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**Identifying the gaps between needs, expectations, and views
of different stakeholders related to car-sharing, bike-
sharing, and scooter-sharing systems**

Abstract

Shared mobility, such as car-sharing, bike-sharing, and scooter-sharing services, is quickly expanding in several countries, including Italy, where it was introduced a few years ago. The benefits of this type of transportation mode have been estimated and reported by many authors. However, since a shared mobility system is a type of transportation that combines the characteristics of private vehicles and transit services, policy-makers may not know how to treat it well. Moreover, although many policies have been proposed to promote shared mobility, they still have little impact in terms of aggregated market shares in urban areas. It may be because the actual requirements of the passengers regarding shared transportation services characteristics are not well understood. Hence, it is important to understand what needs to be improved in shared mobility services.

Aiming to contribute to filling this gap, two separate studies are carried out, namely the analysis of car sharing, scooter sharing, and bike sharing (separately) and the analysis of shared mobility services (as a whole, not related to a specific one). In the analysis of each shared mobility service (separately), 12 sub-criteria are compared by four different stakeholder groups (users, non-users, local authorities, and services operators) to determine their standpoints on the importance of each sub-criterion that people can consider in their decisions to use each shared mobility service. Also, in the separate analysis of each shared mobility service, each stakeholder rated the importance of specific criteria associated with their specific role. Hence, the criteria rated by government members differ from those rated by operators and users/non-users. However, users and non-users rated the same criteria in order to understand their perceptions' gaps.

This study applies Multi-Actor Multi-Criteria Analysis (MAMCA) because it is an appropriate method when different stakeholders are involved. One step of the MAMCA is to determine the main criteria and weights, which is done through a perception-based analysis that was implemented by using a Bayesian Best-Worst Method (BWM). This method is chosen because it is the only one ensuring a very high quality of the computed weights while requiring a small amount of data. The latter aspect is essential because some of the shareholders are members of the

government and operators, which are few in number. Other advantages of this method include the combination of weight quality, fewer inconsistencies between criteria, fewer data required to obtain highly reliable results, low equalizing bias, and average transparency of the method.

Before calculating the optimal group weights by Bayesian BWM, the consistency of the interviewees' answers was checked using the input-based approach, and acceptable ones (their obtained global input-based consistency ratio is less than the input-based consistency ratio thresholds) were considered. After eliminating pairwise comparisons with unacceptable consistency ratios, different sample sizes can be obtained and utilized for different levels of the model. Also, it is important to note that Bayesian BWM can provide much more information than the original BWM. For example, Bayesian BWM can provide the credal ranking and confidence level in the weight-directed graph. This helps to understand the importance perceived by stakeholders of one criterion over other criteria. From a methodological viewpoint, the experimental design proposed in the present work also helps to make some original contributions to the field of multicriteria analyses and Bayesian BWM applications.

In order to collect the required data, nine different surveys have been designed and administered in the Turin metropolitan area in Italy. Data on operators and government members were collected through phone calls to targeted contact points, while for users and non-users, a panel maintained by a survey company was used to have a representative sample of the population in the study area (using online surveys). Survey data are used to calculate criteria and sub-criteria weights to determine how the comparative criteria are rated in terms of importance by different stakeholders of different shared mobility services. Hence, surveys provide insights into how specific individuals or groups perceive certain aspects. In those surveys administered to users and non-users of each shared mobility service, in addition to BWM-related questions, questions about their routines, daily travel views, and socio-demographic characteristics were also asked.

This study helps determine the relative importance of sub-criteria and main-criteria from each stakeholder's perspective and contributes to understanding how one main-criterion/sub-criterion can be of different importance across different shared mobility services. Besides, it helps to distinguish stakeholders' views on each sub-criterion and, more specifically, to know how different stakeholders score the importance of the comparison factors associated with their role as shared mobility service stakeholders. Based on these results, suggestions for government members and each shared mobility service operator are given to attract more users and non-users and to understand which shared mobility system is most appropriate to implement in Turin, according to users' and non-users' perceptions. Also, this study contributes to presenting scenarios to determine how to increase the use of bike-sharing and scooter-sharing services compared to car-sharing services, given their larger social benefits.