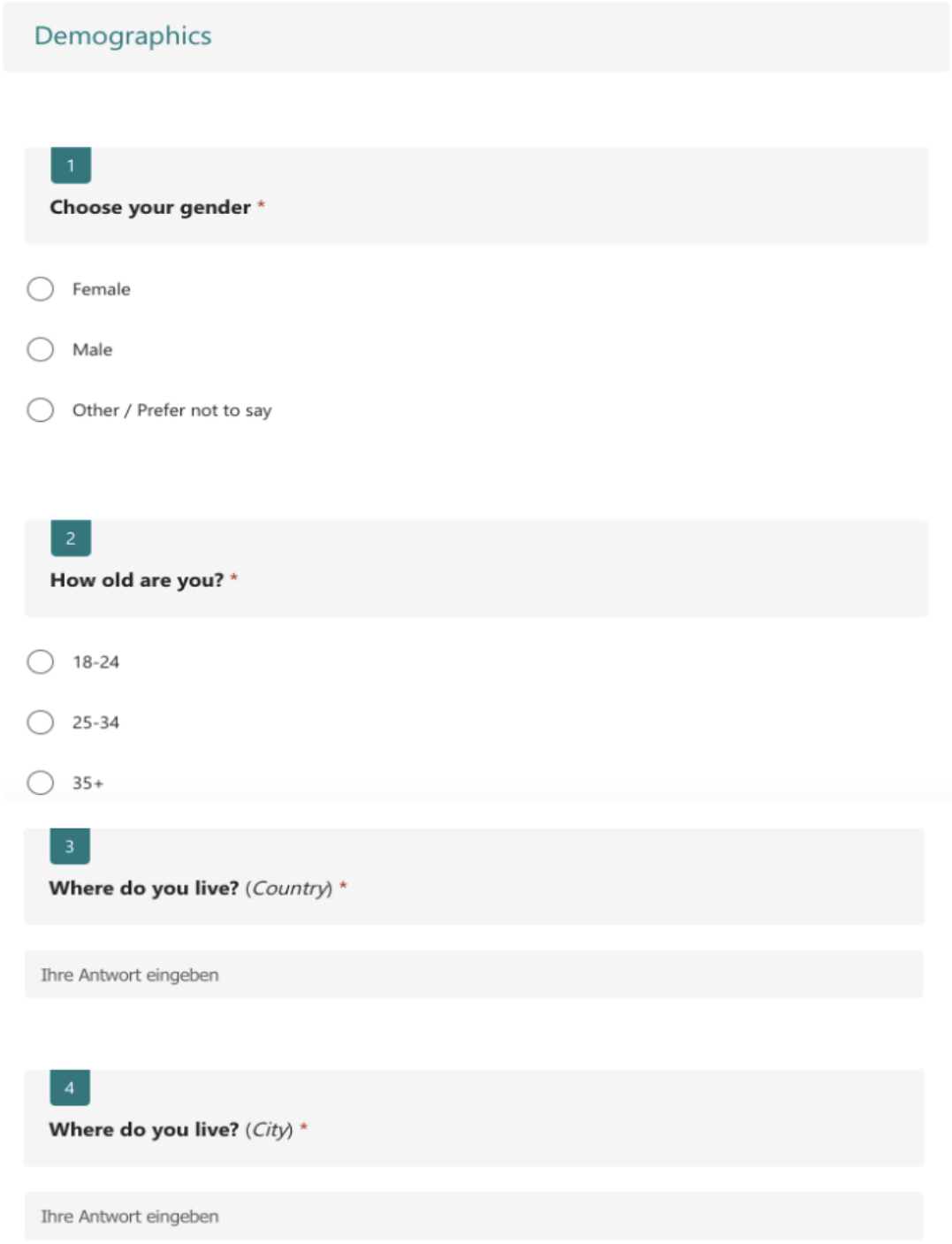
Wouter: Predictive maintenance has some benefits, but I'd argue that vandalism is a bigger cost factor. For example, in cities like Amsterdam and Cologne, many e-scooters end up in canals, which creates significant recovery and repair costs.
To address this, operators are designing more robust vehicles that can last up to four years, compared to earlier models that only lasted one or two years. However, reducing vandalism remains a challenge, and maintenance costs are still a relatively small piece of the puzzle compared to preventing damage.

Customer-Centric Innovation
Leander: How are companies reshaping their business models to better meet customer needs and expectations?
Wouter: There have been improvements in the booking process and minor adjustments to pricing models, but I'd argue that pricing isn't a major factor for most users. For example, if a trip costs €1.80 or €2.50, it's unlikely to significantly affect consumer behavior.
Subscription models and bundles have been tested, but for frequent users, owning an e-scooter or e-bike often makes more sense financially. The sharing model works better for occasional use or in multiple cities, but its appeal for daily users is limited.

Future Trends and Innovations
Leander: Looking ahead, what are the most promising trends or innovations that will shape the micromobility industry in the next 5–10 years?
Wouter: I'd highlight:
Consolidation: The number of operators will continue to shrink.
Shift to E-Bikes: E-bikes are gaining popularity over e-scooters due to city preferences and profitability.
Government Subsidies: We'll see more cities regulating and subsidizing micromobility systems, especially in smaller cities where the market alone cannot sustain these services.
Public-Private Partnerships: Governments may increasingly treat micromobility as part of public transport, funding it to ensure societal benefits.

Closing Remarks
Leander: Thank you so much for your time and insights. One last question—do you know anyone in your network who might be open to an interview on this topic?
Wouter: Sure. Let me think about it, and I'll follow up with you.
Leander: Perfect. Thanks again for your time. Have a great day!
Wouter: You too. Good luck with your research!

11.2 Survey



Demographics

1

Choose your gender *

- Female
- Male
- Other / Prefer not to say

2

How old are you? *

- 18-24
- 25-34
- 35+

3

Where do you live? (*Country*) *

Ihre Antwort eingeben

4

Where do you live? (*City*) *

Ihre Antwort eingeben

5

Employment Status *

- ◯ Student
- ◯ Employed full-time
- ◯ Employed part-time
- ◯ Self-employed
- ◯ Unemployed
- ◯ Sonstiges

6

Annual Income Bracket: *(gross)* *

- ◯ Less than €20,000
- ◯ €20,000 - €40,000
- ◯ €40,000 - €60,000
- ◯ €60,000 - €80,000
- ◯ More than €80,000
- ◯ Prefer not to say

Modem of transport

7

How do you usually get from A to B in your city? (*Distance 1-2km/15-30min walking time*) *

- [ ] Walking
- [ ] Public transportation
- [ ] Private car
- [ ] Private bike
- [ ] Ride-hailing services (Uber, Bolt, etc.)
- [ ] Bike/Scooter sharing
- [ ] E-Moped sharing
- [ ] Sonstiges

8

How do you usually get from A to B in your city?(*Distance 2-3km/30-45min walking time*) *

- [ ] Walking
- [ ] Public transportation
- [ ] Private car
- [ ] Private bike
- [ ] Ride-hailing services (Uber, Bolt, etc.)
- [ ] Bike/Scooter sharing
- [ ] E-Moped sharing
- [ ] Sonstiges

9

How do you usually get from A to B in your city?(*Distance 3-4km/45-60min walking time*) *

- [ ] Walking
- [ ] Public transportation
- [ ] Private car
- [ ] Private bike
- [ ] Ride-hailing services (Uber, Bolt, etc.)
- [ ] Bike/Scooter sharing
- [ ] E-Moped sharing
- [ ] Sonstiges

Micro-mobility services

10

How often do you use micro-mobility services? (*e.g., e-scooter sharing, e-moped sharing etc.)* *

- ◯ Daily
- ◯ Weekly
- ◯ Monthly
- ◯ Every few months
- ◯ Once or twice a year
- ◯ Never

11

What factors are most important when choosing a transportation? *(Rank from most to least important)* *

- Cost
- Convenience (availability, parking)
- Environmental impact
- Speed
- Safety
- Comfort

12

What are the main reasons you use micro-mobility services? *(Select all that apply)* *

- [ ] Cost-effective
- [ ] Convenient
- [ ] Environmentally friendly
- [ ] Saves time
- [ ] Fun to use
- [ ] N/A because I don't use them

13

How satisfied are you with the current micro-mobility services available in your city? (*5= Very satisfied, 1=Very dissatisfied*) *

☆ ☆ ☆ ☆ ☆

14

What challenges have you faced when using micro-mobility services? *(Select all that apply)* *

- [ ] High cost
- [ ] Availability of vehicles
- [ ] Difficulty parking/returning
- [ ] Lack of safety features
- [ ] Inconvenient payment methods
- [ ] Poor customer service

15

How much would you be willing to pay for short-term micro-mobility rentals? *(e.g., 15-minute rides)* *

- ◯ 2€ - 3€
- ◯ 3€ - 5€
- ◯ More than 5€
- ◯ I wouldn't

Alternative business models

16

Would you consider subscribing to a micro-mobility service? (*e.g., monthly flat fee for unlimited rides*) *

- ◯ Yes
- ◯ No
- ◯ Maybe (depends on price/features)

17

If you selected *"No"* or "*Maybe (depends on price/features)*", please specify why not/on what it depends on

Ihre Antwort eingeben

18

How much would you be willing to pay for a monthly subscription to micro-mobility services? *(unlimited rides)* *

- ◯ less than 40€
- ◯ 40-60€
- ◯ 60-80€
- ◯ more than 80€
- ◯ I wouldn't

19

Would you be interested in midterm renting options for e-mopeds? (*e.g., renting for 1-3 months*) *

- ◯ Yes
- ◯ No
- ◯ Maybe
- ◯ Sonstiges

20

How much would you be willing to pay for a monthly E-Moped rental? (*like Swapfiets***)** *

- ◯ 70-80€
- ◯ 80-90€
- ◯ 90-100€
- ◯ More than 100€
- ◯ I wouldn`t

21

What improvements would you like to see in micro-mobility services in the future? *(Open-ended)*

Ihre Antwort eingeben

22

Are there any products/services that micro-mobility companies can offer that would make you use them more often?

Ihre Antwort eingeben