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Business models and tariff simulation in car-sharing services

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ABSTRACT

The paper considers an important new and growing business in sustainable transportation, car-sharing services. This is, to our knowledge, the first comprehensive analysis of car-sharing services from the business model point of view. Specifically, we apply and introduce a standard and reproducible way to compare the business models of car-sharing companies. Our analysis results show that a crucial issue in defining car-sharing services is the creation of customized tariff plans. Thus, as a second contribution of our paper, we introduce a specific solution based on Monte Carlo simulation. This tool simulates the existing price and tariff policies or the introduction of new ones for different profiles of car-sharing users, according to different mobility needs and the traffic congestion of the urban area. As an example, we use our methodology to provide an in-depth description of the situation in the city of Turin, Italy.

1. Introduction

According to the Intergovernmental Panel on Climate Change (IPCC), the transport sector was responsible for 11% of the increase in total annual anthropogenic greenhouse gas (GHG) emissions between 2000 and 2010, estimated in 10 Gt of carbon-dioxide equivalents, with 14% of world GHG emissions released by the transport business. Considering only urban areas, approximately 80% of global GHG emissions originate in cities, with a significant share corresponding to transport activities (Firnkorn and Müller, 2015a; World Bank, 2013). The prevalence of private vehicle utilization for mobility purposes in cities with low-density development configures a largely irreversible pattern, which must be avoided in future urbanization and reversed in many existing cities that suffer from the consequences of this development model. In 2014, there were 1 billion passenger cars worldwide, and this number is projected to increase to 2.8 billion by 2050 (although this figure might be mitigated by city management policies). The consequences of the predominant use of individual vehicles in car-centric cities are well known: congestion, noise, higher energy use, parking shortage, inefficient land use, pollution, waste, and climate changes (Firnkorn and Müller, 2015a; Perboli et al., 2014).

Among the alternatives, car-sharing is an innovative mobility option that arises as one of the solutions for mobility improvement and reduction in private car utilization. Car-sharing systems are becoming increasingly popular all over the world, and the number of available shared vehicles has also increased because new vehicles have been added to the fleets of existing operators and new operators have begun their activities. Car manufacturers (such as Daimler, BMW, and FCA group) are directly involved in car-sharing operations, searching for new channels to market their cars. As car-sharing emerges as a mainstream alternative for mobility, the competition among different players is increasing, as is the motivation for the pursuit of further development of services and sources of differentiation between new competitors. Despite the emerging importance of this type of mobility and large number of papers

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published in the past two decades, there is a lack of studies on the car-sharing services that link the business models of the companies operating the service, their business development, and operational models (Ferrero et al., forthcoming).

The aim of our research is to fill this gap, providing the first analysis of the business models of car-sharing companies, applying it to a set of companies operating in the same catchment area, and comparing them. Thus, the first contribution of this paper is to provide a solid and reproducible methodology to compare the behavior of car-sharing companies, starting from the value proposition and business model up to the definition and validation of the tariffs to use, in order to increase market penetration. Four different car-sharing companies are selected for this analysis: Car2Go (Car2go, 2015; Firnkorn and Müller, 2011), Enjoy (Enjoy, 2015), Car City Club (IoGuido) (IoGuido, 2015), and BlueTorino (BlueTorino, 2016). These companies are chosen to cope with a large set of possible actors, including two large-sized companies sharing the same catchment area (Car2Go and Enjoy), a traditional station-based company (IoGuido), and a large company using a fleet of green vehicles (BlueTorino). Moreover, all of these companies have a part of their catchment area in common: the Turin urban area. A comparative analysis of the companies is conducted, highlighting the main aspects of the companies' business models and the different solutions used to create value and competitive advantages through service differentiation.

The second contribution to the literature is related to the tariffs and customer segments that should be of interest. In fact, car-sharing services are moving from a single tariff based on time or distance to a more complicated mix of offers, as occurred in the Telco market about 10 years ago. The big difference in the car-sharing market is the availability of a consolidated database on user preferences. Thus, we develop an evaluation tool for the economics of car-sharing utilization by introducing a Monte-Carlo-based simulator. This tool simulates the existing price and tariff policies or the introduction of new ones for different profiles of car-sharing users, according to different mobility needs and the traffic congestion of the urban area. Due to the presence of all of the companies under study in the urban area of Turin and to the availability of a large set of data related to the traffic congestion (Perboli et al., 2017b), Turin is chosen for our simulations. The information on the different car-sharing companies is collected through the company websites and other public documents. After the data collection phase, information on different car-sharing providers is compared using the GUEST methodology (Perboli, 2016; Perboli and and Gentile, 2015), in order to find commonalities and differences between different business strategies. The data collected in this first phase are also used to set the parameters for the Monte-Carlo-based simulator, with the aim to calculate the costs related to car-sharing usage for different customer profiles, and to compare them with the costs related to car ownership.

The remainder of the paper is organized as follows. Section 2 recalls the relevant literature. Section 3 introduces GUEST, the Lean Business methodology applied in the study and data gathering. Section 4 presents the selected car-sharing operators and their business models, while a comparative analysis of the companies and their business models is presented in Section 5. The simulation environment of tariffs and user costs is presented in Section 6, while the resulting comparison of the cost structures of the service utilization of the analyzed car-sharing companies is discussed in Section 7. Finally, the conclusions are reported in Section 8.

2. Literature review

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, there is just one study in which an extensive and structured analysis has been performed, in order to classify the whole research field and determine its main streams (Ferrero et al., forthcoming). In fact, partial visions and state-of-the-art reviews of car-sharing exist, but there is a lack of global vision (Jorge and Correia, 2013; Laporte et al., 2015; Shaheen et al., 2015). Existing works can be split into two main groups: studies considering the technical and modeling aspects (Agatz et al., 2012; Furuhata et al., 2013; Laporte et al., 2015; Schmöller et al., 2015; Wagner et al., 2016) and papers dealing with the business perspectives of car-sharing obtained through surveys (Chan and Shaheen, 2012; Shaheen and Cohen, 2013; Firnkorn and Müller, 2015b; Zoepf and Keith, 2016). Regarding the first group, in Schmöller et al. (2015), the booking data of a German free-floating car-sharing system are analyzed in order to identify the factors influencing customer demand, finding that socio-demographic data are suitable for making long-term demand predictions. From the perspective of car-sharing providers, Wagner et al. (2016) present a method that provides strategic and operational decision support, in order to explain the spatial variation in car-sharing activity in the proximity of particular points of interest. Free-floating electric car-sharing fleets are addressed in Firnkorn and Müller (2015b), through an online survey of Car2Go users, with the aim to analyze the willingness to adopt these services as a substitute for car ownership. Zoepf and Keith (2016) analyze the results of a discrete choice survey administered to members of a North American car-sharing operator, with the aim to quantify how users value price, distance, schedule, and vehicle type. Recently, the increasing interest in autonomous vehicles has been addressed in Krueger et al. (2016), in order to identify the characteristics of users that are willing to join a car-sharing service based on these types of vehicles. The results show that service attributes, such as travel cost, travel time, and waiting time, may be critical to determining the use and acceptance of shared autonomous vehicles. Considering the collaboration between governments and private companies, in Terrien et al. (2016), the authors propose a framework to foster the collaboration between the public and private sector, with the aim of providing recommendations for both sectors. Finally, Kent (2014) analyzes how car-sharing services can address the health problems connected to the use of private cars, highlighting the potential health benefits related to the adoption of more active modes of transportation.

Regarding survey-based studies, they mainly use expert opinions to determine the key factors of the potential growth of the car-sharing market. Shaheen and Cohen (2007) collect 33 expert surveys on an international basis (21 countries), showing that the main key factors characterizing car-sharing operations are related to member-to-vehicle ratios, market segments, parking approaches, vehicle and fuel variety, insurance, and technology. Similarly, in Shaheen et al. (2009), a 10-year retrospective in the Canadian and U.S. markets is used to analyze the car-sharing evolution in North America through the three phases of market development: market