



Circular Economy in the E-Scooter Sharing Industry: A Qualitative Analysis of Tier's Strategic Use of Circular Economy Principles

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Abstract

The transition towards a circular economy (CE) has become imperative across various industries, particularly in sectors with significant environmental impacts such as transportation, which accounts for approximately 25% of global CO₂ emissions. This study explores the integration of circular strategies within the micro-mobility sector, focusing on the e-scooter sharing industry and, specifically, on the practices of the company called Tier. By examining the circular initiatives implemented by the company, the research highlights not only the operational feasibility and visibility of circular strategies but also the competitive advantages they can generate. The findings contribute to the theoretical understanding of CE practices in urban mobility and provide practical implications for mobility providers seeking to incorporate circularity as a means of enhancing sustainability and achieving strategic differentiation.

Keywords: Circular Economy; Circular Strategies; 10R Framework; Competitive Advantage; E-Scooter Sharing Industry; Tier

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Sumário

A transição para uma economia circular tornou-se imperativa em diversos setores, especialmente naqueles com elevado impacto ambiental, como é o caso dos transportes, responsáveis por cerca de 25% das emissões globais de CO₂. Este estudo investiga a integração de estratégias circulares no setor da micro-mobilidade, com foco na indústria de partilha de trotinetes elétricas e, em particular, nas práticas adotadas pela empresa Tier. Através da análise das iniciativas circulares implementadas, a investigação evidencia não apenas a viabilidade operacional e a visibilidade destas estratégias, mas também as vantagens competitivas que delas podem advir. Os resultados contribuem para o aprofundamento teórico das práticas de economia circular na mobilidade urbana e oferecem implicações práticas para os operadores do setor que pretendem adotar a circularidade como forma de promover a sustentabilidade e alcançar uma diferenciação estratégica.

Palavras-chave: Economia circular; Estratégias circulares; Estrutura 10R; Vantagem competitiva; Indústria de partilha de scooters elétricas; Tier

Título: Economia circular na indústria de partilha de scooters elétricas: uma análise qualitativa da utilização estratégica dos princípios da economia circular pela Tier

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Index of Abbreviations

CBM	Circular Business Model
CBMI	Circular Business Model Innovation
CE	Circular Economy
ESG	Environmental, Social and Governance
EU	European Union
GDP	Gross Domestic Product
MaaS	Mobility-as-a-Service
PaaS	Product-as-a-Service
PSS	Product Service System
SBM	Sustainable Business Model
RBV	Resource-Based View
ROI	Return on Investment

1. Introduction

Conventional linear consumption models ('take-make-dispose') are facing growing limitations due to resource scarcity (Ellen MacArthur Foundation, 2013). These challenges are intensified by the increasing global demand driven by a rising and more affluent population (Lacy & Rutqvist, 2015). Consequently, this has led to unsustainable resource depletion, elevated price levels, and heightened market volatility (Ellen MacArthur Foundation, 2013). Today's patterns of resource extraction, processing, consumption, and disposal are driving major global crises such as climate change, biodiversity decline, pollution, and increasing waste (United Nations Environment Programme, 2014; Lacy & Rutqvist, 2015). Not only resource constraints, but also technological development and socio-economic opportunity are drivers of CE (Lacy & Rutqvist, 2015). Therefore, the adaptation of a CE is endorsed as a replacement for the end-of-life concept and the transition to a CE could be the biggest revolution and opportunity for the organization of production and consumption in our global economy for 250 years (Lacy & Rutqvist, 2015; Ellen MacArthur Foundation, 2013). CE aims to avoid waste, shift to renewable energy, and especially for technical products which are durable, to shift from an ownership perspective to leasing, sharing or renting business models (Ellen MacArthur Foundation, 2013). By applying circular economy strategies and improving resource efficiency, the material demand associated with the shift to renewable energy systems can be reduced, and therefore a more inclusive global transition to clean energy and mitigating potential socioeconomic consequences will be supported (United Nations Environment Programme, 2024). If the CE can substitute the linear economy and decouple growth from limited resource use, it can also release \$4.5 trillion in added economic output by 2030 (Lacy & Rutqvist, 2015). Furthermore, the IPCC's Sixth Assessment Report highlights the CE as a key strategy for reducing greenhouse gas emissions (IPCC, 2023).

In parallel, over 70% of EU citizens live in urban areas that generate 23% of all transport greenhouse gas emission (European Commission, 2021; Statista, 2024). In 2019, transport was responsible for around a quarter of the EU's total CO₂ emissions in 2019 which is also the case specifically in Germany. Road transport accounted for 71.7 % of this (Parlament, 2019; Fraunhofer Institute ISE, 2020). To tackle this problem, a transition from the current linear economic model to a CE model is required (Accenture strategy, 2014). Two of the CE business models that offer a competitive advantage are the sharing economy concept and product-as-a-service (PaaS) (World

Economic Forum, 2022). When the environmental crisis and climate change, the trend of urbanization and the circular concepts of sharing economy and PaaS come together, Tier which was once called a unicorn, is a company to be considered in the micro mobility industry. The reason for it is that Tier provides e-scooter sharing services across Europe since 2018 to follow their mission: “change mobility for good, together” (Tier Mobility SE, n. a.). Therefore, this research aims to analyze how Tier used circular strategies effectively as a powerful strategic tool to obtain competitive advantage. Although Tier offers various e-vehicles such as e-scooters, e-bikes and e-mopeds, this research focuses on e-scooters. The concept of competitive advantage in combination with circular strategies is of great importance in this industry, as the market for e-scooter sharing services is highly competitive (Schellong, Sadek, Schaezberger, & Barrack, 2019). To illustrate and structure the research objectives of this research, Figure 1 has been selected:

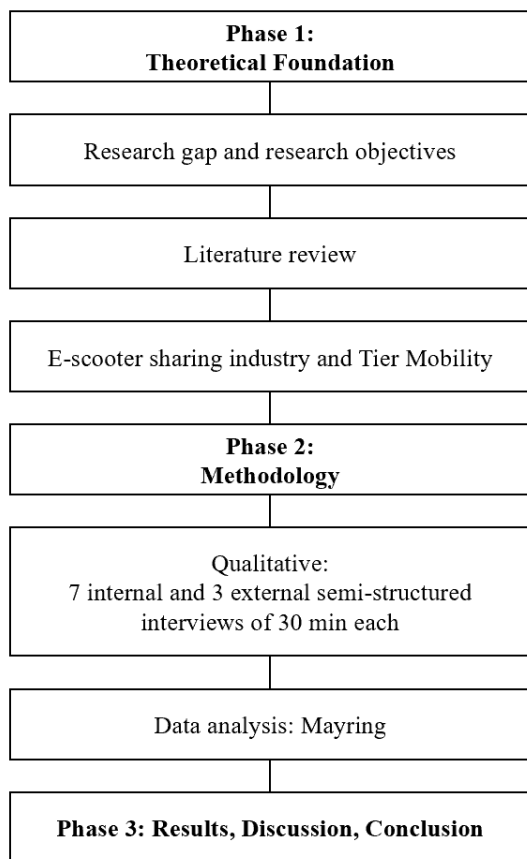


Figure 1: Research Procedure
Source: Own illustration

This research starts with the literature review to present all relevant theories related to the topic, beginning with the concept of competitive advantage, including its development of definitions over time and various sources contributing to competitive advantage. This is followed by the centerpiece of this research: the concept of CE. This chapter is divided into circular strategies with a particular focus on the 10R framework developed by Potting et al. (2017) (Refuse, Rethink, Reduce, Reuse, Repair, Refurbish, Remanufacture, Repurpose, Recycle, Recover), circular advantage, and circular business models (CBM) as well as its innovation. Lastly, the e-scooter sharing industry with the example of Tier is presented.

Although the company Tier has been renamed to Dott after the merger with Dott in 2024, the term Tier will be used throughout this thesis for consistency and readability, and the merger is not part of this study. The literature review is followed by the methodology which is a qualitative research based on interviews conducted with senior employees of Tier and with the most relevant stakeholder groups: a user, a city, and an impact investor.

After presenting the analysis, results, discussion, and their integration into the literature from chapter 2, the final chapter summarizes the key conclusions, addresses the study's implications, limitations, and provides a future outlook. In the following, the existing research gap is systematically derived and contextualized, illustrating the underlying problem and thereby providing the basis for the formulation of the central research question of this thesis.

2. Research Gap & Problem Statement

To begin with, the concept of the CE has been extensively examined in academic and institutional literature, particularly since the publication of the influential report by the Ellen MacArthur Foundation in 2013 (Ellen MacArthur Foundation, 2013; European Parliament, 2023; United Nations Environment Programme, 2024). This growing interest is also reflected in the extensive body of research on circular strategies and business models across various traditional linear sectors, e.g. circular automotive, circular fashion, circular packaging, or circular agriculture (Prochatzki et al. 2023; Rathinamoorthy, 2018; Zhu et al. 2022; Dagevos & de Lauwere, 2021). It is also known that shared economy and products as a service are relevant business models that contribute to CE (World Economic Forum, 2022; Ellen MacArthur Foundation, 2013). Nevertheless, the development of a solid business case for action is imperative for companies. In the absence of profitability or competitive advantage, sustainable and circular practices risk lacking long-term viability (Remmert, 2024).

The industry of e-scooter sharing services evolved in Europe in 2018 and in Germany in 2019 (Weimer, 2021). Therefore, research on this topic just started 7 years ago and there exist several papers about the environmental impact of this industry, challenges and barriers (Weschke et al., 2022; Hollingsworth et al., 2019; James et al., 2019; Krauss et al.; 2024; Severingiz et al., 2020). Although sustainability and CE are recognized as potential sources of competitive advantage (Carroll et al., 2021; Lacy & Rutqvist, 2015), it remains unclear which specific strategies generate competitive advantage within the e-scooter sharing industry. In addition, the e-scooter sharing industry faces the challenge of being highly competitive. Once relevant competitors such as Bird which was founded in the US and expanded to Europe, went bankrupt in December 2023 (Schellong et al., 2019; Manager Magazin, 2023). In contrast, Tier was able to expand rapidly across Europe while having fewer financial resources in comparison to its competitors, and officially declared climate neutrality in 2020 (Weimer, 2021). Due to its distinctive strategic approach and positioning, Tier has been selected as a representative company for this thesis, serving as the foundation to investigate the following research question, which aims to generate insights applicable to the broader e-scooter sharing industry. This research aims to answer the following main research question: *“Which specific circular strategies can be effectively implemented to create a competitive advantage in the e-scooter sharing industry?”*

To address this question, the following sub questions will be addressed:

(RQ1): Which specific circular strategies from the 10R framework have been integrated into the company’s operations and strategy of Tier?

(RQ2): What competitive advantages have emerged from the implementation of these identified circular strategies from RQ1?

The procedure of this research is conceptualized in the following illustration (Figure 2):

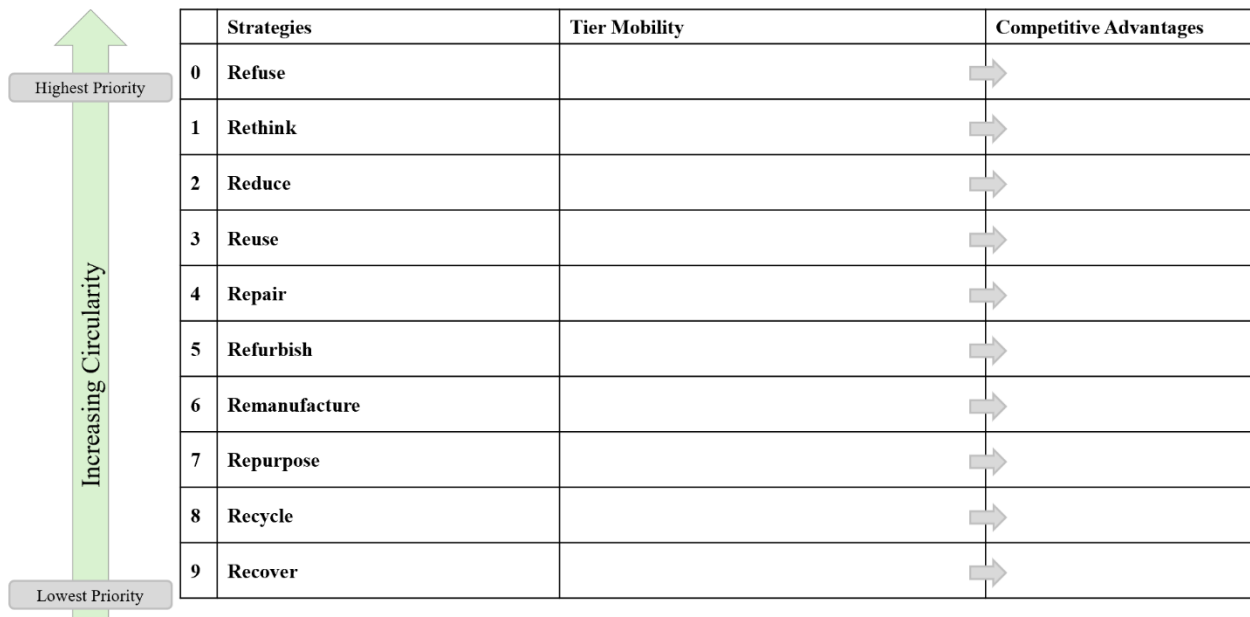


Figure 2: Overview of Circular Strategies

Source: Own illustration

This study makes a valuable contribution to existing literature by analyzing both the adoption of circular strategies and their strategic impact on competitive advantage in the context of the e-scooter sharing industry. In the following section, the definitions of key terms related to this research are presented to create a consistent and common understanding as a basis for the subsequent analysis.

3. Literature Review

3.1 Resource-Based View and Competitive Advantage

This chapter outlines the concept of competitive advantage by showing the evolution of the concept over time and its roots in the Resource-Based View (RBV), as well as the emergence of the different sources from which competitive advantage can develop. The RBV, which first emerged in 1959, and was developed 35 years later by Wernerfelt is the first strategic approach focusing on internal resources of a company (Wernerfelt, 1984; Penrose, 1959). Previous traditional strategic approaches have not focused on internal resources, but on market-centric strategy analyses, such as Porter's Five Forces (Porter, 1979). RBV is a solidly established theoretical framework that has been heavily researched in academia. It provides the foundation for understanding firms as a bundle of resources and explains how sustainable competitive advantages can be derived from the effective utilization of internal resources (Barney, 1991; Wernerfelt, 1984). The central idea is that if a company wants to achieve a competitive advantage, it must acquire, apply and control valuable, rare, inimitable and non-substitutable (VRIN) resources and capabilities, and use them wisely, and have an organization (VRIO) (Barney, 1991; Wernerfelt, 1984). While there exist several definitions, developments and criticism of competitive advantage (Porter, 1979), this research will focus on the following definition: A company has a competitive advantage if it can produce more economically and/or satisfy customer needs better and thus perform better than its competitors and experiences superior performance (Peteraf, 1993; Barney, 1991). Traditionally, competitive advantage can arise through differentiation or cost leadership, whereby the latter is achieved when a company can sell a product or service cheaper than the competitions and differentiation is achieved when a company can offer a unique product or service achieved through innovation, superior customer service or a strong brand (Porter, 1985). However, Christensen (2001) argues that traditional competitive advantages, such as cost leadership and differentiation, are becoming increasingly less important. Instead, it is required to continuously open new markets, adapt strategies and question existing business models. Companies that are able to adapt quickly to change and develop innovative solutions will be successful in the long term (Christensen, 2001). This is related to the concept of dynamic capabilities which can be seen as a development of the RBV, stating that companies must not only own valuable resources, but also develop the ability to adapt them to market changes, introducing the three main dimensions: Sensing (recognizing

opportunities), Seizing (exploiting opportunities), and Transforming (adapting the organization) (Teece et al., 1997; Barney, 2001; Barreto, 2010).

The sources of competitive advantage were not only researched by Porter through the classic strategies of cost leadership and differentiation, but also by many more authors who identified additional sources of competitive advantage. (Porter, 1985; Christensen, 1997). Process innovations can lead to cost reductions, enabling companies to become market leaders (Christensen, 1997). Moreover, companies which continuously drive forward innovation are able to displace market leaders and competitive advantage can evolve through open innovation strategies by incorporating external sources of innovation (Christensen, 1997; Christensen, 2003; Chesbrough, 2003).

This idea of competitive advantage is developed further as companies are forced to develop new activities, resources and capabilities due to limited resources. Therefore, companies will attain a lasting competitive advantage by pursuing knowledge, innovation or brand-specific advantages (Rodriguez et al., 2002; Wernerfelt, 1984; Barney, 1991). Business model innovation in particular is widely recognized as an important source of competitive advantage, as it changes the competitive environment or supports the strategic implementation of innovative processes, products, and services. (Chesbrough, 2007; Baden-Fuller & Morgan, 2010; Björkdahl, 2009; McGrath, 2010; Boons & Lüdeke-Freund, 2012). Additionally, sustainable strategies can be a source of competitive advantage through the reduction of negative environmental impact of business activities which offers scope for operational efficiency, cost reduction and entry into new markets (Marshall, 2023). Studies investigating how companies sustain competitive advantages through sustainability-driven differentiation under competitive pressure indicate a strong positive correlation between the implementation of strategic sustainability practices and improved financial performance which is measured in return on capital and market valuation multiples. The findings also highlight that sustainability can serve not only as a baseline requirement but also as a distinctive factor. Some firms appear to gain a genuine strategic edge by embracing sustainability initiatives that are difficult for rivals to replicate (Ioannou & Serafeim, 2019). Especially start-ups, such as Tier in this case, rely on investors and their financing. This leads to the point that a company's approach to sustainability can serve as an indicator for risk management: Banks or private equity firms will look at how a company deals with environmental issues, for example, when deciding whether to

grant a loan or make an investment (Carroll et al., 2021). Therefore, start-ups can benefit from sustainable strategies when raising funds from investors (Maia et al., 2022). However, financial resources are not seen as the key driver for competitive advantage, start-ups can gain advantages through unique expertise, innovative business models or specialized networks regardless of limited financial resources (Barney, 1991).

3.2 Circular Economy

This chapter presents the concept of CE by presenting the development of the concept, different circular strategies and the 10R framework which is the relevant one for this study. Furthermore, different CBMs and their innovations relevant for this research are presented as well as circular start-ups.

Nowadays, companies that integrate sustainability into their business strategies, can secure a significant competitive advantage (Bogenschütz, 2025; Martins de Souza, 2024; Carroll, et al., 2021; Escaler, 2020). The fact that sustainability helps to improve efficiency is linked to the trend of CE, which means the shift from a linear to a CE as shown in Figure 3 (Carroll et al., 2021; Potting et al., 2017; Accenture strategy, 2014).

The popularity of CE is not only shown by the numbers of definitions, but also by the fact that the European Commission developed the European Circular Action Plan in 2015 which was updated latest in 2020 as part of the European Green Deal to make Europe cleaner and more competitive (European Commission, 2015; European Commission, 2020). According to Ellen Mac Arthur, CE describes a regenerative and resource-friendly economic system which avoids “end-of-life” concepts though reuse, repair, remanufacturing and recycling (Ellen MacArthur Foundation, 2013). According to the European Parliament, *“the CE is a model of production and consumption, which involves sharing, leasing, reusing, repairing, refurbishing and recycling existing materials and products as long as possible. In this way, the life cycle of products is extended.”* (European Parliament, 2023). The shift from a linear to a CE is illustrated in Figure 3:

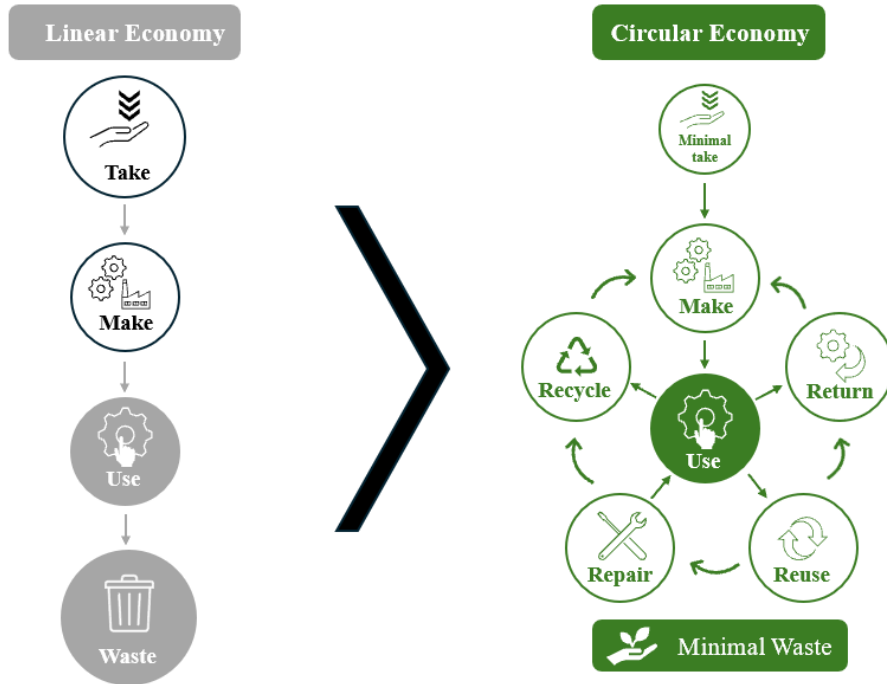


Figure 3: Circular Economy

Source: Own illustration based on World Economic Forum 2022

This research refers to a dynamic perspective of CE “going circular” instead of a static perspective of a completely circular system without any loss of material and energy, which is theoretically not possible (Geissdoerfer et al., 2020; Zotti & Bigano, 2019; Skene, 2018). The model of CE implicates four levers of value creation and two of them will be focused on this research: the power of the inner circle and the power of circling longer. While the first means the minimization of material consumption through better reuse, such as manufacturing, the second addresses the maximization of the life of products through better durability and reparability (Ellen MacArthur Foundation, 2013). CE promises cost savings, new business models, such as leasing, sharing economy and PaaS, and value creation through more resilience and profitability on the long term (Ellen MacArthur Foundation, 2013). Among others, technology advancements, acceptance of alternative business models such as sharing models, and urbanisation are main drivers indicating that the linear model is increasingly being challenged (Ellen MacArthur Foundation, 2020).

3.2.1 Circular Advantage

In the light of digital momentum and the increasing popularity of the term, CE is no longer the domain of multinational corporations alone, but must be considered by all organizations, including small and medium-sized enterprises, as a requirement for future resilience and competitive

advantage (Howard & Webster, 2018). Competitive markets for circular goods and services are an essential prerequisite for the creation of a self-sustaining CE. They drive the innovation, investment and workforce development that CE requires (DCCEEW, 2024). Circular business advantage refers to companies applying the concept of CE as a core element of their growth strategy to generate value (Howard & Webster, 2018; Lacy & Rutqvist, 2015). Companies that strive for a circular advantage must create new business models that are free from constraints of linear thinking (Lacy & Rutqvist, 2015). Such a model breaks with the traditional, linear production methods of the 20th century and overcomes previous sustainability thinking, which focused primarily on doing less harm. Instead, it focuses on positive, regenerative value creation, where CBMs enable clean and long-term sustainable production (Howard & Webster, 2018). There exist several trend predictions for circular advantage and CBMs which although they come up with different definitions, all point in the same direction. Firstly, six predictions considering the concept of circular advantage include: (1) ownership of products will be a thing of the past, (2) future trade will be determined by legislation and prices for raw materials and recycled materials, (3) servitisation and sharing will be central to business value, (4) business relationships will be more flexible and based on transparency and co-operation, (5) customers will increasingly try to bypass traditional retail channels, and (6) whether global or local, the issues of resources, pollution and workers are intertwined (Howard & Webster, 2018). Secondly, five key CBMs include (1) circular inputs and circular supply-chain, (2) sharing economy concept and sharing platform, (3) PaaS, (4) product life- and use extension, and (5) resource recovery and recycling (World Economic Forum, 2022; Lacy & Rutqvist, 2015; Accenture strategy, 2014). Regarding (1) ownership of products will be a thing of the past, it is crucial that performance takes precedence over quantity, durability over disposable items, and companies have the opportunity to develop new relationships with consumers (Lacy & Rutqvist, 2015). More and more customers are choosing to buy a desired function or service rather than a specific product which addresses the business model (5) PaaS (Lacy & Rutqvist, 2015). Especially “Mobility as a Service” (MaaS) replaces the traditional vehicle ownership model with integrated, digital mobility services that combine public and private transportation and can be conveniently booked via a platform. The aim is to offer individual, time-saving and cost-efficient mobility, a market that is set to grow to around 500 billion US dollars by 2030 (Statista Research Department, 2025). At the same time, new capabilities are essential for the introduction of a CE. The shift toward a circular economy demands a profound transformation in corporate strategy and planning. It

moves beyond the traditional focus on the core business and calls for proactive engagement in circular ecosystems that integrate suppliers, producers, retailers, service providers, and end-users. Unlocking real value and designing impactful measures requires the involvement of all actors along the circular value chain (Accenture strategy, 2014). Numerous studies have assessed the potential value and market impact of the CE in various industries around the world. While a report by European Commission forecasts up to EUR 600 billion in net savings for EU companies, the Ellen MacArthur Foundation estimates EUR 630 billion in value potential by this year within selected manufacturing sectors in the EU and up to EUR 700 billion in material cost savings globally (Europäische Kommission, 2015; Ellen MacArthur Foundation, 2013).

3.2.2 Circular Strategies

A range of strategies of CE have been developed to substitute the concept of end-of-life, whereby CE is often defined by differentiating the biological cycle (addresses organic materials) and the technological cycle (addresses manufactured materials) (Wouterszoon Jansen et al., 2022). The Ellen MacArthur Foundation has developed the ReSOLVE framework consisting of Regenerate, Share, Optimise, Loop, Virtualise, and Exchange, which outlines six actions that businesses and governments can take to drive the transition to CE (Ellen MacArthur Foundation, 2020). This research focuses on 4 of them: regenerating in means of shifting to renewable energy; sharing with focus on shared assets such as e-scooters; optimizing products to increase its performance and efficiency and the loop of recycling materials (Ellen MacArthur Foundation, 2020). Especially the integration and contribution of shared economy and selling services rather than the products itself, namely product service system (PSS) is embedded in many research papers (Mentink, 2014; Laubscher & Marinelli, 2014; Ellen MacArthur Foundation, 2020). Also, the shift from fossil fuels to renewable energy is frequently associated with CE (Adabre et al., 2022). In regard to strategies addressing the technical cycle, the 10R framework is one of the most frequently cited (Kirchherr et al., 2023). However, there exist more than 100R frameworks which have been developed over time, starting with the most popular 3R framework of the Reduce-Reuse-Recycle pattern (European Union, 2008; Zorpas, 2024). Moreover, an examination of various R strategies showed that they range from 3Rs to 10Rs with 3Rs to 5Rs being a dominant strategy with a distinct hierarchy, as opposed to the 10Rs strategy which seeks to carve out nuances and maximize value (Reike et al., 2017; Rahman et al., 2021). In addition, the framework by Zorpas (2020) states that a key component of a circular strategy should be the 10R approach. This is consistent with the 10R

framework by Potting et al. (2017) which is identified to be the most relevant one in the e-scooter sharing industry and to address the core point of this research (Potting et al., 2017). It provides ten hierarchical strategies aimed at reducing material consumption and waste production. Hereby the 10Rs, namely, refuse, rethink, reduce, reuse, repair, refurbish, remanufacture, repurpose, recycle and recover, are prioritized from most effective to least effective, which is presented in Figure 4 (Raad voor de leefomgeving en infrastructuur, Rli, 2015; Kirchherr et al., 2017; Potting et al., 2017).

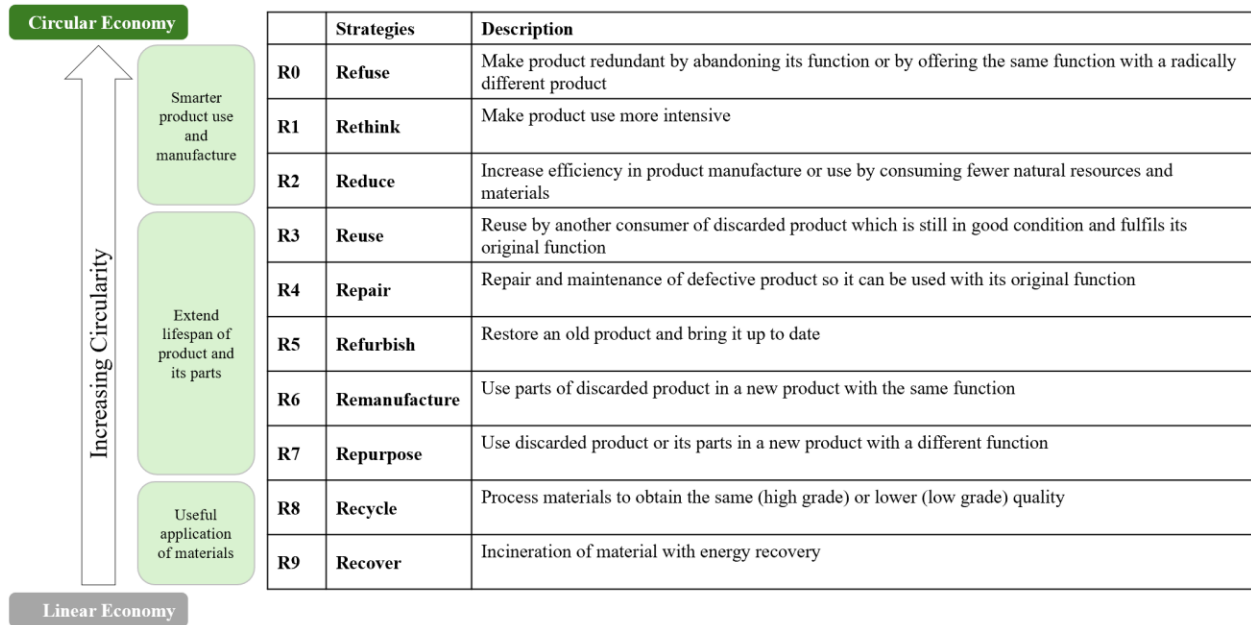


Figure 4: Definitions of Circular Strategies
 Source: Own illustration based on Potting et al. (2017)

These 10R strategies can further be categorized into three categories which represent the length of the circular waste stream that each strategy represents. These categories can be seen in the green boxes in Figure 4. The shorter the circular waste stream (loop), the more sustainable the strategy is. The higher the ladder they are, the narrower the circular flow. This strategy relies on reduced use of materials, making it inherently more circular. Lower values indicate earlier stages of the value chain, while higher values correspond to later stages (Malooly & Daphne, 2023). The first three strategies, refuse (R0), rethink (R1) and reduce (R2) focus on short loops on smarter product use and manufacture. R3, R4, R5, R6 and R7 belong to medium loops focusing on life extension strategies. Lastly, recycling and recovery are part of long loops focusing on creative material application (Malooly & Daphne, 2023). In addition to the definition of the R-strategies shown in Figure 4, there are several different definitions. In the wider conception of refuse (R0), it bans the use of specific materials considered harmful to the planet, terminates a particular production

process or eliminates an environmentally harmful product in favor of an efficient alternative, or eventually eliminates it altogether (Malooly & Daphne, 2023; Ho et al., 2024). The definition of rethink (R1) can be extended to mean not only making the product use more intensive, e. g. by sharing product, but also to rethink and refuse to establish further opportunities for the application of CE (Ho et al. 2024; Potting et al. 2017). The reducing strategy (R2) is not only defined by increasing efficiency in product manufacture or use by consuming fewer material resources and materials (Potting et al. 2017) but also encompasses reducing the ecological footprint of production and consumption activities (Ho et al. 2024). The reuse (R3) of products that remain functional and in good condition by a new user contributes to the strategy of closing the resource loop. This approach may also involve repairing or refurbishing items to extend their lifespan (Potting et al. 2017; Kirchherr et al. 2023; Papamichael et al. 2024). This underlines the overlaps between the various R-strategies, which cannot always be strictly separated from one another. The repair strategy (R4) involves fixing and maintaining defective products to restore their original functionality. Repairs can be carried out either by the company itself, by specialized repair shops, or through collaborative partnerships (Potting et al., 2017; Ho et al., 2024; Malooly & Daphne, 2023; Jonas et al., 2023). R5, namely refurbishment, involves the restoration of an old product as well as its modernization and upcycling (Potting et al. 2017; Rodrigo-González et al., 2021). This can be done within the product by updated components and/or on the outside of the product through new materials, paint etc. (Malooly & Daphne, 2023). Remanufacturing (R6) refers to reusing components from discarded products to create a new product with the same function. It involves rebuilding the item to match the original specifications by combining reused, repaired, and new parts (Potting et al., 2017; Rodrigo-González et al., 2021). Here, too, it is crucial that R-strategies interact and are more of an interconnected strategy than they are when viewed individually. The 8th R-strategy, repurpose, i.e. discarded products or parts of them are used in a new product with a different function, or a product is modified or reworked to make it suitable for a new application (Potting et al. 2017; Prasad, 2023). Repurposing promotes innovation and can lead to the development of unique products with added value (Malooly & Daphne, 2023). The penultimate R-strategy of the framework used in this study, namely recycling, involves the processing of materials to obtain the same (high quality) or lower (low quality) quality. This approach is used when a product has reached the end of its life but still contains recoverable materials (Potting et al. 2017; Malooly & Daphne, 2023; de Oliveira et al., 2021). Recovery (R9) which is the last R-strategy

examined in this research, is defined by the incineration of material with energy recovery (Potting et al., 2017; Papamichael et al., 2024; Malooly & Daphne, 2023).

3.2.3 Circular Business Model Innovation & Circular Start-Ups

The transition from a linear to a CE depends not only on political decision-makers but also on the implementation of CE principles into their business models by the companies (Ellen MacArthur Foundation, 2015; van Renswoude et al., 2015). From CE principles, CBMs can be derived. The conceptualization and implementation of a CBM can be described through circular business model innovation (CBMI), whereby the process of CBMI can come in four different types: (1) circular start-ups, (2) diversifying or (3) transforming the business model towards CE or (4) acquisition of external CBMs, shown in Figure 5 (Geissdoerfer et al., 2020). This research focuses on circular start-ups which establish new business models through integrating circular strategies outside of an existing company. This means they have their own brand, employees and resources but e.g. it can be funded by investors, incubators etc. (Geissdoerfer et al., 2020). The main CBM strategy integrated by service-based start-ups is reducing (Henry et al., 2020) which is the 3rd R of the 10R framework by Potting et al. (2017).

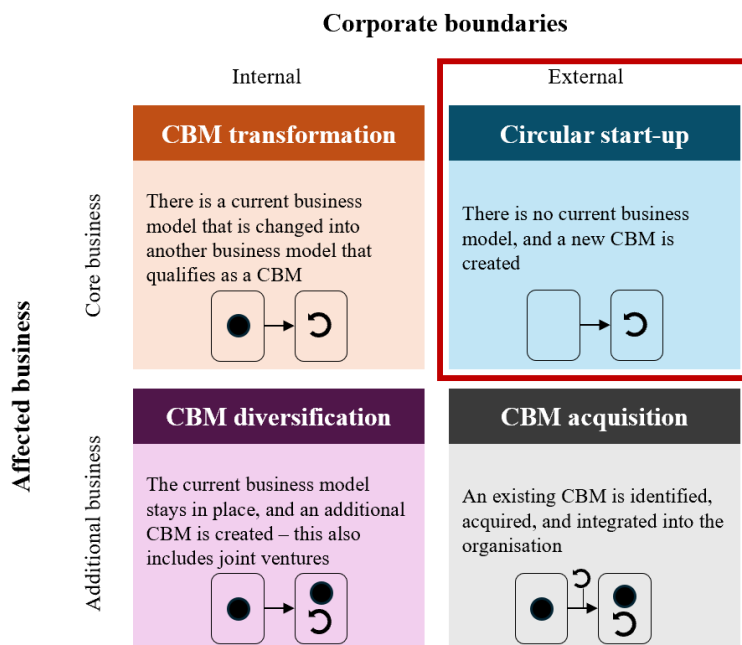


Figure 5: Circular Business Model Innovation
Source: Own illustration based on Geissdoerfer (2020)

Drivers of circular start-ups, meaning factors which support the implementation of CBMI, are mainly embedded in financial and market drivers. This illustrates that circular start-ups are driven by the requirement to adapt to a higher demand for more sustainable offerings. Besides, the goals for circular start-ups are mostly financial benefits in terms of cost reduction and business growth. (Geissdoerfer et al., 2022). This is related to the fact that start-ups depend on a higher market attractiveness with a positive financial return to prevail (Geissdoerfer et al., 2022). Additionally, PSS are often seen as one of the main drivers of CBM and are responsible for the most frequently referenced practical applications in CBM (Antikainen & Valkokari, 2016; Bocken et al., 2017; Kühl et al., 2018; Yang & Evans, 2019). Moreover, start-ups, as new players in the market, have a greater ability to implement more disruptive CBMs than incumbents, as they have greater flexibility and responsiveness to market change (Bergset & Fichter, 2015; Hockerts & Wüstenhagen, 2010; Rizos, et al., 2016; Henry et al., 2020). Start-ups using circular strategies are more efficient and sustainable start-ups have better access to funding as many investors value ESG (Martins de Souza et al., 2024).

Barriers for circular start-ups, i.e. factors that hinder the integration of CBMI, include financial uncertainty and high initial investments. However, start-ups appear to face fewer organizational barriers, as circular start-ups are typically established with a circular mindset, led by a sustainability-minded founder. As start-ups do not have problems with a lack of customer demand, they are likely to have a stronger connection to new sustainability challenges and customer needs. What is interesting for this research is that 2/3 of the start-ups surveyed in the research of Geissdoerfer et al. (2022) would consider a merger or acquisition to optimise their CBM and operational efficiency (Geissdoerfer et al., 2022).

3.3 The E-Scooter Sharing Industry and Business Operations of Tier

The transport sector makes a major contribution to the smooth functioning of the European economy by accounting for 7% of GDP in the EU and employing 5% of the population (Federal Ministry for Digital and Transport, 2020). But mobility is not only beneficial, it also comes with costs for society. Therefore, the greatest challenge for the mobility sector is to substantially lower its emissions and become more sustainable. However, this transformation is also offering opportunities for innovation and developing new products and services, boosting competitiveness

and striving global leadership as other markets move rapidly towards zero-emission mobility (European Commission, 2020).

Over the past seven years, e-scooter sharing has rapidly gained popularity as a form of shared micro-mobility in numerous cities around the globe (Caspi et al., 2020; Mathew et al., 2019). Transport systems have already changed in 2018 based on new technologies and new business models like shared mobility services (Shaheen et al., 2018; Kamargianni et al., 2016). Hereby, shared e-scooter services are one of the new types of urban micro-mobility in 2020 (Caspi et al., 2020). E-scooter sharing refers to a transport system involving small, battery-powered vehicles that are rented short-term via mobile apps. Designed for single riders, this dockless service allows scooters to be picked up and dropped off at any location within a designated service area (Hollingsworth et al., 2019; Caspi et al., 2020). MaaS enables convenient door-to-door transport without owning a private vehicle and describes the purchase mobility services that are geared towards the needs of the consumer instead of buying the vehicle (Kamargianni et al., 2016; Brezovec & Hampl, 2021). The most important tasks for providers include optimizing operational processes, strengthening the longevity of products, developing a strategy for rapid growth, and increasing the funding (Schellong et al., 2019). The main challenges of e-scooter sharing services include environmental impact, vehicle life span, lack of regulatory framework, accidents, and required parking areas (Lee et al., 2021; Hollingsworth et al., 2019; Sikka et al., 2019; James et al., 2019; Severingiz et al., 2020). While the first e-scooters appeared in the USA in 2017, the first e-scooter sharing system was introduced in Germany in 2019 (Caspi et al., 2020; Gubmann et al., 2019).

The first e-scooters in 2019 in Germany were provided by Tier which is a German company founded 2018 in Berlin by Lawrence Leuschner and offers a sharing service of e-scooters. After starting in Germany, Tier expanded rapidly first in Europe, but also globally (Weimer, 2021). Users register via the provider's app using a mobile phone number. By scanning the QR code of a vehicle, users can hire it and start their journey immediately. The prices for the electronic means of transport vary from city to city (Fricke, 2024). Once the destination has been reached, the vehicle can be parked at a suitable location and the hire will be terminated via the app. It is then available for the next user (Fricke, 2024). At the end of 2019 Tier operates in 40 cities and 12 countries. On the contrary of its competitors, in 2021 Tier claims to be climate-neutral (Fricke, 2024). In January

2024, the Berlin-based e-scooter provider Tier merged with its smaller competitor Dott (Fricke, 2024; Schwär & Wirminghaus, 2024). Five years ago, the e-scooter sharing services started with 25 competitors. Following Bird's exit from the European market in 2023, there are now five players left. Size helps with profitability which is crucial for all start-ups right now (Leuschner, 2024).

4. Methodology

4.1 Qualitative Research

In order to answer the research question and verify the literature presented in chapter 3 about CE and competitive advantage, empirical social research with qualitative data was carried out. Interviews are regarded as a central instrument of qualitative research and were chosen for this industry research. While the choice of the right type of interview (structured, semi-structured, unstructured) depends on the research question, semi-structured interviews are recommended in business research (Rowley, 2012). Although the guide provides a structure, there is some scope for the dialogue to address topical issues and for the conversation to unfold (Magaldi & Berler, 2020). The qualitative approach provides in-depth insights into the experiences and opinions of the interviewees by examining the interviews for recurring patterns, which allows for a more nuanced understanding of the industry (Bogner et al. 2014).

4.2 Data Collection

The data was collected by conducting expert interviews with a selected sample of people who offered insights relevant to the research question (Homburg, 2020). The experts of this research have specified expertise (Helfferrich, 2019) and are separated into two groups. The employees of Tier, giving insights into the internal view of the company are categorized under the interview group “internal” as shown in Table 1:

Code	Job Title	Company	Experience
Int1	Head of Regulatory Affairs	Tier	> 6 years
Int2	Executive Director & Co-CEO	Tier	> 6 years
Int3	Head of Operations Central & Southern Germany	Tier	> 5 years
Int4	Head of Business Operations DACH Region	Tier	> 6 years
Int5	Regional M&R Manager West Germany	Tier	> 4 years
Int6	Central Policy & Sustainability Manager	Tier	> 3 years
Int7	Managing Director	Tier	> 3 years

Table 1: Overview of Internal Experts

Source: Own illustration

The selection of employees of Tier was chosen wisely to get a diversified view from managers of different departments. While Regulatory Affairs is relevant for the perspective towards relevant stakeholders, such as cities and investors, the perspectives of the Executive Director, Managing Director and Sustainability Manager are important to understand the strategic planning and

implementation of circular strategies. The Heads of Operations as well as the Manufacturing Manager could make valuable contributions to the operational integration of the strategic planned circularity. The second interviewee group comprises the 3 most relevant stakeholders in the e-scooter sharing industry, namely users, cities and impact investors. The interviewees were chosen to get the external view on the effect of circular strategies on the competitive advantage of Tier. The sample shown in Table 2 include one user who frequently uses e-scooters daily, one expert that is employed at city Mannheim, being responsible for tenders and the decision if e-scooter sharing providers are allowed to operate; and lastly, one expert in the field of impact investing in the mobility industry.

Code	Stakeholder Group	Industry/Company	Experience
Ext1U	User	Investment banker living in Frankfurt	> 6 years
Ext2C	City	Responsible Stadt Mannheim:	> 7 years
Ext3I	Investment Director	Novator: invested in Tier	> 8 years

Table 2: Overview of External Experts

Source: Own illustration

In the following chapter 5 “Results and Findings” the insights of the interviewees will be referred through the codes which were mentioned in the first columns of Table 1 and Table 2.

The structure of the interviews can be found in Appendix A and B.

4.4 Data analysis

Interviews were corrected and translated from German and English. As almost all experts were German and results should be as realistic as possible, interviews were hold in mothertongue (Piekkari & Welch, 2006). After conducting, recording and transcribing, the interviews, the collected data was structured, categorized and analyzed using the method of Mayring. This method is divided into two different main methods: (1) inductive category development; and (2) deductive category development. While the latter covers predefined, theoretically grounded categories applied to the material, inductive categories are derived from the qualitative data collection, namely the interviews conducted (Mayring, 2000). Since qualitative data must be prepared systematically and in a structured way to obtain valid statements, this method of analysis was chosen (Kuckartz & Rädoler, 2022). The following categories were developed:

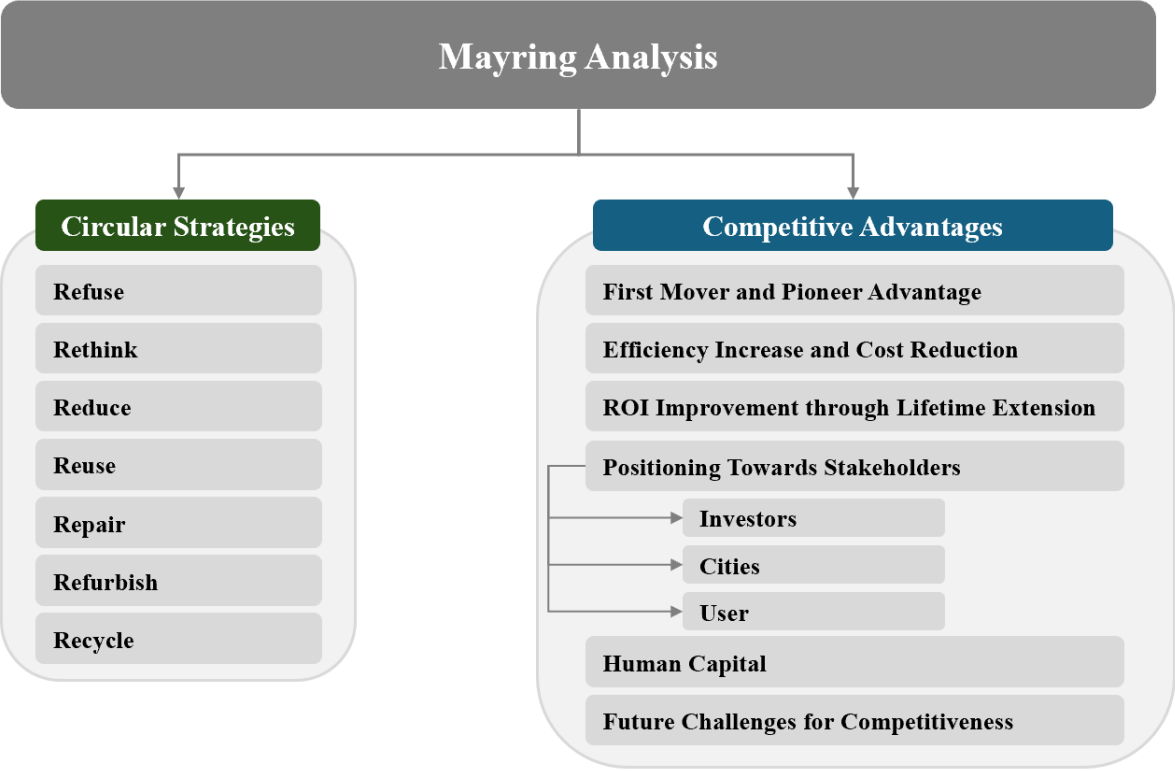


Figure 6: Categories of Mayring Analysis
Source: Own illustration

5. Results and Findings

This chapter will present the key findings that can be derived from 10 conducted interviews. Mostly, deductive categories were developed. However, two relevant inductive categories were created, contributing to the sources of competitive advantage and future challenges for competitiveness. Therefore, the results are presented in a mix of inductive-deductive findings, starting with deductive categories. The order of the categories presented is in line with the two research questions. Therefore, the results addressing RQ1 will be presented first, followed by the key findings covering the second research question.

5.1 Deductive Categories

The deductive categories can be derived from the previously presented literature review in chapter 3. Whereby, the focus of circular strategies lays on the 10R-strategies (refuse, rethink, reduce, reuse, repair, refurbish, remanufacture, repurpose, recycle, recover), competitive advantages are categorized into different sources of competitive advantage, namely pioneer advantage, efficiency increase and cost reduction, ROI improvement through lifetime extension, and positioning towards stakeholders.

5.1.1 Circular Strategies

The circular strategies presented in the following sections are derived from the first research question: “(RQ1): *Which specific circular strategies from the 10R framework have been integrated into the company’s operations and strategy of Tier?*”

5.1.1.1 Refuse

E-Vehicles and Cargo Bikes in Operations

Int2 and Int3 introduced the first refuse strategy of Tier that implies the shift from combustion engine vehicles to electric vehicles in Tier’s operations. As explained in chapter 3.3, the operations of an e-scooter sharing provider consist of vehicles with which the driver can collect scooters and batteries and then take them to the warehouses for repairs or recharging. According to Int1, Int3 and Int4 Tier not only decided then to switch from combustion engine vehicles to electric vans for its operations, but also to develop cargo bikes with which the scooter batteries can be collected and transported to the warehouses to reduce CO₂ emissions on the operational side.

5.1.1.2 Rethink

Swappable Batteries

The first and most important rethinking strategy is the innovation of swappable batteries which were mentioned and explained by Int1, Int2, Int3 and Int4. This is because different generations of e-scooters have been developed over time. In 2019, when Tier started its operations in Germany, the company started with the first generation of e-scooters, i.e. the battery is permanently installed in the vehicle and cannot be removed. As can be seen in Figure 7 on the left, the battery is in the footboard, which is highlighted by the red frame. Relatively early on, Tier began the innovation process to develop a new generation of e-scooters that is the first in the entire market worldwide to have a replaceable battery which can also be seen in Figure 7 on the right. Because the change to swappable batteries is a significant result of this study, the following illustration is chosen to support the understanding of this change of e-scooter model:

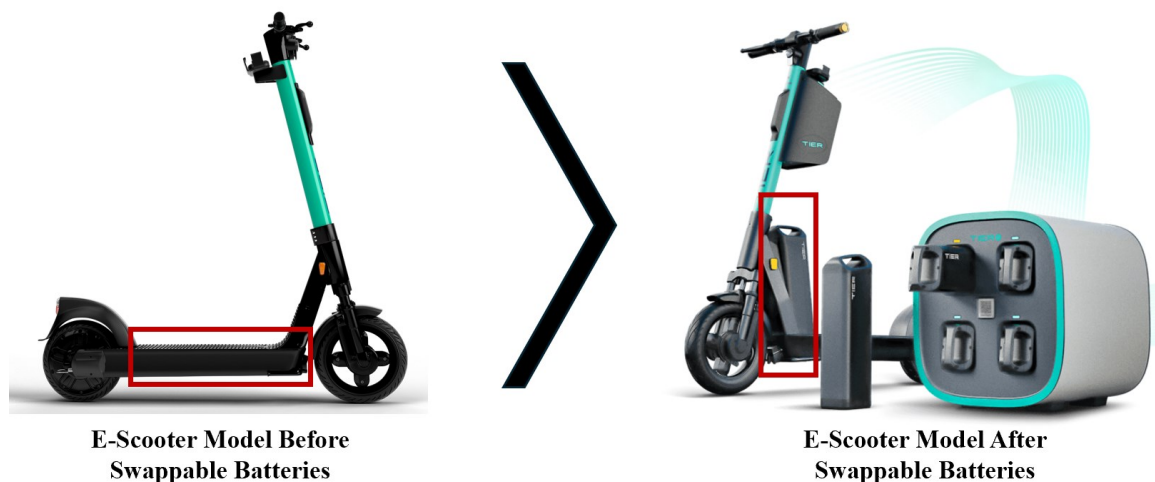


Figure 7: Innovation of Swappable Batteries

Source: Own illustration based on (Tier, n. d.; Schwär, 2019)

This rethinking of the whole e-scooter itself leads to several benefits and competitive advantages because instead of collecting the whole scooter, now only the battery must be collected. This will be explained in the chapter of competitive advantage. As this vehicle innovation was also responsible for the reduction of an enormous amount of CO₂ emissions, this innovation is also part of Tier's reduction strategy.

Integration into the Mobility System

The next rethinking strategies are part of creating a community and integrating Tier into the whole mobility system, which was highlighted by Int1, Int3 and Int4 and further enhances the shift to CE. The first part of it consists of the development of the Tier Energy Network which was actively used for one year and means the idea of customers swapping batteries themselves to avoid logistics trips, especially in areas with fewer scooters. To this end, small charging stations (Figure 7) were installed in kiosks and supermarkets. This solution should not only increase efficiency, but also drastically reduce emissions, as customers would swap the battery as part of their own journeys. Through this, users are part of the community by contributing to maintaining the sharing system and are motivated via app-based bonus programs to place or relocate the scooters correctly, as pointed out by Int7. The third strategy identified by Int1 and Int7 is to integrate Tier into the overall mobility system to achieve sustainable micro-mobility by seamlessly connecting Tier with public transport and platforms (FreeNow). Ext2C highlights that partnerships with urban transport operators and integration of micromobility into local public transport play a key role because it promotes seamless mobility and increases the visibility of providers. The aim is to achieve a sensible, regionally balanced integration.

Agile Working

According to Int4 and Int7, a clear rethinking strategy was applied to the planning and execution of operational tasks. By combining tasks and making them more flexible, Tier was able to reduce unnecessary work steps which are also related to emission reduction and thus make processes more efficient and sustainable. Instead of meeting rigid targets, cities were analyzed individually to adapt tasks as required and work in an agile way. In addition, ranger drivers perform several tasks at the same time and carry out small repairs directly on site, eliminating the need for transportation to the warehouse and saving resources.

5.1.1.3 Reduce

Reducing Emissions and Service Tasks

Swappable Batteries

When looking at the development of swappable batteries, the switch to these interchangeable batteries alone has reduced local emissions in cities by 90%, mentioned by Int1. Based on the

interview with Int2, this is due to saving on traffic and its derived reduction of CO₂ emissions because there are simply fewer (large) vehicles on the roads because instead of collecting the whole scooter, you just collect the batteries. In accordance with Int4, the innovation of swappable batteries was not only developed for reduced emissions purposes, but also to reduce service tasks and logistics. The reason for this is that the replaceable batteries mean that Tier drivers no longer must collect all the scooters, as was the case before the new generation, but only the batteries. This saves a lot of time and service work. Additionally, Int3 and Int4 emphasize that the innovation of cargo bikes which are used in operations as an alternative for e-vans was only possible because of the swappable batteries, because cargo bikes can carry batteries but not whole e-scooter. So, cargo bikes emit only a fraction of an electric car, leading to huge emissions savings, especially in summer.

Tier Energy Network

By the integration of the Tier Energy Network, the goal was also the reduce emissions because the customer would take over tasks that would generate a lot more emissions if Tier would do it. This is highlighted by the following quote of Int1: *"Yes, that's the classic trip: I have to drive to some part of town for one or two scooters, I have a high mileage, I need a lot of time, I'm stuck in traffic jams a lot [...] and of course there are also more CO₂ emissions from the logistics vehicles and if the customers then swap themselves, the idea was to reduce precisely these trips and then also to do something good for the customers with the corresponding free minutes or other goodies."* (Int1, ll. 110-116).

5.1.1.4 Reuse

E-Scooters:

Transitions and Resale

Based on the interview with Int1, Tier takes a holistic approach to old e-scooter models that cannot be used everywhere due to local requirements. Instead of disposing of them, they are reused in markets with suitable regulations. In addition, Tier regularly buys fleets from competitors, sometimes from insolvent providers, and gives these vehicles a second life, which was highlighted by Int2. Tier's approach of completely refurbishing old fleets and reselling them directly to end customers is another strategy for shifting the reuse to new owners and was also highlighted by Int2.

This saves resources, reduces recycling costs and at the same time creates new sources of income, which in turn can be reinvested, in the spirit of a closed cycle.

Batteries and Spare Parts

Based on the interview with Int1, even after their use in e-scooter sharing, batteries often still have 60-70% of their capacity. According to Int1 and Int6, Tier partners up with second-life application partners to use this remaining capacity, e.g. as solar storage or in privately usable wall boxes. This involves bundling cells without completely dismantling the battery. Int6 and Int7 emphasize that through this reuse strategy, Tier aims to extend the service life of vehicles by repairing and reusing individual parts as comprehensively as possible. In the event of damage caused by vandalism or accidents, the vehicles are completely dismantled so that components that are still usable can be reused elsewhere.

5.1.1.5 Repair

Scooters

Tier clearly follows a *“repair first strategy, everything that can still be repaired is repaired before it is taken out of the market.”* (Int7, ll. 170-173) and employees of Tier *“[...] have been repairing the e-scooters since the first day [...].”* (Int5, ll. 158-159). Referring to Int2 and Int6, from the very beginning, Tier pursued the goal of repairing e-scooters for as long as possible until the repair and material costs exceed the residual value and the expected turnover. Int3 and Int2 pointed out that while the industry initially assumed a service life of only 2-3 months in the years 2018 and 2019, Tier was able to increase this significantly through repairs: the first models lasted 3 years, today the service life is often 5-8 years. As expressed by Int3, this gives the company an economic advantage, as it gets more out of the capital invested. Consistent maintenance is a decisive factor because several hundred employees are involved in repairs or the reuse of components every day. By investing in spare parts and working with manufacturers to develop more robust vehicles, the service life has been steadily increased. Tier pursues a clear second-life strategy and critically examines when a vehicle has really reached the end of its life cycle. This robustness of e-scooters is also perceived by the cities, which decide which providers are permitted in the city, as highlighted by Ext2C. The initial appearance of the scooters also plays a major role in customer

perception. It is not the aesthetic of the e-scooter that is important, but its robustness and functionality which is grounded in consistent repairs, as Ext1U emphasizes.

5.1.1.6 Refurbish

Scooters

As stated by all 7 internal interviewees, Tier is pursuing a comprehensive refurbishment strategy to extend the service life of its e-scooters and save resources. Additional repair centers have been set up for this purpose, namely project “Phoenix”. In these centers, older or defective scooters are completely overhauled: they are dismantled, repaired, repainted and fitted with spare parts. Referring to Int4, unusable vehicles are cannibalized and serve as a source of spare parts for other vehicles. This creates a three-stage process: spare parts recovery, central storage and refurbishment. As expressed by Int6 and Int7, for the past two years, the focus has clearly been on reuse instead of buying new. The procedure of Tier is to stop procuring new vehicles and instead sustainably refurbish existing fleets and get them back on the road with a quality standard that comes close to new scooters.

Batteries

The refurbishing strategy not only includes e.scooters, but also the batteries of vehicles. As expressed by Int2, Tier pursues a comprehensive strategy for refurbishing and reusing batteries to conserve resources and extend their service life. In addition to working with partner companies in France and Germany, the company has set up its own workshops and repair centers. There, trained employees of Tier dismantle batteries, identify functioning cells and use them to build new batteries, as highlighted by Int1, Int3, Int5 and Int7. In Germany, around 50,000 batteries were repaired by Tier employees themselves.

5.1.1.7 Recycle

Tier pursues a professional and partnership-based recycling strategy. Following Int3’s statement, all recycling processes are carried out exclusively with official, licensed partners to ensure that batteries and vehicles are recycled properly and sustainably. Additionally, Int6 noted that there are central recycling centers and local recycling partners in every city so that most of the waste is recycled and not landfilled. Moreover, Tier works with second-life partners who, for example, reuse old battery cells or process them into new products, as pointed out by Int7. Also, according

to Int7, particular attention is paid to avoiding recycling wherever possible by first repairing batteries in the refurbish center as mentioned in the previous chapter or converting them into new, rechargeable units. In this way, Tier closes material cycles and extends life cycles. Only truly defective or non-reusable batteries are ultimately recycled. To summarize, Tier takes a CE approach to handling old batteries and vehicles, prioritizing repair and reuse over recycling and consistently relying on trustworthy partner networks for implementation.

5.1.2 Competitive Advantages

The sources and effects of competitive advantages presented in the following sections are answering the second research question: “(RQ2): *What competitive advantages have emerged from the implementation of these identified circular strategies from RQ1?*”.

5.1.2.1 First Mover / Pioneer Advantage

Tier was the first provider to develop and use swappable batteries, which were explained in the previous chapter, as an innovation on the market. This counts also globally: *“It has to be said that we were also the first to have them on the market, so we were completely the first not only in Europe, but also in the USA and China in Asia.”*, making it a pioneer (Int1, ll. 76-78; Int2, ll. 57-59). However, as stated by Int3 and Int4, it is also reflected that this lead was caught up relatively quickly by competitors. Rather than speaking of imitation, it is assumed that there was a joint recognition of market trends and co-development. Nevertheless, Tier had a considerable advantage in the initial phase through rapid scaling, media presence and early market entry in several cities simultaneously, which, among other things, gave them a large user base and quick access to capital, as pointed out by Int4. To summarize, thanks to its early innovations and rapid market entry, Tier had a clear pioneering and first-mover advantage, which led to rapid scaling, particularly in the early days. These pioneer advantage of the business model disrupting the mobility segment was also highlighted by Ext3I. However, this advantage was reduced over time by other providers. This general pioneer advantage of Tier was also perceived externally by Ext1U, because it was the first provider of scooters he knew about from the beginning and so he has been using them ever since. As the scooters are available everywhere, the likelihood of a Tier scooter being near is very high, as pointed out by Ext1U. Additionally, cities, represented by Ext2C, perceived Tier as the “*top dog*” (Ext2C, l. 173).

5.1.2.2 Efficiency Increase and Cost Reduction

Swappable Batteries (Rethink & Reduce)

Through the development and implementation of swappable batteries, Tier could gain an enormous reduction of logistical effort, as noted by Int1, Int2, and Ext3I. Referring to Int1 and Int2, this is because it is no longer necessary to bring complete vehicles into the warehouse because only the batteries are replaced. Therefore, large transport vehicles or storage areas are no longer necessary. Smaller, partly non-motorized vehicles such as cargo bikes are sufficient. This efficiency increase is highlighted by Int3: By using the new generation of scooters with swappable batteries, it has been possible to save at least 50% of operating costs. Whereas previously only around 25 complete scooters could be transported and charged per trip, the new batteries enable double the output, around 50 batteries at once. In addition, background charging of the batteries means that up to 100 vehicles can now be operated per shift, which was not possible with the first generation of scooters. As only the batteries must be charged in the warehouse, the space required in the warehouses has also been massively reduced, e.g. from 1500 m² to 200 m², as Int3 pointed out. Another advantage of the swappable batteries was mentioned by Int5, saying "*[...] that the scooter really only came in when it was really faulty. And we were able to invest more time in the scooters that were really broken.*" (Int5, ll. 82-84). This increase in efficiency has also reduced personnel and travel costs by up to two thirds in some cases, as Int4 pointed out. Int3 and Int2 summarize that interchangeable batteries have enabled faster service deployment with smaller vehicles and higher profitability through cost reduction without compromising quality. In summary, the efficient cost structure and high utilization of Tier have led to better KPIs that outperformed all other market players, which Ext3I says has contributed to its competitive advantage with respect to impact investors.

Repairs

The independent repair of batteries offers both economic and sustainable advantages. As a battery costs around 150 euros, a repair is financially worthwhile as it increases the return on investment. This is why Tier has not only worked with external partners but has also set up its own battery workshop with trained personnel in order to be able to repair more cost-effectively and efficiently than external providers, pointed out by Int2. Int2 also noted that by setting up an in-house workshop with trained personnel, repairs can be carried out more cost-effectively than by external providers. This in-house expertise makes it possible to handle simple cases in-house and outsource more

complex ones if necessary. According to Int6, an analysis also showed that refurbishing existing vehicles makes more economic sense than buying new ones.

5.1.2.1 ROI Improvement through lifetime extension

As stated by Int2, Int3 and Int6, the lifetime of e-scooters has increased significantly over time. While initially only 2-3 months was considered the industry norm, targeted repairs, innovations, e.g. swappable batteries, and more robust construction have resulted in significantly longer operating times. The current lifetime is 3 to 7 years. This extension brings with it a clear competitive advantage, as it increases the ROI and enables more turnover with capital already invested in the long term which was also noted by Int2. The improvement of ROI also has a positive effect on the relationship with impact investors, as the investors' capital is well invested due to the longer service life of the e-scooters mentioned by Ext3I. Additionally, Int1 mentioned that through replacing the battery without moving the vehicle, which is possible through swappable batteries, reduces transport damage and fewer vehicle movements extend the service life of the e-scooter. Lastly, the competitive advantage of Tier increased through more powerful batteries, *“which in turn reduces the trips we need to make to change the batteries, reduces the number of employees and generally reduces the number of vehicles, so that is already an advantage.”* (Int3, ll. 98-101).

5.1.2.3 Positioning and Branding towards Stakeholders

Investors

Referring to Int6, impact investors play a central role, so it is important to demonstrate both environmental and economic benefits (e.g. positive impact in cities and cost savings through CE). According to Int2 sustainability has a positive effect on investors and cities because it shows that you are not just taking the easy way out, but are focusing on long-term, resource-saving solutions and this creates trust. The investments in more expensive but more sustainable solutions were not made for cost reasons, but for strategic brand positioning with the aim of improving investor perception. Int2 also mentioned that repairs and refurbishments allow for efficient use of capital, which is particularly relevant for investors as it shows that their money is being used wisely and sustainably. This is supported by Ext3I, pointing out that the robust design of the scooters led to longer lifetimes. From Int3's perspective, refurbishing may not be cheap, but it is cheaper than buying new, which is a clear advantage in a mature industry with cautious investors. Int2 highlighted that practicing sustainability sends out a signal in the short term and has a long-term

advantage in terms of cost structure and brand image, which in turn increases the value of the company. Finally, Ext3I pointed out that the attractiveness of investing in Tier was mainly due to the management team, as they come from the logistics sector and successfully run the company with prudent capital allocation and relatively high scooter utilization.

Cities

Based on the interview with Int6, cities play a major role as stakeholders, "*[...] because they're the ones who ultimately give us the authorization to operate in the city.*" (Int6, ll. 115-116). Because cities decide on operating licenses, it is crucial to stand out from the competition through sustainable positioning, especially in the context of tenders where only a few providers are approved. Additionally, according to Ext2C, the city of Mannheim, was looking for 3 e-scooter sharing providers for a total of 2,000 vehicles, with five companies having to submit concepts. The evaluation was based on a publicly accessible matrix with knock-out criteria and additional requirements such as sustainability and vehicle robustness; whereby legally only aspects of road safety could be directly demanded. Indirectly, however, environmental aspects are supported which can be found in Appendix D1. Hereby, the strategic goal number 6 describes that Mannheim is a climate-friendly and resilient city that is a role model for environmentally conscious living and behaviour. According to Appendix D2 from Ext2C, sharing systems increase individual mobility options and reduce the proportion of car owners. Especially if they are optimally integrated into existing services, they have the potential to reduce the negative effects of traffic and reclaim urban space. These advantages, coupled with innovation distinguish sharing systems and qualify them as a building block of a sustainable overall transport system. They have the fundamental potential to contribute to achieving environmental and climate policy goals in the transport network (Appendix D2). As pointed out in Appendix D2, vehicles must be designed to be as durable as possible in the interests of the environment. Defective vehicles and parts must be disposed of by suppliers in an environmentally friendly way. The predominant use of emission-free vehicles for service should be aimed for.

Ext2C noted that Tier is perceived as being particularly willing to cooperate. Tier sets itself apart with a consistently circular strategy, long vehicle lifecycles and clear sustainability goals. This approach has already had a positive impact on tenders and strengthens relationships with cities, highlighted by Int6. This shows that circular strategies were used as a strong differentiating factor

to stand out from other providers. According to Int2, cities are quicker to accept e-scooters if companies pursue sustainable goals and are actively environmentally friendly. The clear commitment to sustainability by refusing combustion engine vehicles in the operations has led to Tier getting more opportunities to operate. Int2 pointed out that otherwise, some cities would have closed the door. According to Int7, success in tenders show that this strategy is a competitive advantage, especially through cooperation with the transport association, cities want to see that providers are making a positive contribution.

User

The perspective of users was specially pointed out by Int3 and Int6. Users are one of the most relevant stakeholders and their perception is highly important. Therefore, the first impressions of an e-scooter count. If scooters appear damaged or outdated (e.g. defective lights, crooked tires), users doubt the quality and tend to avoid the provider. Additionally, the aesthetics and functionality influence the usage, because customers react sensitively to external and functional defects, so the condition on first contact is decisive. Referring to Int6, these factors lead to the fact that refurbishing counts as a competitive advantage, because refurbished vehicles look and feel “new”, which makes them more attractive to customers than old, worn-out models. Without having to purchase new vehicles, it offers a user experience similar to that of a new vehicle, which appeals to customers while conserving resources. Ext1U shares this perception and emphasises that the original appearance of the scooters also plays an important role in customer perception. It is not the aesthetics of the e-scooter that is decisive, but its robustness and functionality which is generated to continuous repairs and refurbishments.

5.2 Inductive Categories

5.2.1 Human Capital as Competitive Advantage

As emphasized by Int2, right from the start, there was a special spirit at Tier that motivated many employees to join the company, not just because of its commercial success, but because they identified with the mission of “change mobility for good”. Many employees consciously joined the company because they want to be part of a company that takes responsibility and makes a real impact through projects such as the major in-house refurbishment. This spirit was particularly noticeable in the first years: the employees were extremely committed, worked with exceptional

dedication and contributed significantly to the rapid growth with their energy, as highlighted by Int3. According to Int3, the management team was open to new ideas, tried out a lot and used existing resources to implement creative concepts. As explained by Int5, the strong company culture was reinforced by regular meetings, where successes were celebrated and motivation shared, e.g. drivers and mechanics also felt involved and contributed to the positive atmosphere. Int4 pointed out that, at the beginning, Tier was the smallest provider on the market with significantly less capital than competitors such as Bird. But it was precisely this lack of resources that was compensated for by speed, drive and human commitment. According to Int6, the employees made the difference. Sustainability is not only communicated externally but also practiced internally and this commitment creates a sense of pride and identification with the company for many of them.

5.2.2 Future Challenges for Competitiveness

Int1, Int3, Int4, Int5 and Int6 highlighted future challenges for competitive advantage in the e-scooter sharing industry. A central issue is the lack of differentiation because almost all providers adopt circular or sustainable strategies due to cost and efficiency reasons. As a result, "*there's relatively little room for differentiation*" (Int1, ll. 191–194). On the contrary to Ext1U, user often place low priority on environmental aspects and instead value convenience, pricing, and safety, which limits the impact of sustainability efforts as a competitive lever, outlined by Int1. As pointed out by Int3, particularly battery recycling poses major challenges. The volume of batteries has grown so significantly that finding reliable recycling partners has become increasingly difficult. Furthermore, the shift from expansion strategy to profitability has revealed skill gaps among personnel. Some teams are strong in scaling but less effective in managing operational efficiency, as pointed out by Int3. As the market for e-scooters remains highly competitive, further consolidation will be necessary, as has already taken place with the merger of Tier and Dott, as Ext3I points out. Finally, balancing circularity and profitability remains a fundamental ongoing challenge, as highlighted by Int6. Many circular strategies lead to higher costs, e. g. the sourcing of low-carbon materials. Therefore, companies often struggle to justify these investments while ensuring financial health. This tension underlines the complexity of integrating circularity without compromising economic profitability.

6. Reflection and Result Discussion

Chapter 3 provided a comprehensive overview of the key concepts related to the CE, including strategic approaches, competitive advantages, and insights into the e-scooter sharing sector with a particular emphasis on Tier. Building upon this theoretical foundation, the following chapter links these insights to the empirical findings of chapter 5 and offers a critical discussion of the results.

Starting on the surface, Tier's business model of PaaS, can be seen as a circular business leading to circular advantage, which was stated in the literature (World Economic Forum, 2022; Lacy & Rutqvist, 2015; Howard & Webster, 2018). Additionally, the business model of Tier is addressing the trends of (1) ownership of products will be a thing of the past, and (2) servitisation and sharing will be central to business value (Howard & Webster, 2018). Moreover, Tier integrated key CBM trends of (2) sharing economy concept, (3) PSS, (4) product life- and use extension, and (5) resource recovery and recycling (World Economic Forum, 2022; Lacy & Rutqvist, 2015; Accenture strategy, 2014). Especially through addressing (4) product life- and use extension, Tier tackles one of the most prominent challenges in the e-scooter sharing industry: the lifespan of the e-scooters (Lee et al., 2021; Hollingsworth et al., 2019; Sikka et al., 2019; James et al., 2019; Severingiz et al., 2020).

Moreover, Tier also matches the definition of a circular start-up, which started new CBM only relying on investors (Geissdoerfer et al., 2020). If we go into further detail about the study and the corresponding results, then the findings in regard to the 10R framework are central. As stated in the theory, the 10R framework is a central tool for integrating circular strategies (Zorpas, 2020; Kirchherr et al., 2023; Potting et al. 2017), which is also visible through the results of this study. Moreover, this research shows the practicality of circular strategies in the e-scooter sharing industry. Along this research, it can be identified that R0 (refuse), R1 (rethink), R2 (reduce), R3 (reuse), R4 (repair), R5 (refurbish), and R8 (recycle) are integrated circular strategies at Tier as an example for the e-scooter sharing industry. However, R6 (remanufacture), R7 (repurpose), R8 (recycle), R9 (recover) which are also part of the 10R framework are not integrated directly. Therefore, 4 out of the 10R framework are not considered in the results of this study. This aligns with the fact stated in the literature review, that various combinations of R-strategies with differing number of Rs do exist (European Union, 2008; Zorpas, 2024; Rahman et al., 2021; Reike et al., 2017). However, in line with Potting et al. (2017) and Rodrigo-González et al. (2021), the results show that different

Rs may overlap, e. g. R4 (repair) and R5 (refurbish) have a lot of similarity and in the interviews, especially the internal interviewees used both terms to explain the same processes of repairing and refurbishing batteries and whole scooters. Also, when it comes to recycling, the recycling process especially for batteries often includes the recovery process, although the term “recovery” was never used by the interviewees, underlining the overlaps of different R-strategies. In addition, different strategies can be classified under more than one R-strategy, as it is often unclear whether a measure is a new strategy or the effect of another strategy, e.g. the development of swappable batteries, which is a rethinking strategy, could also reduce emissions, meaning that it could also be classified as a reduction strategy. Therefore, the missing R-strategies could be addressed indirectly by Tier. Also, the concepts of the power of the inner circle as well as the power of circling longer by Ellen MacArthur Foundation (2013), are part of the reuse strategy of Tier, especially by extending the lifetime of the e-scooters through better durability and reparability. These findings are answering the first research question. Looking at the competitive advantage gained, the sources of competitive advantage are almost all in line with the ones presented in the literature. According to Christensen (1997), process innovations can lead to cost reductions, enabling companies to become market leaders, which was shown in this study by developing swappable batteries which lead to more efficient operations processes. Because companies that continuously drive innovation and pursue knowledge are able to displace market leaders and can therefore achieve competitive advantage (Christensen, 1997; Christensen, 2003; Chesbrough, 2003; Rodriguez et al., 2002; Wernerfelt, 1984; Barney, 1991), the innovation of swappable batteries generally led to competitive advantage of Tier. The integration of circular approaches of Tier and the overall approach to sustainability led to a competitive advantage, not only in terms of the effect on ROI through repairs and refurbishments of the scooters and batteries, but also in terms of positioning towards investors, which is in line with the literature and research presented in chapter 3.1 (Marshall, 2023; Iannou & Serafin, 2019; Carroll et al., 2021; Maia et al., 2022). From the perspective of external stakeholders, the sources of competitive advantage in regard to positioning were further validated and viewed critically.

However, one of the traditional sources of competitive advantage, namely cost leadership, does not apply to the e-scooter sharing industry, because Ext1U outlined that there are no price differences between the providers. Therefore, competitive advantage in the e-scooter sharing industry cannot

be achieved through lower prices. Nevertheless, internal cost reductions lead to efficiency increases, leading to real competitive advantage.

Also, in line with the arrangement of the 10R framework which are ordered from top to bottom from highest to lowest priority (Potting et al., 2017), this research supports that the priority of R1-strategies (Rethink) is the highest one in regard to effects on competitive advantage. The rethink strategies of swappable batteries as well as the integration into the whole mobility system, can have intense efficiency increase, visibility and usability of e-scooters of Tier. R-strategies that are part of lifetime extension, such as repair, refurbish and reuse are in the middle field of priority which is also shown in the impact to competitive advantage. Especially, ROI could be improved through repairs and refurbishments due to the extension of the lifetime of e-scooters. As stated in the literature review, recycling and recovering are the strategies with the lowest priority (Potting et al., 2017), which is supported by the statements of interviewees that recycling is the least desirable solution. That start-ups using circular strategies are more efficient and have better access to funding as many investors value ESG (Martins de Souza et al., 2024) supported by Ext3I, stating that investors prefer backing businesses that benefit society.

Moreover, the competitive advantage of human capital at Tier is in line with Geissdoerfer et al. (2022), stating that it seems that start-ups do not have problems with organizational barriers, which is since circular start-ups are often 'born' with a circular mindset, led by a sustainability-minded founder (Geissdoerfer et al., 2022). Although the last category "Future Challenges for Competitiveness" illustrates the complexity of circularity in some cases, the results show the practicability of circular strategies in the e-scooter sharing industry.

7. Conclusion

7.1 Research Summary

The aim of this research was to explore how CE strategies can be leveraged to create competitive advantages in the e-scooter sharing industry, with a specific focus on Tier. By conducting interviews with internal and external experts, following the qualitative approach, results could be gained about the integration of circular strategies and its competitive advantage.

The results show that the 5 circular strategies: R1 (Rethink), R2 (Reduce), R3 (Reuse), R4 (Repair), and R5 (Refurbish) are the most intense integrated ones and are essential for building both operational efficiency and a strong market position. Furthermore, the integration of circular strategies into the business model of an e-scooter sharing provider not only contribute to cost savings and operational resilience but also strengthens brand positioning towards investors, especially impact investors, cities and users. Especially rethink strategies do not only have a huge impact on circularity, but also on competitive advantage through efficiency increases based on innovation.

However, it became clear that circular strategies need to be tailored to each company, considering its specific context and market environment. The 10R framework provided a valuable basis for analysis, but strategic implementation requires flexible and practical adaptation to realise its full potential. In conclusion, the research underlines that circular strategies are not only a response to ecological and societal challenges but can also act as a profound driver of competitive advantage, provided they are strategically embedded across all dimensions of the organization and benefit profitability.

7.2 Theoretical and Practical Implications

The findings of this study carry significant theoretical and practical implications. Theoretically, the study contributes to the growing body of research of circular strategies, the e-scooter sharing industry as well as gaining a competitive advantage in it.

This research highlights the applicability of R-strategies in the e-scooter sharing industry which is not as heavily researched yet such as traditional mobility industries. Because it is highly relevant that companies can have gains through circular practices, the second research question contributes majorly to the outcome of addressing circularity.

Practically, this study offers actionable insights for mobility service providers seeking to integrate circular strategies into their business which not only have sustainable impact on the environment but also lead to competitive advantage. It shows that integrating circular strategies, particularly in relation to rethinking, repairing, refurbishing and reusing, not only helps reduce CO₂ emissions, but also significantly improves operational efficiency, cost structures, and positioning towards stakeholders. The latter plays a particularly important role, as start-ups are heavily dependent on investors and cities. Without both, e-scooter sharing providers are unable to maintain their operations, highlighting the relevance of integrating these stakeholders into this research. E-scooter sharing providers can use these insights to develop more resilient business models and increase the sustainability and durability of their competitive advantage, which is of great importance in such a competitive industry. In addition, the study provides guidelines for policymakers and can therefore use these findings to create regulatory frameworks that incentivise the adoption of circular strategies among shared mobility providers.

7.3 Limitations

Despite the valuable insights gained from this study, some limitations must be considered to ensure transparency and put the results into context. First, the study is based on a qualitative approach and relies primarily on seven internal and three external respondents. Although efforts were made to ensure diversity among the respondents by selecting individuals from different positions within the company, the limited number of participants could limit the generalizability of the results. Although a qualitative approach provides comprehensive insights, the responses may be subjective and thus influence the results. However, this effect was reduced by including external stakeholders in this study. Finally, the geographical focus on Germany limits the transferability of the results, as there are economic and legal differences across Europe.

7.4 Future Outlook

The limitations identified can be addressed in the future by conducting a study with a larger and more representative sample of interviewees, including different providers and more interviewees per stakeholder group. Additionally, suppliers could be included, as the supply chain makes a relevant contribution to the CE. Especially in view of current political developments (US election and tariffs towards China and Europe), the supply of e-scooters could be affected. Another point to be considered in future research is the merger of Tier with Dott which was deliberately omitted

in this study. Furthermore, quantitative methods would be beneficial to test hypotheses, not only to analyze the effectiveness of circular strategies on competitiveness, but also to examine how the integration of circular strategies evolves over time and whether the competitive advantages identified remain. This could be complemented by quantitative analysis comparing financial performance indicators of providers implementing circular strategies with those of providers pursuing traditional linear models. Given the growing relevance of digitalization in CE initiatives (e.g., smart maintenance, IoT tracking), future studies could examine how technological innovations further enable the application of circular principles in shared mobility. The geographical limitation to Germany could be extended by a comparative study. However, it would be useful to focus on Europe, as this is the most important market for the e-scooter sharing industry.

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Appendices

Appendix A: Interview Guideline Internal Interviews

Main Question: *How has Tier leveraged the 10Rs effectively as a powerful strategic tool to obtain a competitive advantage?*

(RQ1): Which specific circular strategies from the 10R framework have been integrated into the company's operations and strategy of Tier?

(RQ2): What competitive advantages have emerged from the implementation of these identified circular strategies from RQ1?

1. **Introduction:**

Please introduce yourself quickly including your career at Tier, your current position and length of employment at Tier and how your daily tasks look like

2. **R-Strategies and Competitive Advantage:**

I. Refuse:

- a. Which strategy or practices have been integrated into the company's operations and/or strategy of Tier that address the "Refuse" strategy, e.g. refusing fossil fuels, meat at events and how do you implement it? Was it part at the beginning of Tier or integrated over time? Which improvements have you made over time?
- b. How did the practices benefit your operations, such as cost reduction, efficiency increase, etc.? What was the reason you integrated that?

II. Rethink

- a. Which strategy or practices have been integrated into the company's operations and/or strategy of Tier that address the "Rethink" strategy, e.g. rethinking the batteries (swapable, energy network), e-scooter sharing service itself in Europe, etc. and how do you implement it? Was it part at the beginning of Tier or integrated over time? Which improvements have you made over time?
- b. How did the practices benefit your operations, such as cost reduction, efficiency increase, etc.? What was the reason you integrated that?

III. Reduce

- a. Which strategy or practices have been integrated into the company's operations and/or strategy of Tier that address the "Reduce" strategy, e.g. reducing CO₂-emissions through

evans in operations and how do you implement it? Was it part at the beginning of Tier or integrated over time? Which improvements have you made over time?

- b. How did the practices benefit your operations, such as cost reduction, efficiency increase, etc.? What was the reason you integrated that?

IV. Reuse

- a. Which strategy or practices have been integrated into the company's operations and/or strategy of Tier that address the "Reuse" strategy, e.g. reusing parts of scooters, damaged batteries, etc., and how do you implement it? Was it part at the beginning of Tier or integrated over time? Which improvements have you made over time?
- b. How did the practices benefit your operations, such as cost reduction, efficiency increase, etc.? What was the reason you integrated that?

V. Repair

- a. Which strategy or practices have been integrated into the company's operations and/or strategy of Tier that address the "Repair" strategy, e.g. repairing scooters as first mover, and how do you implement it? Was it part at the beginning of Tier or integrated over time? Which improvements have you made over time?
- b. How did the practices benefit your operations, such as cost reduction, efficiency increase, etc.? What was the reason you integrated that?

VI. Refurbish

- a. Which strategy or practices have been integrated into the company's operations and/or strategy of Tier that address the "Refurbish" strategy, e.g. refurbishing scooters and selling them, and how do you implement it? Was it part at the beginning of Tier or integrated over time? Which improvements have you made over time?
- b. How did the practices benefit your operations, such as cost reduction, efficiency increase, etc.? What was the reason you integrated that?

VII. Remanufacture

- a. Which strategy or practices have been integrated into the company's operations and/or strategy of Tier that address the "Remanufacture" strategy, and how do you implement it? Was it part at the beginning of Tier or integrated over time? Which improvements have you made over time?
- b. How did the practices benefit your operations, such as cost reduction, efficiency increase, etc.? What was the reason you integrated that?

VIII. Repurpose

- a. Which strategy or practices have been integrated into the company's operations and/or strategy of Tier that address the "Repurpose" strategy, e.g. repurposing refurbished scooters by selling them as brand product, and how do you implement it? Was it part at the beginning of Tier or integrated over time? Which improvements have you made over time?
- b. How did the practices benefit your operations, such as cost reduction, efficiency increase, etc.? What was the reason you integrated that?

IX. Recycle

- a. Which strategy or practices have been integrated into the company's operations and/or strategy of Tier that address the "Repair" strategy, e.g. recycling batteries (most relevant one), and how do you implement it? Was it part at the beginning of Tier or integrated over time? Which improvements have you made over time?
- b. How did the practices benefit your operations, such as cost reduction, efficiency increase, etc.? What was the reason you integrated that?

X. Recover

- a. Which strategy or practices have been integrated into the company's operations and/or strategy of Tier that address the "Recover" strategy, e.g. repairing scooters as first mover, and how do you implement it? Was it part at the beginning of Tier or integrated over time? Which improvements have you made over time?
- b. How did the practices benefit your operations, such as cost reduction, efficiency increase, etc.? What was the reason you integrated that?

Appendix B: Interview Guideline External Interviews

1. Introduction:

Please introduce yourself quickly including your career at Novator, your current position and length of employment at Tier and how your daily tasks look like

2. Circular Strategies:

- a. How do you perceive the integration of the following circular strategies in the e-scooter sharing industry:
 1. Refuse
 2. Rethink
 3. Reduce
 4. Reuse
 5. Repair
 6. Refurbish
 7. Remanufacture
 8. Repurpose
 9. Recycle
- b. Do these strategies impact the willingness to use (Ext1U)/to allow (Ext2C) / to invest (Ext3I) (in) an e-scooter sharing provider?
- c. Why is Tier preferred over other market players?
- c. Which of the mentioned R-strategies have the highest impact and which the lowest impact? Please specify the impacts.
- e. Would you say circular strategies can lead to competitive advantage for e-scooter sharing providers? If yes, how do these competitive advantages look like?
- f. What are current challenges in this sector?
- g. How does the political situation affect the e-scooter sharing industry
- h. Is the merger with Dott influencing the positioning of Tier?

Appendix C: Final Category System

Category	Definition
First Order Category: Circular Strategy	Strategies that substitute the concept of end-of-life.
Second Order Category: Refuse	Practices that render a product obsolete by abandoning its function or offering the same function with a completely different product, as well as prohibiting the use of certain materials considered harmful to the planet, end a specific production process or remove an environmentally harmful product from circulation in favour of an efficient alternative, or ultimately eliminate it altogether.
<p>"Another small point is that we only offer vegetarian food at events, etc.. Of course, this also has nothing to do with any kind of sales maxim, but rather with identification, with conviction, in order to make a clear stand and to believe that we have a standing, both internally and externally." (Int1, ll. 231-234)</p> <p>"[...] also the policy degree at company events or employee events that at least meat should be avoided and then especially at events that the materials are not disposable, but everything is reusable." (Int7, ll. 106-108)</p> <p>"Another thing that occurred to me was no domestic flights." (Int.1, l. 340)</p> <p>"So travel policy is also an issue, for example, taking the train from Düsseldorf to Berlin is also a cost issue. Of course I could also fly, but it takes much longer. About the same time, by the way. But that's also a very clear point to say that we don't do it out of conviction and not just for cost reasons. And I would even say 50:50 that the motivation was partly for cost reasons and partly or maybe even 40% for cost reasons and 60% simply out of conviction, because it simply fits the brand, because we generally as a company, and there was never anyone who said anything about it, who said, man, but I would like to fly now, and that doesn't suit me, because everyone simply accepted and supported it." (Int2, ll. 242-249)</p> <p>"So what we always do or what is a company requirement is that we don't make unnecessary trips or that when we travel, we use trains or sustainable solutions to get around somehow, so we shouldn't book flights, we shouldn't drive that by car. These are things that we are really conscious of as company guidelines." (Int3, ll. 49-52)</p> <p>"because of the founder of Tier at the time. I would just say his thing, he's a hardcore vegan and climate activist and that's what he wanted. That was also his company. Yes, so I would definitely include that in our company as a conscious refusal." (Int3, ll. 68-71)</p> <p>"What else do we have explicitly? Refused. Well, I think what a lot of people were talking about now was the travel policy in general, I think that has always played an important role, which perhaps wasn't seen so strictly with competitors or because I've also heard." (Int4, ll. 73-76)</p> <p>"[...]on the environmental issue, I can say that we have made it quite clear that we don't do company cars. That's a classic Refuse story, where we've simply said we don't want to. Of course, there is always the question, because of course you always rent a car from time to time,</p>	

but in essence it was very clear for everyone, including managers, that there would be no company cars." (Int4, ll. 66-70)

"In Switzerland, we run all our warehouses with green electricity plus, so we are there to work with clean electricity and that's not a point that just occurred to me." (Int7, ll. 208-210)

"[...]as a small social point you can definitely include the fact that we resisted this gig economy right from the start. We definitely didn't do that from the outset because we said that we wanted reasonable employment contracts and that our partners should also have reasonable employment contracts. Our partners also have to pay the minimum wage and so on." (Int4, ll. 80-83)

Second Order Category: Rethink	Practices that make product use more intensive and establish further opportunities for the application of CE
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"This switch was based on the replacement or exchange battery." (Int1, l. 80)

"Yes, and back then we had the idea that customers would swap the batteries and then we could save ourselves one or two logistics trips, especially in areas where there are perhaps fewer scooters." (Int1, ll. 107-109)

"At the same time, we also tried the Energy Network, where our customers change the batteries for us, so to speak. We put small chargers in kiosks or REWE stores or in the city at the main train station and tried to have our customers swap batteries." (Int3, ll. 101-104)

"It really would have been a game changer from an environmental point of view, because it would have eliminated the entire car journey. Basically, the customer drives from A to B, where he has to go anyway, and then changes the battery. There are no emissions at all at that moment, apart from the emissions associated with charging the battery. That was a brilliant idea." (Int4, ll. 101-105)

"At the symposium last week we had the vision to form a community, so you're saying Tier-Dott ale a community within our users who help us to continue to ensure order, that this is not our own employees, that you somehow motivate them in the app with bonus programs et cetera to set up the scooter, to place it over there or to take this vehicle, that would be another topic where you directly involve the customers, perhaps reward them with the incentive, in order to create a bit of a cycle." (Int7, ll. 317-322)

"[...]we develop the batteries together with the vehicles, with our manufacturers. Because the focus is, of course, on developing the best possible battery for rental for the use that we want to offer. Yes, and that means a lot of storage, a lot of storage space in order to reduce all these logistics processes as much as possible. So a battery should be changed as little as possible per week. Yes, of course, this goes hand in hand with a high mileage for the vehicles." (Int1, ll. 169-174)

"FreeNow is the classic provider, which is of course the largest Mobility as a Service provider in Europe. That's where we generate most of our customers in this area. All the partnerships at city level, with municipal utilities, with mobility providers. Whether it's like in Berlin, MVG in Munich or the underground in Hamburg, these are still the largest in Germany." (Int1, ll. 236-240)

"I think to really become sustainable in terms of sustainable mobility, a scooter needs to be integrated into a whole system, which means connecting it public transport, for example in Switzerland with the SBB or the Ostwind fare network." (Int7, ll. 57-60)

"I do believe that the integration into the overall mobility system will bring a lot, so that you really have the whole thing seamlessly." (Int7, ll. 306-307)

"This integration into public transport, yes, because I think that simply makes the most sense [...] The most sensible use of electric mobility or micro-electric vehicles of this kind is when it simply integrates perfectly with the other systems in the sense of seamless mobility. It creates visibility for the providers." (EXT2C, ll. 229-234)

"We are also experiencing positive feedback, and that is another major focus for us, simply to achieve meaningful integration and what we are also prescribing, which is a novelty. We have distribution quotas, so it is important to us that the providers are also in the outer districts, where the public transport network is not so extensive in the city center. I also have to make it very clear from the figures that, regardless of which providers cover the routes, they replace footpaths or routes that have two stops here that could be covered by streetcar or bus." (EXT2C, ll. 236-241)

"There are also more and more requirements from the cities that go in the direction of, I want local foot patrols that do practically nothing other than walk through the streets and check whether the e-scooters are parked properly and whether everything is in order and the costs are of course also money, yes, and that is such an artificial cost increase on the part of the regulatory authorities. Of course, if I know I have to, I have less work with an e-scooter, then of course I can use the people for other purposes and then it's also more efficient than hiring new employees." (Int1, ll. 314-320)

"As I said, I would now assume 1-2 years, whether it was really through new technologies, through innovations, through other vehicles that were simply developed more robustly, developed more robustly together with the manufacturers, the service life has then been extended over the years to 3-7 years and I think 7 years is the current number of the service life of scooters. As I said, not only because of the repairs, but also because the vehicles themselves were developed and manufactured in a completely different way. In other words, all the parts are thicker, they have been designed for continuous operation and for rental, which means that the vehicles that you produce today for rental and put on the market will no longer be able to be used for private sales because the parts are simply far too cumbersome." (Int2, ll. 164-173)

"Then, without making any changes to the product or the service, we worked with my department to create task combinations. I've already said that, because that basically saves money. One way then. We went there and we tried to reduce unnecessary tasks. In other words, we basically developed tools with which we can map the surface of the city, where we can then see exactly how much value a task actually has. If we now have a zone, from which zones do I have to take scooters away and move them to other zones so that the overall utilization is increased? And this has also helped us to take a more agile approach to the task volume, which was previously always very static. The target set at management level was: you have to revise 2% of tasks per day. In my opinion, that was pointless. Rather, we have to find the right level for each city and a GS target makes no sense, so we implemented it completely flexibly. We were then able to reduce the task volume by 20% with the same turnover, which is great for us because we were able to reduce the number of cars. So in the last year alone, we have almost halved our car fleet through process improvements, which all go in this direction." (Int4, ll. 107-129)

"Exactly, we have a ranger with the driver doing several tasks on a vehicle at the same time and then we say that there are certain on-street repairs, i.e. small things, that the drivers can repair directly on the vehicle outside without having to collect it here, bring it back to the warehouse and we have more work there." (Int7, ll. 151-154)

Second Order Category: Reduce	Practices that increase efficiency in product manufacture or use by consuming fewer natural resources and materials as well as practices that encompass reducing the ecological footprint of production and consumption activities.
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"We have seen that the switch to these interchangeable batteries alone has reduced local emissions in cities by 90%, so that's quite something." (Int1, ll. 87-89)

"Yes, that's the classic trip: I have to drive to some part of town for one or two scooters, I have a high mileage, I need a lot of time, I'm stuck in traffic jams a lot [...] and of course there are also more CO₂ emissions from the logistics vehicles and if the customers then swap themselves, the idea was to reduce precisely these trips and then also to do something good for the customers with the corresponding free minutes or other goodies." (Int1, ll. 110-116)

"[...]is of course that you also save on traffic. You save on CO₂ emissions because you simply have fewer vehicles and fewer large vehicles on the roads." (Int2, ll. 67-69)

"This is the use of vehicles for our operations, i.e. not the vehicles that we have lent to customers, but the vehicles that we have used ourselves, namely our operations vehicles, i.e. the vans and Sprinters. The goal here was to switch to 100% electric vehicles. But here's a small disclaimer and let's be honest, it never worked consistently or was never the case that we had 100% electric vehicles in use in one market. But that was the goal, the clearly stated goal." (Int2, ll. 192-197)

"And we have optimized our commercial vehicles. We have switched to electric vehicles, e-bikes and small cargo bikes and have also tried them out. That's particularly important in the city center [...]" (Int3, ll. 123-125)

"What we have definitely done now, in terms of the infrastructure or the product itself, is of course that we have said we are developing e-bikes. We looked at cargo bikes relatively early on, so now I'll say private cargo bikes, because in the beginning there were no commercial cargo bikes. This whole cargo bike story has actually made a huge leap due to the scooter story and the delivery logistics sector. And then we teamed up with the company Leezen Heroes, which also comes from Münster, and initially designed an e-bike based on a non-commercial bike that could carry 20 batteries. And then we designed it with a company based on our experience with it. The result is basically a cargo bike that can carry up to 30 batteries, can be used in pedestrian zones and emits only a fraction the emissions of an electric car. We have also saved a huge amount of emissions because in summer we almost only use these things." (Int4, ll. 135-144)

"The fact that I don't have to touch the vehicles in the evening to get them into a truck, then touch them again to get them out of the truck in the warehouse, load them back into the truck, drive them into the city and out of the truck again... That means I touch a vehicle incredibly often to transport it somewhere and perhaps also handle it a little more roughly when I load it, so the service life is decreasing rapidly." (Int1, ll. 92-96)

"[...]we develop the batteries together with the vehicles, with our manufacturers. Because the focus is, of course, on developing the best possible battery for rental for the use that we want to offer. Yes, and that means a lot of storage, a lot of storage space in order to reduce all these

logistics processes as much as possible. So a battery should be changed as little as possible per week. Yes, of course, this goes hand in hand with a high mileage for the vehicles.” (Int1, ll. 169-174)

"Let's start with the swappable, if I have a swappable battery, it means that I no longer have to collect the scooter. First of all, someone must have already said that we had to collect the scooters every night, which is of course an incredible amount of work. The Swappable battery has the advantage that you save working time and that you simply save yourself a lot of walking because you no longer just collect each scooter." (Int4, ll. 89-94)

"Then, without making any changes to the product or the service, we worked with my department to create task combinations. I've already said that, because that basically saves money. One way then. We went there and we tried to reduce unnecessary tasks. In other words, we basically developed tools with which we can map the surface of the city, where we can then see exactly how much value a task actually has. If we now have a zone, from which zones do I have to take scooters away and move them to other zones so that the overall utilization is increased? And this has also helped us to take a more agile approach to the task volume, which was previously always very static. The target set at management level was: you have to revise 2% of tasks per day. In my opinion, that was pointless. Rather, we have to find the right level for each city and a GS target makes no sense, so we implemented it completely flexibly. We were then able to reduce the task volume by 20% with the same turnover, which is great for us because we were able to reduce the number of cars. So in the last year alone, we have almost halved our car fleet through process improvements, which all go in this direction." (Int4, ll. 107-129)

"I think you'll see a reduction when you have new scooter models with more battery power, i.e. the generation we still have in Switzerland, with a range of 40 kilometers. The latest model that's coming is at one hundred and ten kilometers. Of course, it's not clear whether it will really be one hundred and ten kilometers in the end, but this way you avoid operational costs on the road when our drivers are on the road, there is less pollution and CO 2. And we always try to optimize the routes of our drivers so that they don't make idle runs, empty runs, et cetera." (Int7, ll. 134-140)

"[...]we're really focused on reducing the amount that we have to consume in the 1st place, so only consuming, you know, ordering spare parts when they're absolutely necessary. Only buying fleet when it's absolutely necessary. This sort of thing." (Int6, ll. 58-61)

<p>Second Order Category: Reuse</p>	<p>Practices that describe the reuse by another consumer of discarded products which are still in good condition and fulfils ist original function.</p>
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"With a battery, I have a lot more options and the partnership is still relatively wide-ranging, for one thing: I take the battery and use it for a similar purpose. That would be projects such as converting it into a solar storage unit, for example. So I practically don't change much about the composition of the battery. So I don't completely dismantle it, but I take the individual cells, combine them into one large cell and then I have a classic wallbox that I can hang up in the garage, in the tool shed or somewhere else to simply store solar power or other things." (Int1, ll. 139-145)

"[...] because a battery like that, even if it's at the end of its service life for sharing use, still has 60-70% of its capacity and it's enough to supply a small house in India with electricity . Because you simply don't have these high loads there, like with a vehicle" (Int1, ll. 155-158)

"And we work with a number of second Life application partners where, for example, batteries, we work with them to give our battery components a second life. That those batteries don't end up in landfills and then we also have a number of in every city we have, like local recycling partners. So the vast majority of our waste ends up getting recycled rather than ending up in landfill." (Int6, ll. 75-79)

"[...] we have had a few different partnerships in the past with different second life application companies. So we basically work with those partners to anytime that we have batteries that you know are no longer usable, we provide those batteries to them.

I think we've used a few different partners in the past that they all do something a little bit different. A lot of them is, you know, in some instances within the battery. It's like some cells are damaged, but not all of them. So some of the companies are able to like reclaim the usable parts of the battery and reuse them in future batteries." (Int6, ll. 191-197)

"Other companies have just repurposed the batteries a whole for, you know, other products. For example, we worked with a company called Bib a year or two ago now where we provided them with a lot of old batteries that they then repurposed and put into electric boats, which is kind of an interesting use case." (Int6, ll. 199-202)

"We once had a project in Switzerland where we gave old batteries to farmers who then used them to power their tractors." (Int7, ll. 212-213)

"[...] we also have older models of scooters, of course, which may still be around for a while, but of course there may also be local specifications in a market with new specifications that an e-scooter or a bike has to meet [...] then you can see that practically all suppliers showcase their latest models in those very cities [...] The question is, what do you do with the old models? [...] And then, of course, there are cities, for example, or even entire countries where I can meet the legal requirements with older vehicles. Yes, so nothing goes into the garbage can. It simply goes to another market where it can fulfill the same purpose." (Int1, ll. 328-338)

"We have often bought up the fleets of competitors, i.e. we have bought up the fleets of competitors who have either gone bankrupt, i.e. who were simply no longer able to maintain their service, or who themselves have said that they no longer need the fleet for themselves. So we bought up the fleet and gave these vehicles a new lease of life." (Int2, ll. 124-127)

"We did the same thing in reverse, i.e. vehicles that we no longer wanted to use, simply because they were no longer generating a return and were no longer profitable and had not been driven long enough. It would have cost too much to repair them again. That's why we also sold some of our fleet to other competitors, which of course gave new money that we were able to spend on something else, either on running costs or to buy new vehicles and reinvest." (Int2, ll. 128-133)

"And also one of the most central points, because we were also very early on the market and I believe that to this day no one has been able or wanted to copy it, at least no one has done it, is that we have an old fleet, which was exactly when we switched to the swap. Now we have also completely refurbished and refitted an old fleet and then resold it to end customers. That means not a competitor, but an end customer, and for the same reason we were able to earn new capital, which we were able to reinvest ourselves, and also less waste, less recycling costs, less general

environmental impact, because we can simply keep these vehicles in our universe, in our cycle." (Int2, ll. 134-141)

"Repairing it as much as possible, reusing parts whenever possible so that we can really extend the lifespan of that vehicle as long as possible." (Int6, ll. 62-63)

"When vandalism or an accident occurs, then everything is dismantled so that we can use the parts again somewhere." (Int7, ll. 165-166)

Second Order Category: Repair	Practices that include the repair and maintenance of defective products so it can be used with its original function and can be covered by the company itself or by repairs stores or partnerships.
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"I think that was our basic idea from the start, that we said that every vehicle would be repaired or repaired for as long as possible, until the residual value or until the repair costs, but also the material costs, exceed both the residual value and the expected future turnover." (Int2, ll. 89-92)

"But this 3-month lifespan as a start in 2018/2019 is realistic and we were able to increase that over 2 years. And we currently have scooters that are already over 3 years old." (Int3, ll. 180-182)

"Lifetimes have always changed. In the beginning it was a completely revolutionary 3 years for the first models, later it was 5-8 years. This is also a competitive advantage, simply to get more out of the invested capital so that we can generate more sales later on with the capital we have already invested." (Int2, ll. 94-97)

"There are [...] industry values that were communicated by Bird and Lime at the time. They said that the scooters last between 2 and 3 months. These were also the same vehicles, so you can take that as a reference, because this figure was already being bandied about in the press. [...] This means that the vehicles have to generate so much revenue within these 2-3 months that you definitely pay off your investment more. That's how we came up with this repair story again, where we said that we would repair every single vehicle again and again and of course spend money on spare parts. And this has enabled us to extend the service life in any case. As I said, I would now assume 1-2 years, whether it was really through new technologies, through innovations, through other vehicles that were simply developed more robustly, developed more robustly together with the manufacturers, the service life has then been extended over the years to 3-7 years and I think 7 years is the current number of the service life of scooters." (Int2, ll. 156-168)

"We are very critical when it comes to saying when a scooter has reached the end of its life [...] This means that several hundred employees are actually involved every day in repairing our scooters or giving them a second life." (Int3, ll. 263-266)

"[...]we've been repairing the e-scooters since the first day I was there." (Int5, ll. 158-159)

"Repairing it as much as possible, reusing parts whenever possible so that we can really extend the lifespan of that vehicle as long as possible." (Int6, ll. 62-63)

"[...]we had to change some of the IOTs. I think we somehow repaired 5000 IOT modules ourselves, partially repaired engines so that we could use them again. And it's actually a repair first strategy, everything that can still be repaired is repaired before it is taken out of the market." (Int7, ll. 170-173)

"[...] we actually carried out a repair push in Berlin, where we repaired four thousand five hundred e-scooters a week. We then resorted to a system like this with a repair line." (Int5, ll. 135-136)

Second Order Category: Refurbish	Practices that restore an old product and bring it up to date, including its modernisation and upcycling.
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"And then, of course, there is the possibility that I have a battery that has individual damaged cells, where I then have to do a bit more, yes, that would practically be a refurbish process. I take the battery apart, look at which cells still work and then take the ones that work and reassemble them into a new battery. It also costs more money and takes longer, but there are also some ongoing projects." (Int1, ll. 147-151)

"Batteries are an important point. I think we were also one of the first on the market to tackle this. We worked together with repair partners, there is a French company, there is a German company, who did this in order to simply not throw the batteries away, because that is not really good for the environment either if you somehow have to recycle lithium-ion batteries." (Int2, ll. 105-109)

"[...] we not only worked with partners, but also set up a battery workshop ourselves, with our own employees and purchased materials, so that we could repair batteries more cheaply than the suppliers or partners could." (Int2, ll. 111-113)

"We have our own repair center where we make batteries that we can repair ourselves. We repair them and bring them back to the market." (Int3, ll. 236-238)

"And then we tackled the issue of battery repair ourselves [...] And they completely dismantled one of these batteries and then thought, okay, where does water get in here? Because our main problem with the previous battery model was water damage. It was basically about sealing and then we basically, because you could basically unscrew the cap from the battery, took out the core of the battery, then filled in a layer of silicone at the bottom, closed it up again and we were then able to do that ourselves. We then trained employees to do it. And we did that for a relatively long time. I think we repaired 50,000 batteries in this way in Germany alone, and that within a short period of time." (Int4, ll. 201-210)

"And we then set up our own repair room in Cologne, with a repair line and self-made plugs and stuff. Yes, and that's how it came about that we said we could also carry out these repairs ourselves [...]" (Int5, ll. 332-334)

"[...] we try to avoid recycling them directly as much as possible. On the one hand, we can try to repair batteries in Poland and reuse them. On the other hand, we work together with recycling partners. And we in Switzerland are working on a new project here. Exactly, and that's how we collect them, or they actually take our old batteries, which no longer have enough power, some of which are defective or really defective, which should go into the recycling process, take them apart, test all the cells and every cell that still works, make them into rechargeable batteries again and these actually end up and there is why Rex for photovoltaic systems as intermediate storage and buildings that we try to close the cycle again." (Int7, ll. 186-193)

"[...]we have set up additional repair centers. Some of these are in Germany, but some are also central company-wide repair centers where vehicles are sent to be completely refurbished so that they are more durable and can simply be used for longer. They are freshened up again, painted again, screws tightened again, simply so that they are not as good as new, that would be

a bit too much to say. But basically they are simply refurbished so that they last longer on the market." (Int2, ll. 99-105)

"And then we've also tried to refurbish old scooters and sell them to the private market, so private customers will get a Tier scooter in black, not green, but black. Black. Then you buy it and then you have the same support as everyone who buys a scooter from Media Markt. That was also an additional source of income or an additional model, and it worked." (Int3, ll. 119-123)

"But we have a refurbish center in Poland, for example. Scooters that are 2-3 years old are completely overhauled there: new foils are applied, all spare parts are replaced." (Int3, ll. 183-185)

"So then, for the first time in 23, we looked at how I actually determine the residual value of scooters that are broken. Do I deduct the future income, so to speak? Or do I take the spare part value and set a price to do that? Then we did a bit of math. And then we realized that we have so many scooters in the back lock that it would make sense to dismantle them. And then we developed it together with Poland. Dott was also working on a similar project at the time. The infrastructure that we now have in Warsaw comes from Dott, but we also ran a similar project in Poland (labor costs), where we started taking scooters apart. We sent scooters there to be dismantled and then distributed to the cities as spare parts. We did that because a scooter has electronic parts and mechanical parts. The mechanical parts have a much longer service life than the electronic parts. And that actually means that the scooter should/must have parts and then you basically just have a dead scooter that no longer has a motor. But of course we still need wheels and so on [...] You can then say, yes, we refurbish our scooters, and that goes one step further than just getting spare parts, because what we're doing there now is sending broken scooters to them, they basically cannibalize the scooters that no longer work. And then repair them directly with the parts on site. They also repaint the scooters and give them a second life, so to speak. So this has grown over several stages. First of all, spare parts acquisition and a location and centralization of spare parts acquisition, so to speak, then refurbishment and this is now the final stage, so to speak. So it was a three-stage process, which saves massively on spare parts transportation, especially from overseas and so on " (Int4, ll. 156-183)

"We started refurbishing electric scooters that were no longer repairable or where the working time exceeded the value of the scooter afterwards, we then dismantled them and used the spare parts to get other scooters back on the road." (Int5, ll. 111-113)

"And then I think the biggest thing that we do in terms of circularity is refurbishing all of our vehicles. So it was a big project that we started on the Dott side previously and now are scaling to incorporate both Tier and Dott fleets of whenever a vehicles reaching towards the end of its lifespan. And it's a bit worn out. We have a central facility in Warsaw where we rework all of these vehicles. We deconstruct them like repair every piece of it, refurbish the whole thing and put it back together. So it's really the quality of like a brand new vehicle without having to consume new materials, purchase any materials and then those go back out on the streets for several more years and then this also is how we are able to then limit the number of new vehicles that we are purchasing, etc." (Int6, ll. 64-72)

"The last two years, they've said that they're not going to buy new e-scooters and e-bikes, but they're going to focus on reuse and refurbishment, replacing them within the markets. There is now something new, a large refurbishment project in Phoenix in Poland. The current strategy

<p>was not to buy any new vehicles, but to extend the life cycle of the ones we have by not buying new vehicles." (Int7, ll. 99-104)</p>	
<p>Second Order Category: Recycle</p>	<p>Practices to process materials to obtain the same (high grade) or lower (low grade) quality and is applied when a product can no longer be used and contains materials that can be recovered.</p>
<p>"Recycling was also a company requirement that it had to be done with official partners. Yes, that when you recycle a scooter now, you really know that it was recycled by a partner who has a license and not somewhere in the backyard." (Int3, ll. 221-223)</p> <p>"In other words, we have partners with whom we initiate these recycling processes." (Int3, ll. 231-232)</p> <p>"And then we have a recycling center, where we always work with official and licensed partners. We have never tried to accept dubious offers. It is very, very expensive, but there are some companies that deal with these things." (Int3, ll. 238-240)</p> <p>"And we work with a number of second Life application partners where, for example, batteries, we work with them to give our battery components a second life. That those batteries don't end up in landfills and then we also have a number of in every city we have, like local recycling partners. So the vast majority of our waste ends up getting recycled rather than ending up in landfill." (Int6, ll. 75-79)</p> <p>"we try to avoid recycling them directly as much as possible. On the one hand, we can try to repair batteries in Poland and reuse them. On the other hand, we work together with recycling partners. And we in Switzerland are working on a new project here. Exactly, and that's how we collect them, or they actually take our old batteries, which no longer have enough power, some of which are defective or really defective, which should go into the recycling process, take them apart, test all the cells and every cell that still works, make them into rechargeable batteries again and these actually end up and there is why Rex for photovoltaic systems as intermediate storage and buildings that we try to close the cycle again." (Int7, ll. 186-193)</p>	
<p>First Order Category: Competitive Advantage</p>	<p>Effects of circular strategies that lead to a strengthened market position.</p>
<p>Second Order Category: First Mover and Pioneer Advantage</p>	<p>Competitive advantage due to the fact that a company was first on the market or was the first to integrate a new innovation.</p>
<p>"[...] back then it was still Tier and very special, because we were practically the first provider to use these permanently installed batteries." (Int1, ll. 76-78)</p> <p>"It has to be said that we were also the first to have them on the market, so we were completely the first not only in Europe, but also in the USA and China in Asia." (Int2, ll. 57-59)</p> <p>"On the one hand, we can see that Tier was a real pioneer at the time in terms of being as sustainable as possible in precisely these areas, the first climate-neutral provider, the first provider with exchangeable batteries and so on." (Int1, ll. 188-191)</p>	

"And this is where everyone has followed suit, so I don't think there are any or only a few providers that do this with an integrated battery because that's already pretty outdated." (Int3, ll. 162-163)

"Because I think with all the innovations, Tier were often, let's say, the first. But I think that probably relatively quickly. reached our competitors You can't speak of imitation. I think it was simply a case of co-development, that they simply recognized the same trends and then got together with companies and did it. So I didn't see any pioneering advantage or anything like that with us." (Int4, ll. 146-150)

"Yes, and then, and this is where the pioneer advantage comes into play, we launched in 8 cities at the same time. That means we had all the media on our side. We launched almost immediately, without any competition. It took others over 3 months. It would have taken them until the end of the summer to catch up with us. But by then we already had a lot more users and that was the advantage, simply because we were the first, we had a user base that was much bigger than anything the others had and that led to us clearing Series A relatively quickly." (Int4, ll. 257-263)

"Well, the key point of their business model was really to disrupt their mobility segment in the cities and offer something that wasn't provided before." (Ext3I, ll. 72-73)

Second Order Category: Efficiency Increase and Cost Reduction	Competitive advantage in regard to lower cost structures and higher efficiency than its competitors.
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"That means I don't have to charge the vehicle, just the battery. Yes, and to change the battery, I don't need a large truck that drives through the cities every evening; if in doubt, a cargo bike or smaller electrically powered vehicles will suffice. In other words, we have seen that I need fewer vehicles, smaller vehicles - they don't always have to be motorized, so the cargo bike is also sufficient and if I no longer have to bring the e-scooters into the warehouse, then I no longer need a large warehouse that can hold 1000 or 2000 vehicles." (Int1, ll. 80-86)

"One reason was clearly because we expected to save costs. In the beginning, you had to collect the vehicles again when you had to load them. To do this, you need large vehicles, you need many vehicles and you need a large storage capacity with a large power capacity. These exchangeable batteries save you the large vehicles, save you the large warehouses, save you the large power installation in the warehouse and ultimately you can just be on the road. In other words, the main motivation for doing this is, as I said, apart from simply bringing innovation to the market, but definitely cost savings and efficiency savings." (Int2, ll. 60-66)

"For us personally, it's a competitive advantage, it's faster and we can drive smaller cars and simply do things better." (Int3, ll. 96-97)

"[...] increase profitability by simply reducing costs." (Int2, l. 70)

"You could say that at least 50% of the operating costs have been saved. You have to imagine that about 25 vehicles fit into a large Six Sprinter. That means that once you go out, you have served 25 vehicles with the old model. With the new generation of scooters, where you only have to load the batteries instead of the whole scooter, you can load 50 batteries [...] That means you automatically double the possibilities, which I would say is at least 50%. And probably more, because you didn't have to carry the scooters back and forth all the time [...] And you just had the charging times in storage. You have to charge the scooters for 5 hours and only then can you take them out again. With the new generation of batteries, they mostly charge in the

background, so you can do 100 vehicles in one shift, which used to be impossible with the first generation of scooters. So I would say 50% cost savings. That sounds like a lot, but it really is. Plus you probably have more space in the warehouse. Before, all the scooters had to be loaded there. In the first huge warehouses that we had, we had Lidaracks, we got trestles from Bauhaus and then you had 100 chargers in a row and then you had to put the scooters there, so sometimes it was unbelievable what we actually did in the first few months. And now you've gone from 1500 square meters or 1000 square meters of halls to 200 square meters in some cases. And that's more efficient and easier than before." (Int3, ll. 136-152)

"[...] but for efficiency and for the company that offers this service, I think the batteries on site with the scooter are definitely better." (Int3, ll. 160-162)

"This means, for example, that I can change a battery as well as reposition it. e have always said that this saves around 50% in terms of labor and travel. I would even say that this has decreased by two thirds over time. So we have become much, much more efficient. We are now at an average of around 10 swaps in Germany. That's where we were in the past, and it's a bit down to the dot merger, but we were at 12 before. That was a big efficiency gain." (Int4, ll. 94-99)

"The advantage of the swappable batteries is that the scooter really only came in when it was really faulty. And we were able to invest more time in the scooters that were really broken." (Int5, ll. 82-84)

"You have a battery that costs one hundred and fifty euros, I'll just say it's worth it, and if you can repair it afterwards, you'll actually get more out of the capital you've invested [...] we not only worked with partners, but also set up a battery workshop ourselves, with our own employees and purchased materials, so that we could repair batteries more cheaply than the suppliers or partners could." (Int2, ll. 109-113)

"And by saying that we can acquire this expertise ourselves, we can also guarantee that what we do is correct. We have the confidence to do this ourselves and therefore you can, for example, take the margin that you logically give to another provider yourself or you can save it or you can earn it yourself somewhere. But I think a mixed calculation makes sense. This means that you can hand over large quantities that you might repair relatively quickly and cheaply and do the complicated ones yourself. That depends on the expertise and the faults in question. But I think it's best if you mix it up, i.e. if you hand over one part and do another part yourself." (Int2, ll. 116-123)

"[...] we did do an analysis that did find that it is cheaper to refurbish a vehicle and continue its life rather than purchasing a new one. So yeah, from a first point, it's not just a sustainability benefit, but a huge cost savings as well." (Int6, ll. 93-96)

"[...] so to speak, and give them a little goodie in return, which of course also reduced our cars, driving time and energy consumption." (Int3, ll. 104-105)

"That would allow them to cut down on costs so they can't run operations efficiently. They run efficient cost structure, and they successfully kept the scooter utilisation rates high, so in terms of all the KP is that you looked at, they were performing better than the other players." (Ext3I, ll. 108-110)

Second Order Category: ROI Improvement through lifetime extension	The effect of extended lifetime of vehicles on the capital invested.
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"Because I only have to touch the vehicle by the battery to change the battery, I don't have any transport damage or anything else, so of course I always increase the service life of every vehicle." (Int1, ll. 97-99)

"Lifetimes have always changed. In the beginning it was a completely revolutionary 3 years for the first models, later it was 5-8 years. This is also a competitive advantage, simply to get more out of the invested capital so that we can generate more sales later on with the capital we have already invested." (Int2, ll. 94-97)

"There are [...] industry values that were communicated by Bird and Lime at the time. They said that the scooters last between 2 and 3 months. These were also the same vehicles, so you can take that as a reference, because this figure was already being bandied about in the press. [...] This means that the vehicles have to generate so much revenue within these 2-3 months that you definitely pay off your investment more. That's how we came up with this repair story again, where we said that we would repair every single vehicle again and again and of course spend money on spare parts. And this has enabled us to extend the service life in any case. As I said, I would now assume 1-2 years, whether it was really through new technologies, through innovations, through other vehicles that were simply developed more robustly, developed more robustly together with the manufacturers, the service life has then been extended over the years to 3-7 years and I think 7 years is the current number of the service life of scooters." (Int2, ll. 156-168)

"But this 3-month lifespan as a start in 2018/2019 is realistic and we were able to increase that over 2 years. And we currently have scooters that are already over 3 years old." (Int3, ll. 180-182)

"So, it was a three-stage process, which saves massively on spare parts transportation, especially from overseas and so on. So it was a good thing for our footprint." (Int4, ll. 182-183)

"Because now we have a fleet that is expected to last much longer." (Int6, l. 72)

"There is also the option of buying batteries that have more power, so for example: there is the first battery that lasts I don't know 30 kilometers, then there are batteries that last 50 kilometers, which in turn reduces the trips we need to make to change the batteries, reduces the number of employees and generally reduces the number of vehicles, so that is already an advantage." (Int3, ll. 98-101)

"Yes, there are. Scooters were more robust. That's right. Yeah, their design was good. Robust so. Their life was longer." (Ext3I, ll. 118-119)

<p>Second Order Category: Positioning Towards Stakeholders</p>	<p>Competitive advantage through the positioning towards the most relevant stakeholders in the e-scooter sharing industry, namely investors, cities and users.</p>
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Investors:

"And I think you mentioned investors as well. It's also a big thing for a lot of our investors are impact investors. So it's really important to them for us to show that we are, you know, a sustainable company that we are making a clear positive impact in our cities. As well as you know, the financial benefit of cost savings of these circular approach. So they kind of get the best of both worlds there." (Int6, ll. 127-131)

"[...]but it was also quite important in terms of not only investors, but also in terms of cities, because many cities have generally accepted e-scooters more readily, accepted them more and

accepted them more quickly when we told them that we are not the wild ones who just drive around the city and don't care about anything, but we have a sustainable purpose behind it and we are also doing something about it. And we're not just taking the easy route, but also the more difficult and cost-intensive one. And that's another reason why we might have had more opportunities to offer our service there, and cities would certainly have made life more difficult for us or perhaps even closed the door and not even opened it if we hadn't gone down this route. We have also won tenders and tenders only because we have offered this, because we have said that we have an all-electric fleet." (Int2, ll. 222-231)

"[...] and we didn't do it for cost reasons. In other words, if you look at the figures, an e-Sprinter from a comparable brand costs more to buy, costs more to maintain and you can use it less efficiently because it simply has a shorter range and needs to be recharged more often. In other words, it wasn't a competitive advantage in that sense or a motivation to directly generate sales or save costs, but it goes in a different direction, namely positioning the brand. Where you then indirectly expect more sales, a different market position, a better market position, more market share, but this is very, very difficult to measure. And if then, as I said, only indirectly and in no way directly brought in more sales, that also goes more in the direction of investors and the perception of the brand." (Int2, ll. 197-205)

"And secondly, to be able to demonstrate to investors that the capital they provide us with can also be put to good use. So, that's basically what we did with the repairs." (Int2, ll. 97-99)

"This means that a refurbish is still expensive afterwards, but cheaper than buying a new one, and in the industry, which is now 6 years old, this is also a competitive advantage, because investors' money is no longer as loose as it was at the beginning. So no one is going around throwing 100000000 150000000 into the pot again and saying, "Do it like this. In the meantime, you realize that investors are very cautious because not every provider is profitable." (Int3, ll. 188-192)

"So yes, in the short term it was certainly a competitive advantage, also in terms of signs to investors, that we are doing things differently there, that we can also save costs significantly, but at the same time, of course, if you look at the P&L, it was also a competitive advantage [...] The advantage was in terms of costs and reputation on the market." (Int2, ll. 76-84)

"[...]what attracted us to Tier was their management team." (Ext3I, ll. 100-101)

"Yes, there are. Scooters were more robust. That's right. Yeah, their design was good. Robust so. Their life was longer." (Ext3I, ll. 118-119)

Cities:

"[...] but it was also quite important in terms of not only investors, but also in terms of cities, because many cities have generally accepted e-scooters more readily, accepted them more and accepted them more quickly when we told them that we are not the wild ones who just drive around the city and don't care about anything, but we have a sustainable purpose behind it and we are also doing something about it. And we're not just taking the easy route, but also the more difficult and cost-intensive one. And that's another reason why we might have had more opportunities to offer our service there, and cities would certainly have made life more difficult for us or perhaps even closed the door and not even opened it if we hadn't gone down this route. We have also won tenders and tenders only because we have offered this, because we have said that we have an all-electric fleet." (Int2, ll. 222-231)

"There's also huge effort in terms of winning over cities themselves because they're the ones who ultimately give us the authorization to operate in the city. And it's a slightly different situation in each country in each city, but a lot of our markets, there's a tender process where we have to apply. And only a few operators would be selected. So being able to position ourselves as a really sustainable operator, that's, you know, extending life spans, taking this really circular approach to all of our operations is a key way that we've been able to differentiate ourselves from competitors by showing cities you know, yes, like a brand new vehicle seems really nice and shiny, but if you really want to achieve your sustainability goals, it's actually really a lot better. A lot of times if we have long lasting vehicles that stay in the markets for a long time and just like in general, take this really circular approach. It's something that has scored really well in a lot of our applications in the past. So that's a key differentiator for us and something that really helps us in our relationships with cities as well." (Int6, ll. 115-127)

"Yes, this is particularly important in tenders, so I think it was a decisive point in the tender in Sankt Gallen in Switzerland that we have this cooperation with the tariff association, a point that really set us apart from the other providers." (Int7, ll. 77-79)

"And of course all of this always helps us, especially for tenders - the cities want to see that we are doing something and that it has a positive effect on us." (Int7, ll. 215-216)

"[...] we have now introduced the tender process for the first time, or carried it out for the first time on 1.1.25 It is the case that the whole thing was preceded by a relatively lengthy process of a sharing strategy, which we have raised to the level of the transport association, simply because here in Mannheim we are very close to other interfaces that are facing the same issues, the same challenges." (EXT2C, ll. 31-35)

"[...] regionally and have developed a sharing strategy. Within the Rhine-Neckar transport association, which can also be viewed publicly via the VAN. And it has simply tried to define certain standards and the role in the overall transport structure for these services and has also made very clear recommendations." (EXT2C, ll. 37-40)

"[...] came up with a kind of distribution procedure for special uses. This means that all interested providers were informed in good time. There was a corresponding announcement via the City of Mannheim's procurement platform, even if it is not legally an award in that sense, via the municipal procurement platforms, that 3 providers were being sought for a total contingent of 2,000 vehicles. The documents to be submitted, the conditions, the fees and in this process, 5 providers applied. They had to submit a concept in which they described how they would fulfill the requirements of the city of Mannheim and how they would contribute to this. And we also had an evaluation matrix that was published before the process, which we looked at and how we evaluated them." (EXT2C, ll. 42-51)

"In the evaluation matrix, you have to differentiate between KO criteria, for example, things that the provider simply has to explain. Some of these are things that he has to do for legal reasons alone." (EXT2C, ll. 54-56)

"Then there was also sustainability in a certain area, in the sense that we simply demand in the overall concept that the vehicles must have a certain robustness. However, since we are still acting in accordance with road traffic law, it is relatively controversial to what extent we are allowed to ask about or regulate things that do not directly affect road safety as part of special use, which means we were rather cautious in the evaluation matrix." (EXT2C, ll. 60-65)

"In fact, we've only included it indirectly, because we've said that it's a bit difficult for us to demand something like that legally, because according to the current state of road law in Baden Württemberg, for example, it's different in NRW. Only road traffic regulations are allowed, for example, to ensure safety in public spaces, and whether you have an incorrectly parked e-vehicle or an incorrectly parked diesel Sprinter is ultimately irrelevant, even if you get knocked over by it and so on." (EXT2C, ll. 76-81)

"But we have it in our guideline, so to speak, that we expressly welcome it and want it." (EXT2C, ll. 85-86)

"Exactly, we can indirectly aim for this by saying, for example, that certain noise protection guidelines must be adhered to when breaking out and there is of course the advantage that e-vehicles are simply much quieter than diesel sprinters." (EXT2C, ll. 88-90)

"Yes, you can certainly say that over the years we have perceived TIER here, as in the whole of Germany, as the top dog and so on, which has always tried to cooperate. Yes." (EXT2C, ll. 172-174)

"Yes, exactly, so for us there are two levels, the question is what do we really get regulated by road traffic law? And here it's primarily complaint management, safety and order, which also plays a major role for us, but we also do this in part via road traffic law through the Mobilstation, so we simply have a concept of setting up fixed barrier areas and turning them into sharing hubs with bike rental and car sharing." (EXT2C, ll. 223-227)

User:

"If the thing doesn't rattle differently and you have no idea, then you say that was okay, but if you now take a Tier scooter, the tire hangs crosswise in front, you don't want to blink, nothing happens, the light doesn't work either, then at some point you ask yourself: Should I actually still take the Tier scooters? So yes, I totally agree with you, it's the look that counts, it's the first impression that counts." (Int3, ll. 202-206)

"And then in terms of competitive advantage, one thing that we found is that refurbished vehicles perform much better than the ones that just like stay in the market forever and then kind of get old, cause the older vehicle gets people want to use it less. They always want to go for the newer thing. And so for us, if we're competing against other companies in the same market, that might have newer vehicles by refurbishing, we get to have that competitive advantage of presenting. Something that feels new to user. Something that's really interesting to them without actually having to purchase a new vehicle, consume more resources in that way." (Int6, ll. 98-105)

"So, Tier was the first provider of scooters that I recognize from the beginning. Therefore I have used them from the start. Also they are available anywhere I am going, so the chance that there is a scooter from Tier close to me is very high. And also I have not had any problems with the app or the scooters so I just scan the QR-Code and it always works totally fine." (EXT1U, ll. 34-38)

"Yeah I think the most important part for me and for any user is that the scooter functions well, and there are no problems with the brakes, the app, the bell or anything else. So yes for me this is important. And I think that is clear, I mean you just know if the scooter works when you have already scanned the QR-Code and paid the fee for accessing the scooter. So when you pay for the service, you expect that it works well. And especially the stability. I think older models are a bit more instable and thinner, but the new ones are very stable and you feel safe. When there

are some thing broken I do not feel safe, so in general I would say is that maintenance and quality play a major role." (EXT1U, ll. 42-49)

"It is more that it is super important that the scooter looks like it would function. So there is nothing loose, nothing broken and it should look stable. So yeah I think the first look is very important to go for the scooter or not. But its more about functionality than looking pretty or so on. And maybe also if it looks kind of knew. I think when it looks new I also perceive it as more safe because it seems like either it is really new or the provider has taken care of it, like repair it and so on." (EXT1U, ll. 55-60)

"To be honest this is very important for me. And I think the point is here that as a user I do not know what 20 or 30% means. Can I drive for 2 minutes or 20 minutes. You know. And on the map you see the battery left on the scooter. So I would really prefer a scooter that has for example 50 or 60% of battery than one that only has 20%. Although maybe it would be enough for a short drive. But then again, as a user I pay for the access and on top for the minutes. So you do not want to take a scooter which just stops in the middle of the route and then you have to take a new one and pay the access fee again." (EXT1U, ll. 64-71)

"But I have heard a lot of providers that are not really sustainable, that they just throw away scooters that are broken and so on and I am definitely not a fan of that. And just how I said, I prefer providers like Tier where I know that they take care of advices and position themselves also that they really want to do something good, if I can say it like this." (EXT1U, ll. 81-85)

"So in general all these strategies related to repair or refurbish. I think these are the points I have already said. Maybe it is not the repair itself but more what it does to the perception of the user. When it looks good and functioning which is probably the effect of repairments and refurbishing, I go for the scooter and prefer it over another one. And the fact that the provider is repairing or refurbishing as a circular approach is also important but has second priority for me. Which is important for me is the recycling of the batteries because I think this is the most obvious point you see when you use in general electric vehicles. What happens to the batteries. So I think especially the reuse, repair, refurbishment of batteries is something I think about." (EXT1U, ll. 91-99)

"When it comes to branding, Tier is also the provider where I know the most about. So I know that they say they are climate-neutral. And this is a big step I think. And when I know this as a user, it motivates me even more to use them. But for this the marketing is essential. And also I do not know if this is reality or only my perception but I have the image that Tier really has like a mission to be sustainable so it is kind of I trust them that they really want to do something good and not only make money. I know for sure, every company needs to make money and must be profitable. But when you are a startup in the sustainability field or circular, this is relevant and also essential." (EXT1U, ll. 117-124)

"So the most relevant point within these is the refusal of gas vehicles in operations because this is something I see myself as a user on the street. What I have seen is that there are also bikes who just change the batteries and this is also something I saw and this is different from the beginning years. And this is an important point because when there is a company like Tier who want to change the mobility sector and have less cars on the street, it is contra productive from my point of view when the take those big vans and drive on the streets, just like all other cars. So yeah this is something I have recognized. But maybe just because I really use these scooters everyday." (EXT1U, ll. 131-139)

"Refuse as much as possible on emissions and harmful things for the environment. This is a responsibility any company should have and should act after it." (EXT1U, ll. 142-144)

"But I think this was a good act to support second-life concepts and this is the right way to go for all companies." (EXT1U, ll. 147-149)

"[...] from my point of view the whole industry of e-scooter sharing is there to develop and maybe lead the transition of the mobility sector. So this is there reason to exist [...]. But it is more about seeing an improvement to efforts on circularity over time. But this is something I would require from all providers because this should be kind of their mission [...]. So it is more that when all have the same prices, I go for the one who has more and especially real efforts towards being circular. But higher sustainability or circularity efforts should not be correlated to higher price." (EXT1U, ll. 155-165)

"What I can say is that I perceive Tier as more mhmm lets say engaged in sustainable and circular efforts based on the things I have mentioned before. But I think one important reason for it is that Tier was one of the first here and in general in Germany and I think they expanded really fast so not only me but a lot of others chose Tier just because they were the first. Which can be a major benefit for them." (EXT1U, ll. 172-176)

"And sometimes I read something on LinkedIn about the CEO which is kind of famous in the sustainable area and also there exist interviews and podcasts, so Tier was always kind of present and due to their presence to the environment, I would say yes that I perceive them kind of more sustainable maybe." (EXT1U, ll. 178-181)

"[...] so I think all the things I see, like cargo bikes that collect batteries instead of huge vans on the street give me trust that they really want to be as sustainable as possible and also rethink their processes and look for innovation. But I think there is a lot more going on or for example if a company like tier declares that they are 100% climate neutral. I am like ok that is nice but what is behind. How is this measured. So I trust more in actions I can really see instead of statement that just say oh look how sustainable we are." (EXT1U, ll. 184-189)

"So I think what I said before is here important. For some cases I think it can influence me a bit, for example when it says in the app, look we do this and this to be mor ecircular. But like I said before I trust more in the actions. But also this is something I can say as a heavy user because I use the scooters every day and my eyes are open for that. I think a person that only uses scooters when it is convenient, e. g. once in two weeks to go to the hairdresser or I do not know, then those actions are not visible for such light users. So maybe it is a mix of both. But only statements that are marketed do not have a big impact on me." (EXT1U, ll. 193-199)

"[...] definitely yes, so I do not have had any problems with the scooters, most of the time they are charged properly, they function, there is nothing loose, I feel safe. To the second part I would say that maybe the circular efforts can have a small impact because I only want to recommend things or companies that are good also in being sustainable. Especially when you can choose between less and more sustainable providers. But I would not say that this is the turning point. Like I explained it at the first questions, priority is functioning, availability and safety, after this comes circular or sustainable efforts." (EXT1U, ll. 204-211)

Second Order Category: Human Capital	The advantages of a company whose employees share the same mindset and therefore work more efficiently.
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"We had many employees who only worked for us or wanted to work for us because they stood behind the company's philosophy, namely "change mobility for good". We now not only have the sales maxim as a goal, but actually also other values that we exemplify. And that's why there were many employees who were only there because we embodied these values. And that includes, among other things, that we have set ourselves the goal of operating the fleet purely electrically." (Int2, ll. 206-212)

"But to be honest, that was a unique experience with Tier in my life so far. I've never worked with so many employees or with so many people who were so motivated. I think that was the thing, I never met anyone in the first 3 years who wasn't prepared to work 12, 13 or 14 hours for 3 weeks straight. It was this spirit that was unique and I think that's what made the difference." (Int3, ll. 272-276)

"And then of course the management, who were also keen to try things out and were interested in concepts. We had crazy ideas and we followed them through completely. But you also have to say that the money was there and so we really tried out every idea that we wanted or that sounded interesting. I think that was one of the reasons why it became a unicorn. Because we had such a hyper-expansion for the first 2 years. I've never seen anything like it. I think we opened up cities every week, opened up countries, we went everywhere. That was the thing. The spirit was mega." (Int3, ll. 276-282)

"I thought that was very, very clever. For the very first two weeks, they sent you somewhere in the international market and said, "You're new to us now. You want a manager position, so you screw now, you swap now, you do for two weeks what every ordinary employee at Tier does. And that in fast-forward. I flew to Malmö and then to Linz. And I looked at the operations from the ground up and really got my hands dirty. And then I knew how to do it. I knew every single process in Operations and that meant that we had a generation of people in the company who really understood the business." (Int4, ll. 239-245)

"Yes, so now we have this, this spirit that Lawrence Leuschner brought across. I remember there were, I think, just under 300 employees. Every week there was an all-hands call where it was announced that we had launched, that we had achieved this. Of course, it was one highlight after another, precisely because when you start and come up, you have that and in the workshops. Yes, everyone got a lift. I'd say the drivers maybe less so and the mechanics not so much afterwards, but everything about the mechanics and drivers actually got involved and they drove the team forward and also tried to motivate people and provide them with everything possible so that they had fun at work and that worked well at the beginning, no question." (Int5, ll. 263-271)

"Tier was the smallest player, the very smallest player, for the first 6 months. So we had competition from Bird, competition from Lime, which had already existed in the USA 4 years earlier. Voi was founded at a similar time in Scandinavia. The startup environment there was much friendlier than here in Germany. And we had a start-up from Berlin back then called Flash. They were much better financed than us at the beginning. So I think we had the smallest seed funding round of all the players and that's why it was not for our expansion the money that was responsible, but I would say the human capital and speed." (Int4, ll. 231-238)

"the whole foundation of both Tier and Dott and now Tier-Dott combined has been built on sustainability, you know our whole company mission is to have a positive impact in our cities. Related to mobility, but that also extends internally of making sure that everything that we do

is as sustainable as it can be and a lot of people who join the company join like at least in part for that reason, because they wanna be part of a company that is doing something good, that is being responsible in every step. So people are really engaged to see when we are delivering on, you know, these circular projects or anything that's going to benefit the sustainability of the company. And I think especially with our big refurbishment project because it's conducted in house like we do all the refurbishments ourselves. It really has this sort of like hands on feel of like a lot of people, the company feel a sense of ownership and like pride that we have this project." (Int6, ll. 148-158)

Appendix D: Regulations City Mannheim

D1. Beschlussvorlage V218/2024:

Kurzfassung des Sachverhalts

I. Bezug zum städtischen Zielsystem (Strategische Ziele und/oder Ziele der Dienststellen)

- Ziel 2: Mannheim bietet eine vorbildliche urbane Lebensqualität mit hoher Sicherheit als Grundlage für ein gesundes, glückliches Leben für Menschen jeden Alters und gewinnt damit mehr Menschen für sich.
- Ziel 6: Mannheim ist eine klimagerechte – perspektivisch klimaneutrale – und resiliente Stadt, die Vorbild für umweltbewusstes Leben und Handeln ist.

II. Woran sind Fortschritte erkennbar? Erwartete Wirkung des Beschlusses

- Reduktion der Beschwerdelage zu Elektrokleinstfahrzeugen der Vermietsysteme, bessere Integration der Angebote in ÖPNV und Stadtbild

III. Welche Maßnahmen bzw. welche Leistung wird beschlossen?

- Beschluss einer Leitlinie für die Regulierung und Ordnung von Vermietsystemen für Elektrokleinstfahrzeuge (EKF) in Mannheim
- Beschluss der hierfür erforderlichen Satzungsänderungen

IV. Benötigte Ressourcen (Personal, Sachmittel) / Finanzielle Auswirkungen (einmalig/laufend) und Deckung (Haushaltsjahr, Kostenart)

- Bei Sondernutzungsgebühren von 6 €/Fahrzeug/Monat und einer Deckelung der Gesamtflotte auf 2.000 Fahrzeuge ist zukünftig mit Einnahmen von ca. 140.000 € p.a. (zzgl. Verwaltungsgebühren) zu rechnen
- Die Gebühreneinnahmen werden zur Deckung des zusätzlichen Personal- und Sachaufwands für die weitere Ausarbeitung und dauerhafte Umsetzung der Leitlinie zur Regulierung und Ordnung der E-Tretrollervermietdienste verwendet.

VRN-Leitfaden Sharing-Mobilität

1.2. Ziele des VRN-Leitfadens Sharing-Mobilität

In den verschiedenen räumlichen Gebietseinheiten des VRN ist ein vielfältiges und attraktives, aber auch verschiedenartiges Mobilitätsangebot anzutreffen. Dabei basieren nachhaltige und intermodale Verkehrssysteme auf aktiver Mobilität und dem ÖPNV. Deren Förderung im Hinblick auf Angebotsweiterungen und Wahrnehmbarkeitserhöhung bilden die zentralen Handlungsschwerpunkte im Zuge der Verkehrswende.

Geteilte Mobilitätsangebote (sog. Sharingangebote bzw. Sharing Modes) adressieren Nutzeneffizienz, Flexibilität und Intermodalität zur Gestaltung der Verkehrswende. Sie steigern die individuellen Mobilitätsoptionen und verringern Motorisierungsgrade. Konkret verfügen sie bei systemoptimaler Integration in Bestandsservices über die Potentiale, negative Verkehrseffekte zu reduzieren und urbane Räume zurückzugewinnen. Diese Vorteile, gepaart mit Innovation und Vielfalt, zeichnen Sharingsysteme aus und qualifizieren sie als ein Baustein eines zukunftsfähigen Gesamtverkehrssystems. Sie besitzen grundsätzlich das Potential, zum Erreichen der umwelt- und klimapolitischen Ziele im Verkehrsverbund beizutragen.

Als Teil der Mikro² - und Nahmobilität können die beschriebenen Angebote dieses Leitfadens künftig einen Part zur Bewältigung der sog. „letzten Meile“ darstellen. Es wird erwartet, dass sie insbesondere dazu beitragen, intermodale Wege unkomplizierter zurückzulegen und die Unabhängigkeit vom privaten Fahrzeug zu fördern. Sharingangebote bieten neben einer Ergänzung des ÖPNV in räumlicher, auch eine Attraktivierung in zeitlicher Hinsicht. So deckt z. B. das Carsharing unterschiedliche Zeiten und Fahrtzwecke ab, die ausschließlich mit dem ÖPNV nicht bedient werden können. Damit zielen geteilte Mobilitätsformen darauf ab, systembedingte Angebotslücken des Umweltverbundes zu schließen und somit ein ganzheitliches und attraktives Mobilitätsangebot zu generieren.

In gleichem Maße sind negative Eigenschaften von Sharingangeboten zu berücksichtigen. Dabei treten insbesondere stationslose Sharingangebote, auch Free-Floating-Angebote genannt, hervor. Sie können im verdichteten urbanen Raum Nutzungskonflikte verstärken. Erfahrungen zeigen, dass durch Sharingmobilität speziell Zufußgehende sowie Menschen mit Mobilitäts- oder Sinneinschränkungen in der Nutzung des öffentlichen Raums gefährdet oder eingeschränkt werden. Kommunen stehen daher vor der Herausforderung, den Sharingangeboten eine angemessene Positionierung zu gewährleisten und die Interessen anderer Nutzender des öffentlichen Raums abzuwägen. In diesem Prozess sind u. U. Maßnahmen zu ergreifen, die die Sicherheit und Leichtigkeit des Verkehrs aller sicherstellen sowie die Ordnung und das Erscheinungsbild der Kommune gewährleisten.

Vor diesem Hintergrund werden einige relevante Zusammenhänge formuliert:

- ▶ Der Erhalt eines geordneten Ortsbildes sowie die Gewährleistung der Verkehrssicherheit im öffentlichen Raum sind im Zusammenhang mit geteilten Mobilitätsangeboten von zentraler Bedeutung. Aus diesem Grund wird als Zielzustand eine Angebotssteuerung mit definierten Standards gewünscht, die in der Anhörung mit den Anbietenden erarbeitet werden.
- ▶ Die Barrierefreiheit ist ein sicherzustellendes Gut. Dies gilt sowohl für gegenwärtige als auch zukünftige Konzeptionen. Sharingangebote sollten in ihrer Ausgestaltung nach Möglichkeit alle Dimensionen von Einschränkungen berücksichtigen und Teilhabe ermöglichen. Konkrete Vorgaben ergehen durch kommunale Planungen.
- ▶ Die Integration in das Gesamtverkehrssystem drückt sich z. B. in einer Tarifintegration in die Mobilitätskette bzw. in der verbesserten Verknüpfung der einzelnen Modi durch Mobilstationen aus. Ebenso ist ein gemeinsames digitales Dashboard Grundlage für das Monitoring und die Weiterentwicklung von Sharingangeboten.
- ▶ Vor diesen Hintergründen sind Anreize für die Rückgabe an Stationen zu schaffen. Wesentlich ist der Kontakt der Anbietenden zu den Kommunen und zum Verbund, um aufkommende Problemstellungen zu erkennen und zu beseitigen. Die Kriterien für die einzelnen Angebote sollen dabei, wie in dem vorliegenden VRN-Leitfaden beschrieben, von den Anbietenden erfüllt werden.

Entlang dieser Überlegungen und im Zusammenspiel mit zukünftigen Konzeptionen wird die Inanspruchnahme von geteilten Mobilitätsdienstleistungen nutzendenfreundlich, der Betrieb strukturiert und der Auftritt einheitlich gestaltet. Die Überlassung der Daten in ein verbundweites Dashboard ermöglicht es die Datendarstellung und Aufbereitung zu bündeln.

² Das Zukunftsinstitut definiert Mikromobilität als „elektrisch angetriebene leichte Kleinstfahrzeuge (mit einem Bruttogewicht von weniger als 500 kg), beispielsweise Elektrofahräder, Elektromoller oder Segways“. (<https://www.zukunftsinstitut.de>). Andere Quellen schließen auch nicht elektrisch betriebene Kleinstfahrzeuge, die vor allem die individuelle Mobilität auf kurzen Strecken erleichtern, in den Begriff mit ein.

VRN–Leitfaden Sharing–Mobilität

Ein Anspruch auf die Nutzung und Verfügbarkeit der Abstellflächen besteht für Anbietende nicht. Grundsätzlich können Abstellflächen durch die Kommune oder die Polizei auch dauerhaft oder auch kurzfristig oder anlassbezogen (z. B. im Rahmen von Baumaßnahmen, Veranstaltungen oder Versammlungen) geschlossen werden.

Die Anbietenden können in einzelnen Gebieten oder auch ortsweit zur flächendeckenden Nutzung von Abstellflächen verpflichtet werden. Zusätzlich durch die Kommune definierte Abstellverbotszonen bleiben davon unberührt. In Ortsteilen oder Orten mit stationsgebundenem Betrieb ist die morgendliche Ausbringung vorseiten der Anbietenden und ein fahrtbedingtes Beenden der Ausleihe vorseiten der Nutzenden ausschließlich auf ausgewiesenen Flächen vorgesehen. Kommunen können, unabhängig vorangegangener Ausführungen, einen Free-Floating-Betrieb für ihr Ortsgebiet oder Teile davon zu lassen. Folgend obliegt es den Kommunen, ein hybrides System einzusetzen, bei dem einzelne Abstellflächen ausgewiesen werden können und in einem Radius, von z. B. 150 m um diese Abstellflächen, automatisch ein Free-Floating-Betrieb verboten wird.

Flottenverteilung

Um die Überfüllung von Stationen oder des öffentlichen Raumes zu vermeiden, sind die Anbietenden verpflichtet, die EKF bedarfsgerecht durch ein entsprechendes Flottenmanagementsystem umzuverteilen.

Damit nicht einzelne Ortsgebiete durch abgestellte EKF überlastet werden, besteht für Kommunen die Möglichkeit, die Verteilung von Fahrzeugen im Rahmen eines Zonenkonzepts zu steuern. Die Kommune kann dabei das Ortsgebiet in verschiedene Zonen einteilen und für einzelne Zonen festlegen, welcher Anteil der Gesamtflotte der verschiedenen Anbietenden zur Herstellung des täglichen Betriebsbeginns maximal in einer Zone stehen darf. Bei der Festlegung der Maximalquoten durch die Kommune ist das Gebot der Verhältnismäßigkeit zu beachten.

Beispielhaft ist eine dreistufige Staffelung nachfolgend dargestellt.

- **Gebiet 1:**
Kernbereich/Innenstadt: maximal 30 % der Flotte, da hier die Flächenkonkurrenz und -nutzung besonders groß und intensiv ist und gleichzeitig das ÖPNV-Netz bereits sehr engmaschig eine verkehrliche Anbindung sicherstellt, sodass EKF hier nur einen begrenzten verkehrlichen Nutzen haben.
- **Gebiet 2:**
Kernstadt: maximal 40 % der Flotte, da hier aufgrund dichter Besiedelung noch immer eine Flächenkonkurrenz besteht.
- **Gebiet 3:**
Sonstiges Stadtgebiet: keine Begrenzung, da hier aufgrund einer dünneren Besiedelung eine geringere Flächenkonkurrenz besteht und aufgrund des dünneren ÖPNV-Netzes der verkehrliche Nutzen von EKF für die letzte Meile im Umweltverbund den größten Nutzen hat.

Der Verteilzustand ist täglich herzustellen.

Lärm- und Umweltschutz

Im Hinblick auf Lärmemissionen gelten für Anbietende die Regelungen des BImSchG und der TA Lärm. Anbietende sind dazu verpflichtet, den Betrieb inkl. der Umverteilung, Entfernung, Wartung oder des Ausbringens von EKF so zu gestalten, dass die Nachtruhe grundsätzlich eingehalten wird und tagsüber Lärmbelastigungen geringgehalten werden. Dies betrifft auch akustische Alarm- oder Ortungssignale an Fahrzeugen. Diese Funktionen sind technisch so auszugestalten, dass ein Missbrauch durch Dritte ausgeschlossen ist.

Fahrzeuge und Zubehör sind so auszugestalten, dass diese im Interesse der Umwelt möglichst langlebig sind. Defekte Fahrzeuge und Teile sind durch Anbietende sach- und umweltgerecht zu entsorgen. Für das Umverteilen von EKF, aber auch für das Ausbringen und für Wartungszwecke ist der überwiegende Einsatz lokal emissionsfreier Fahrzeuge für den Service anzustreben.

⁵ vgl. Difu, DLR 2022; E-Tretroller in Städten – Nutzung, Konflikte und kommunale Handlungsmöglichkeiten; Abb. 20, S. 36

Acknowledgement of Use of AI

During the writing process, ChatGPT was used to support spelling and grammar corrections. In addition, AI tools aided in summarizing expert interview transcripts for the appendix. All AI-assisted outputs were critically examined to ensure both accuracy and relevance. AI was employed strictly as a supportive instrument and did not influence the author's independent reasoning or conceptual contributions. Every piece of content generated with AI assistance was carefully reviewed and revised where necessary. The final version of the thesis is the result of the author's own intellectual work and judgement. AI use was aligned with academic integrity guidelines and was confined to supportive functions that did not compromise the originality of the thesis. Its application was carried out with full awareness of the tool's limitations, particularly the potential for factual errors.

A handwritten signature in black ink, appearing to read 'Alina Rothe', with a stylized flourish at the end.

Alina Rothe, 29.05.2025