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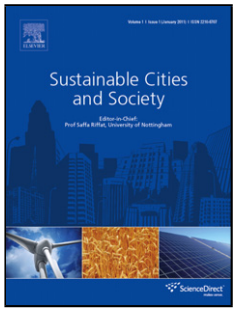

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Author: Francesco Ferrero Guido Perboli Mariangela Rosano
Andrea Vesco

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Car-sharing services: an annotated review

Francesco Ferrero[c], Guido Perboli[b,d], Mariangela Rosano[b], Andrea Vesco[a]

[a] *Istituto Superiore Mario Boella, Turin, Italy*
[b] *ICT for City Logistics and Enterprises - Politecnico di Torino, Turin, Italy*
[c] *Luxembourg Institute of Science and Technology, Luxemburg*
[d] *CIRRELT, Montreal, Canada*

Abstract

The growth of car-sharing services as a new and more sustainable way of transportation is shifting the private mobility from ownership to service use. Despite the emerging importance of this type of mobility and the large number of papers present in the scientific literature, to the best of our knowledge no extensive and structured analysis has been performed to classify the research and determine the mainstreams. Aim of this study is to introduce a taxonomy and analyze the different aspects of car-sharing, including the different car-sharing services and the research questions considered in the papers. We analyze and classify 137 papers, covering the last fifteen years of research and deriving an insight of the mainstreams. Finally, we deeply study the trends and research perspectives of the literature, showing the unbalancing between the literature related to the operational level and the economic, business development and customer validation aspects.

Keywords: Car-sharing, Taxonomy, Optimization, Business models.

1. Introduction

In the last years the growth of car-sharing services as a new and more sustainable way of transportation is shifting the private mobility from ownership to service use. The basic idea of car-sharing is quite simple: share the usage of a vehicle fleet by members for trip making on a per trip basis. Although the first shared used vehicles system can be traced back to 1948 in the city of Zurich (Switzerland), motivated by economic reasons, in the following years other attempts of public car-sharing systems were not successful. In the 1980s, several successful car-sharing programs were started, with a consolidation in the early 1990s, thanks to a new awareness of the citizens and a real burst due to a more pervasive diffusion of ICT and mobile services in 2000s. Car-sharing increases mobility for community members to reach destinations otherwise inaccessible by public transit, walking or biking, while increasing the citizens' awareness about the social and environmental impact of using private cars. It encourages and supports multi-modal communities by providing an additional transportation option. From the point of view of building a sustainable city, the vehicles used in car-sharing are typically fuel efficient and lead to positive effects in reduction of urban emissions and city congestion [111].

Recently, also car producers started to enter directly in the market, as Daimler, BMW and FCA group, are directly involved in car-sharing operations with the scope of finding new channels to market the produced cars [9, 147, 144, 146, 145]. Presently, some large companies start to exist Worldwide, as Zipcar with over 900,000 members and 11,000 vehicles [167] and Car2Go with 2,000,000 members and 14,000 cars in several countries, including China [162, 68]. So, the market is growing fast and with this increasing demand also the demand of better understanding and control of the system increases. In fact, car-sharing is not just a matter of business or fleet optimization, but creates a complex system made by different actors, including citizens, public authorities and municipalities, companies. The system becomes complex for the strong links between the actors, as well as for the implications on the governance of a city when a large car-sharing service is introduced, as the integration with the existing public transport network and the policies for letting different companies to compete in the same urban area.

Despite the emerging importance of this type of mobility and the large number of papers present in the scientific literature, to the best of our knowledge no extensive and structured analysis has been