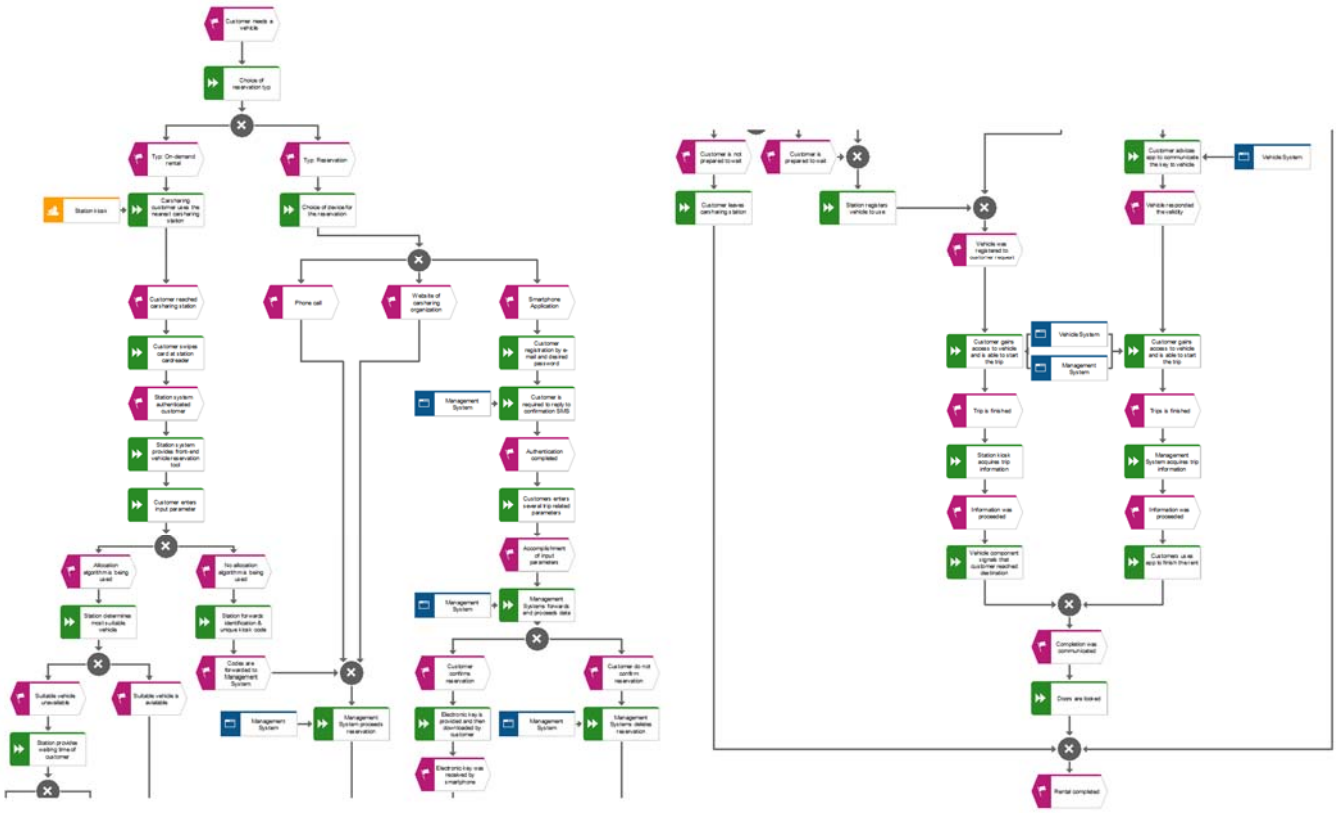
IWI Discussion Paper Series
73 (Februar 16, 2016)[1]

ISSN 1612-3646

Comparison of Standard and Electric Carsharing Processes and IT-Infrastructures

Jan Isermann[2], Kathrin Kühne[3],

and **Michael H. Breitner [4]**



Business Process: Trip Registration

[1] Copies or PDF file are available on request: Institut für Wirtschaftsinformatik, Leibniz Universität Hannover, Königsworther Platz 1, 30167 Hannover, Germany (www.iwi.uni-hannover.de)
[2] Student of Economics and Management at Leibniz Universität Hannover (jan.isermann@gmail.com)
[3] Doctoral Student, Institut für Wirtschaftsinformatik (kuehne@iwi.uni-hannover.de)
[4] Full Professor for Information Systems and Business Administration and Head of Institut für Wirtschaftsinformatik (breitner@iwi.uni-hannover.de)

1 Introducation

In the last decades, carsharing, which describes "a distinct business process wherein CSOs [carsharing operators] typically provide their members with short-term vehicle access" (Stillwater et al., 2008), became increasingly popular as an alternative form of transportation. Carsharing providers around the world recorded impressively rising numbers of active members. Within a period of five years, between 2006 and 2010, the worldwide number of registered members almost tripled to a total of about 1.25 million, whereas the fleetsize almost doubled to 31,000 vehicles in 2010 (Shaheen and Cohen, 2013). This development may mainly be accredited to an increasing environmental consciousness and sense of responsibility of vehicle users towards nature, as well as financial factors (Buchinger and Braet, 2013; Shaheen and Cohen, 2013). Including economic uncertainty, rising energy and private car ownership costs, as well as efforts for increasing vehicle efficiency in order to reduce greenhouse gas emissions, those factors are encouraging drivers to actively seek alternatives to a regular vehicle ownership. Therefore, as one of these alternatives, carsharing allows individuals to remain mobile and flexible, thus gaining the advantages of a private automobile, while avoiding responsibilities and costs that result from owning a private vehicle (Shaheen and Cohen, 2013; Markel, 2010; Stillwater et al., 2008; Katzev, 2002). Furthermore, research has shown that carsharing also actively contributes to reduce one's greenhouse gas emissions by 55 percent, while also helping to avoid other negative side-effects of an increased traffic density, for instance unsolicited congestions or air pollution in cities (Shaheen and Cohen, 2013; Lee et al., 2012; Parent and Gallais, 2002).

As worldwide greenhouse gas emissions grow nonetheless due to a continuous increase in overall transportation, the interest in so called smart or innovative mobility solutions like electric vehicles and respective carsharing concepts has grown even further (Alli et al., 2012; Barth et al., 2003; Figueiredo et al., 2002). Therefore, since electric vehicles produce little to none emissions at all, carsharing companies have deployed electric vehicles worldwide in order to test their applicability and economic viability in real environments (Shaheen and Cohen, 2013; Alli et al., 2012). However, the electric vehicle industry and e-carsharing providers are facing various obstacles in penetrating the market (Buchinger and Braet, 2013). Besides economical and organisational challenges, electric vehicles are critically renowned by customers as a result of their short driving ranges, the extensive charging times, or their high acquisition costs (Buchinger and Braet, 2013). Likewise, carsharing companies are facing issues incorporating electric vehicles in their services, since they supposedly require adjusted IT-infrastructures and Intelligent Transportation Technologies, which in turn allow for a maximisation of returns by fully exploiting the vehicles resources and the companies capacities. This is especially important for both conventional and, moreover, e-carsharing companies, considering that they have to think and act economically in the first place (Buchinger and Braet, 2013; Markel, 2010). Furthermore, as electric vehicles are comparably expensive in their acquisition, they consequently reach their amortisation point later than conventional vehicles and thus, require a frequent utilisation by customers, which can only be guaranteed by adjusting and optimising the carsharing companies IT infrastructure and associated business processes (Alli et al., 2012). Yet, since any intrusions, changes, and additions to IT systems used also have an impact on the underlying business processes, the applicable sub processes presumably have to be adapted to the new structures as well.

Despite this urgent need, research has confined itself to mostly analysing and describing essential information technologies and respective carsharing systems, subsequently creating a research gap. In order to fill this gap, this paper tries to analyse the common conventional and e-carsharing infrastructures, based-on which the business processes will be modeled and compared. Therefore, after the introduction and the description of the purpose and value of this paper in chapter one, the differences be-tween casual car rental and carsharing, as well as a brief distinction of the common carsharing systems will be provided in chapter two. The first section of the third chapter, however, deals with specific intel-ligent transportation technologies that are typically being deployed in carsharing systems and the mo-tives for their utilisation, thus allowing for a more universal comprehension regarding the structure of these initiatives. The consecutive section builds on these previous findings and relates the individual technologies with one another, thus establishing a general IT-infrastructure, based on which the model-ing of the business processes will be conducted, although due to their extent, the respective results will be presented in the appendix of this paper. In the fifth and second to last chapter, the actual compari-son of the business processes of conventional and e-carsharing systems will be conducted, therefore giving answers to the initial research question, whereas the last chapter provides both a critical acclaim concerning the results of the paper and a final conclusion.

relocation, and simulation, their holistic depiction would have meant such a severe increase in detail that the illustration of both processes would have scarcely fit in this paper. Furthermore, some differences are so minor (e.g. slightly varying variables) that their graphical depiction would have been unnecessary, but nonetheless tedious. Therefore, the choice fell on modeling a universal process, while subsequently discussing the various disparities in the following chapter. However, reducing the complexity of the overall process consequently means lowering its explanatory contribution and value. This lack of detail constitutes a problem and it would, nonetheless, still be of peculiar interest and importance for researches, practitioners, and carsharing operators alike to graphically model the respective business processes in greatest illustrative detail. Therefore, future papers could venture deeper and focus on individual tasks. By specialising in, for instance, relocation processes, it would become viable not only to completely model a representative process, but also to compare it visually to both analogous conventional carsharing procedures, as well as alternative practices being applied in e-carsharing systems.

Another issue of this paper might be the choice of studies that were examined in the course of the paper. Since the initial research was solely limited to German and English research papers, the existence of further relevant studies cannot be ruled out. This could bias the results of this paper, as the studies were conducted in well-developed industrial countries, where the infrastructure of both the road network and electrical grid are highly advanced. As follows, other countries with a less developed infrastructure could require adjustments regarding the infrastructure of the carsharing system itself, as well as respective business processes. Hence, future researchers focusing on carsharing business processes should resolve this issue by either evaluating the additional challenges in these environments, or by comparing carsharing initiatives of industrial with less developed countries.

Furthermore, not only the choice of studies might have biased the depiction of the business process, but also that solely scientific papers, which focused on rather experimental carsharing systems and initiatives, were observed. As business processes highly relate to and have a foundation in reality, examining the carsharing initiatives from a customer's perspective could have provided further insights towards an integrated business process. This is especially true when it comes to subsidiary processes that are relatively unimportant in scientific evaluations, but, nevertheless, have a high relevance for carsharing operators and customers alike. One of those examples could be the billing process, as in the research papers, it was - if ever - merely described. In most cases, the respective description was reduced to the reference that customers are obliged to pay monthly, as well as fixed fees per mile and minute. Therefore, further information on common and potential pricing mechanisms and corresponding incentives were omitted, since they were not deemed important in the first place. As for the business process, by going through an actual rental and billing process of an established carsharing provider, further knowledge could be contributed.

6 Conclusion

As the business processes of both conventional carsharing companies and their electric vehicle counterparts have probably never been illustrated holistically, the purpose of this paper was, on the one hand, to examine respective and common carsharing infrastructures, their systems in-use, and finally, on the other hand, to model and compare the associated business processes. Therefore, after the definition of terms and distinction of the various forms of carsharing programmes in the first and second chapter, the diverse intelligent transportation technologies and reasons for their implementation in carsharing initiatives were discussed. This was accomplished by including the findings of carsharing concepts being described in a variety of assorted case studies that encompassed both electric and convential carsharing programmes. Thereupon, it has been shown that applying intelligent transportation technologies is highly advisable and very common, since it not only strongly impacts the economic viability of carsharing initiatives through an increased efficiency, but also improves the customers' convenience and satisfaction thereof.

Furthermore, as the potential of these technologies cannot fully be realized when being utilised individually, they usually are integrated as technology bundles into bigger systems. Generally, these systems would be separated as per their functions and the localisation of the processes being supported by them. Thus, in most studies the carsharing operators applied trip registration, vehicle, and management systems. The vehicle system usually provided data being used by the management system,

supported the customer's trip by enabling navigational aids and means of communication, and partly managed vehicle access. Moreover, the management system comprised of the most processes, also constituted as the prime processes, thus being the heart of the carsharing infrastructure, since it facilitated the general fleet management, as well as vehicle access, billing, and evaluation of the carsharing system itself. Last but not least, the trip registration system, which is localised in either carsharing stations or modern smartphone apps, was found to support processes that generally could be handled by the management system itself, but in some cases is conducted by the former due to certain advantages. Based-upon these systems, their infrastructure, and functions, the underlying business processes were derived in the second part of the third chapter. However, as it was found during the examination of case studies that both types of carsharing programmes tend to apply the systems and technologies, these associated business processes were designed to fit both settings.

Anyhow, the initial purpose of this paper was to conduct a comparison between the business processes of both carsharing systems. However, as their differences were so minute and therefore hardly representable, the comparison was conducted not graphically but written in chapter four. These differences mainly concerned the structure of the sub processes, such as the choice and setup of mathematical models and respective algorithms concerning the relocation and distribution of vehicles and the evaluation of the carsharing system itself. Notably, one should refrain from generalising the discussed findings, as the setup and choice of systems still depends strongly on both contextual and environmental factors, as well as preferences of the carsharing providers and the general purpose of the system. Nonetheless, this paper contributes to a general understanding of what characterises carsharing programmes and which systems and functions might be necessary to operate them sustainably and user-friendly.