Mapping Sharing Economy Landscapes: A Segmentation Analysis of World's Cities

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Abstract. *The sharing economy offers a contemporary and environmentally friendly approach to distributing resources, goods, and services among individuals, facilitating waste reduction and sustainable consumption. Over time, sharing platforms have emerged across various sectors such as tourism, transportation, finance, education, and others. The following paper focuses on global cities and the development of the sharing economy ecosystem within them. The main goal of this study is to map certain types of cities according to the level of sharing economy ecosystem development. The conducted analysis is the cluster analysis, using the k-means algorithm on the Sharing Economy Index (SEI) data for 2023. The results show that three segments (Basicville, Mediapolis, and Coexistia) can be identified based on the analysis of nine proposed indicators. The pivotal importance of conducting this analysis lies in its ability to systematically compare cities belonging to similar clusters. Through such comparative assessments, invaluable insights emerge, facilitating the refinement and optimization of sharing economy systems across diverse urban landscapes.*

Keywords. *Sharing economy, Sharing Economy Index, cluster analysis, sharing economy ecosystem.*

1 Introduction

Over recent years, there has been a noticeable increase in the sharing economy industry, which affects different aspects of today's social and economic system. The Sharing Economy (SE) involves business models or activities that encourage the sharing of underused assets, aiming to enhance overall efficiency and sustainability (Belk, 2014; Puschmann & Alt, 2016). All SE business models can be divided into three main types: the SE models whose object of sharing is a physical asset, the SE models whose object of sharing is service, and SE models whose object of sharing is also a service with the inclusion of physical asset (Bojkovic et al., 2022). Physical-asset-based SE models are the models that offer assets such as property, vehicle, etc., and the best-known brands from this category are Airbnb (platform for offering accommodation), Turo (business model that offers vehicles), and BlaBlaCar (a platform that connects the users to reduce the number of empty seats in cars). The second type of SE businesses are the businesses that are offering the skills and time of individuals. They include activities such as object cleaning, giving classes, babysitting, and others. The most popular service-based SE models are Sittingaround (a babysitting service platform), TaskRabbit (a platform that offers cleaning services), and Superprof (a platform for tutorials). The service-sharing economy models that require physical assets to fulfil the service usually refer to driving service companies such as Lyft and Uber (Codagnone, Abadie, & Biagi, 2016; Farrell & Greig, 2016; Kuhn & Maleki, 2017).

The impact of the sharing economy can be measured through economic lens (revenue generated, GDP contribution, employment), social lens (user participation, environmental impact), technological adoption (digital platforms), trust (number of reviews, trust metrics) and others (Vaughan & Hawksworth, 2014; Simic & Liem, 2023). Among these metrics, the one that attracted our attention is the composite indicator approach and the Sharing Economy Index (SEI) developed by (ConsumerChoiceCenter, 2024). This multidimensional metric tries to encapsulate the complexity of sharing economy ecosystem using nine indicators.

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Given the prevalence of cities adopting smart, digitally driven, urban, and environmentally conscious practices through the integration of sharing economy ecosystems, the following study aims to categorise these cities into distinct segments based on their level of sharing ecosystem development measured by SEI. This segmentation aims to provide insights into cities' diverse sharing ecosystems and identify those with more and less developed sharing ecosystem. As a segmentation analysis, cluster analysis was chosen (Gower, 1967).

The paper is structured as follows. The second section reviews previous attempts at cluster analysis implementation in the sharing economy. Subsequently, the following section explains the Sharing Economy Index (SEI), its indicators, as well as the ranking methodology. After explaining the SEI, the conducted case study setting is presented. Ultimately, the paper ends with an overview of the results, the main conclusions and some research limitations.

2 Implementation of cluster analysis in sharing economy

This paper has a goal of dividing cities into clusters according to their similarities in the Sharing Economy Index, by using the cluster analysis. In relation to the sharing economy, the cluster analysis has already been used for similar purpose in the past. Jovanović and co-authors (2023) segmented European countries based on the participation of citizens in the shared mobility. For that purpose, they used 12 indicators and observed 26 European countries, with the k-means algorithm of cluster analysis. The cluster analysis showed that European countries should be segmented into three clusters and that the city's geographical position did not impact the cluster membership.

Another paper categorised European countries based on the characteristics of individuals who utilise shared accommodation services. Using data from the Eurostat survey on household internet usage in 2019, researchers also applied the k-means clustering algorithm to analyse the data. The findings suggested that there are variations in consumer behaviour across Europe, particularly influenced by socio-economic factors. The Western European nations showed increased usage, and Central European countries had a mid-level of usage, whereas the Eastern European countries have not yet developed shared accommodation services (Maričić et al, 2023).

Mátrai and Tóth (2020) attempted segmenting 64 global public bike sharing systems. Their analysis included several steps: multinomial regression, cluster analysis (k-means), internal cluster validation, and external cluster validation. The outcome of the analyses were four clusters that differed in ownership and the operator type. One of the conclusions showed that geographical location does not have impact on the cluster structure, since the clusters were not homogeneous in this way.

Lastly, one of the papers defined the positive relationship between the bike sharing systems and public expenditures. For the analysis, the authors analysed the Polish market of bike sharing containing 19 bike-sharing systems that, on average, have 44 stations and 488 bikes. To analyse the data, a cluster analysis with the k-means method was used. The analysis has divided all systems into three clusters depending on the number of stations and owned bikes and has shown that the municipality budget has a very high correlation (94%) with the development level of the bike sharing systems in Poland (Suchanek & Wołek, 2018).

The four presented studies show that segmentation analysis in the field of sharing economy is a prominent topic which attracts interest.

3 Sharing Economy Index (SEI)

The Sharing Economy Index (SEI), introduced in 2020 by the Consumer Choice Center, aims to rank 60 global cities to assist consumers in selecting destinations aligned with their sharing economy preferences. The ranking system of Index’s fourth edition comprises nine indicators, with a maximum score of 160, evaluating aspects such as the availability and accessibility of services like ride-hailing, carpooling, professional car sharing, ultra-fast delivery apps, peer-to-peer lending, gym sharing, library sharing, flat sharing, and e-scooters (ConsumerChoiceCenter, 2024).

Ride-hailing involves hiring a private driver and vehicle via a platform to reach a specified destination, with cities scored based on availability and accessibility, garnering up to 40 points. Carpooling, which involves sharing rides for different purposes, accounts for 10 points. Professional car sharing, where individuals rent private vehicles for long-term use from others or companies through sharing economy platforms, is assessed for a maximum of 30 points. Ultra-fast delivery apps, which swiftly deliver restaurant orders to consumers within 15 minutes, contribute 10 points if available. Peer-to-peer lending, facilitating direct borrowing from individuals through fintech platforms, is evaluated based on regulatory factors impacting sector growth, with a potential score of 20 points. Gym sharing, determined by the ease of accessing gyms or fitness studios via mobile apps, earns 10 points if feasible. Library-sharing apps and websites, enabling access to multiple libraries, contribute up to 10 points. Flat sharing, allowing travellers to rent accommodations from private homeowners instead of hotels, is rated for a maximum of 20 points. Lastly, cities with available e-scooters for rental receive an additional 10 points (ConsumerChoiceCenter.com, 2024).

4 Case study settings

The goal of this study is to segment 60 cities ranked by the SEI using the nine indicators and the most recent data, data for the year 2023. To better understand the similarities and differences between cities and ease the comparability between the cities, we wanted to segment them into several homogeneous groups. As the grouping algorithm, cluster analysis was chosen (Maricic, Uskokovic & Jeremic, 2023). Implementing cluster analysis in the sharing economy is crucial for identifying cities with similar sharing dynamics, enabling targeted interventions and optimising resource allocation to promote sustainable growth and resilience.

We opted for the k-means algorithm as it has previously been used in the field of research (Maricic et al., 2023), as well as the fact that the results of the k-means algorithm are easier to interpret and communicate with the decision-makers. Besides, the k-means algorithm is an often-used unsupervised machine learning technique used for clustering. It operates by iteratively partitioning the dataset into k clusters based on the similarity of data points, aiming to minimise the variance within each cluster (Maricic, Ignjatovic & Jeremic, 2022). This iterative process involves recalculating cluster centroids and assigning data points to the nearest centroid until convergence, providing a straightforward and efficient method for pattern recognition and data segmentation. The k-means algorithm was not repeated to ensure that the best partitioning was achieved, as the analysis was done in SPSS 23, which does not allow different initialisation methods.

To determine the best cluster structure, we observed the WSS (Within-Cluster Sum of Squares) and the distribution of cities per cluster. Namely, we did not want to retain cluster structures with a small number of cities (Fraley & Raftery, 1998). Additionally, we did not normalise the data as we observed indicator data, which was almost all on the same scale.

5 Results

The cities were grouped based on the indicator values of the Sharing Economy Index and divided into three segments according to their sharing economy ecosystem development. The three segments are: Basicville – cities with the low SE ecosystem development, Mediapolis – cities with the middle SE ecosystem development, and Coexistia – cities with highly developed SE ecosystems. Based on the performed ANOVA analysis, two out of nine indicators are similar for all global cities. Those indications are carpool app/platform ($p=0.794$) and e-scooters ($p=0.477$). One more indicator is very close to the insignificance level, and it is gym sharing ($p=0.048$). Global cities were analysed based on the remaining six indicators that are significant according to ANOVA analysis.

The *Basicville* cluster refers to the global cities in which most of the indicators have the lowest value between three clusters. The rail-hailing is non-existent (mean 00.00), while the ultra-fast delivery apps are almost non-existent with the mean value of 2.86. Peer-to-peer lending (mean 7.86) and flat sharing (mean 8.43) do exist in these cities but are not developed enough and have certain restrictions. Surprisingly, out of all defined clusters, library sharing (mean 10.00) is the most developed in Basicville

cities. Professional car sharing had a high development with mean value 27.14 out of 30 (Table 1). This cluster consists of seven cities, and its members are Athens, Copenhagen, Istanbul, Ljubljana, Luxembourg City, Sofia, and Tokyo.

Table 1. Mean results for Clusters (Source: Authors' work)

Characteristics	Basicville (mean)	Mediapolis (mean)	Coexistia (mean)
Ride-Hailing	0.00	34.17	28.41
Carpooling App or Platform	8.57	8.33	9.02
Professional Car Sharing	27.14	25.00	29.27
Ultra-fast Delivery Apps	2.86	8.33	8.29
Peer-to-peer Lending	7.86	9.58	14.39
Gym Sharing	7.14	6.67	9.27
Library Sharing	10.00	1.67	9.76
Flat Sharing	8.43	15.92	8.71
E-Scooters	8.57	10.00	9.27
Number of Cases	7	12	41

The second cluster consists of the cities that are relatively developed compared to the previous cluster and is named *Mediapolis*. The library sharing (mean 1.67) is poorly developed in these cities, while other types of sharing economy models are developed, but not to the highest level. Ride-hailing (mean 34.17) and flat-sharing (mean 15.92) are the most developed forms of SE in this cluster. Most of the cities have ultra-fast delivery apps with the mean value of 8.33 for the cluster representative. Additionally, besides having the developed system of professional car sharing (mean 25.00), this type of sharing economy is the least developed in Mediapolis cities. Mediapolis includes 12 cities, and the representatives of this cluster group are Belgrade, Buenos Aires, Mexico City, Minsk, Sao Paulo, and Tbilisi.

The last cluster is named Coexistia, since most of the six observed indicators have high values and are rally close to being the leaders, while two indicators have the highest mean values. The representative of this cluster is the leader in professional car sharing (mean 29.27) and peer-to-peer lending (mean 14.39). The least developed form of sharing economy in this segment is flat sharing (mean 8.71). Other indicator values show that even though these cities are not the leaders in all sharing economy models but are very close to being fully developed in those segments as well. This cluster includes 41 global cities, and some of the members are Amsterdam, Berlin, Bucharest, London, Madrid, New York City, Taipei, Vienna, and Zagreb.

6 Discussion and conclusion

The outcome of the analysis showed that global cities can be divided into three segments according to the presence and development level of the sharing economy ecosystem. All sharing economy models exist in every cluster, except for ride-hailing, which is non-existent in the first cluster (Basicville). The most developed SE model I professional car sharing, since all clusters have the mean value close to the highest possible (30). The limitation of the research was the significance level for two indicators. According to the ANOVA analysis, the values between the three groups for the indicators carpool app/platform ($p=0.794$) and e-scooters ($p=0.477$) do not differ. This could indicate that the two indicators could be removed from the ranking system or from the future segmentation analysis. Additionally, gym sharing had the significance of 0.048, which is very close to the value that is considered insignificant, raising the conclusion that gym sharing could also be relatively same among clusters. This means that these three indicators are possibly not the best indicators for explanation of the city's SE development. Another limitation is that the observed cities are from different continents, cultures, and size.

Future research activities could be divided into two directions. One direction is focusing on the current structure of SEI to develop indicators that vary more among cities. Indicators that could potentially be used may be found within other types of shearing economy models such as bike sharing models, education sharing models, etc. That will bring even better opportunities for the comparison of cities and more accurate results. The big advantage is also the ability to compare cities within one cluster, and among different clusters. This would enable cities to connect and further develop their sharing economy

ecosystem based on the knowledge collected from other cities. Ultimately, the future development of the sharing economy relies on integrating technology, balancing regulation, and fostering societal acceptance.

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