

## **ANALYSIS OF THE CAR SHARING ACTIVITY IN POLAND**

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### **Abstract**

As a part of the sustainable urban transport policy, the alternative methods of moving towards individual car transport are promoted. Their aim is to reduce the emission of harmful substances and noise, as well as to reduce the phenomenon of congestion. One of the recently promoted methods of movement in the urban areas is the carsharing system. It allows to reduce the number of private cars and creates the possibility of individual movement of people who do not have their own means of transport. The cooperation of private carsharing operators with municipal transport operators allows for the mutual integration of these entities. In order to be able to improve to carsharing system, the activity of using services of carsharing should be examined. It seems to be easy because operators record data on the history of the rentals of vehicles. The paper presents an analysis of car sharing activity on the example of a selected system operating in Poland. The analysis was made on the basis of data from the Carsharing system operator, covering a period of three months. The histogram of the total number of reservations and rentals is presented, depending on the factors selected. The analysis allowed to formulate conclusions and recommendations that could improve the effectiveness of functioning of the carsharing system in Poland.

**Keywords:** Car sharing system, activity of transport services, transport systems

### **1. INTRODUCTION**

Motor vehicles are one of the commonly used means of transport. They provide convenience and privacy in travelling. Although having your own vehicle has many advantages, there are also disadvantages. The purchase of a motor engine vehicle requires high initial financial outlays and subsequent costs associated with its operation. Some vehicles are not used for a large part of the day, which in the face of declining urban space in large agglomerations becomes a major challenge. It should be noted, that the number of newly built roads is not able to keep up with the growing number of cars. In addition, modern trends in the development of transport are related to reduction of private motor vehicle traffic in urban space. This is explained, among others, by environmental considerations, energy intensity and increased efficiency of travel in these agglomerations. The consequence of the limitations described above for owning and using private cars in agglomerations seems to be searching for other solutions in the field of road transport. One of the solutions may be a car sharing system, consisting of short-term rentals for short distances. This solution brings the benefits of owning cars, at the same time eliminating unexpected costs and obligations related to insurance, maintenance and servicing of the vehicle. The benefits of using the car sharing system allow to increase the average daily vehicle usage, reducing downtime during the day. It leads to reduction in the number of vehicles necessary to meet the needs of users. What is more, car sharing providers offer a fleet of low-emission or zero-emission vehicles, which contributes to reducing emissions of combustion products. In addition, car sharing operators sometimes work together with a public transport operators and local self-governments. For example, Bremen City Council has undertaken cooperation with the Cambio company. The company is supported through the technological solutions and activities aimed at raising the level of public awareness. Cambio, as the operator of the car sharing system, also cooperates with the public transport operator - BSAG. The agreement contributed to the introduction of common tariffs for tickets valid for public transport and car sharing system. Bremen participated in the CIVITAS VIVALDI project implemented in the years 2002 - 2006, on which one effect was the development of car sharing service and the creation of transfer places for public

transport with access to city bike rental service. In addition, the services of car sharing are characterized by flexibility associated with the simple booking of vehicles and the possibility of using various types of vehicles [1,5,6].

Car sharing system is also a preferred choice for companies. According to the report of the project “More Options for Energy Efficient Mobility through Car-Sharing (MOMO)” for European Commission from 2010, 16 % of service customers in the car sharing system are business customers. An incentive for this group of customers is primarily the reduction in the cost of maintaining the fleet and businesses car parks. Businesses customers sometimes have a greater demand for daytime travel, which results in an increase in the use of vehicles in this period to 45 %. System operators who observe this phenomenon often create a special offer and price lists for this type of customers. The above mentioned project report MOMO includes the areas of residence of system users. As it turned out, half of the customers live in densely populated central areas, one third of individual users live in the city centers, 12 % in other urban areas and only 5 % are inhabitants of peripheral areas. A similar spatial distribution occurs in the case of business customers.

The functioning of the car sharing system allows to collect a lot of data related to the usage of the service. Based on the ability of tracking the location of vehicles, number of reservations and rentals, their duration at the selected time and monitoring selected operational parameters concerned with operation of vehicles, it is possible to assess the activity of the system, identifying the weaknesses. It may be the basis for proposing the solutions that may improve the effectiveness of the car sharing service.

This paper contains the results of research on the activity of the car sharing system in Polish market during the selected period of time. This was done on the basis of data gathered from one of the largest cars sharing operators in Poland. The characteristics of everyday availability of vehicles are presented depending on selected factors. Data on the total and average length and number of rentals were also summarized, as well as the distribution of number of rentals in the selected hours. Additionally, attention was paid to the duration of booking time.

## **2. CAR SHARING SYSTEM IN POLAND**

Despite the benefits of the mentioned solution, which has systematically gained popularity in many European countries since the 1990's, in Poland the first commercial car sharing service was introduced in 2016. Traficar initiated the functioning of the system in the open model in Cracow. It offered the service of sharing initially 100 vehicles. Currently, Traficar is the largest car sharing operator in Poland. It covers Cracow, Warsaw, Wroclaw, Poznan, Katowice and the Tri-City. An open model of operation means that the vehicle can be rented and returned anywhere within the operator's area of functioning. In the second half of 2017, in cooperation with IKEA network, Traficar extended its service with cargo delivery vehicles. The vehicles can be rented in the base model, where the start and end of the rental is possible in the selected car parks of popular stores. Already the service is known as TrafiCargo and enables the use of 51 vehicles located in 9 Polish cities [2,3,8].

4Mobility is second operator that appeared in the capital of Poland. The company was established in September 2016 and currently operates also in Poznan. The company is distinguished by the possibility of renting vehicles of various segments, also of premium class. Customers in Warsaw have at their disposal 300 vehicles of various brands. These are Mini, BMW and Hyundai vehicles. Users living in Poznan can take advantage of renting one of 30 Audi vehicles. These are A3 and Q3 models. A large selection of vehicles makes the offer reach a wide range of customers. The company offers its service in two variants: free and basic. The application for mobile devices is used to select the nearest vehicle, locate it on the map and the reservation. After rental is completed, the customer may terminate the service leaving the vehicle on any car park within the given city. After renting the vehicle appears again in the application and is available for subsequent users [10].



Panek is the second largest operator of car sharing in Poland. The company provides its services only in Warsaw. In June 2018, the open model system had a fleet of 300 hybrid vehicles and plans to increase this number to 1000, expanding its service to other cities in Poland. New vehicles are expected to include delivery vehicles and electric ones. The operator is also taking part in the tender for the supplier of the urban car sharing for Warsaw [7].

Currently, there are six companies in Poland that provide the service of car sharing, providing their services in 9 cities. Most car sharing operators in Poland use a similar payment system. The tariff usually consists of three variables: driving time, distance travelled, and parking time. In the case of electric vehicles, companies give up the mileage rate to a higher price for the duration of rental. A summary of service fees according to the described scheme is presented in **Table 1** [7-12].

**Table 1** Prices for the car sharing services of the selected Polish operators [own study]

Operator		Price per minute PLN	Price per kilometer PLN	Price per stop-over* PLN	Comments
Panek		0.50	0.65	0.10	Maximum price per 24 hours is 90 PLN
4Mobility (in Warsaw)	Open model	0.55	0.80	0.12	Hyundai i30
		0.60	0.80	0.12	Mini
		0.65	0.80	0.16	BMW 1
EasyShare		0.50	0.80	0.10 (between 7 a.m to 10 p.m)	Maximum price per 24 hours is 90 PLN
				0.10 (between 10 p.m to 7 a.m)	
ClickToGo		0.50	0.80	0.10	-
Vozilla		0.90	-	0.10	-
Traficar		0.50	0.80	0.10	-

\*break in the journey during the rental period

### 3. ANALYSIS OF CAR SHARING ACTIVITY ON THE POLISH MARKET

The analysis concerns the car sharing service provided by one of the biggest operators in Poland. The research on service activity includes the periods of three months in 2018 (from February to April), in which the selected activity parameters were recorded, among others:

- vehicle side number,
- duration of reservation,
- duration of rental,
- distance travelled.

The data refer to a sample of 200 vehicles of which the amount of time the study did not change. In addition, the data has been processed in such way that it only takes into account those vehicles marked in the system as available (the were not under inspections or repairs). Collected data were organized and analyzed with the use of MiniTab software. **Figure 1** shows the change in the availability of vehicles over the analyzed period. The number of available vehicles ranged from 164 to 183 and amounted to average of 179 vehicles.

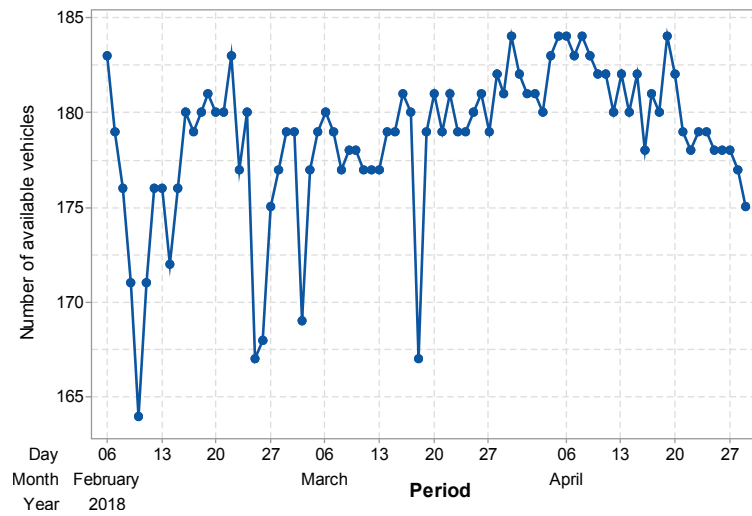


Figure 1 Number of available vehicles

Based on the data of the total time of rental per one vehicle, a goodness of fit test was carried out using the Anderson-Darling function. Of the twelve distributions considered, the 3-p Weibull model had the greatest accuracy of fit (p value equal to 0.491), as shown in Table 2.

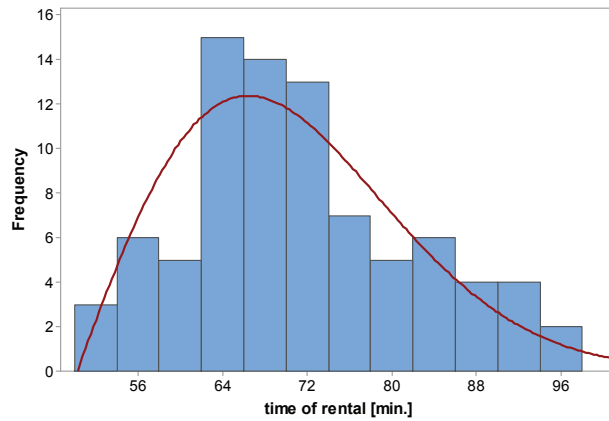
Table 2 Results of goodness of fit tests

Distribution	Anderson-Darling test	p-value
Normal	0.957	0.015
Lognormal	0.470	0.242
3-Parameter Lognormal	0.331	*
Exponential	28.035	<0.003
2-Parameter Exponential	6.245	<0.010
Weibull	1.746	<0.010
3-Parameter Weibull	0.347	0.491
Gamma	0.607	0.123
3-Parameter Gamma	0.323	*
Logistic	0.833	0.018
Loglogistic	0.497	0.170
3-Parameter Loglogistic	0.362	*

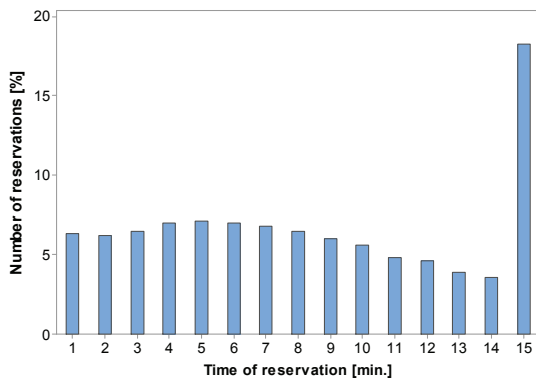
\* Scale: Adjusted Maximum Likelihood estimate

According to the obtained 3-p Weibull distribution, a histogram of the total length of rental of one vehicle available in the analyzed period is presented in Figure 2. The total rental time of one vehicle during the day is in the range of 62 - 74 minutes.

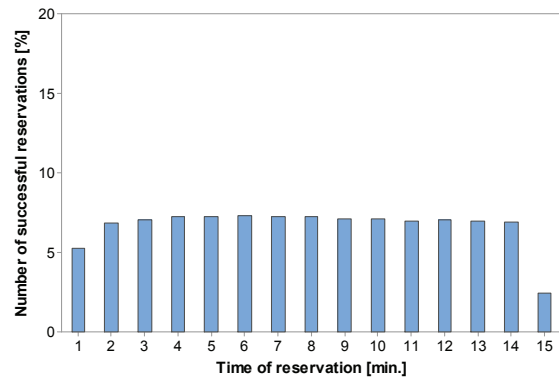
Figure 3 shows the distribution of the number of reservations for the different durations. The largest percentage of the duration of reservation are those lasting 15 minutes. However, not all of them have to be successful, as shown in Figure 4. Successful realization of the rental must be understood as the conclusion of a transport contract and the start of the rental. It may be result from many factors, such as resignation from rent caused by improper technical condition of the vehicle, not reaching the vehicle on time.



**Figure 2** Histogram of daily total time of rental per vehicle

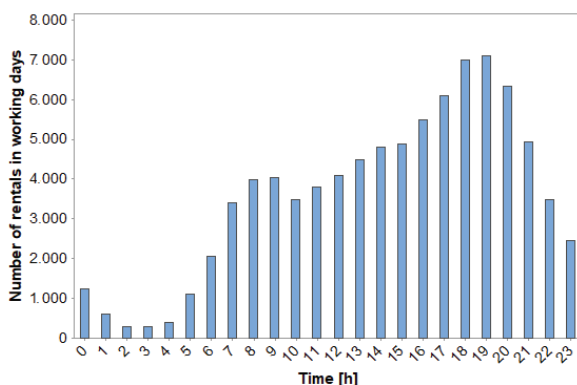


**Figure 3** Distribution of the total number of reservation

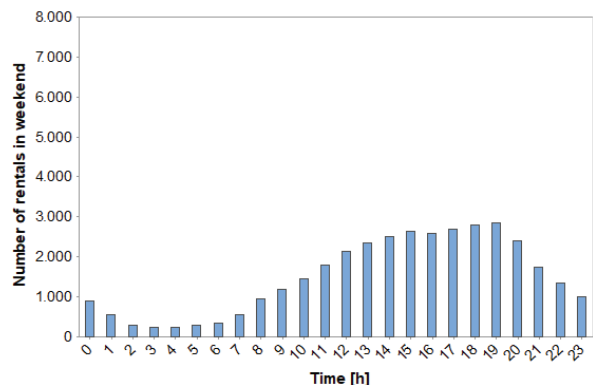


**Figure 4** Distribution of the successful number of reservation

It is important to analyze the activity of car sharing service by presenting a histogram of the number of rentals separately for working days and weekends, as shown in the **Figure 5** and **Figure 6**, respectively.



**Figure 5** Distribution of hourly rental in working days



**Figure 6** Distribution of hourly rental in weekends

**Figure 5** shows the activity on the carsharing service on working days. It can be seen the most interest in the service takes place between the hours of 4 p.m. - 9 p.m. A significant increase in number of rentals takes occurs in the morning between the hours 5 a.m. to 7 a.m. and gradually increases during the day reaching maximum value just over 7.000.

The distribution of interest in the carsharing service on weekends is similar to those on working day, especially on the mornings until 4 a.m., the number of rentals is at the same level. Then the number of rentals increases not exceeding the number of 3.000, which does not constitute even half of the maximum number on working days.

To increase the mean number of rentals, more attention should be paid on moving vehicles in less popular locations to those places that are preferred by customers during the day. The number of vehicles that are excluded from the service longer than one day should be limited. In case of reservations it should be noticed that those reservations lasting 15 minutes are often canceled automatically because the customers cannot reach the car at the appointed time. In the situation when the same customers renew their reservation, the vehicle is unavailable to others. Is a drawback, which can be eliminated by changes in the reservation system, e.g. by introducing an additional fee for the same customer to renew the reservation.

#### 4. CONCLUSION

The analysis of the carsharing activity on the Polish market allowed to determine the frequency of rentals of vehicles at particular and the times of the days, including working days and weekends. On the basis of the obtained distributions of rentals and the time of reservation it can be stated that the main purpose of rentals on working days may be business trips in the city area. Frequency of rentals per one vehicle during the day in the period covered by the survey ranged from 2 to 15 times. The biggest increase in carsharing service may be observed at the early hours of starting work by the majority of the society as well as in the evening hours. A significant difference in the daily number of vehicle rentals can be seen between business days and weekends. Future research in the area of carsharing may be extended by including an additional survey among the customers on the quality of the service in order to learn about the pros and cons of visible from the point of view of the recipients. In combination with the results obtained as a part of the following study, it will allow to improve the quality of the service and better match the offer to the users' requirements. The carsharing service is popular especially among young people and becomes an innovative element of the urban transport system. It can be used as an alternative to private motor vehicles, taxis and traditional public transport. For local authorities, the service became an opportunity to reduce the number of vehicles and solve the problem of insufficient number of parking spaces. In addition, carsharing can contribute to the promotion of zero-emission electric vehicles.

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