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Andrzej HANUSIK[1]

IDENTIFICATION AND RISK ASSESSMENT IN CARSHARING

Summary. There are many new concepts for doing business in the modern market. Carsharing is one of such models that are directly related to the sharing economy. The current body of literature shows an absence of reports about risk management in carsharing operators. Further investigation of scientific databases confirms the existence of a research gap in this field. The purpose of this article is for identification of risks in carsharing and their latter assessment in terms of probability of occurrence, impact on customer relationships, the importance of a given category and the cost they generate. A way of aggregating various categories of risks into one synthetic indicator to prioritise them was proposed. The methodology of the process was based on a methodological triangulation which is established on the following studies – analysis and criticism of literature which helps to place discussed research problems on a theoretical basis, qualitative research and observations allowing to identify individual categories of risks and quantitative research enabling the description of given categories of risks by appropriate variables on which further risk modelling is performed. Such research may be a basis for subsequent analysis and an impulse to an academic debate. Besides, it may contribute to the creation of further studies, which deal with the problem of assessment of the risk in concepts related to sharing economy.

Keywords: sharing economy, carsharing, risk assessment

[1] Department of Transport, University of Economics, 1 Maja 50, 40-287 Katowice, Poland.
Email: andrzej.hanusik@ue.katowice.pl. ORCID: https://orcid.org/0000-0001-9696-7344

1. INTRODUCTION

The modern market has a very dynamic composition, which forces the search for newer and more innovative solutions. Current situation brings many changes – both related to the purely practical business environment and the field of economic sciences. Certainly, it can be assumed that the advantage of the modern world is the creativity of business entities and consumers, and thus, innovations that are present on the free market (reflected by actions of enterprises or market-based organisations) [1] on the non-market social level (both individual and group) and even in the sector of government entities [2]. Globalisation and extremely rapid development of technologies can be considered as factors of these changes. Furthermore, these factors drive the world towards an increasingly homogenous community. These changes concern not only the way of communication, increasing mobility or standardisation of offered products but also the way of thinking (economic, social and cultural). This situation prompted the emergence of new concepts of offering using services or items on the market.

Increasingly, the phenomenon of the shift in the focus of approach to economic goods is noticed in the business models of enterprises and the consumption behaviour of people. Business entities are realising a growing awareness of the fact that access to a given good rather than the necessity of possessing it, is more economically effective. Sharing economy is a process involving the joint use of goods by many entities, extended by the aspect of engaging in joint activities [3]. Therefore, the traditional approach to market exchange, where ownership is, above all, an unlimited possibility to dispose of the good by its owner and a possibility of creating some kinds of boundaries for other entities that do not have such good, hence, restricting access, renting or selling the good [4].

The phenomenon of sharing economy is undeniably associated with market growth, which is being progressively discussed by academics and businesspersons. The popularity of the concept and constantly growing pace of solution in this area influences the change of currently operating business models of enterprises. Sharing economy is based on transactions related to granting access to a given good without transferring ownership to it. Hence, the entity receives only a certain unit of time specified in a contract, in which it can use the given food; acquires the right to temporary usage [5]. This approach allows the use of certain goods by entities that would not be able to buy them. This situation allows increasing the productivity of the economy (by increasing the possibilities for individual entities) and contributes to minimising the phenomenon of exclusion. The weakness of this concept lies in the anonymity of entities using a shared good (in some cases) and the possibility of improper use of the good. Consequently, there is a risk that the entity, which only uses a given good, may not care for it as much as in the situation that it owns it. This may result in decreasing the quality of commonly used goods or services. Accordingly, this situation can be observed in the case of goods shared by people rather than by enterprises.

Carsharing is one element of the sharing economy. Carsharing consist of a paid access to a car, which is not fully used by its owners (in case of private carsharing) or to a specially adapted vehicle for a short rental (in case of business carsharing). Access to vehicles is based on one-time or periodic payments. Cars are almost only used for short local journeys, as renting a car for a longer period attracts very high costs [6]. The whole transaction is concluded and settled using a dedicated application, so there is no need for direct contact with the client. The use of a sharing economy (including carsharing), in urban areas, may contribute to the improvement of the transport situation in the given area; transport will become cleaner, more intelligent and more sustainable. More so, the mobility behaviour of citizens and business entities would change, which will contribute to increasing the efficiency usage of infrastructure and

reduction of cost [7]. Such a solution is a very convenient form for consumers; however, it is associated with an increased risk for the entity offering the carsharing services.

It can be presumed that concepts related to sharing economy will develop dynamically in the future. It is related to the market itself and the nature of the Y-generation who are increasingly active on the market. This generation is keen on searching for innovative solutions, thus, they wholly embrace the sharing economy. Additionally, the Y-generation are eager to take risky actions [8], which impacts on the costs and risk bore by carsharing operators. Therefore, it is necessary to identify risky activities and the probability of their occurrence for entities offering carsharing services to create an efficient and effective risk management system

2. METHODOLOGY AND DATA

The research methods and techniques used in this work were based on methodological triangulation (Figure 1). The structure of the study allowed for an in-depth analysis of the problem and for obtaining more reliable conclusions.

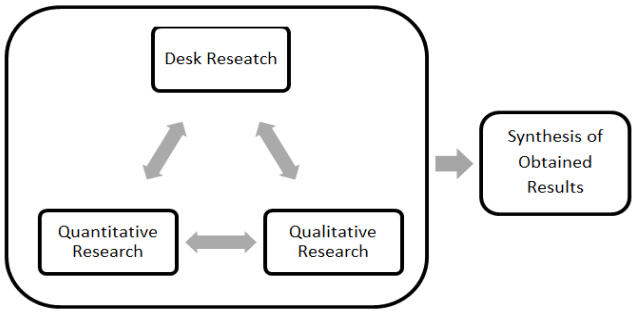

Fig. 1. Methodological triangulation used in this study

In the first part of the article, the method of analysis and criticism of literature (desk research) was used. It includes a systematic and orderly study of previous scientific works and existing publication resources [9]. The use of this method allowed the identification of the research problem and defined ways to solve it.

Furthermore, observations were made to identify risks that occur in carsharing activities. This method consists of discreet observation of people using carsharing, their behaviour when renting a vehicle, its use and return. This allowed identifying the types of risks to be considered in the risk analysis.

Thereafter, the IDI (Individual In-depth Interview) method was used. In-depth interview is a qualitative research technique, which involves conducting intensive individual interviews with a small number of respondents. The result of the interviews provides information about their knowledge and point of view on the selected topic. IDIs are used in the case of new research problems that were not previously scientifically discussed or were discussed superficially [10]. In-depth interviews were conducted with carsharing users, sharing economy experts, and carsharing services providers. The structure of the interviews was semi-structured (respondents were asked questions following the prepared scenario with freedom of expression allowed). Conducted interviews allowed the identification of subsequent risk categories and their initial assessment.

The last step related to collecting data was surveying the assessment of individual risk categories in terms of likelihood of their occurrence, impact on customer relations (if detected by the customer) and a subjective indication of a maximum of three risks most relevant to carsharing activities. Overall, 528 people took part in the survey (snowball sampling). The survey was conducted from October 1, 2019, to October 22, 2019, using paper and online forms. Fourteen surveys were rejected due to wrong filling, lack of information or illegibility.

Next, based on previous steps and additional analyses, individual risk categories were assessed in terms of the following indicators:

- X_1 – probability of risk occurrence (expressed in the form of assessments obtained through surveys), where:
  - 1 – very low probability of occurrence,
  - 2 – low probability of occurrence,
  - 3 – average probability of occurrence,
  - 4 – high probability of occurrence,
  - 5 – very high probability of occurrence.
- X_2 – impact on relations with customers (expressed in the form of assessments obtained through surveys), where:
  - 1 – very large negative impact,
  - 2 – large negative impact,
  - 3 – medium negative impact,
  - 4 – little negative impact,
  - 5 – very little negative impact.
- X_3 – significance of a given risk category - number of survey responses (expressed in%).
- X4 – costs associated with the occurrence of a given risk - to determine the most likely cost associated with the occurrence of a given risk (C_o), a triple estimation was used (following the PERT methodology). Optimistic (C_c), most likely (C_m) and pessimistic (C_p) cost values were adopted for each risk. The value was received via IDIs. The expected value of the beta distribution was calculated from the formula [11]:

$$C_o = \frac{C_c + 4C_m + C_p}{6} \tag{1}$$

Thereafter, the calculation of key risks in carsharing activities was made. First, the assignation of superior importance indicators and lesser importance indicators for the carsharing enterprises were made. The weights were determined by analysing in-depth interviews with representatives of carsharing companies. It should be noted that each risk category has been described by four indicators, which are characterised by different units and the values associated with the highest level of risk in individual categories, once strive for maximum, once for minimum. This situation required aggregating all indicators into one synthetic indicator (S_i), which allowed obtaining comparable results:

$$S_i = \frac{1}{\sum_{i=1}^{n} w_i} \times \sum_{i=1}^{n} (w_i \times X'_{ij}) \tag{2}$$

where X'_{ij} represents aggregated values for individual indicators. Aggregated values were calculated from the formulas:

$$X'_i = \frac{x_{ij}}{\max(x_{ij})} \quad for\ values\ striving\ for\ maximum \tag{3}$$

or

$$X'_i = \frac{\min(X_{ij})}{X_{ij}} \; for\ values\ striving\ for\ minimum \tag{4}$$

where X_{ij} is the indicator value for a particular risk category. The maximum value means that the highest score is associated with the highest risk, whereas, the minimum, the lowest score is the highest risk.

It is likewise worth noting that:

$$S_i \in (0; 1> \tag{5}$$

To simplify the calculation, the weight values for individual indicators have been allocated using the percentage presented in decimal form:

$$\sum_{i=1}^{n} w_i = 1 \tag{6}$$

Thus, the formula for the synthetic indicator has been simplified to the form:

$$S_i = \sum_{i=1}^{n} (w_i \times X'_{ij}) \tag{7}$$

The procedure carried out in this way leads to the aggregation of individual indicators into one synthetic indicator, which allows for prioritising individual risk categories and placing them in the strategy of a carsharing company.

3. RESULTS

Through the observations and individual in-depth interviews (IDI), the following types of risk have been identified to occur in carsharing:

- Y_1 – vehicle theft – for the analysis, one of the most popular passenger carsharing vehicles in Poland (Renault Clio) was selected. For example, it is used by Traficar [12];
- Y_2 – gasoline theft – the vehicle is not serviceable, it is necessary to refuel and possibly tow;
- Y_3 – total damage of the vehicle – the car is not capable of further use;
- Y_4 – partial damage of the vehicle – the vehicle is capable of further use after making the necessary repairs;
- Y_5 – leaving the vehicle in a dangerous place – generates the risk of damage or theft - direct costs associated with the necessity of moving the vehicle or are connected with lost sales opportunities;
- Y_6 – leaving the vehicle in an unauthorised place – the risk of receiving a ticket, towing away or damaging it;
- Y_7 – dirty exterior of the car – the risk of losing customers and incurring washing costs;
- Y_8 – dirty interior of the car – the risk of losing customers and incurring cleaning costs;
- Y_9 – running out of gasoline/discharging an electric vehicle during use – the risk of losing customers, towing costs;
- Y_{10} – mobile application problems – the risk of losing customers;

- Y_{11} – making the vehicle available to third parties – the possibility of damage, the problem with debt collection;
- Y_{12} – driving in a state of intoxication – the possibility of damage, the risk of losing customers, negative opinions from customers;
- Y_{13} – counterfeit documents during registration – a problem with establishing the driver's identity and with debt collection;
- Y_{14} – lack of funds for service fee - freezing capital, the need to start the debt collection.

Categories of risk listed above were assessed by respondents in terms of three measures and supplemented by the estimation of costs associated with their occurrence. The costs were estimated based on the real value of the vehicles, their equipment, fuel prices or costs related to transport-related services; cleaning, towing, repairs or costs of the debt collection process. Table 1 shows the results of the conducted research (rounded to two decimal places).

Tab. 1

Research results

	mX_1 *max*	mX_2 *min*	mX_3 [%] *max*	X_4 [PLN] *max*	
Y_1	2,58	1,93	37,88	C_c = 20 000; C_m= 50 000; C_p = 60 000 *the cost depends on the age and condition of the car*	$C_o \approx$ 46 667
Y_2	2,69	2,31	12,12	C_c = 150; C_m= 250; C_p = 500 *the cost depends on the price of gasoline and the need for towing*	$C_o \approx$ 275
Y_3	3,00	1,75	41,67	C_c = 20 000; C_m= 50 000; C_p = 60 000 *the cost depends on the age and condition of the car*	$C_o \approx$ 46 667
Y_4	3,92	2,08	48,48	C_c = 2 000; C_m= 5 000; C_p = 20 000 *the cost depends on the scale of damage*	$C_o \approx$ 7 000
Y_5	3,53	2,62	21,97	C_c = 20; C_m= 50; C_p = 200 *the cost of moving the vehicle and loss of customers*	$C_o \approx$ 70
Y_6	3,77	2,74	25,00	C_c = 20; C_m= 100; C_p = 1 000 *the cost of moving, towing away, parking and loss of customers*	$C_o \approx$ 237
Y_7	4,02	3,55	3,03	C_c = 10; C_m= 30; C_p = 80 *the cost of travelling to the car wash and washing*	$C_o \approx$ 35
Y_8	4,01	2,88	21,97	C_c = 100; C_m= 250; C_p = 1 000 *the cost of travelling and cleaning service*	$C_o \approx$ 350
Y_9	3,40	2,39	11,36	C_c = 50; C_m= 100; C_p = 300 *the cost of towing and loss of customers*	$C_o \approx$ 125
Y_{10}	3,19	2,44	23,48	C_c = 30; C_m= 300; C_p = 5 000 *the cost of losing customers*	$C_o \approx$ 1 038
Y_{11}	3,23	2,83	18,94	C_c = 0; C_m= 30; C_p = 150 *the cost of non-payment, debt collecting and loss of customers*	$C_o \approx$ 45

Y_{12}	3,08	2,23	16,67	$C_c = 0$; $C_m = 30$; $C_p = 1\,000$ *the cost of non-payment and a lawsuit*	$C_o \approx$ 187
Y_{13}	2,65	2,48	15,15	$C_c = 0$; $C_m = 30$; $C_p = 1\,000$ *the cost of non-payment and possible damage*	$C_o \approx$ 1 687
Y_{14}	2,92	2,82	2,27	$C_c = 0$; $C_m = 30$; $C_p = 100$ *the cost of non-payment*	$C_o \approx$ 37

The values of the X_1, X_2 and X_3 measures presented in the table are the values obtained in the survey. Costs are indicative values, which should be considered individually in each case. Nevertheless, certain values must be adopted to conduct a risk analysis. Their size depends primarily on the scale of the problem or the occurring abuses. The values of individual measures were estimated using IDI. Triple cost estimation was used to best fit the model to reality.

The next part of the research was to calculate the value of the synthetic indicator. The following weights of individual factors were adopted in this study: w1 = 0.30; w2 = 0.20; w3 = 0.20; w4 = 0.30. The base for establishing the weights of individual factors were the expectations of the carsharing companies. According to IDIs, the costs and probability of risk occurrence are the most important (they constitute 60% of weight). Customer relations (the X_2 and X_3 measures) represent 20% in the analysis (10% per gauge). Table 2 presents the results of the conducted analysis (to obtain more accurate results, the values of the calculated indices have been rounded to four decimal places).

Tab. 2

Synthetic indicator results

	X_1 **$w_1 = 0,30$**	**X_2** **$w_2 = 0,20$**	**X_3** **$w_3 = 0,20$**	**X_4** **$w_4 = 0,30$**	$\sum$
Y_1	0,1925	0,1813	0,1563	0,3000	**0,8301**
Y_2	0,2007	0,1515	0,0500	0,0018	**0,4040**
Y_3	0,2239	0,2000	0,1719	0,3000	**0,8958**
Y_4	0,2925	0,1683	0,2000	0,0450	**0,7058**
Y_5	0,2634	0,1336	0,0906	0,0004	**0,4880**
Y_6	0,2813	0,1277	0,1031	0,0015	**0,5136**
Y_7	0,3000	0,0986	0,0125	0,0002	**0,4113**
Y_8	0,2993	0,1215	0,0906	0,0022	**0,5136**
Y_9	0,2537	0,1464	0,0469	0,0008	**0,4478**
Y_{10}	0,2381	0,1434	0,0969	0,0067	**0,4851**
Y_{11}	0,2410	0,1237	0,0781	0,0003	**0,4431**
Y_{12}	0,2299	0,1570	0,0688	0,0012	**0,4569**
Y_{13}	0,1978	0,1411	0,0625	0,0108	**0,4122**
Y_{14}	0,2179	0,1241	0,0094	0,0002	**0,3516**

The conducted analysis allows for prioritising individual risk categories in terms of their importance for carsharing companies. The analysis methodology presented in this work can be a starting point for further in-depth research. Moreover, the results obtained may be the starting point for creating risk management strategies for carsharing companies.

4. DISCUSSION

After the analysis, individual risk categories were ordered according to their importance for the risk management strategy of carsharing enterprises. Table 3 presents values of the synthetic measure in a hierarchical order.

Tab. 3
Synthetic indicator results in descending order

Y_3	0,8958
Y_1	0,8301
Y_4	0,7058
Y_6	0,5136
Y_8	0,5136
Y_5	0,4880
Y_{10}	0,4851
Y_{12}	0,4569
Y_9	0,4478
Y_{11}	0,4431
Y_{13}	0,4122
Y_7	0,4113
Y_2	0,4040
Y_{14}	0,3516

The key risks for carsharing companies were total vehicle damage (Y_3), vehicle theft (Y_1) and partial vehicle damage (Y_4). This situation is associated with the higher costs of these events, in this case, a good solution is vehicle insurance and a record in the regulations about the assignation of costs related to vehicle damage to the consumer, such solutions are practically used in all carsharing companies, that is, Traficar [13], Panek [14] or Drive Now [15]. The fee is usually transferred to the user in a situation when there is a necessity of paying a parking fee (Y_6), cleaning the car (Y_8) or when an unauthorised person drives a vehicle (Y_{11}).

Leaving the vehicle in a dangerous place (Y_5) may similarly be a big problem, as this may result in damage to the vehicle or loss of customers. The solution may be the so-called "cutting out zones", that is, determining areas in which the car cannot be left unattended.

Application issues (Y_{10}) are very important problems. Although they are not associated with high costs, they have a relatively large impact on the relationship with customers. Moreover, according to the conducted research, problems with applications happen at times, which also has an impact on the company's image.

Driving in a state of intoxication (Y_{12}) is a very big problem for road safety. Furthermore, carsharing vehicles are often available in entertainment districts, which may encourage inebriated people to use them, for example, when returning home. It should be noted that driving in the state of intoxication is not a very important risk for carsharing companies, in the event of an accident, collision or dirt, the driver is held liable. Nevertheless, preventive actions may be part of the CSR strategy of carsharing operators.

Running out of gasoline or discharging an electric car (Y_9) during usage of the vehicle is unlikely. This situation is caused by a lack of care on the part of the enterprises to constantly supplement them. However, it should be noted that when such a situation occurs, it could

contribute to significant traffic difficulties, negative opinion about the entrepreneur, and in the worst case, even to a collision or accident.

The use of counterfeit documents during registration (Y_{13}) is not a common situation. Although, it may lead to problems with determining the driver's data and the subsequent recovery of receivables, nevertheless, carsharing companies often protect themselves in an additional way, the second stage of verification is the need to connect to the credit card system and / or make a small amount transfer. Such activities significantly impede the provision of false data. However, they do not protect the enterprise against possible losses related to the collection of receivables due to lack of funds for travel (Y_{14}). However, the losses, in this case, are small. More so, usually after sending a reminder, the customer decides to pay. Nevertheless, in some cases it is necessary to start the debt collection process, which is not profitable for small amounts (such as those usually associated with car journeys for minutes), which may result in the operator's unwillingness to initiate proceedings; the case will probably result in blocking the account. However, these small unrecovered amounts do not affect the overall balance of the enterprise (the effect of scale works here), besides, they are also not often encountered, which is the reason this risk was ranked last in the hierarchy.

The dirty exterior of the car (Y_7) is the situation with the highest probability of occurrence. Whereas the costs associated with levelling it are small, and the mere contamination of the car body does not affect the customer's decision to rent the car. The standard public approach is the fact that cars are utility items that could get dirty. Moreover, soiling the outside of the car does not affect the comfort of travelling (unless the windows, lights or mirrors are dirty).

Gasoline theft (Y_2) in modern times is quite a common situation (especially in transport companies). This situation is primarily related to gasoline prices, a strong correlation can be observed between the number of thefts and the price of gasoline [16]. Nevertheless, there are many effective methods to prevent theft. Additionally, vehicles of the carsharing fleet are constantly monitored, so thieves prefer to steal from private cars.

5. CONCLUSION

The analysis allowed obtaining a catalogue of risks related to carsharing activities and prioritise them in terms of importance for operators. To the best of the author's knowledge, no article dealing with these issues has been published before now. The author is also aware of the diversity of expectations of individual operators, which means that the conducted research indicates only the most important factors in the industry. Moreover, the choice of measures for assessing individual risk categories depends on the individual preferences of operators. Nevertheless, the analysis may prove to be the foundation for further research and provide a starting point for creating risk assessment strategies in carsharing activities.

Furthermore, it should be noted that each analysis is tailored to a specific market. The approach of customers, the likelihood of a given risk or prices may vary depending on the geographical location, the economic system of the given country or cultural conditions. This analysis is adapted to the specifics of the Polish market; however, some features may be common with other areas.

The author's goal was to identify the research gap regarding the concept of sharing economics and initiate an academic debate on this topic. This article is to constitute an introduction to further extended research in this field.

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