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P2P BUSINESS MODEL OPPORTUNITIES IN THE CASE OF ELECTRIC MOBILITY

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Abstract: *The implementation of systemic innovations such as electric mobility is a challenging endeavour.This research builds upon an ecosystem and system theoretical perspective, and then proposes s two business model scenarios, in which private households can play the role of service providers in the electric mobility market. Using a specific business model framework, both scenarios are described. We focus on the case where private households are engaged in providing car sharing and charging infrastructure. Both scenarios are beneficial in order to boost electric mobility as a systemic innovation.*

Key Words: ***Electric mobility, Business models, Peer-to-Peer business***

1. INTRODUCTION

Nowadays, we are witnessing a big transition in the mobility system. Because of the scarcity of fossil fuels, countries and regions around the world are pushing the development of the electric vehicle as a substitute for the car powered by the combustion engine. Whereas the current production of electricity is mostly achieved by burning fossil fuels, electricity can still be generated through the exploitation of renewable resources. Hence, electric vehicles can contribute to the achievement of green mobility, given that electrical power is produced by leveraging green sources of energy such as wind and sun.

E-mobility is, however, still at its infancy. It is a systemic innovation that requires much development efforts. Many countries in Europe are investing big amounts of money, in order to fund research in the area of electric mobility. For instance, in Germany four model regions were created to investigate how electric mobility can function as a system.[1] According to ABDELKAFI ET AL. (2013, p. 1340003-4):

"Electric mobility denotes a system of interacting actors, technologies, and infrastructures that aims to achieve sustainable transportation by means of electricity." [1]

RAMMLER / SAUTER-SERVAES (2013) also recognize the systemic character of electric mobility. The authors mention that systemic innovation combines two types of innovations: innovations in the product and innovations in the way of utilization. An example of product innovations is the electric car, and an example of innovations in the way of utilization is car-sharing.

Electric mobility is challenging because of many reasons. First, it induces big changes in the urban infrastructure, thus requiring high investments. Second, since technology is not mature, a lot of progress is necessary, especially with respect to battery technology. Third, the roles of actors in the automotive value chain are changing dramatically. In addition, established players such as original equipment manufacturers (OEM) and component or module suppliers are experiencing big changes in their businesses [2]. Competition from overseas is intensifying, and some players such as suppliers may go out of business, if they do not adapt quickly. At the same time, new players enter this industry. Some of them are completely new such as start-up companies providing connectivity within the mobility business. Start-up companies have the potential to revolutionize whole industries due to the innovativeness of their business models. Other companies, however, are operating in other sectors, but with the rise of electric mobility, these companies can see many opportunities in the mobility business. Utility companies, for instance, are a good case in point.

To function as a system, electric mobility still needs the emergence of new business models. The limitations of the technology (e.g. short distance range) can be compensated by adequate business models (Abdelkafi et al. 2013). New business models have also the potential to contribute to the diffusion of electric vehicles.

Currently, two types of business models are thriving in the mobility market: the peer-to-peer business models, where the car owners rent their cars to users who pay a fee for the service (e.g. Nachbarschaftsauto, Tamyca, Autonetzer, carzapp), and business models, in which

[1] http://www.schaufenster-elektromobilitaet.org/programm/

drivers share their cars with others who want to get a transport service to a destination on the driver's route (flinc, car2gether, carpooling) [2]. These business models can achieve new synergies and help the mitigation of diverse challenges [3].

This paper focuses on P2P business model opportunities for private households. It aims to describe two scenarios how private households can participate in the electric mobility system. As commercial actors, private households can be effective contributors, only if they can deliver value with available resources. The case, in which households have to invest additional resources, is not dealt with in this paper.

The next section provides an overview of useful concepts to explain systemic innovations. Section three describes business models, in particular P2P business models. Section four is the main part of this work, as it introduces conceptually two scenarios how private households can do entrepreneurial activities that support the electric mobility system. Section five concludes and provides directions for future research.

2. THEORETICAL FOUNDATION

A first explanatory approach to systemic innovation is found in the research of business ecosystems. A business ecosystem is a community that consists of companies and other institutions or individuals that interact with each other, with the objective of producing goods and services to serve a specific market [5]. PELTONIEMI / VUORI (2004) take the dynamic perspective into account and define an ecosystem as a population of interconnected organisations that influence the system [6]. QUADGRAAS (2005) defines an ecosystem as *"*a set of complex products and services made by multiple firms in which no firm is dominant*"* [7]. In this work, a business ecosystem consists of an environment, different actors in the system, and interactions between the actors.

To succeed in a new systemic innovation, established and new companies should secure their position in the system [8]. Ecosystems can exhibit a high level of complexity. Complexity is determined by the level of the system order and the interconnectedness of the system elements [6]. Also, the dynamic evolution of organisations and their interdependencies increase the complexity in an ecosystem [9].

According to Fathi and Harandi (2012), an ecosystem has four different layers: *Leaders, Contributors, Users and Environment*. The leaders inspire the other ecosystem members how the ecosystem could develop. For instance, in the case of electric mobility, BMW can be such a leader .The contributors are organizations of any kind that support the ecosystem development by carrying out their tasks. The users are the addressees of any value proposition within the ecosystem. They are the buyers of the products and services. The environment defines the conditions, in which the ecosystem evolves [10]. These layers can be useful to generate different types of business models. Obviously, P2P business models are defined at the user layer. With adequate business models, private households can offer services that can be valuable for the success of the electric mobility ecosystem. But ecosystems are not static and evolve over time. MOORE (1993) defines four steps of evolution in an ecosystem. At each step, different challenges with respect to cooperation and competition have to be considered [5]. Figure 1 illustrates these steps.

Fig. 1. *Functional system perspective (Source: Moore 1993)*

These four steps: Birth, expansion, leadership, and self-renewal provide a structure for the evolution process of an ecosystem. Due to self-renewal, complete structures in systemic innovations can be destroyed, and markets can be revolutionized. Currently, the ecosystem of electric mobility is not fully developed; the electric mobility ecosystem can be said to be at the moment in the expansion phase.

System theory can also be useful to understand the systemic development of electric mobility System theory is adequate to explain complex phenomena. Systems consist of interconnected elements, which are dynamic and evolve over time [11]. If an actor leaves the system, he loses his system function [12]. SKYTTNER (1996) defines a system as "… the organized collection of men, machines and material required to accomplish a specific purpose and tied together by communication links." [13]

Every system is part of a bigger system. The demarcation of a system is a necessary, but a difficult task. For instance, the electric mobility system consists of many actors such as car manufactures, energy suppliers, users, service companies, IT suppliers, and fleet management companies.

The development of the electric mobility system can be affected by political decisions [14]. Systemic innovations, in turn, can influence the political agenda [15]. In fact, every system is influenced by factors from outside, since every system is part of a bigger system [16]. A system can be defined by its objectives or the tasks it should perform. The holistic view of a system is more advantageous than the consideration of individual elements or parts of a system [17]. Complexity is a system property; it increases, when the system states change rapidly, leading to many variations in the system behaviour. A system is called complicated, if its constituent elements and the relationships between them exhibit a high level of variety [12]. These two characteristics are valuable, because they help us to understand the electric mobility system.

This paper aims to analyse the contribution of P2P business models to the electric mobility system. Business models harmonize the whole system and ensure that it functions smoothly. Business models are not independent in an ecosystem; they are essential in order for the whole system to work [4]. Electric mobility has not achieved a wide diffusion so far, because there is a need for business

models that enable customers to see the value of the new system in comparison to the old one. The actors who contribute to systemic innovations design the functionality of the system with their individual actions. This approach is based on autopoiesis [18].[2] Hence, P2P business models can have an influence on the whole mobility system.

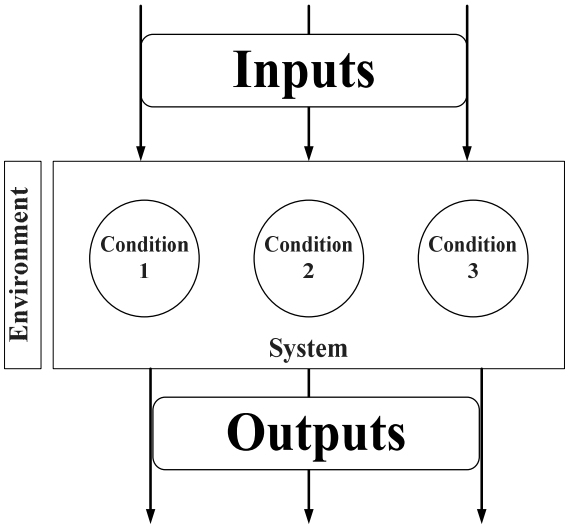

Fig. 2. *Functional system perspective (Source: Ropohl, G. 2006)*

The figure above illustrates the functional system perspective. Such a perspective only focuses on the attitudes and characteristics that are observable. The system has certain inputs coming into it and outputs going out of it. There are also observable attributes that specify the behaviour of the system. The functions of the system are determined by the behaviour conditions. Depending on the behaviour conditions of the system, a certain input can lead to varying outputs. A functional system perspective focuses on the behaviour of a system as a whole and its environment [16].

Despite the actors of the system are heterogeneous, the system can work adequately. This heterogeneity is even important, in order for the system to achieve its objectives and to exhibit the right behaviour [16]. Given the electric mobility system, we propose to analyse two scenarios based on P2P business models and their contributions to the whole electric mobility system. Unlike technical processes, in particular production processes, systemic innovations do not have obvious inputs and outputs.

3. BUSINESS MODELS AND THE P2P CONCEPT

This work focuses on the functionality of the electric mobility system and on business models that can enhance the whole system performance.

Business model literature has been growing steadily in last years. There are many attempts to operationalize a business model [19]. In general a business model is the logic how a company works [20]. It consists of many interconnected elements [21]. Within this value based perspective, each element has a specific function for the company. According to BIEGER/REINHOLD (2011), six elements are available in a business model: value proposition, value creation, value communication and transfer, value capture, value dissemination and value development [22]. A similar approach is proposed by JOHNSON (2010), who introduces the four-box-business model concept. Each box describes a business model element. The customer value proposition fulfills a customer requirement in a better way than competitors or a requirement that is not satisfied yet. The profit formula describes how the company makes money. And finally the key resources and processes that describe how the value proposition is created [23]. In this work, however, we use the business model framework by Abdelkafi et al. (2013). This framework is based on previous works in the field of business models and is comprehensive.

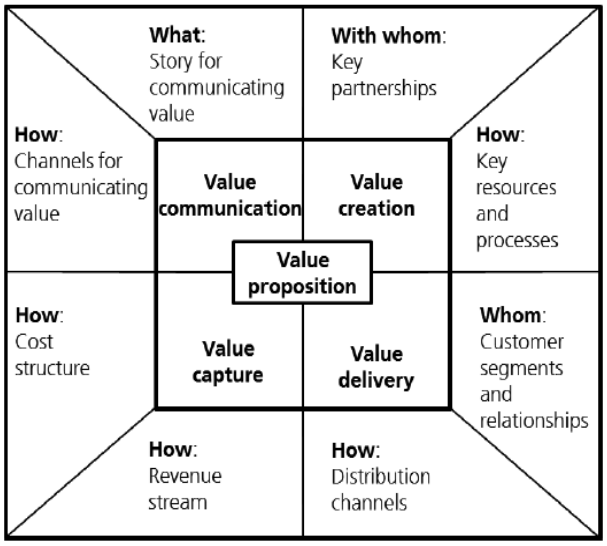

Fig. 3 *Business Model Framework (Source: Abdelkafi et al. 2013)*

The value proposition is placed at the center of this framework. This element describes the jobs to be done for the customer. In addition to the value proposition, the framework consists of four further value dimensions: value communication, value creation, value capture, and value delivery. Value communication describes how the value proposition is communicated to the customer, in particular what stories and channels are used to reach the customers. Value creation defines how the value is generated, focusing on the key resources, key processes and key partnerships that are required to produce the value proposition. Value delivery is focused on distribution channels, customer segments and the relationships of the company with them. Finally, value capture denotes the way how the company makes money and how the cost structure looks like [1].

Hence, since business models are able to contribute to the efficient functionality of a systemic innovation, it seems better to draw on an activity-based representation of business models. In this regard, ZOTT/AMIT (2010) introduce three design elements: content, structure and governance. These design elements determine the activities to be done (content), how these activities have

[2] The contrast to autopoiesis is the model of a demiurge, a person who has the power to design a system by its own.

to be connected (structure), and who has to perform these activities (governance) [24].

The impact of P2P concepts on value chains has been already recognized by SCHODER / FISCHBACH (2002). P2P concepts do not necessarily lead to the design of a new value chain, but by means of P2P concepts, customers get more control over the value generating steps in the value chain [25]. Hence, it is essential to explain how P2P business models function.

The P2P-concept was originally used in the computer industry and describes a network where the members are consumers and producers of resources [26]. Especially in the music industry, P2P business models were attractive [e.g. [26/27/28]. In lending, P2P business models are also well-established [24].

P2P concepts connect individuals. The members of the P2P network are not determined by single actors, since all members are equal [29]. Based on [30], BENDER / WEIKUM (2008) define a P2P system as.:

"… a self-organised system of equal, autonomous functional units (peers) with the aim to collaboratively use decentral resources in a network environment that avoids central services."[31]

In Peer-to-Peer business models, customers and producers or service providers are, by definition, private persons and not institutions. P2P works without central coordination; it is based on collaborative economics. The P2P concept has mainly resulted out of the advance of Internet technology that enables the offering of a value proposition based on decentral ressources [25]. In the case of electric mobility, the private car owner can offer his car to be used by a customer. The connection between customer and provider often occurs over an online platform. Both parties have to register on such a platform, and then the nearest car can be reserved for the time that is preferred by the customer [30]. This concept is already available for cars. For instance, SHAHEEN ET AL. (2012) focus on private vehicle sharing in North America and on the drivers and barriers of this concept. They postulate that with respect to the availability of private cars and the interconnectivity between the users and owners, private car sharing can be the next big trend. Furthermore, ithas the power to revolutionize the whole sector. The P2P business models are based on collaborative consumption [3/43] and shared economy [32]. Different modes of car sharing as P2P car sharing are observable. For instance, in fractional ownership, different users own together one car and can use it collaboratively. What's more, no individual owner has an exclusive right to use the car, as he can only enjoy a partial ownership.

The second car sharing model is a hybrid P2P car sharing model. The private owner gives his car in a commercial car sharing fleet, where the car can be taken by other users. Consequently, the customer does not need any personal contact to the car owner. The advantage of this model is that the costs of owning and insuring a car are partially transferred to the car sharing company. Another advantage for the car owners is that they can get access to other cars in the fleet and can benefit from privileged renting conditions.

The next car sharing model is a complete P2P car sharing system. Different private persons share their cars with other private users. The renting session is typically short term and the insurance is provided by the P2P car sharing organization that brings both parties together. This is a P2P marketplace for car sharing. The connection between car owner and customer is achieved via the internet and mobile applications [33].

Hence, P2P business models can be beneficial for systemic innovations [34]. The pure P2P business models without a commercial background are drivers of sharing activities. HUGHES ET AL. (2008) develop an analytical tool for the analysis of business model performance and use *Napster* for a practical validation of their tool. In their study, the authors show the evolution of P2P systems and postulate that legal constraints are solvable by restricting access [35]. Thus, legal aspects are critical to P2P systems. In addition, UEDA ET AL (2009) address some challenges concerning the sustainable values of products and services in a globalized world. The authors introduce their paper also with the dilemma between social and individual value of products and services. Generally they cluster different models of value creation, where the customer and producer interact in different ways. One model from the authors fits very well, because of changing environment conditions, it is difficult to make a good prediction. This case is also observable for electric mobility. Because of the openess and the less structured market, it is difficult to predict some aspects in the future such as strategy [44].

4. HOW P2P BUSINESS MODELS CAN REVOLUTIONIZE ELECTRIC MOBILITY

In order for P2P business models in the case of electric mobility to succeed, we have to take into account the mobility behaviour of the typical car user. With respect to empirical studies [36/37], we can anticipate that inhabitants of cities that own an electric car may want to drive out of the city in their free time, for example during the weekend. The inhabitants in districts outside the city typically own a traditional car with a combustion engine and drive in their free time to the city next to their home. This assumption is logical because of the shopping opportunities in both areas. In the cities, there are more stores, shops, and therefore consumption opportunities. Instead of using this offer in the cities, the typical city inhabitants want to drive outside the city in their free time. This is a strong assumption, but a study from the public transport service provider in *Munich* shows that the number of people who go out of the city and the number of people who to come to the city in their free time activities are about the same [38]. Another empirical study about the driving situation is available for *Leipzig*. By considering the smaller neighbour towns, the study focuses on the traffic in *Leipzig*. The volume of traffic is heavy on weekdays. With 31.8%, free time is the second strongest reason for any mobility [39]. A very similar result has been found in Munich. Free time activities are the strongest reason for any mobility [41].

The question is how we can match these findings with a P2P business model with potential for success.

67% of the households that are living outside the city own at least one car. These households use their cars very intensively in their free-time. In addition, the intensity of using a car is higher outside the city than inside it, because the public transportation service is well-developed in cities.

In the following, we conceptually introduce an interesting variation of a P2P business model. Under the assumption that city inhabitants want to leave the cities during their free time, and rural habitants want to come into the cities for reasons of shopping and further consumption, a good business model could contribute to decreasing the level of traffic in the town. The city inhabitants constitute the target group of electric cars. If we assume that they own one car and want to drive outside the city, they can match their driving behaviour with the inhabitants in the rural areas. In fact, they can exchange their cars, so that both groups can benefit. The inhabitants of the rural area drive with their conventional car to the city. There, they can get an electric car to be used in the city. The inhabitants of the city thus give their electric cars and get a conventional car that can be used to go out of the city. It is clear that this concept is based on several assumptions, but it definitely needs to be tested in a practical setting, in order to estimate its chances to be successful [3].

The customer value proposition is the access to long distance vehicles for electric car owners and access to electric cars for in-commuters. The electric vehicles could also provide additional benefits such as reduced parking fees or privileged parking areas. The value creation is the exchange process. Of course, a platform for exchanging cars and doing money transactions is required. The platform provider can also provide an insurance service for the drivers. The value delivery addresses customer groups that own electric and conventional cars. With a mobile application, the contact between the two partners is very easy to carry out. The point of the exchange of cars can be flexibly determined; either the gas station, or parking area, etc. With respect to value capture, costs are low, because the registered people on the platform have their own cars. The P2P business model only introduces an opportunity to earn additional money with the car. An adequate payment system can charge the customers for the type of car itself and the number of driven kilometers. The platform owner acts as an intermediary that gets fees for matching the car drivers. Value communication should address the advantages of the P2P business model. In fact, ecological driving and a great availability of cars are advantages of this system, especially in rural areas, because existing studies show that more than one car is generally available in each household [39].

The second conceptual P2P business model is based on the fact that renewable energy can be produced by private households. In 2013, 29.7 TWh were generated with photovoltaic modules. In sum 1.4 million photovoltaic modules are currently available [40]. With respect to the number of private households that are generating electricity with solar energy in Germany, it is possible to use this electricity for charging electric cars. The charging station could be installed in the gateway of the house owner, who wants to sell his renewable electricity for car charging. Beside technical and legal restrictions, the opportunity for the house owner is to generate money with the renewable energy.

With regard to the business model framework we want briefly to discuss how the business model elements can be defined. The value proposition in this case is the recharging process for the customer. The value creation is very easy for the provider. In fact, only an installed photovoltaic module is necessary to create the electrical energy. The charging station and the paying modalities are more challenging. Concerning legal restrictions, for example in Germany, a key partnership with the local energy provider can be useful. The energy provider could install the charging stations at the entrance of the house and gets paid for every charging process. The billing process can be automated and the house owner can have a mobile application that provides information on the current charging situation. Regarding value delivery, target customers are clearly the drivers of electric cars. A partnership with frequent chargers may be possible. The revenues have to be shared with the charging station operator, mainly the local energy provider. Two cost factors are essential for the P2P entrepreneur in this case: investments in the photovoltaic module and charging stations. The investments in the photovoltaic modules can also be used for the energy supply in the house. The charging station could be leased by the household or stay in the property of the local energy provider. The revenue stream depends on the kind of billing. A good overview is done by MEISTER (2010), who discusses different payment concepts and interesting financial possibilities for the operator of charging stations [42]. Currently, the pay-per-KwH-model is the most popular one. Value communication is very important for green mobility. Therefore, the charging stations should be well visible for possible prospects. Social media can be a good channel to reach possible charging prospects also with respect to mobile applications and navigation systems. Also the statement that renewable energy is shared with drivers of electric cars seems convincing in a sustainable society.

To sum up, two conceptual P2P business model opportunities were introduced and discussed. Both business model opportunities are still not exploited, although they can be beneficial for the whole system of electric mobility. This paper proposes business models that can support the diffusion of electric mobility. Of course some challenges exist, especially in the second P2P business model opportunity with regard to legal aspects. The first business model opportunity that focuses on car sharing can benefit from cooperation with professional car rental companies. In addition, the competitive challenge is important for both business model options. In both cases, private households compete with professional service providers such as energy suppliers, gas stations and professional car rental companies. We conceptualize just two P2P business model opportunities in the case of electric mobility.

5. CONCLUSIONS AND DIRECTIONS FOR FUTURE RESEARCH

In this paper, two business model opportunities are conceptually discussed. Both can benefit the users of electric cars and further possible prospects. The business model opportunity in the case of car exchange reduces the level of traffic in the cities, leading to less CO^2 emissions. Concerning the massive air pollution in mega-cities such as those in Asia, this P2P concept seems worth to scrutinize carefully. Furthermore, this concept can improve public awareness of this new mobility, since a broad community in the rural areas can use electric cars [3]. The second P2P concept offers a business model opportunity that increases the level of availability of charging points, while reducing the range fear of electric drivers [36]. The need for a comprehensive grid of charging points has also been recognized by Ueda et al. (2009): "*A vehicle that is powered completely by electricity needs a system of external source of energy, namely an electric grid with appropriate connection points.*" Furthermore, the authors discuss different challenges in the case of electric mobility. To ensure a high level of access to charging stations in urban areas, new business models are essential [44].

Both concepts can be useful to electric mobility, as they improve long distance mobility. Both P2P concepts do not need a new infrastructure because existing technical equipment (cars and photovoltaic modules) can be used to push electric mobility and accelerate this systemic innovation. Future research should investigate how the mobility behavior is affected by these two P2P business model opportunities and what possible drivers to and barriers against the success of both P2P concepts are. Furthermore, the conditions under which P2P concepts can scale up are worth investigating.

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