

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. In more detail, we apply and introduce a standard and reproducible way to compare the business models of car-sharing companies. One of the results of our analysis is that a crucial issue in defining car-sharing services is the creation of customized tariff plans. Thus, as 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 traffic congestion of the urban area. As an example, we use our methodology to describe in depth the situation of the city of Turin, in Italy.

Keywords: Car-sharing, Business models, GUEST, Lean Business, Tariffs simulation.

1. Introduction

According to the International Panel of Climate Change (IPCC), the transport sector was responsible for 11% of the increase in total annual anthropogenic GHG emissions between 2000 and 2010, estimated in 10Gt 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 are originated in cities, with a significant share corresponding to transport activities (World Bank, 2013; Firnkorn and Müller, 2015a). 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 predominant use of individual vehicles in car-centric cities are well known: congestion, noise, higher energy use, shortage in parking, 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 answers for mobility improvement and reduction in private car utilization. Car-sharing systems are increasingly popular all over the world, and the number of available shared vehicles also

increases because new vehicles are added to the fleets of existing operators and new operators start their activities. Car manufacturers (such as Daimler, BMW and FCA group) are directly involved in car-sharing operations, searching new channels to market their cars. As car-sharing emerges as a mainstream mobility alternative, the competition among different players is increasing and is also increasing 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 the large number of papers published in the past two decades, it emerges a lack in the car-sharing services literature: an absence of studies linking the business models of the companies operating the service, their business development and the operational models (Ferrero et al., 2017).

Aim of our research is to fulfill this gap, providing the first analysis of 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 the business model up to the definition and validation of the tariffs to use in order to increase the market penetration. Four different car-sharing companies were selected for this analysis: Car2Go (Car2go, 2015; Firnkorn and Müller, 2011), Enjoy (Enjoy, 2015), Car City Club (IoGuido) (IoGuido, 2015), BlueTorino (BlueTorino, 2016). The choice was done in order 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), a large company using a fleet of green vehicles (BlueTorino). Moreover, all those companies have a part of their catchment area in common: 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 the customers segments that should be interested. In fact, car-sharing services are moving from a single tariff based on time or distance to more complicated mix of offers, as happened in the Telco market about 10 years ago. The big difference, in the car-sharing market, is the availability of a consolidated database of data about the user preferences. Thus, we develop an evaluation tool of 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 traffic congestion of the urban area. Due to the presence of all 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., 2015), Turin was chosen for our simulations.

The information about the different car-sharing companies are collected through the company websites and other public documents. After the data collection phase, information about different car-sharing providers are compared using GUEST methodology (Perboli, 2016; Perboli and Gentile, 2015), in order to find commonalities and differences between different business strategies. 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 paper is organized as follows. Section 2 recalls the relevant literature. Section 3 introduces GUEST, the Lean Business methodology applied in the study and the 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. Finally, the simulation environment of tariffs and user costs is presented in Section 6, while the resulting comparison of cost structures of the utilization of services of analyzed car-sharing operators is discussed in Section 7. Finally, 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 mainstreams (Ferrero et al., 2017). In fact, partial visions and state of the art reviews of car-sharing exist, but there is a lack in terms of global vision (Jorge and Correia, 2013; Laporte et al., 2015; Shaheen et al., 2015). Existing works can be mainly split in two 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 by 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 the 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 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 on-line survey of Car2Go users, with the aim to analyze the willingness to adopt these services as a substitute of 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 type of vehicles. Results show that service attributes, such as travel cost, travel time, and waiting time, may be critical to determine 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 public and private sector, with the aim to provide recommendations for both sectors. Finally, Kent (2014) analyzes how car-sharing services can address health problems connected to the use of private cars, highlighting the potential health benefits related to the adoption of more active transport modes.

Regarding survey-based studies, they use mainly expert opinions to determine the key factors of car-sharing potential market growth. Shaheen and Cohen (2007) collect 33 expert surveys on

an international basis (21 countries), showing as the main key factors characterizing car-sharing operations are related to member-to-vehicle ratios, market segments, parking approaches, vehicles and fuels variety, insurance, and technology. Similarly, in [Shaheen et al. \(2009\)](#) a ten years retrospective in Canada and U.S. market is used to analyze the car-sharing evolution in North America through the three phases of market development: market entry and experimentation, growth and market diversification, and commercial mainstreaming. Based on a 26 existing organization survey in North America, [Shaheen et al. \(2006\)](#) shows that car-sharing membership growth potential is between 6,9% in Canada and 12,5% in U.S. The same study identifies car-sharing education, impact evaluation, and supporting policy approaches as the key factors for car-sharing growth. Unfortunately, the findings of these surveys are quite limited due to the methodology in use (expert surveys only) and disregard the underlying business model. Finally, [Shaheen and Cohen \(2013\)](#) give a large depiction of car-sharing services again by a survey over 26 experts, showing the directions of market growth, but again without a clear description and comparison of the Business Models.

To our knowledge, [Beutel et al. \(2014\)](#) is the main study considering the business of sharing mobility services. In details, the authors mainly focus on car-pooling, using a framework linking business factors and service strategies. The framework considers service aspects, partially considering additional issues, as the business model, its link to the business development and the value proposition of the different car-sharing companies. More recently, different pricing schemes are analyzed in [Ciari et al. \(2015\)](#) in order to define how different pricing strategies can lead to different service demand. Geographic, financial, and environmental factors are examined in [Rabbitt and Ghosh \(2013\)](#) using multiple alternative scenarios, applied to a collected travel information of the Irish population in order to evaluate the market potential of car-sharing. Results show how car-sharing systems could lead to cost savings for members, reduction of travel related pollution, and increase of share of sustainable modes of travel.

While such a lack of business model based perspective might be partially tolerated in a pioneering phase, it must be compulsorily considered in a more mature phase of the market ([Osterwalder and Pigneur, 2010](#)). Moreover, there is a lack of studies focused on the economic implications of car-sharing membership in the daily routine of the members.

This issue is addressed in this paper. First, a full and detailed study of the value propositions and the business models of four car-sharing companies competing in the same catchment area is presented. Second, an analysis of the cost benefits related to car-sharing membership for different customer profiles, compared with the costs related to car ownership is performed. In particular, analyzing two different car-sharing modes (traditional and free floating), it emerges how the free floating mode in conjunction with an aggressive and well studied tariff scheme can also push effectively the usage of green vehicles, and electric vehicles in particular.

3. Methodology and theoretical basis

Although there are already extensive studies concerning the potential impacts of car-sharing, the user behavior and potential demands and also case studies of operating companies, few studies have been conducted through a comparison of different car-sharing companies. More specifically, there is a lack in the analysis of the coexistence of different car-sharing companies

in the same environment and how they can operate in a competing scenario (a situation that becomes more common given the car-sharing market growth and the entrance of new players in the market). The definition of the methodology is crucial. On one hand, the relative novelty of the car-sharing services pushes to consider the methods developed in the literature for startups (Osterwalder and Pigneur, 2010; Ries, 2011). On the other hand, the methodology should be adaptable to existing companies and repeatable. For these reasons, we adopt the GUEST methodology, developed in the past years by Perboli and Gentile (Perboli, 2016; Perboli and Gentile, 2015). GUEST is a lean business methodology extending the work done by Osterwalder (Osterwalder and Pigneur, 2010) and all the Lean Startup movement, adapting their results to the environment of already existing companies and to products or services of companies which are actors of a Multi-Actor Complex System (MACS). The GUEST methodology is originally a strategic methodology for supporting the actors in a Multi-Actor Complex System (MACS) in taking their decisions during the development of new products and services. One of the main aspects of this methodology is the standardization of the heterogeneous tools usually used for the business development. In this paper, the standardization capabilities of the GUEST methodology are exploited with the aim to compare the strategies of the different car-sharing operators examined. GUEST is the acronym of the 5 consecutive steps of the methodology itself, which have the following meaning:

- Go: a full description of the company profile, its present behavior and business development status, its environment, the external actors in the system and their interactions;
- Uniform: the knowledge of the system must be assessed in a standard way, in order to obtain a shared vision of the MACS. In particular, in this phase the governance and the business models are explicitly described by means of the Business Model Canvas (Osterwalder and Pigneur, 2010);
- Evaluate: the governance and the business models are assessed in a series of actions. The full structure of the costs and of the revenues is explicitly described in order to evaluate the goals of the initiative. Moreover, a series of problems and opportunities are identified, as well as the actions able to manage them and the KPIs to measure the effectiveness of the actions;
- Solve: given the specific problems and the actions highlighted to cope with them, a list of operational models are proposed;
- Test: the actions are actually implemented in case studies and their performance are evaluated. Moreover, the findings of the actions are disseminated according to the Results Dissemination Plan.

Regarding the present application of GUEST to car-sharing services, the five steps were declined as follows:

- Go: the data of the car-sharing companies are gathered by means of primary data;
- Uniform (Section 4): for each company, a Business Model Canvas (BMC) is derived;

- Evaluate (Section 5): a deep analysis and comparison of the BMCs is performed, bringing out as the main key linking factor between the business and the operational models of car-sharing companies the tariffs evaluation. So, it is a priority to have a tool able to evaluate the impact of tariffs on different types of customers;
- Solve (Section 6): a Monte Carlo method is developed to obtain, for a given customer type, the real cost paid by users under real urban areas congestion rates;
- Test (Section 7): the Monte Carlo method is then tested on three typical customer types (Commuters, Professional users, Casual users) in the urban area of a medium-sized city, Turin.

The primary data needed for the first step (Go) consists in information about the companies included in the analysis, regarding their strategies and business aspects. The main sources were financial statements and other public data made available by companies listed in stock markets, the company web sites and the official data given by the companies themselves. Other sources were scientific publications focused on the companies included in this study (when available), public contracts in case of publicly owned companies and regulation contracts for the operation of private companies.

4. Business Model Canvas

The aim of the analysis of the company's business models is to identify the resulting differences and similarities between different service modes, including round trip car-sharing, point-to-point station based car-sharing and free-floating car-sharing. The pool of companies includes different private sector and public operators in order to understand eventual differences in the business models of both sectors. Furthermore, another objective is the understanding of the implications of electric vehicles in the business model, in fact a company operating only with electric vehicles (BlueTorino) is included in the comparison.

A description of the selected car-sharing companies is conducted based on the identification of their main business aspects, which are represented with the utilization of the Business Model Canvas (BMC). The BMC, a strategic management and entrepreneurial tool (Osterwalder and Pigneur, 2010), illustrates in a visual way the business model of a company or organization, which, according to Osterwalder, describes the rationale of how an organization creates, delivers and captures its value. Given its user-friendly display of information in a graphical template, it allows an easier understanding of a company, the creation of alternative scenarios and the evaluation of possible trade-offs between the elements that compose the system.

For these reasons, the construction of the BMC for each company studied was considered a pertinent methodology to endorse a comparative analysis. The key factor determining the success of the canvas can be explained by the immediate display of the main information needed to determine the areas in which the managerial team should concentrate its efforts. Moreover, the relationships between the elements of the organization and the way they should be logically linked are presented in an efficient way.

The Business Model Canvas consists in nine different building blocks, which are defined as follows.

- Customer segments: it defines the different segments (of people and/or organizations) a company aims to reach and serve.
- Value proposition: the value proposition of a company is the combination of products and services the company offers to satisfy its customer segments' needs. Basically, it determines why customers choose one operator according to the value the company creates to clients with the mix of services and products delivered.
- Channels: it defines how a company reaches and communicates with its customer segments to deliver a value proposition. The communication, distribution and sales channels comprise the company interface with its clients, playing a very important role in the customer experience.
- Customer relationships: it specifies the types of relationships a company establishes with specific customer segments, enabling clients acquisition and retention and business development.
- Key resources: the key resources are the assets needed to guarantee the company operations, the relationship with the customers, the creation and offer of a value proposition and the revenues.
- Revenue streams: is summaries the sources of the revenues the company generates from the commercialization of its products and services to each of its customer segments.
- Key activities: this block displays the most important actions a company must take on a regular basis in order to offer a value proposition, reach markets, maintain customer relationships and earn revenues.
- Key partnerships: it determines the network of partners and suppliers necessary to make the business model operate correctly. Through the creation of partnerships, companies can optimize the allocation of resources and achieve scale economies, reduce risk and uncertainty in the competitive environment, acquire particular resources and activities, compete in broader markets, promote their brands and reach new clients.
- Cost structure: the main costs incurred to operate a business model are detailed, including the cost for the acquisition of key resources, partnerships and activities.

4.1. *Car2Go*

Car2Go, a subsidiary of Daimler AG, was founded in 2008 in the city of Ulm, in Germany, and currently offers car-sharing services across 30 cities in 8 different Countries in Europe and North America, serving over one million customers with about 13000 vehicles. The company is the first one operating a free-floating car-sharing service, and is one of the biggest players on the car-sharing market worldwide (Car2go, 2015; Firnkorn and Müller, 2011). The business model is the same in every location the company operates, offering free-floating rentals and its business model is summarized in the Business Model Canvas in Figure 1.

A key element of Car2Go strategy is operating in large scales in the cities, covering the most important central areas with a high number of vehicles in the fleet. As a result, the company aims

to meet the customer demands with high availability of vehicles, generating greater revenues and guaranteeing higher customer satisfaction. The characteristics of the vehicle fleet also play a key role on brand recognition: the fleet is completely composed of Smart ForTwo vehicles, gasoline or electric powered (recently introduced in some selected cities), produced by Smart Automobile, a division of Daimler AG. All the vehicles are painted in white and blue with company name, logo and slogans to create a strong visual identity that allows the vehicle to serve as a marketing channel, increasing brand recognition.

Subscription fees (charged upon the registration of new customers) and rental fees (including rental, fuel consumption, mileage, insurance, parking in authorized areas and maintenance) are the two main revenue streams for the company.

Customers can locate and reserve a vehicle through Car2Go website, by means of a smart-phone application or directly on the street, where the car is parked; the website and the application serve also as marketing and communication channels. Car2Go has mainly focused its marketing efforts in the segment of young adults, which corresponds to a relevant percentage of users, and corporate clients. Car2Go value proposition is based on delivering an innovative and environmental friendly transportation service, offering flexible urban mobility. The service has been designed in order to complement available transportation alternatives, meeting customer demands that are not satisfied with public transportation services or with the use of private vehicles; the value proposition is disclosed through the website and the mobile application. Other channels to reach the population and conquer new clients are marketing campaigns launched in areas of high circulation of people in the cities, especially when the company is starting its operations in a new site. Customer relationships are automated, and the customer interface consists of the website and the application, which are developed to provide all the necessary means for customers to help themselves in a self-service basis.

In order to leverage its operations, the company works in partnership with local governments, whom can collaborate giving public spaces for designated parking areas or establishing agreements for the use of standard parking spots by the company customers and for the free circulation in limited traffic areas. A key partnership has been established with Europcar, an international car hire company, with the aim to take benefit from the extensive knowledge of the car rental company on the areas of fleet management and logistics and from cross-selling and cross-marketing practices. In order to save personnel costs and maintain the cars in usage conditions, the company also establishes a partnership with its own clients, stimulating them to refuel the vehicles in exchange for free minutes of the service.

4.2. Enjoy

Enjoy, a car-sharing company created by ENI, an Italian oil and gas company, started operating in Milan in the end of 2013 with great success: besides Milan, it is already present in Rome, in Florence and in the first semester of 2015 launched its services in Turin. Enjoy business model is based on free-floating car rentals; customers can register themselves for free in the company website and the service becomes immediately available (Enjoy, 2015). The business model is the same in every location the company operates, offering free-floating rentals and its business model is summarized in the Business Model Canvas in Figure 2.

The main customer segments Enjoy serves are, similarly to the other car-sharing companies, private users and corporate clients. Enjoy charges a fee per minute of utilization, which already includes costs with fuel, parking, maintenance and insurance, but hourly and daily discounted fees are also available. In agreement with local authorities, Enjoy vehicles are allowed to circulate in limited traffic zones in the city centers and can be parked in regular paid public parking spots; the municipalities, on the other hand, usually fix a maximum limit for the number of vehicles operating on the fleet and charge an annual fee per active vehicle.

Together with ENI, Enjoy main partners are Trenitalia, the main Italian train operator company (the companies have agreements for the integration of services and mutual collaboration), FCA (Fiat Chrysler Automobiles), an Italian car manufacturer (supplier of the Fiat 500 fleet, painted in red and carrying the company logo on the doors), and CartaSi, a credit card company with which Enjoy has specific agreements for the payment system and services. The partnership with Trenitalia is strategic for Enjoy in its focus on corporate clients, which represent an important customer segment. Both companies benefit from cross-marketing, as each company announces the partner services in their customer channels. The company has also established partnerships with other supplier companies, e.g. a company specialized in vehicle cleaning, a uniform supplier for the service team, etc. Other important partnerships must be negotiated with the local municipalities for the regulation of the service and the guarantee of circulation and parking permits for service users in standard public parking spots inside the area covered by the service.

Similarly to other car-sharing companies, other value propositions are the accessibility, flexibility, practicality and environmental friendly characteristics of the service.

Customer relationships are automated, and the customer interface consists mainly of the website and the mobile application, which are developed to provide all the necessary means for customers to help themselves on a self-service basis; a 24 hour operating call center is also available for customer assistance. Enjoy does not charge registration or fixed annual fees to its clients. Therefore, rental fees are the main revenue stream: the company charges an all-inclusive per minute fee.

Enjoy also incurs in paying municipalities annual fees in order to be allowed to operate and benefit from specific terms agreed with local municipalities, for example the possibility of parking the cars in any standard paid parking spot and circulating in limited traffic zones.

4.3. Car city club (IoGuido)

Car City Club is a car-sharing company run by the city municipalities; it is an associate member of the car-sharing initiative (ICS), a national coordination structure promoted and sustained by the Italian Ministry of the Environment. The aim of the ICS is to offer support to local municipalities interested in developing local car-sharing services, stimulating the creation of a national car-sharing network and promoting sustainable mobility policies (IoGuido, 2015). The associated companies must comply with homogeneous standards regarding services, emissions and safety, in order to guarantee a minimum quality, the interoperability among the participant cities and common services and user procedures. Given the standards and the know-how supported by the ICS, the associated companies business model is the same, with similar operational procedures. The business model is illustrated in Figure 3.

Car City Club offers two different rental possibilities: the classic modality, in which customers must deliver the car in the same parking area where they started the rental, and the one-way rental, in which the customer can deliver the car in a parking area different to that in which the journey started. In both cases, customers must make a previous reservation, indicating the vehicle they want to rent and the initial location (according to availability), the renting period and the location where they want to deliver the car at the end of the rental. The company charges a fee per kilometer in addition to an hourly fixed fee: prices vary according to the vehicle chosen, the rental conditions (classic or one-way rental) and the period of the day, and the fee per kilometer also decreases with the increase in the distance traveled; daily rentals are also possible.

IoGuido main customer segments are both private users and corporate clients, who complement or substitute their fleet for the shared vehicles; among the clients there are also public entities, e.g. the city municipality. The company value propositions are based on the creation of a mobility alternative, complementing the other existing public transportation systems with a low environmental impact, offering its users the possibility of utilizing a private vehicle without the necessity of owning one. Customers recognize value in the wide variety of vehicles in the company fleet, which allow them to choose a model according to different needs (in the last years the fleet has increased also with the inclusion of electric vehicles).

The main channels to reach customers are the company website, a smartphone application and, differently from other car-sharing companies, a call center, through which clients can register themselves and make car reservations. Customer relationships are therefore mainly automated, with interfaces consisting in the website and the application.

IoGuido charges an annual fee from its customer to keep their profiles active and the rental fees. Annual fees vary according to user characteristics (private or corporate clients) and to the service options. Users can choose to pay an annual fee to have full access to the service during the year, or alternatively they can pay a smaller fixed activation fee every time they use the service (in addition to hourly and per kilometer fees).

The key company resources required to make the business model work are the vehicle fleet, the exclusive parking spots, the service team, and the website and smartphone application. Beside the car rental, other key activities must be performed to keep the business running properly: the maintenance of the vehicles (including cleaning and fueling), the management of the fleet (vehicle repositioning, checking if cars were delivered in appropriate spots etc.) and the customer service.

Car City Club main partnership is established with ICS (for technical, legal and financial support), in association with the Italian Ministry of the Environment. Being a public service company run by the city municipality, Car City Club benefits of distinct advantages, namely the gratuity for customers to park in the streets while the service is active, the designated parking spots in public areas and the right for its cars to circulate in restricted traffic areas, as well as tax related benefits. The company also seeks to establish further partnerships with other companies (e.g. retail stores, shopping malls, universities) thus offering exclusive parking spots in their parking areas and/or other combined agreements and promotions in order to reach new clients. IoGuido has also established other partnerships or agreements with strategic suppliers,

for example car manufacturers (the vehicle fleet is composed exclusively by FCA Group cars), fuel distributors and insurance companies.

Some of the costs are subsidized by the Italian Ministry of the Environment, in the scope of stimulating local municipalities to develop car-sharing companies in association with the ICS organization, in order to improve urban mobility with integrated, more effective and environmental friendly services.

4.4. *BlueTorino*

BlueTorino is a car-sharing service run by the Bolloré Group, an International company operating in different fields, including transport and logistics. Among other, Bolloré Group manages Autolib, an electric car-sharing company operated in association with Paris Municipality. With more than 2500 vehicles and 875 parking stations, with over 4000 charging points, Autolib is the first extensive public electric car-sharing system ever created (BlueTorino, 2016). In the end of 2013, Autolib expanded its operations in France, offering its services in Lyon, and at the beginning of 2014 it also started operating in Bordeaux. Bolloré group has also signed deals to start operating experimental offshoots of Autolib in Indianapolis (USA) and London (UK) in 2015. BlueTorino business model is reported in Figure 4.

BlueTorino starts the operations in Turin in 2016, being the first full electric car-sharing service operating in the city. The development of the service is still not complete, but the company foresees to have at the end of the first phase 150 vehicles, 80 charging stations and 250 parking lots.

The service aims to meet the demand of different segments of customers, comprising frequent users, occasional users, and tourists, offering different service plans in order to reach customers with different needs and characteristics. BlueTorino service is based on full electric powered Bluecars, a model developed by Bolloré group in association with Pininfarina, the independent Italian car designer firm and coachbuilder, and produced by CECOMP, an Italian car manufacturing company. The main channels accessed by customers are the website and the smartphone application; through these channels customers can get all the information concerning the company (services, fares, etc.), find the closest station, check for available cars, parking or charging slots and make reservations. The website and the mobile application are also the main customer interfaces for the company. Fixed and per minute fees are the main revenue streams for BlueTorino, which customer segments are mainly private clients, with special fees for the younger ones (from 18 to 25 years old). Furthermore, it is possible to choose a single day subscription (mainly for tourists).

Essential resources for BlueTorino are the vehicle fleet and the stations with parking spots and charging facilities; in addition, the company relies on its website and smartphone application as the main customer interfaces, which are fundamental to deliver the service properly. In order to manage operations, another key resource is an integrated information system, containing all the necessary information regarding revenue streams, customer profiles, reservations, car availability and positioning, which are fundamental inputs for the correct operation of the service by the management team.

The key activities for BlueTorino are the maintenance of vehicles, the management of the fleet and the recharging of vehicles. However, the company still has to manage the fleet and

eventually reposition vehicles that might be overly concentrated in some areas of the city. Another important activity is the customer service: the service team must assist the users in any case of need and be available 24 hours a day. The development and maintenance of information systems is also quite important for the managerial activities in the company. Besides, the development and maintenance of the website and the smartphone application are fundamental for the service performance, as these two platforms are the main customer interfaces.

The main partners of BlueTorino are, besides Bolloré Group, Bluecar, responsible for the development and commercialization of the electric vehicles, Pininfarina, coachbuilder and car designer company, batScap, a research center dedicated to the development of the batteries, and CECOMP, the vehicle producer.

5. Comparative analysis of car-sharing companies

The objectives of the comparative analysis are to identify the advantages and limitations of the different strategies adopted by the companies and to analyze the conditions in which the companies might coexist and compete in their shared markets.

To begin with, all the companies share value propositions inherent to the car-sharing concept, offering a mobility alternative with low environmental impact, complementary to the available public and private transportation modes and economically efficient when compared to car ownership. However, the degree in which the companies succeed in delivering these values to their customers depends on their operations characteristics.

One of the main sources of differentiation for car-sharing operators is the service model adopted, which is also evaluated in the value proposition of the companies. The option for traditional round trip car-sharing reduces the complexity of fleet management, since the vehicles are returned to the same dedicated parking spaces where they were initially rented, but provides less flexibility for the users. Consequently, this operation model, which is one of the two adopted by the company IoGuido car-sharing, is not the most convenient for the customers' routine needs of transportation between their homes and workplaces, being more suitable for occasional usage. The point-to-point station based service model, on the other hand, grants customers more flexibility when compared to round-trip car-sharing. As a trade-off, the car-sharing operators face more challenging logistic operations, since the positioning of the cars are subject to unbalances resulting from concentrated demands and usage patterns. It is a key-issue for the operators to deal effectively with this problem in order to increase the vehicle usage and the market penetration. The point-to-point free floating service model, offered by Enjoy and Car2Go, is the car-sharing service that provides to the customers the maximum flexibility among the existing operation models. Beside reducing the need for dedicated parking spaces, this model carries the highest fleet management complexity. Moreover, the elimination of proprietary parking spaces might create difficulties for customers in areas where it is hard to find available standard parking spots. This problem is usually addressed by the free-floating car-sharing companies with the creation of designated parking spots in critical areas as train and metro stations. For the point-to-point free floating service model, the fleet availability is an extremely important value that must be delivered by the car-sharing companies if they wish to reach the aforementioned objectives, especially if they aim for substituting car ownership.

Enjoy, Car2Go and BlueTorino rely on large scale operations with large fleets to address this question, trying to minimize fleet management efforts and letting the spontaneous use of the service by their customers to relocate the largest percentage of vehicles. The characteristics of the vehicles offered in the fleet are also a considerable value for customers: usually, car-sharing companies bet on compact urban vehicles, which are easy to drive and can be parked in limited spaces. The standardization of the fleets provides the companies a stronger visual identity, increasing brand recognition by customers, and also facilitates fleet acquisition and partnering with vehicle suppliers, besides reducing maintenance costs. IoGuido, on the other hand, offers a choice of different vehicle types, ranging from compact cars to sport utility vehicles and cargo vans, meeting different customer needs. BlueTorino has opted for a pure electric vehicle fleet, which is imperative for their strategic views. This option is motivated by environmental purposes and also by the belief of further value creation for educated customers who are aware of the environmental impact caused by the extensive use of fossil fuels. However, electric vehicle fleets increase the operational complexity, since the electric vehicles have lower range and demand considerably more time for recharging, besides the need for proprietary charging stations.

Building a large customer base and increasing the average service usage among customers is very important for the car-sharing companies. Private companies must reach a minimum target of service hours to break-even and turn the operations into a sustainable business, while public companies must meet the public demand to create the aimed positive impacts on traffic, mobility and environmental spheres. The car-sharing companies focus on three aspects to reach their customer bases, corresponding to three of the business model canvas building blocks: customer channels and marketing efforts, partnerships to target specific customer segments, and definition of service plans and billing strategies (which compose the revenue streams) to meet customer demands. To begin with, all of the considered companies rely on common customer channels, reaching their clients through the advertising of their services on proprietary websites or by the word of mouth and supporting their client base through smartphone applications, call center services for personal assistance and once again through the website, besides the social networking channels. Also, all the companies applied similar marketing strategies for the advertising of their services, realizing marketing campaigns in areas of high circulation of the cities where they operate, mainly during the launch of the services.

The definition of pricing strategies is also important when addressing different customer segments, given the fact that different price structures and models of service are more suitable for different customer needs. Among the free floating operators, only BlueTorino provides different fees for different customer targets. In particular, BlueTorino offers a one-day tariff, without subscription fee and with a higher per-minute fee, and a tariff for younger customers (from 18 to 25 years old) with a lower subscription fee (1 € per month) and lower per-minute fee (0,14 € per minute), while the normal tariff charges 5 € per month and 0,19 € per minute. This could be a winning strategy, as real growth rates could exceed the projections with an increased focus on the younger individuals, which have more difficulties to afford insurance costs (Shaheen and Cohen, 2007; Shaheen et al., 2006). All the companies charge the service usage proportionally to the rental period, and the fees already include costs related to refueling

or recharging, maintenance, insurance and parking.

The four companies have established buyer-supplier partnerships in order to assure a reliable supply of the main assets necessary for their operations. Particularly, the companies Enjoy, IoGuido and BlueTorino have agreements with vehicle suppliers for the acquisition of their fleets, which represent significant fixed costs. Car2Go, on the other hand, is a subsidiary of the Daimler AG group, which produces the Smart ForTwo models used in the fleet.

Other important partnerships concern the technology necessary for the operation of the business, including the development of integrated information systems for the fleet management, which must be connected to the devices installed in the vehicles, registration of users, billing process and other internal activities. Car2Go established a partnership with Europcar, a traditional car rental company that provides the necessary know-how for the fleet management. IoGuido, on the other hand, has the support of ICS (Car-Sharing Initiative), which supplies the associated public companies the information systems and technology needed for the operations management.

Finally, it is vital for the car-sharing companies to establish partnerships with the local governments of the cities where they operate in order to align the services with local regulations and establish agreements granting the companies operational conditions, regarding the use of public spaces and parkings, taxations and other benefits. In [Shaheen and Cohen \(2007\)](#) parking facilities are seen as a form of non-monetary support to operators, while in [Shaheen et al. \(2006\)](#) supporting policy approaches are identified as a key factor for the membership growth potential. These agreements are, as expected, more easily handled by public operated companies (for instance, IoGuido), whose strategies and operations are aligned with the public stakeholders. Private operated companies, on the other hand, besides depending on proper regulation for their operations, also need to negotiate with the public authorities the use of standard public parking spots (especially in the case of free-floating companies), the right to use public spaces for the construction of fixed stations (in the case of station-based operations and charging stations) and other benefits (e.g., the access to limited traffic areas).

Regarding the key activities, structural similarities are identified among the analyzed companies. In all cases, the core activity is the offer of short period car rentals, and the backbone activities necessary for the business operation are registration of users, management of reservations, billing operations, fleet management, vehicles maintenance and customer service. The key resources commonly comprise the vehicle fleet, the integrated information systems developed to manage the fleet and the rentals, the websites and smartphones applications, which are the main customer channels, the service and management teams. Companies operating with a station-based service model (IoGuido and BlueTorino) also have their proprietary parking spots, including recharging facilities in case of operation with electric vehicles, as important resources. The cost structure of car-sharing companies is characterized by a high portion of fixed costs, related to the fleet acquisition and the development of complex information systems to operate the business. Station based operators also incur in higher infrastructure costs for the installation of the stations, although free-floating operators also install proprietary parking spots in locations with lower availability of public parking spots. Other common costs among the companies are related to maintenance, cleaning and refueling or recharging the vehicles,

the management of the fleet (including vehicle repositioning), municipal taxes included in the agreements for the service authorization and the use of public facilities, and personnel costs.

Thus, if we do not consider some aspects related to the different mix of the vehicles in the fleet, there is not a clear characterization of the different companies. Moreover, car-sharing operators use the quite old-style marketing strategy of creating the market by showing their products literally on the streets. Unfortunately, even if the revenues are increasing, the profitability is still not reached. For example Car2Go, the leader of car-sharing services with about 13000 vehicles and a presence in 30 cities between Europe and North America, presents constant negative sign related to the car-sharing revenues and a loss of about 42 millions of euro in 2014 (Daimler AG, 2014, 2015). This limited usage of more complex marketing strategies is limiting the penetration of the car-sharing services. In particular, more attention should be given to the tariffs and their effects on specific customer segments rates, as corporate users. This is not a trivial task; in fact in order to assess the real impact of a specific tariff on a single customer type we need simulation tools able to incorporate different sources of information, including socio-demographic data, traffic simulation and user behavior simulation.

6. Monte Carlo based simulation

In order to perform our analysis we developed a Monte Carlo simulation. The aim of the simulator is twofold. First, to provide the managers of car-sharing companies with a tool able to quantify and certify the cost of the car-sharing service for a given user type of a specific city. Second, to use the simulation to compare the commercial behavior of different car-sharing companies and perform what-if analyses of new tariffs options. This is in line with the new trend of car-sharing companies to diversify the offer by introducing special rates according to the business model of the mobility market.

Given a certain city, a set of tariffs described in terms of price per driving minute, price per parking minute (price paid by the customer if the car is parked during the rental period), price per km, customer preferences in terms of trips, trip types, kilometers traveled per year, and a list of possible trips, our Monte Carlo simulation repeats I times the following overall process:

- Identify a set of potential routes.
- Create S scenarios with the random demands in term of customer trips, their temporal distribution and type.
- For each scenario $s \in S$ and until the kilometers traveled per year are not reached
 - Extract a route from the routes list, assign a departure time according to the user preferences and simulate it in terms of actual travel time and apply to it the more profitable tariff of the user type.
- Given the scenario values in terms of cost paid to travel the kilometers traveled per year, compute the expected value of the cost.
- Compute the distribution of the expected value.

In order to obtain the most reliable results of the Monte Carlo simulation, we performed a set of tuning tests. The values for the parameters I (number of repetitions) and $|S|$ (number of scenarios) have been set such that the standard deviation of the distribution of the expected value was less than 1% of its mean. These values were $I = 10$ and $|S| = 30$.

The cost calculation for the utilization of car-sharing services mainly depends on the usage time, the distance traveled and the number of trips (as some companies charge a fixed base price in addition to a price proportional to the distance travel). The period of utilization of the service depends on the distances traveled, on the routes taken and on the traffic conditions (which influence the average speed in which the distances are covered), while the traffic conditions depend on the routes considered in the study, and also on the period of the day. In the following subsections, we give an insight of the scenario definition process, the user profiles, the estimation of the travel times and the tariffs used in the simulation.

6.1. Definition of scenarios

The city of Turin is serviced by four different car-sharing companies (Enjoy, Car2Go, Blue-Torino and Car City Club). A set of different routes was defined, ranging from 2.2 to 7 km, connecting the main business districts, universities, train stations, cultural attractions and residential areas. The choice of Turin as test field of the evaluation of the economies of car-sharing was due to the presence of a broad sensor network, which measure the traffic congestion in real time. Data on traffic patterns of the city was necessary in order to calculate the duration of trips taken on different routes, on different periods of the day. In the case of Turin, real data on traffic are available at <http://www.5t.torino.it/5t/> (5t is a public company responsible for the monitoring of traffic and public means of transportation in Turin) and are collected from 50 speed sensors in the city center and 100 speed sensors distributed in the suburban areas. Data are gathered in different periods of the day, during one workweek, in order to build central and suburban speed profiles (see the two circles in Figure 5, giving the distribution of the actual sensors). The data of the mean vehicle speed, expressed in kilometers per hour (km/h), are accessible at intervals of 5 minutes. We aggregated them into blocks of 30 minutes, for a total of 48 observations per day. Empirical speed profile distributions associated to the path k between two points in the urban area i and j are then generated as inverse of the Kaplan-Meier estimate of the cumulative distribution function (also known as the empirical cdf) of the speed data set aggregated into blocks of 30 minutes. More details on the definition of speed profiles and the use of traffic data in a simulation environment are reported in [Maggioni et al. \(2014\)](#).

6.2. Definition of user profiles

The cost simulation considers three different user profiles: Commuters, Professional users, and Casual users. The first, defined as the Commuter profile, represents individuals that might use car-sharing services to commute between their residences and work places. Hence, their trips were simulated including two different time slots: from 7 to 9am, and from 5 to 7pm, which are aligned to a regular working day. The second user profile, defined as Professional, is represented by individuals that might need a vehicle for work purposes, during a regular working day. Hence, their trips were simulated including three time slots: from 11am to 1pm, from 1pm to 3pm, and from 3pm to 5pm. Finally, the third profile was defined as the Casual

user, who might use the vehicle for different purposes in periods in any time of the day. Hence, the trips were simulated including all time slots comprised in the simulation.

Finally, five different ranges of distance were considered for each of the user profiles in each of the scenarios. The simulation computes the results for annual usage of 1000, 2000, 5000, 6000, 7000, 8000, 9000, 10000 and 15000 km.

6.3. Computation of trip times and overall costs for users

For each user, one route (among the defined routes) was randomly attributed to a time slot. The trip time was then calculated, based on the route distances in the central and suburban areas, and the average speeds on the center and suburb at the given time of the day (randomly attributed among the time slots of the selected user profile), as calculated on the definition of traffic patterns. The parking period for each trip was also determined, based on the probability and duration of parking, as defined in the user profiles. Finally, it was possible to calculate the user costs, according to the utilization of each car-sharing company or private vehicle included in the scenarios and by using the most profitable tariff option associated to the user.

6.4. Tariffs

To compute the overall costs for a user, prices and packages of each car-sharing operator must be analyzed. Car2Go offers monthly minute packages of 120 or 300 minutes at discounted rates for frequent users, and so the cost calculation was optimized for the best possible combination of minute packages per month for each customer. Car2Go and Enjoy minute rates include at least 50km of mileage. Given the fact that the longest route defined in the simulation had a length of 7 km, additional costs per kilometer were not incurred by users in the defined scenarios. Single routes also did not justify the utilization of hourly tariffs. Car City Club has a different pricing structure: customers must pay a minimum hourly fee (the minimum rental period is one hour, although vehicles can be delivered earlier) in addition to a variable cost per kilometer. The tariffs refer to the simplest vehicle available in the one-way service (a Fiat 500 1.2L, the same model offered by Enjoy). Among the three different tariffs provided by BlueTorino, we chose the one with a fixed fee of 5 € per month (60 € per year) and a variable fee of 0.19 € per minute. Finally, the data referring to private vehicle costs were obtained from a database made available at the website <http://www.aci.it/> by ACI (Automobile Club Italiano), a National organization that offers a wide range of public services, including a tool for the calculation of costs of private vehicle utilization. The data refers to a Fiat 500 1.2L, the same model offered by Enjoy and Car City Club. To this costs, the additional fee of parking should be added. Different tariffs exist in any urban area. We decided to consider the cheapest one, equivalent to an annual fee of 200,00 € in Turin (annual authorization for residents). Final prices were then calculated for each of the users simulated for each user profile.

Tables 1 and 2 summarize the price components of these operator and the cost of a private vehicle.

7. Simulation results

Analyzing the simulation results, the most interesting solutions from an economic point of view vary according to the annual distance traveled. Figures 6, 7, 8 report the annual costs

Price components	Car2Go	Enjoy	IoGuido	BlueTorino	Private vehicle
Annual cost	€29 (year 1)	-	€59	€60	€2620
Cost per min	€0.29 (base price)	€0.25	-	€0.18	-
Parking cost	see cost per minute	see cost per minute	-	-	-
Cost per hour	€13.90 (not applied)	€15 (not applied)	€3.68	-	-
Cost per km	€0.29 (> 50km)	€0.25 (> 50km)	€1.08 (> 100km)	-	€0.23

Table 1: Costs of alternatives considered in the simulation

Fixed Costs		Variable costs per km	
Amortization	€559.48	Amortization	€0.066
Insurance	€1929.00	Fuel	€0.105
Taxes and fees	€559.48	Tires	€0.066
		Maintenance	€0.052
Total	€2620.06	Total	€0.232

Table 2: Estimated costs of private vehicle utilization

according to the user profile for the utilization of car-sharing service of the companies operating in Turin. These figures also show the annual cost for the private vehicle.

In the city of Turin the usage of BlueTorino is always more cost effective than the other car-sharing operators, and it is more cost effective than the private vehicle for values lower than 10000 km/year for the commuter and the professional user profiles. The break even point with the private vehicle is lower (8000 km/year) for the casual user profile. Despite having an annual cost higher than the other operators, the lower variable cost allows BlueTorino to be cheaper than Car2Go and Enjoy. In particular, the break even point between BlueTorino with Car2Go is set at about 170 km/year, while between BlueTorino and Enjoy is at about 300 km/year. Moreover, the pricing structure of BlueTorino is composed by a fixed fee of 5 € per month that discourage the occasional use of the service and at the same time is low enough to be amortized with the usage (the break even point with the other companies arrives around 100 minutes of usage). The free floating operators (Car2Go and Enjoy) are more cost effective than the private vehicle for ranges lower than 4000 km/year, and Enjoy is more cost effective than Car2Go thanks to its lower variable fee. However, the price difference between Enjoy and Car2Go is marginal (in particular for the lower ranges) and the choice for the customers could be based on other factors of differentiation, such as perceived quality of the service, vehicle models, commercial partnerships, etc.

The cost of Car City Club (IoGuido) is steadily higher than the other operators. The reason is in the different pricing structure, that has a minimum hourly fixed fee, in addition to a fee per kilometer. Car City Club could be more cost effective for other user profiles, not included in this simulation, such as long distance travelers (the distance fee decrease for longer distances) or customers interested in longer rental time (not for a single trip). At the beginning of 2017 IoGuido car-sharing service in Turin had been closed, mainly because of significant economic losses. Since new competitors have come to the market, IoGuido lost its monopoly over the Turin urban area, not being able to move toward the new free-floating service model.

Above the range of 10000 km/year for commuter and professional user profiles and of 8000 km/year for casual user profile the optimal choice is the private vehicle (considering a small

city-car, similar to the Enjoy's fleet vehicles). In this case the fixed costs of vehicle ownership are amortized and the marginal costs is compensated by the distance covered by the users. For the Professional and Casual user profiles, the results vary moderately. Although Commuters have routes concentrated on the rush hours, with lower average speeds, Professional and Casual users resulted in higher final costs of utilization: this effect is explained by the costs incurred by these user profiles due to the parking time during the rental, in which, by definition, the Commuters did not incur. Since for private vehicle utilization parking costs are modelled as fixed (as users incurred in paying annual parking permits), the costs related to private vehicles are not sensitive to the differences of the Professional and Casual users in the simulation. As a result, for Casual and Professional user profiles, a downshift in the minimum range above which the utilization of a private vehicle is more economically efficient could be observed. In these cases, using a private car became the optimal cost alternative between 6000 and 7000 km per year.

It is interesting to see how BlueTorino is using a mix of aggressive pricing with a green vision of car-sharing, having the double effect of straightening its positioning in the catchment area and pushing the idea that having electric mobility is possible. This is crucial for the owners of BlueTorino, the group Bolloré, who did large investments on the production of electric vehicles and it is trying to standardize and dominate the future market of charge stations. Actually, BlueTorino is becoming a perfect example how the revenues cannot be the first objective of a company. If they will have success, as they did already in France, to make their charging stations the almost unique charging stations in the large and medium cities, this will give to the Bolloré group a great competitive advantage in the next 10 years, also contributing to change the behaviors of the citizens. One of the main result is the higher cost effectiveness of BlueTorino compared with the other operators, given by the lower variable cost that allows customers to amortize the annual fixed charge of 60 € (5 € per month). In this case, private vehicle become more cost effective for ranges higher than 10000 km/year for commuters and professional user profiles and higher than 8000 km/year for casual user profile. After these values the fixed cost related to vehicle ownership are amortized and the marginal cost is compensated by the distance covered by the users. BlueTorino tariff choice is partially in contrast with the business behaviour of the car-sharing market, that removed fixed costs in the past decade. On the contrary, the tariff scheme of BlueTorino, as shown by their preliminary economic results in Turin, show how a limited fixed monthly fee is preventing the causal user. This behaviour is similar the the recent tariff schemes used in the mobile market and it avoids the problem of customers stopping using the service. Fleet size is the main asset of a car-haring company in order to meet the customer demand and to not incur in unbalances within the covered area. The best players rely on large scale operations with large fleets to address this question, trying to minimize vehicle movement management and letting the spontaneous use of the service by customers to reposition the largest percentage of vehicles, but the fleet-size planning becomes very difficult if a large part of the customers is not using the service after the initial period. This is a typical situation in a market green field, where different companies are entering and are giving some reductions in the early stage.

According to preliminary results that were collected in the city of Turin by means of a large

survey from the early beginning up to now, this change is on the way. In particular, there is a need of more flexible and user-specific tariffs (Perboli et al., 2017). In particular, professional users are requesting new ad-hoc tariff schemes. But such an approach requires the availability of new tools for supporting the decision-making process.

8. Conclusions and future directions

The comparison of the operator's business models shows that all the companies share value propositions inherent to the car-sharing concept, offering a mobility alternative with low environmental impact, complementary to the available public and private transportation modes and generally economically efficient when compared to car ownership.

However, the degree in which the companies succeed in delivering these values to their customers depend on their operations characteristics. The service model adopted is the main difference between the analyzed companies: since the option for traditional round trip car-sharing (adopted by IoGuido) lessens the complexity of fleet management, this form of operation provides less flexibility for the users, as they must start and end their journey in the same parking spot and pay for the service during the entire time of rental. On the other hand, the free floating model gives to the customers the greatest flexibility, allowing them to locate, optionally reserve and then access an available vehicle directly on the street and use it for any period of time.

Analyzing the results of the simulation in the city of Turin, the main result is the higher cost effectiveness of BlueTorino compared with the other operators, given by the lower variable cost that allows customers to amortize the annual fixed charge of 60 € (5 € per month). Private vehicle become more cost effective for ranges higher than 10000 km/year for commuters and professional user profiles and higher than 8000 km/year for casual user profile. After these values the fixed cost related to vehicle ownership are amortized and the marginal cost is compensated by the distance covered by the users.

In our opinion, the simulation environment represents a useful tool for the evaluation of cost structures and pricing strategies of car-sharing operators, even if further developments are required to use this tool in cities without a network of sensors for the traffic monitoring. In fact, the traffic congestion and, consequently, the travel time have a key role on the economies of car-sharing services and an accurate forecasting is required. Future research directions will consider approximations of the traffic congestion obtained by means of Extreme Value Theory (Tadei et al., 2012; Perboli et al., 2012), as well as more complex user behaviours and tariff schemes.

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Key Partnerships <ul style="list-style-type: none"> • Europcar • Local governments • Company customers (refueling agreement) • Insurance companies • Fuel distribution companies 	Key Activities <ul style="list-style-type: none"> • Car rentals • Vehicles maintenance • Fleet management • Customer service • Marketing 	Value Proposition <ul style="list-style-type: none"> • Free-floating car sharing service with a large scale fleet • Innovative and environmental friendly transportation service • Flexibility and mobility • Convenience, usability and accessibility of vehicles • Smart ForTwo (gasoline and electric powered) vehicle fleet 	Customer Relationships <ul style="list-style-type: none"> • Automated services through the website and application interfaces • No permanent engagements 	Customer Segments <ul style="list-style-type: none"> • Private users <ul style="list-style-type: none"> - Frequent clients - Occasional clients - Students • Corporate clients
Key Resources <ul style="list-style-type: none"> • Vehicle fleet • Service team • Integrated system, website and application • Designated parking spots (where applicable) 		Channels <ul style="list-style-type: none"> • Website • Smartphone application • Customer service call center • On site marketing campaigns and information points 		
Cost Structure <ul style="list-style-type: none"> • Vehicle fleet acquisition • Maintenance • Fueling and cleaning vehicles • Personnel costs and customer services • Insurance contracts • Other expenses related to improper use of the service • Municipality taxes 		Revenues <ul style="list-style-type: none"> • Fixed subscription fees (only upon registration of new users) • Rental fees (per minute, hour or daily rate) • Extra fees per kilometre (above the included mileage per trip) 		

Figure 1: Business model canvas of Car2go

Key Partnerships <ul style="list-style-type: none"> • ENI • Trenitalia (Italian train operator) • FCA (vehicle supplier) • CartaSi (credit card company) • Other commercial companies and suppliers • Local municipalities • Insurance companies 	Key Activities <ul style="list-style-type: none"> • Car rentals • Vehicles maintenance • Fleet management • Customer service • Marketing and establishing new partnerships 	Value Proposition <ul style="list-style-type: none"> • Free floating car sharing rentals • Fiat 500 fleet (design appeal, iconic car, four seats) • Flexible, environmental friendly and economical mobility service • Integration with train services 	Customer Relationships <ul style="list-style-type: none"> • Automated services through the website and application interfaces 	Customer Segments <ul style="list-style-type: none"> • Private users - Occasional users - Frequent users • Corporate clients - Trenitalia loyalty program clients, including corporations 	
Key Resources <ul style="list-style-type: none"> • Vehicle fleet • Service team • Integrated system, website and application 			Channels <ul style="list-style-type: none"> • Website • Smartphone Application • Customer service call center • Co-marketing with Trenitalia 		
Cost Structure <ul style="list-style-type: none"> • Vehicle fleet acquisition • Maintenance, fueling and cleaning vehicles • Personnel costs and customer services • Insurance contracts • Municipality taxes • Other expenses related to improper use of the service 		Revenues <ul style="list-style-type: none"> • All-inclusive rental fees (per minute, hour or daily rate) • Extra fees per kilometre (above the included mileage per trip) • Cross-selling (Trenitalia partnership) 			

Figure 2: Business model canvas of Enjoy

Key Partnerships <ul style="list-style-type: none"> • Municipality • Car Sharing Initiative (ICS) and Italian Ministry of Environment • Car manufacturers (FCA), fuel distributors, insurance companies • Retail companies, universities and other promotion partners 	Key Activities <ul style="list-style-type: none"> • Car rentals • Vehicles maintenance • Fleet management • Customer service Key Resources <ul style="list-style-type: none"> • Vehicle fleet • Service team • Integrated system, website and application • Exclusive parking areas 	Value Proposition <ul style="list-style-type: none"> • Mobility alternative, integrated with other public transportation modes • Economical, accessible and environmental friendly service • Traditional and one-way car rentals • Varied fleet of vehicles, for different customer needs 	Customer Relationships <ul style="list-style-type: none"> • Self-service automated services through the website and application interfaces • Optional call-center service Channels <ul style="list-style-type: none"> • Website • Smartphone application • Customer service call center 	Customer Segments <ul style="list-style-type: none"> • Private users • Corporate clients • Public entities
Cost Structure <ul style="list-style-type: none"> • Vehicle fleet acquisition • Maintenance • Fueling and cleaning vehicles • Personnel costs and customer services • Insurance contracts • Other expenses related to improper use of the service <p>The company is partially financed by the Italian Ministry of the Environment</p>		Revenues <ul style="list-style-type: none"> • Annual subscription fees (or optionally an activation fee per use) • Fixed rental fees (hourly or daily, according to the period of the day and type of vehicle chosen) • Fees per traveled kilometre 		

Figure 3: Business model canvas of car City Club (IoGuido)

Key Partnerships <ul style="list-style-type: none"> • City of Turin • Bollorè Group • Bluecar • Pininfarina • CECOMP • batScap 	Key Activities <ul style="list-style-type: none"> • Car rentals • Vehicles maintenance • Fleet management • Customer service 	Value Proposition <ul style="list-style-type: none"> • First full electric car sharing service in Turin • One way point-to-point rentals • Efficient and low environmental impact, mobility alternative, complementary to public transportation services • Flexibility, availability and economic efficiency when compared to car ownership 	Customer Relationships <ul style="list-style-type: none"> • Automated services through the website and application interfaces • Customer service call center 	Customer Segments <ul style="list-style-type: none"> • Private users - Frequent users - Occasional users - Tourists - Young drivers - Households
Key Resources <ul style="list-style-type: none"> • Vehicle fleet • Charging stations • Integrated information system, website and application • Management and service team 		Channels <ul style="list-style-type: none"> • Website • Smartphone application • Customer service call-center 	Revenues <ul style="list-style-type: none"> • Private user plans - Subscription fees - Rental fees (per minute) 	
Cost Structure <ul style="list-style-type: none"> • Vehicle fleet acquisition • Installation of charging stations • Maintenance, cleaning and recharging • Development and maintenance of website, app and information system • Personnel costs and customer services • Insurance contracts • Other expenses related to improper use of the service 				

Figure 4: Business model canvas of BlueTorino

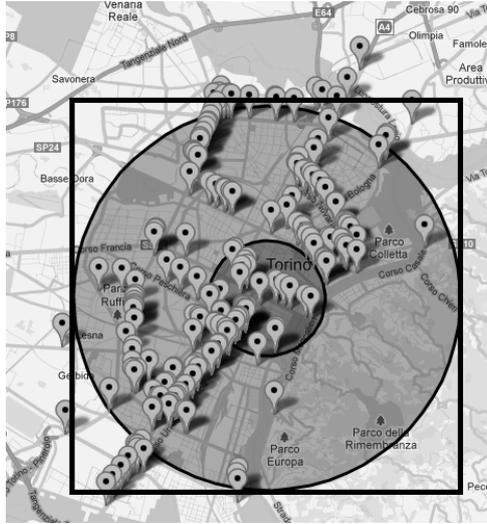


Figure 5: Distribution of central (dark gray circle) and suburban (light gray circle) speed sensors in the city of Turin in Italy. Figure taken from [Tadei et al. \(2014\)](#).

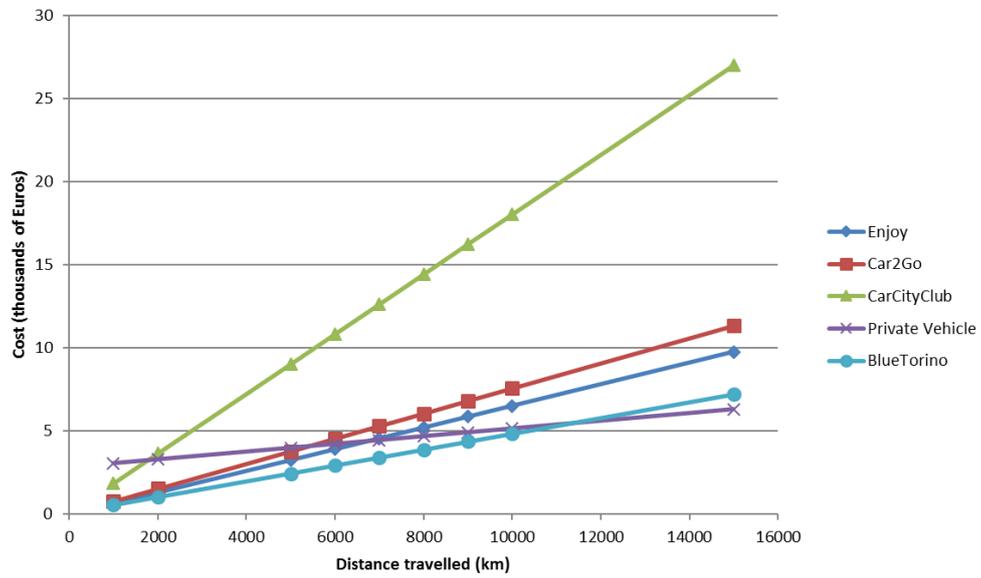


Figure 6: Annual costs for the Commuter user profile in Turin.

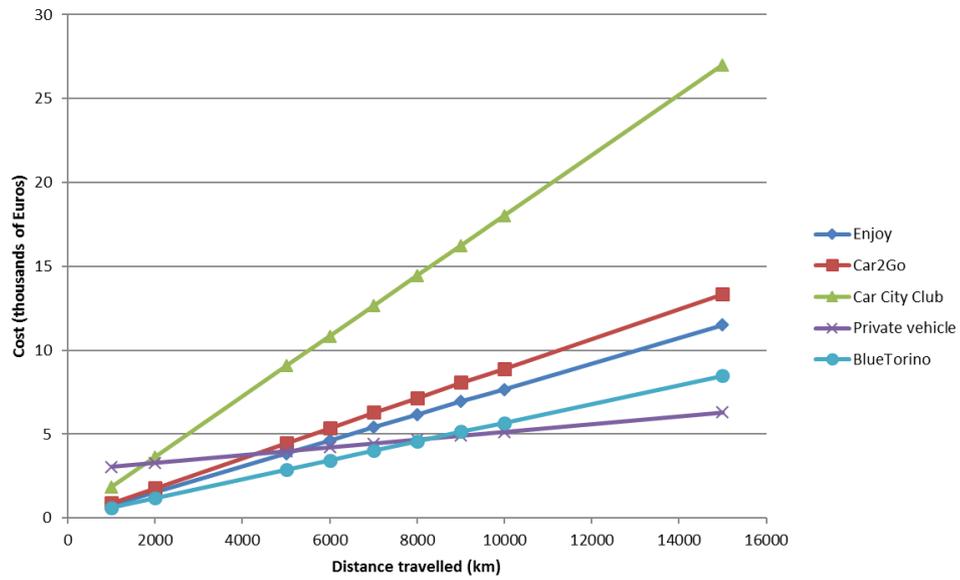


Figure 7: Annual costs for the Casual user profile in Turin.

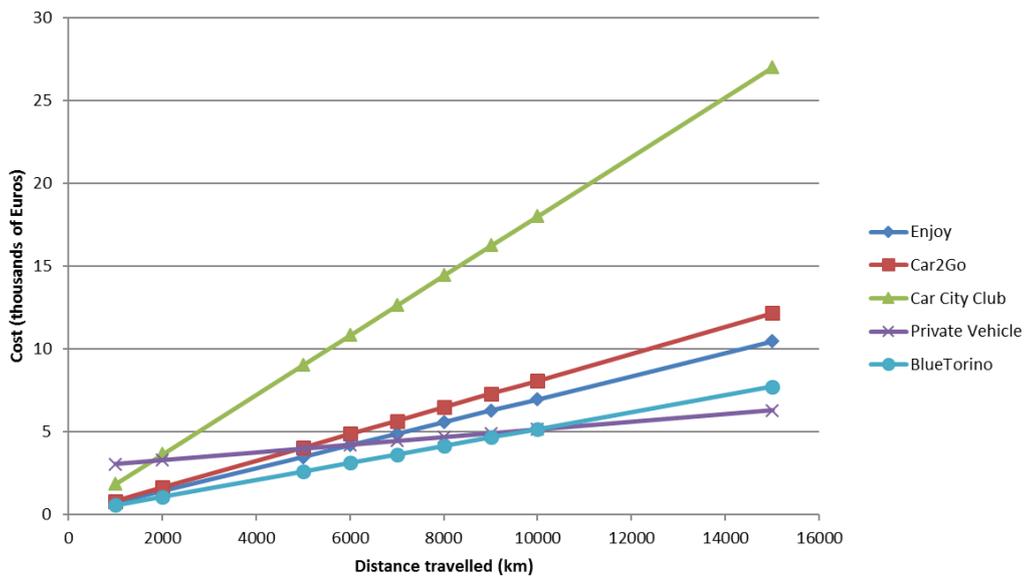


Figure 8: Annual costs for the Professional user profile in Turin.