

# Development of a Carsharing Demand Estimation Approach

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# 1. Introduction and Motivation

Carsharing nowadays has advanced to one of the most promising modes of transportation. Besides being able to cover long or short distances with a high flexibility, it is also facing the challenges of modern urban infrastructure like environmental pollution, parking pressure and rising costs of energy (*Degirmenci and Breitner, 2015*). As part of the new so-called “sharing economy” it also suits the lifestyle of young generations focusing on life quality. Existing carsharing systems support the positive effect on densely populated areas. *Cervero and Tsai (2004)* evaluated the effect of carsharing in San Francisco, USA, and determined that during a two years lasting observation about 30% of users sold at least one personally owned car while two third waived to purchase a new one. Speaking of numbers, their calculations show that during those two years one carsharing vehicle takes seven private cars off the road. In addition to this alleviation in traffic, greenhouse gas emissions are reduced due to the usage of small fuel-efficient cars. Although travelling is conducted more judicious, carsharing users benefit from an enhanced mobility in terms of more destinations reached in less travel time. This example reveals the potential of carsharing in our society.

While on the one hand carsharing is gaining more and more relevance, it is on the other a relatively new phenomenon which offers a wide range of possible research to scientists (*Danielis et al. 2015*). In past, many trial and error approaches were conducted to run profitable carsharing businesses around the world (*Sonneberg et al., 2015*). Theoretical contribution in terms of an economic approach closely linked in a decision making process could be beneficial not only for business purposes. Public authorities trying to integrate carsharing into a sustainable urban transportation concept are also potential recipients (*Huwer, 2004*). For planning purposes an accurate demand estimation is required to introduce, maintain and adjust carsharing systems. One of the major issues in doing so is the fact that every city or area is facing unique

characteristics which are hard to capture in one simple equation. Adding the “human factor” makes it even more challenging to model demand estimation. This is due to essential mobility patterns which are subject to complex, rational and irrational as well as contextual factors (*Danielis et al., 2015*). Much research is done regarding single aspects of demand in the field or carsharing but a holistic or at least a partial approach to estimate its potential is still lacking. This thesis aims to tackle this current gap by providing a practically applicable method guiding decision makers through this endeavor.

*RQ: Which factors should be considered to estimate the demand for carsharing systems?*

This thesis is structured as follows: first, a literature overview on carsharing demand estimation is provided. Second, concepts are identified and categorized to isolate potential demand components. These components are compounded to an overall demand estimation approach and illustrated with examples. An alternative approach is presented, followed by limitations and recommendations. Finally, all aspects are summarized and an outlook is provided.

## 5. Conclusion and Outlook

Carsharing as a growing and promising part of science and society bears a potential to significantly contribute in solving major challenges of today's urban living. Positive effects revealed in cities with a history in carsharing creates the hope of transferring similar developments to other areas by simply introducing this service. However, carsharing has its own critical success factors which decide on whether or not it will turn out beneficial for a certain area. At the beginning, demand is one of these crucial components which needs to be determined with maximum accuracy. Therefore, practical methods for estimation purposes are required.

This thesis provides a literature overview on carsharing demand estimation by reviewing and analyzing underlying concepts of various publications. Potential components for a holistic economic approach are isolated and classified among five identified categories: Location demand / supply, demographical characterizes, geographical characteristics, travel behavior, and user attitude. Within those categories, all components are examined regarding their potential contribution to an overall demand estimation. Relevant components are aggregated and serve as a theoretical method to be applied to population statistics for the determination of a number of potential carsharing service users. Additionally, thresholds are formulated to determine a proportion of individuals that most likely is going to participate in carsharing programs. This quantitative value receives an additional factor containing the average usage of carsharing service and finally results in a demand estimation. An example based on past research is provided and further development opportunities are defined.

After all, a second approach is illustrated which waives the need of population data and provides an alternative survey-based method. This approach is using the

assumption that a potential user waives other modes of transportation if the generalized costs exceed those of carsharing services. A more importantly influencing factor besides different transportation options is the consideration of psychological cost and benefit components as well as transaction costs.

With respect to the research question a catalogue of potential components is provided as well as adjustable to underlying data collections. Two theoretical approaches including practical guidelines are presented and illustrated by means of examples conducted in Italy, Switzerland and the USA.