

# An E-Car Sharing International Market Analysis and German Case Study

## **Masterarbeit**

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# Table of Contents

<b>Table of Contents</b> .....	<b>I</b>
<b>List of Tables</b> .....	<b>III</b>
<b>List of Figures</b> .....	<b>IV</b>
<b>Table of Abbreviations</b> .....	<b>V</b>
<b>1 Introduction</b> .....	<b>1</b>
1.1 Motivation of the Master Thesis .....	1
1.2 Objective of the Master Thesis.....	2
1.3 Structure of the Master Thesis .....	2
<b>2 Car Sharing</b> .....	<b>3</b>
2.1 Definition and Status Quo of Car Sharing in Germany .....	3
2.2 Success Factors and Benefits .....	5
2.2.1 Mobility Behavior .....	5
2.2.2 Car Sharing and Public Transportation .....	6
2.2.3 Other Benefits and Success Factors .....	8
<b>3 Electromobility</b> .....	<b>10</b>
3.1 Definition and Status Quo of Electromobility in Germany.....	10
3.2 Drive Concepts .....	12
3.3 Success Factors and Benefits .....	14
3.4 Vehicle to Grid .....	19
<b>4 International Market Analysis of E-Car Sharing</b> .....	<b>20</b>
4.1 Definition and Function of a Market Analysis.....	20
4.2 Europe .....	23
4.2.1 Germany .....	23
4.2.1.1 Organisational Structure .....	24
4.2.1.2 Cost Structure .....	27
4.2.1.3 Infrastructure of Charging Stations .....	31
4.2.1.4 State Funding.....	33
4.2.2 Switzerland.....	35
4.2.2.1 Organisational Structure .....	35
4.2.2.2 Cost Structure .....	37
4.2.2.3 Infrastructure of Charging Stations .....	40

4.2.2.4	State Funding .....	40
4.2.3	France .....	42
4.2.3.1	Organisational Structure .....	42
4.2.3.2	Cost Structure .....	43
4.2.3.3	Infrastructure of Charging Stations .....	44
4.2.3.4	State Funding .....	46
4.2.4	Market Potential .....	47
4.3	North America.....	51
4.3.1	U.S. and Canada .....	52
4.3.1.1	Organizational Structure .....	52
4.3.1.2	Cost Structure .....	53
4.3.1.3	Infrastructure of Charging Stations .....	56
4.3.1.4	State Funding .....	56
4.3.1.5	Market Potential .....	58
4.4	Discussion of the Market Analysis.....	60
<b>5</b>	<b>A German Case Study.....</b>	<b>68</b>
5.1	Definition and Function of a Business Model.....	68
5.2	Business Model of WIRTZ (2011) .....	69
5.2.1	Strategic Component .....	69
5.2.2	Customer and Market Components.....	70
5.2.3	Value-Added Component.....	74
5.3	Application of the Business of Wirtz (2011) for Quicar .....	76
5.3.1	Strategy Component .....	76
5.3.2	Customer and Market Components.....	77
5.3.3	Value-added Component.....	83
<b>6</b>	<b>Conclusion.....</b>	<b>85</b>
<b>7</b>	<b>Limitations and Future Perspective .....</b>	<b>89</b>
	<b>Reference.....</b>	<b>90</b>
	<b>Appendix I.....</b>	<b>116</b>

# 1 Introduction

## 1.1 Motivation of the Master Thesis

The number of inhabitants in cities continues to grow and in 2008 even exceeded the number of those living in non urban areas. Side effects caused here by the high number of cars are air pollution, congestion, expensive fuel, lack of parking places and high parking charges. Some of these effects even lead to a lower life quality for inhabitants of cities. Due to this it is inevitable to create a new efficient public transport system. Other public transportation (PT) modes, like buses or trains, are not suitable to substitute the car for every trip. Thus Car Sharing seems to be a promising concept to fill that gap, especially against the background that Car Sharing is more disseminated in big cities. This is due to the greater possibility for Car Sharing Organizations (CSOs) to increase its market share due to better infrastructure of PT. Car Sharing can combat the side effects of urbanization, since it fosters the economical use of cars. Customers of Car Sharing drive less kilometers and 23 percent of the customers sold their car due to their membership or decided not to purchase one even if they took this into consideration. The intention of sharing transportation is to realize a comprehensive need-satisfaction with a minimum of effort. At Car Sharing, individuals have the benefits of a personal car without bearing the incurred costs of a private owned car. Even though Car Sharing has become more popular worldwide and the market has grown substantially in the last years, there is still a high growth potential.

Currently the fleets of most CSOs consist of conventional powered cars and Electric Cars (E-Cars) are yet not very present.<sup>1</sup> Since conventional driven cars contribute to an increased CO<sub>2</sub> emission, the integration of Electric Vehicles (E-Vehicles) in Car Sharing fleets becomes more important. When those cars are charged with 100 percent renewable energy, they drive CO<sub>2</sub> free. Thus it is inevitable to provide a charging infrastructure at stations of CSOs and in public. The E-Vehicles are getting more attractive against the background of constantly increasing petrol prices due to the dwindling of fossil resources. Furthermore the disadvantages of E-Cars, like the short range can be best compensated at Car Sharing, since most trips of customers are only short ones. RAMMLER (2011) even mentioned that Electromobility (E-mobility) only has a future in collective transportation and not in individual transportation.<sup>2</sup> But there are also some challenges for the use of E-Cars in CSOs. Long charging times reduce the workload of the cars and the customers are not familiar with the use of E-Cars. Addition-

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<sup>1</sup> Cf. Shaheen/Cohen (2007), P. 87.

<sup>2</sup> Cf. Canzler (2009) P. 320; Lee et al. (2011), P. 3; Rammler (2011), PP. 40, 53.

ally the high purchase price of E-Vehicles and the costs of required charging station infrastructure at the stations are a considerable financial burden for CSOs.

For a successful integration of E-Vehicles in CSOs it is important to improve the capacity of the vehicle batteries and the infrastructure of charging stations, so the use of E-Cars can compete with the use of conventional driven cars and the customers do not have a breakdown due to an empty battery. Furthermore there are not yet sufficient measures worldwide to facilitate or even to make the use of E-Cars in CSOs possible.

## **1.2 Objective of the Master Thesis**

In the present master thesis, the market potential of Electric Car Sharing (E-Car Sharing) should be evaluated. In the ensuing discussion of the market analysis challenges for the CSOs, that are accompanied by the integration of E-Vehicles are presented. Additionally suggested solutions for the specific requirements for CSOs will be developed. In the case study based on the business model of WIRTZ (2011) a business model for an E-Car Sharing offer of Quicar in Hanover will be developed. There, the results of the market analysis are considered and implemented accordingly in the model.

## **1.3 Structure of the Master Thesis**

This master thesis is divided into seven chapters. After the introduction to the topic, the fundamental basic information about the two subject areas Car Sharing and E-Cars are depicted in the second and the third chapter. In the fourth chapter an international market analysis is conducted to assess the current state and the market potential of the E-Car Sharing worldwide. Here, a closer look will be taken especially to the aspects of organizational structure, cost structure, charging infrastructure, state funding and market potential. Subsequently a German case study based on the business model of WIRTZ (2011) is elaborated in the fifth chapter. The case study is illustrated by the example of the integration of E-Cars into the already existing fleet of the CSO Quicar in Hanover, which is operated by Volkswagen (VW). Chapter six contains a summary of the most important results of the international market analysis and the case study. Afterwards limitations of this master thesis and future perspectives are depicted in chapter seven.

First, investments in new E-Cars and in charging infrastructure have to be made, to implement E-Vehicles in the fleet of Quicar. Since Quicar is a project of VW, this financing should not be a barrier. To what extent the financing is done and whether through debt or equity cannot be investigated, since it would exceed the scope of this thesis. The implementation of E-Cars to the fleet and the expansion of the charging infrastructure at the stations could occur gradually, to spread the costs over a longer period. Furthermore, it must be clarified whether the project is funded by the federal state, the state or the city of Hanover. Currently there is no direct funding for the establishment of an E-Car Sharing project, but an exemption of the vehicle tax.

If Quicar provides attractive starting offers for the introduction of the new project, the value capture and thus the sales of Quicar will reduce first. The same applies for the implementation of reduced prices per minute for various target groups. However, new customers can be acquired and long-term loyalty of new and old customers to Quicar can be achieved through those actions. Since the starting offer is only considered to last for a short period, in the medium term the revenue will increase again. Additionally the offering of E-Vehicles can make Quicar more attractive for new customers, because of the growing importance of the environmental concerns in the population.

## **6 Conclusion**

E-Car Sharing is not yet widespread worldwide. Admittedly many CSOs have already integrated hybrid cars in their fleet, but pure E-Cars are only rarely present and moreover usually only pilot projects.

A reason for the low availability of E-Car Sharing offers is that E-Vehicles bear some challenges for the CSOs. One of them is that due to their long charging time they have a lower workload than conventional driven cars. This problem, however, can be minimized by an intelligent booking and charging software. But therefore the CSOs first have to invest in the already existing booking system. An additional financial burden for the CSOs is caused by the high purchase price of E-Cars, which is primarily determined by the battery. Thus, it is particularly important that the development of smaller, more powerful and longer lasting battery will be promoted by the state. Due to the development support and the CO<sub>2</sub> limitation for car manufacturers lower purchase prices of E-Vehicles will occur in the future. Added to the high purchase price, costs for the provision of the charging infrastructure at the Car Sharing stations incur for the CSOs. For an actually CO<sub>2</sub> free driving E-Car, it is important to choose an energy provider that supplies exclusively 100 percent renewable energy to the charging sta-

tions. Only under this condition, the combination of E-Car Sharing contributes to the socially important energy transition.

The profitability of E-Car Sharing is a fundamental requirement for its implementation. Currently, there are no adequate state support measures which guarantee the profitability. In all countries, which have been considered in the international market analysis, indeed the development of E-mobility is supported, particularly the batteries, but this benefits the CSOs only indirectly and in the future. Only in San Diego and Canada Car2go and Communauto are supported in establishing an E-Car Sharing project or in the integration of E-Vehicles in the fleet. In France, at least Car Sharing generally obtained certain privileges by the Car Sharing label. New measures, such as provision for free or discounted parking for E-Cars or the introduction of a buyer's premium could increase the attractiveness for CSOs to integrate E-Vehicles in their fleets.

The public charging infrastructure is insofar important for CSOs, since some allow their customers to recharge the E-Car during their trip. However, this will be usually not necessary due to the short trips that Car Sharing customers normally drive. In almost all CSOs the car has to be connected to the charging station at the parking lot after the trip. Due to the CSOs own charging infrastructure the public charging infrastructure plays basically no significant role for E-Car Sharing services.

The often-mentioned limitation of the range of E-Cars is generally not an issue, because the customer usually travels only short distances. However, in order to satisfy all the customer needs, larger and conventional powered cars should be available in the fleet in addition to E-Vehicles.

Due to the provision of E-Cars, CSOs benefit from the associated reporting. Additionally, the already environmental friendly image of Car Sharing will be enhanced by the implementation of E-Vehicles. Thus new potential customers can be gained. Especially people who consider a purchase of an E-Car, but did not so, due to the high purchase price can be acquired. In line with this environmental-oriented people are addressed by the new concept.

In all countries that have been included in the international market analysis a high market potential for Car Sharing is attested by various studies. Since almost no studies have been found on market potential of E-Car Sharing, studies about the growth potential of Car Sharing and studies on the willingness to buy and the meet of the needs of E-Cars have been combined to assess the market potential of E-Car Sharing. But in the qualitative study about E-Car Sharing from PETERS and DÜTSCHKE (2012), the experts predict a high market potential for E-Car Sharing in Germany. This is confirmed by the project Be Mobility, which was carried out in

Germany. The Business consultancy firm FROST & SULLIVAN (2010) even stated that E-Car Sharing in Europe could develop into one of the most important features of sustainable mobility.

Based on the studies it can be summarized that Car Sharing is worldwide mainly used by individuals who are older than 20 years, whereby the users of Car Sharing in America are slightly younger than in Europe. The gender distribution is almost balanced. Furthermore Car Sharing customers more often use PT and rarely use private cars. Additionally they have a higher income than average and a higher education as well. Since studies on the interest and the need satisfaction of E-Cars also have a similar target group, the market potential of E-Car Sharing can be furthermore confirmed. In addition, the introduction of E-Vehicles to the Car Sharing fleets creates an opportunity for the CSOs to gain new customers.

Although the provision of E-Cars bears a number of challenges for the CSOs, they are in light of the CO<sub>2</sub>-free driving and the associated contribution to the environment, in long term an important part of the Car Sharing fleet. Furthermore E-Cars are cheaper compared to conventional driven cars in maintenance costs. This is, among others, because of the continuously increasing petrol costs. Indeed, the high required investments of the CSOs for E-Vehicles and the according charging infrastructure at the stations cannot be compensated by the low maintenance costs, but at least they make a contribution. Also, E-mobility benefits from a combination with Car Sharing, since the public access to the technology of E-Cars is facilitated.

In summary it can be said that E-Car Sharing offers many benefits to the CSOs, which do not predominate the related challenges yet. Due to the barely existing support of the countries, the profitability is currently not guaranteed. If this situation will change, an integration of E-Vehicles into the Car Sharing fleet will be advantageous, since E-Cars fit into the mobility behavior of Car Sharing customers.

In the implementation of the V2G concept, synergies between the fleet and the electricity system can be developed. Due to the still small number of E-Cars this is currently not useful. If the share of E-Vehicles will increase in future, however, CSOs should consider this concept for their fleet to generate benefits.

The development of a business model for an E-Car Sharing offer of Quicar in Hanover illustrates, based on the business model of WIRTZ (2011), the main aspects that have to be taken into account. The most important ones are the customer and market component and the procurement model.

An important prerequisite for the business model is the agreement of the E-Car-Sharing project of Quicar with the concern strategy of VW. This condition is fulfilled, since the project supports the aim of VW to become a global economic and environmental leading automotive company. The most important network partners are primarily a charging station manufacturer and an energy supplier, who only provides the stations with renewable energy. Since Quicar has a wide target group, it is particularly important to develop some specific target group-oriented offers. Furthermore special start discounts should be offered to make the use of E-Cars for potential and already existing customers more attractive. In order to make people attentive of the new service, specific target group-related advertising has to be made.

An E-Car Sharing project of Quicar would be unique in Hanover. With Flinkster and Stadtmobil there are only two competitors, who do not provide E-Cars. Due to the very low number of stations in Hanover Flinkster is no significant competitor. In a cost comparison of the three providers it was ascertained that Quicar has the lowest fixed costs, but the highest variable costs. But Quicar offers their customers more flexibility, because the cars do not have to be parked at the pickup station and additionally one way trips are possible at a few stations. In the cost comparison it was assumed that Quicar does not increase the current price for using E-Vehicles. If Quicar shall raise the prices for E-Cars, they may not exceed the willingness to pay of the customers. Otherwise customers will not make use of the E-Car in Quicars fleet.

The revenue structure of Quicar based on direct and transaction-dependent costs and should not be changed with the implementation of E-Cars. The revenues are confronted by the purchase cost for E-Vehicles and the according charging infrastructure at the stations.

The particularity of the manufacturing of an E-Car Sharing project is to provide E-Cars with sufficient range for customers. This requires installing an intelligent booking and charging system.

The most important aspects of the procurement model are the purchase of E-Vehicles, the charging stations, and the choice of the energy supplier. Quicar already has a sufficient number of stations available, due to their current Car Sharing offer. Since Quicar is a project of VW the E-Cars can be procured there. For the acquisition of charging stations, a supplier has to be selected that meets the requirements of Quicar. To ensure the functionality and speed of the charging process, it is particularly important to buy charging stations, which are state of the art. When choosing an energy supplier for the charging stations, it has to be considered that he needs to provide only renewable energy, so that Quicars E-Vehicles actually drive CO<sub>2</sub> free.

The financing of the E-Car Sharing project of Quicar does not change fundamentally compared to the current offer. However, a solid financial plan has to be laid out for the purchase of E-Cars, the charging infrastructure and the additional energy. Furthermore, possible supporting measures of the city, the country or the state have to be checked. Currently there are no special measures for E-Car Sharing beside the tax exemption for E-Vehicles.

In summary it can be stated that an E-Car Sharing project in Hanover would be unique. Due to their current project in Hanover and the group affiliation to VW, Quicar has the general resources and the know-how available for an E-Car Sharing project. But the current business model has to be adjusted according to the described aspects in this master thesis.

## **7 Limitations and Future Perspective**

In order to assess the market potential of E-Car Sharing, an international market analysis was carried out on the basis of the desk research method. The disadvantage of the desk research method is that the data is partially outdated and competitors also have access to them. Another limitation of this method is that the data is sometimes not directly related to the topic. Thus, only one study of the potential of E-Car Sharing in Germany was found. To assess the market potential of E-Car Sharing, studies on the growth potential of Car Sharing and the acceptance of E-mobility have been combined. Additionally merely one study on the market potential of Car Sharing in North America was found, whereby the validity of their results could not be confirmed by another study. The result is that the estimation and forecast about the market potential of E-Car Sharing is vague. Furthermore for some countries vague or no information about the charging infrastructure could be found. In addition to this only a selection of countries in the respective continents was examined more closely. This may lead to a restricted validity of the results, as the situation in other countries could change the overall result. Moreover, no information about E-Car Sharing for Asian could be found, which should be initially investigated in the international market analysis.

To determine the market potential and the target group of E-Car Sharing more exactly, future studies for the particular countries have to be conducted. Furthermore, the proposed solutions for the challenges of E-Car Sharing in this paper have to be checked on their practicality and usefulness. To ensure the profitability of E-Car Sharing and the necessary adjustment of the cost structure of a CSO an efficiency analysis for the respective business model has to be conducted.