Barriers to vehicle-sharing among NGOs during disaster relief operations: Findings from a developing country's perspective

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Abstract

NGOs (Non-governmental Organizations) are still lagging in adopting the benefits of vehicle-sharing during disaster relief operations. Therefore, the primary objective of this investigation is to scrutinize the impediments that impede the cooperative efforts among NGOs in the context of vehicular resource sharing within the framework of disaster relief operations. The idea is to enhance relief operations' transport capacity, reduce pollution and congestion, and benefit the total environment without increasing the number of vehicles. In order to study this little-known area of research, an exploratory study is conducted by interviewing experts (i.e., those responsible for administering relief distributions) from both local and international NGOs in a regularly disaster-troubled developing country, Bangladesh. Using the innovation resistance theory, this study examines and categorizes a list of potential important barriers. In this study, various types of barriers are identified based on the innovation resistance theory. These barriers are categorized into five groups, including risk (consisting of 10 barriers), usage (comprising of 7 barriers), tradition (including 4 barriers), value (comprised of 2 barriers), and image (consisting of 1 barrier). Accordingly, vehicle-sharing is linked with many potential side-effects or uncertainties, as the majority of the identified barriers are connected to risks. It is also worth noting that certain vehicle-sharing barriers, which may seem crucial, can be addressed for better outcomes. For example, a strategy could be to communicate potential legal barriers and predetermine accountability for possible accidents. The research outcomes also suggest that the implementation of a vehicle-sharing initiative within the realm of disaster relief operations is susceptible to a multitude of intricate and technically oriented usage challenges that are inherently unavoidable. Notable among these issues are the physical characteristics of the vehicles, the potential for complications arising from the commingling of similar relief items, instances of vehicular overloading, and encounters with roadblocks along the designated routes. A list of vehicle-sharing obstacles will aid policymakers in transforming relief operations to become effective. The findings have implications for HOs (Humanitarian Organizations), logistics service providers, as well as disaster preparedness, response, and recovery professionals. As far as we are aware of, this study signifies the first empirical investigation of vehicle-sharing barriers in the context of humanitarian operations.

Keywords Humanitarian logistics, Vehicle-sharing, Disaster management, Logistical collaboration

Paper type Research paper

Introduction

The number of disasters that have affected the most vulnerable populations has risen steadily worldwide. The number of disasters, for instance, increased from 24 in 1950 to nearly 280 in 2016 (Cozzolino et al., 2017). In 2018, 130 million people were forced to receive humanitarian aid as a result of such catastrophes, and over the several years, the number of people repeatedly afflicted throughout the countries by such disasters has reached record highs (Adem et al., 2018, Baharmand and Comes, 2019). According to Centre for Research on the Epidemiology of Disasters (CRED) (2023), in the year 2022, the Emergency Event Database, commonly referred to as EM-DAT, documented a total of 387 occurrences of disasters on a global scale. These events had significant repercussions, leading to the tragic loss of 30,704 human lives and impacting the lives of approximately 185 million individuals. The economic ramifications were equally substantial, amounting to an estimated sum of approximately US$ 223.8 billion in losses. The most alarming prediction is that the frequency of disasters would grow by a factor of at least five in the next 50 years, highlighting the critical nature of disaster response (Thomas and Kopczak, 2005, Ganguly et al., 2017). Thus, relief operations are a major focus for governments, NGOs (Non-governmental Organizations), and private sector groups throughout the globe. Humanitarian organizations (HOs) are a subset of NGOs that provide aid and assistance to individuals in crisis situations. HOs work to provide essential necessities such as food, water, shelter, and medical care to affected populations, as well as to promote long-term development to assist communities in becoming more resilient. HOs include the International Committee of the Red Cross (ICRC), Oxfam, and the World Food Programme (WFP) of the United Nations (UN) (Saw et al., 2018).

In this context, it is significant to highlight that logistics (such as transportation and storage) account for roughly 80% of the overall funding spent on disaster relief activities, and that up to 40% of the distributed funds are often lost or wasted (Trunick, 2005, Day et al., 2012, Bealt et al., 2016). These kinds of inefficiencies are typical in disaster relief operations owing to factors such as the dispersion or lack of consolidation of several shipments, as well as the underutilization of important resources (Altay and Labonte, 2014). Despite this, few HOs monitor and analyze the effects of these crucial logistical challenges on their ability to carry out relief operations effectively (Bealt et al., 2016). This is to be anticipated, for example, given that many HOs do not equip their relief teams with sufficiently trained logisticians (Kovács et al., 2012, Rajakaruna et al., 2017). Therefore, Hirschinger *et al.* (2016) identify the relief transport system as the bottleneck to efficient humanitarian assistance due to its associated limits. Thus, humanitarian groups are being hampered by inefficiencies, which make it difficult for them to distribute aid effectively to those in need due to limited resources (Gossler et al., 2019).

If these inefficiencies can be reduced, then humanitarian help may be expanded to save more lives. Therefore, in the context of disaster relief logistics, L'Hermitte and Nair (2021) proposed the idea of "sharing resources" based on analogous cost-effectiveness-related considerations. This idea involves sharing essential logistical resources, including vehicles that are not being used to their full potential. Though comparable innovative sharing services like Uber and Airbnb are flourishing in today's market (Sutherland and Jarrahi, 2018), researchers in the field of humanitarian aid are still oblivious of the barriers related to vehicle-sharing that prevent these groups from sharing their underutilized vehicles. Despite the fact that the private sector has already incorporated vehicle-sharing as a standard practice (Islam, 2018), there has, to the best of the authors' knowledge, been no research on the barriers to vehicle-sharing between HOs. Clearly, this is an important area where more study needs to be done. While there may be instances of shared challenges between impediments to vehicle sharing and hurdles in collaborative endeavors among NGOs, distinctions in the character of these challenges may exist. To illustrate, obstacles to vehicle sharing tend to exhibit a more operational or functional focus, whereas in

contrast, coordination and collaboration barriers encompass a more expansive terrain, incorporating the intricate organizational and interpersonal dynamics within the framework of disaster relief efforts.

Although there are notable operational distinctions between the private sector and HOs, the latter can adopt vehicle-sharing strategies pioneered by the private sector to gain valuable insights and promote the integration of vehicle-sharing as a commonplace practice in the humanitarian aid sector (Falagara Sigala and Wakolbinger, 2019). As a starting point for such a novel endeavor, this study poses the following research question: *What are the obstacles to vehicle-sharing among NGOs during disaster relief operations?* Thus, this study examines a list of potential barriers using the innovation resistance theory. The concept of resistance stems from a research idea that attempts to comprehend why users deny innovative services such as vehicle-sharing (Chen and Kuo, 2017). The resistance theory considers obstacles like as value, usage, risk, tradition, and image; these are some of the topics that will be elaborated upon more in the current study. Therefore, the scope of this study incorporates a total of five potential obstacles to investigation using an exploratory qualitative methodology. We conduct semi-structured interviews with experts from NGOs to learn more about the challenges.

It is imperative to underscore that the utilization of the Resource-Based View (RBV) theory or other innovation adoption theories is less-suited for the specific focus and objectives of this research endeavor. For instance, the RBV theory is fundamentally oriented toward the attainment of competitive advantages vis-à-vis rival enterprises, as elucidated by Wade and Hulland (2004). In contrast, the paramount aim within the domain of disaster relief is the expeditious and efficient provision of assistance to individuals in distress, with an emphasis on humanitarian objectives rather than competitive superiority (Islam et al., 2020). Therefore, the RBV theory finds its optimal application within profit-centric organizations that actively pursue competitive edges, a distinction that further diminishes its relevance to the present research context. Moreover, it is imperative to underscore that theories designed to explicate the dynamics of innovation adoption behavior are not suited for an understanding of resistance behavior. This delineation arises from empirical observations where researchers, upon acquiring substantial insights into an innovative service, discerned that individuals exhibiting "active" innovation resistance harbor unfavorable perceptions of this concept, as documented by Laukkanen (2016). Thus, this conceptual framework deviates from conventional theories pertaining to adoption behavior, given that the determinants of individuals rejecting innovative services differ from those elucidating their adoption, as posited by Gatignon and Robertson (1989). Moreover, the choice of employing the Innovation Resistance Theory over the Technology-Organization-Environment (TOE) framework can be justified within the context of this study. The Innovation Resistance Theory is specifically tailored to address the resistance and barriers encountered by NGOs in the adoption of vehicle-sharing practices for disaster relief operations. In contrast, the TOE framework, which encompasses a broader scope, may not offer the granularity required to understand and categorize the specific resistance factors and objections that are central to this context (Nguyen et al., 2022). The TOE framework focuses on the interplay of technology, organization, and the external environment in innovation adoption (Baker, 2012), but its more generalized perspective does not provide the detailed insights into the resistance-related issues that are crucial for effective implementation in the humanitarian sector. Therefore, the Innovation Resistance Theory is a more suitable choice as it aligns with the research's emphasis on understanding the specific barriers and resistance to enhance the adoption of vehicle-sharing initiatives in disaster relief operations.

In a keyway, this research adds to the existing body of knowledge that has been accumulated. To begin, to the best of our knowledge, this is the first time that an attempt has been made to make use of the innovation resistance theory to study the opposition of NGOs to the concept of sharing a vehicle. It is essential that this concept be applied to the humanitarian sector, as persuading transport users, such as officials of HOs, to look into new innovative services is one of the most difficult challenges confronting service organizations (Mani and Chouk, 2018). This is challenging to achieve because it requires significant behavioral shifts on the part of shippers (in terms of aid delivery, NGOs serve as shippers), who must forsake a practice to which they have gotten used in order to embrace the new notion (Meuter et al., 2005). The issue cannot be fixed at this time since the source of the issue, the lack of collaboration, has not been found. Is this more of a mental hurdle for NGOs, or are there technical concerns with vehicle-sharing that are at play here? It is still not obvious if the lack of cooperation shown by NGOs is due to psychological or functional obstacles (such as problems with transport operations). To the best of the authors' knowledge, this will be the first time that these major problems with no clear answers have been explored for the purpose of policy analysis in the humanitarian sector. The research findings are expected to have a positive impact on various organizations, including NGOs, and emergency managers, by providing them with valuable insights to improve their transport operations and better serve their stakeholders (e.g., donor organizations, aid victims and governments).

The following describes the layout of the study. The next part will examine the related literature. The methodology used and the findings are then detailed. After a findings-and-discussion section, the paper concludes with its ramifications. The last section is a summary of the whole research project.

Literature review

Definition of an underutilized vehicle

The phrase "degree of utilization" is often used in the transport industry to quantify the amount of unused cargo space within a vehicle (Caplice and Sheffi, 1994). In this study, the "lading factor" provides an useful lens through which to characterize the "nature of vehicle utilization" alluded to by Piecyk and McKinnon (2010). This is a "partially empty vehicle trip," when portion of a vehicle's area is filled by relief items of a HO, but the rest is wasted due to low freight usage. What we call "waste" occurs when a resource is not used as effectively as it may be. Few studies showed that a large fraction of road-based trips is wasted, although HOs seldom report such malfeasance. For example, UK vacant vehicles cost about £160 million yearly (Department for Transport, 2017). Also, about 26% of EU road trips remain underused (European Commission DG for Mobility and Transport, 2017). Nearly 30% of vehicles in Japan are underutilized (Hirata and Fukaya, 2020). Thus, there is a lot of wasted space.

The idea of vehicle-sharing

To maximize the utilization of underutilized vehicle trips, the concept of vehicle-sharing can be implemented. The concept is like collaborative consumption behaviors, which center on the notion of sharing transport resources rather than individually acquiring and financing them. Möhlmann (2015: p. 193) gives one example of how the idea of "collaborative consumption" can be useful, “Collaborative consumption…takes place in organized systems or networks, in which participants conduct sharing activities in the form of renting, lending, trading, bartering, and swapping of goods, services, transportation solutions, space, or money.” This means HOs are often ready to pay for temporary access to an underused transport service for collaborative consumption or usage, which is considerably more lucrative or cheaper than purchasing it separately. Thus, the core idea of sharing resources has emerged as a new consumption pattern that is disrupting traditional buying methods and transforming

consumer relationships. This shift has already been observed in sectors like hospitality and transport, as exemplified by the success of companies such as Airbnb and Uber (Acquier et al., 2017).

Benefits of vehicle-sharing

Sharing underutilized vehicles between HOs offers many benefits, including environmental advantages, increased transport capacity to disaster-affected areas, and economic benefits, as illustrated in Figure 1.

- *Environmental benefits.* The transport sector is the leading emitter of greenhouse emissions (Dahal and Niemelä, 2016). Such emissions are largely dependent on the distance a vehicle travels, known as its Vehicle Miles Travelled (VMT) (Goodchild et al., 2017). This is concerning, as VMT in the USA has been increasing by approximately 1% each year (Ward et al., 2019). However, VMT may be lowered by sharing unused vehicle space. For instance, a single joint trip to a disaster-affected area could suffice instead of two separate trips. Vehicle-sharing options may also help to reduce traffic congestion and air pollution, as well as improve health outcomes since fewer vehicles are on the road. While such sustainability issues, particularly from an environmental view, hold paramount significance in the design of commercial supply chains and has consistently been a subject of exploration in the pertinent literature, it is noteworthy that the integration of sustainability principles into the design of humanitarian supply chain networks represents a relatively recent and burgeoning research trend within relevant studies (Desi-Nezhad et al., 2022). During an emergency situation, this advantage of vehicle-sharing initiatives or activities could be even greater, as road-based evacuation attempts can result in severe congestion, entrapment, increased injuries, and loss of life (Baou et al., 2018). For instance, about 6 million people from Florida's coastal districts were evacuated when category 4 hurricane Irma reached the southwest corner of the state (Cangialosi et al., 2018). Such a massive sudden evacuation reduces the capacity of evacuation roads and fails to meet the demand for increased traffic fleeing the evacuation zone (Dulebenets et al., 2019).

- *Benefits of increasing transport capacity.* Road carriers have been reported to be hesitant to deliver relief supplies to disaster-affected areas owing to a number of dangers, including accidents, vehicle breakdowns, and human injuries (Baharmand and Comes, 2019). Thus, in many disaster-affected areas, a major problem is the low availability of transport services, particularly when the infrastructure is destabilized. This can make it difficult for humanitarian aid to access the affected areas, notably when transport conditions are at their worst (Guo and Kapucu, 2020). Most importantly, small, or medium-sized HOs may face difficulties in accessing transport services as local logistics service providers may not be willing to sign contracts with them due to their low reputations. This issue became apparent particularly during the 2015 Nepal earthquake (Baharmand et al., 2017). As an instructive case in point, observations stemming from the aftermath of the 2015 Nepal earthquake unveiled that local logistics service providers demonstrated a marked reluctance in formalizing contractual arrangements with HOs categorized as small to medium in scale. In contrast, they exhibited a pronounced preference for forging collaborative alliances with reputable and sizeable humanitarian entities operating within the sector. Thus, HOs encountered challenges characterized by instances where logistics service providers declined the transportation of relief supplies to remote locales, citing concerns related to risk factors, or deviations from previously stipulated shipment conditions. Thus, adopting vehicle-sharing practices could benefit all NGOs involved in the transport process, by increasing the overall capacity of the relief distribution system. So, HOs, regardless of their scale, should collaborate to improve the availability of transport services with the idea of augmenting the overall transport capacity within disaster-stricken regions.

- *Economic benefits.* As noted by Rizet et al. (2012), sharing a vehicle has been found to be the most effective means of reducing significant transport costs. An example of the benefits of shared vehicles can be seen in the distribution of operating costs, such as fuel, driver, and other fixed costs, among multiple NGOs traveling to the same destination with a full vehicle load. This reduces the financial burden on each NGO and can make it easier for them to save on transport costs. This benefit is especially significant given that logistics is the second-largest administrative expense for HOs after personnel (Trunick, 2005, Gossler et al., 2019). In particular, during relief operations, freight rates are often excessively high due to some factors, including poor transport infrastructure, and intense competition among HOs for limited local transport capacity (Gossler et al., 2019).

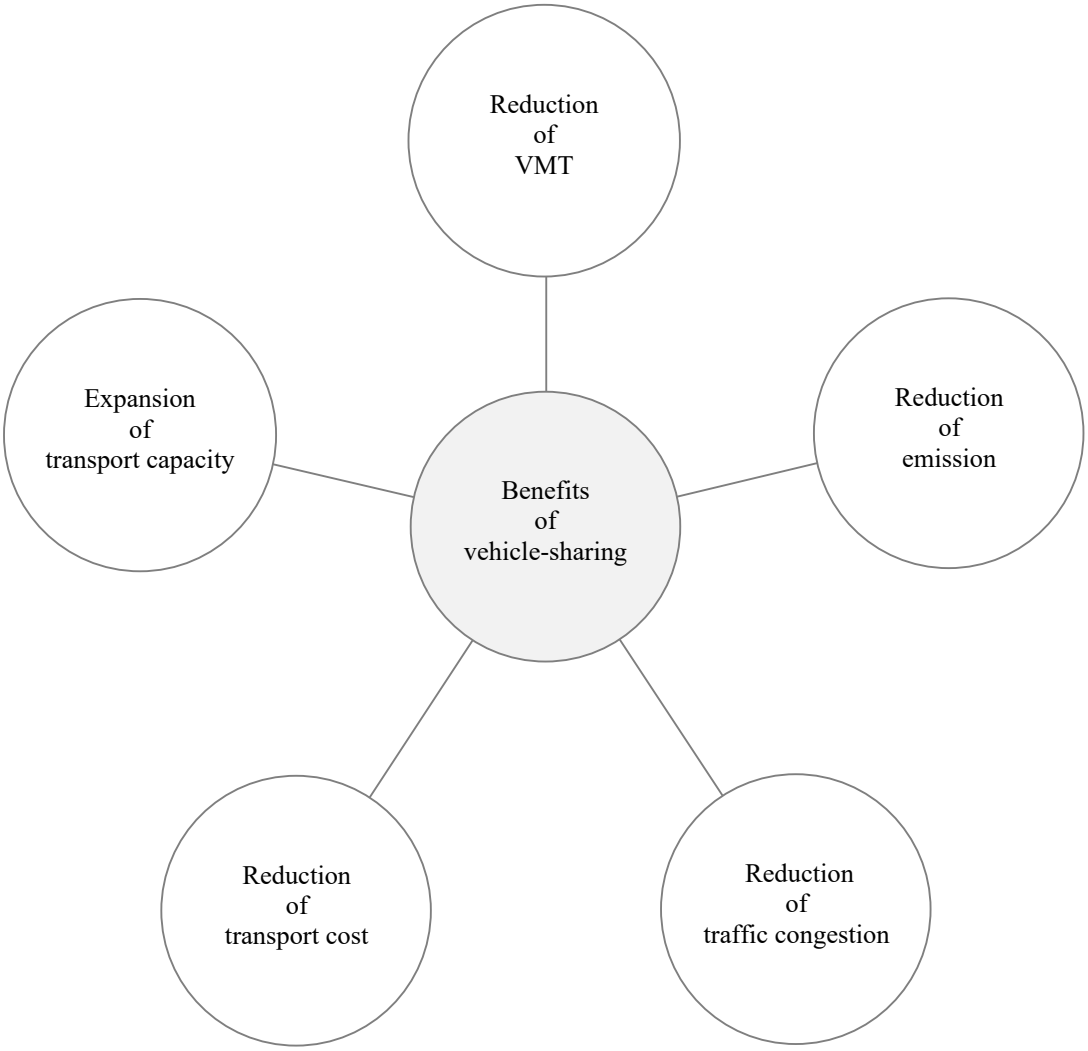

Figure 1: Potential benefits of vehicle-sharing among HOs

Collaboration in humanitarian logistics

In the literature on humanitarian logistics, different aspects of collaborative relationships for enhancing logistical services, such as better managing the flow and storage of relief products in affected areas, are discussed. For instance, when Haiti's capital city was impacted by a 7.0 MW earthquake in 2010, resulting in a death toll between 217,000 and 230,000, there were important issues with the "last mile distribution" of relief supplies (Salam and Khan, 2020). The term "last mile distribution" refers to the final stage of the supply chain, where goods are delivered to their recipients, and there were significant logistical challenges in coordinating the delivery of relief items from distribution centers to the Haitian people. Considering these challenges, the role of logistics services in disaster relief operations has emerged as a hot issue among experts and scholars in recent years. As a result, the humanitarian logistics literature has explored the concept of fostering partnerships between HOs and Logistics Service Providers (LSPs) to enhance the effectiveness of relief operations. Within this research stream, Bealt et al. (2016) examine both the challenges and advantages associated with developing partnerships between HOs and LSPs. Also, Baharmand and Comes (2019) investigate the use of blockchain-based smart contracts in the context of humanitarian supply chains, and identify several obstacles to their adoption. These barriers are classified as organizational, technological, and environmental. Lastly, Falagara and Wakolbinger (2019) investigate the potential for outsourcing humanitarian logistics activities to LSPs as a means to support both LSPs and HOs in developing strategic relationships.

Another line of research explores the horizontal cooperation that occurs between NGOs, which is the issue that is most pertinent to the present study. While the literature on the application of collaboration between NGOs is relatively scarce (Chen et al., 2020), it is widely recognized that NGOs should establish complementary relationships with one another that facilitate the sharing of tangible and intangible resources. Such collaborative efforts can lead to increased asset utilization (Pazirandeh and Maghsoudi, 2018; Azmat and Kummer, 2019; Farahani et al., 2020). Despite the potential benefits of collaboration, building strong relationships between NGOs can be particularly challenging due to their often highly competitive nature when it comes to collecting donations. This is compounded by an absence of mutual trust or common commitment to goals in the context of a temporary relief chain (Dubey et al., 2019). In addition, given that each NGO has its own distinct culture, interests, and operational approach, they often tend to manage their disaster relief operations independently of one another (Agarwal et al., 2019). Another potential challenge is the cost associated with communication and negotiation (Balcik et al., 2010). Horizontal collaboration initiatives also present a number of other challenges, including the need to protect competitive advantages and a general lack of awareness regarding the potential benefits of collaboration (Blecken and Schulz, 2010). As a result of these collaboration issues and concerns, inadequate collaboration between HOs during the 2008 Wenchuan earthquake in China resulted in both overstocked and understocked situations when allocating relief supplies. Therefore, Chen et al. (2020) investigate collaborative relationships between local and international NGOs to demonstrate that resource sharing through collaboration can enhance the sustainability of the humanitarian supply chain. Likewise, Adem et al. (2018) report that contextual factors, such as host government policies and the socio-economic environment of a disaster, influence the motivations for supply chain collaboration between local and international NGOs. Moreover, Tran and AbouAssi (2020) pinpoint the organizational traits that are likely to be critical for facilitating collaboration between local and international NGOs, particularly in developing nations. None of the above studies that examine collaborative issues between NGOs thus far have explored the concept of vehicle-sharing, or a list of the challenges that could impede successful vehicle-sharing initiatives.

Innovation resistance theory

As mentioned earlier in the introduction, this study utilizes the innovation resistance theory to examine and categorize a range of possible obstacles to the adoption of vehicle-sharing among NGOs. The concept of resistance originates from a research idea that seeks to understand why users decline to adopt innovative services, such as vehicle-sharing. For instance, after gaining sufficient knowledge about an innovative service, researchers found that users who demonstrate "active" innovation resistance hold negative perceptions towards this concept (Laukkanen, 2016). Therefore, this theory diverges from conventional adoption behavior theories since the factors that account for why individuals reject innovative services are not the same as those that explain why they adopt them (Gatignon and Robertson, 1989). Hence, the theory of resistance encompasses obstacles such as value, usage, risk, tradition, and image. These barriers have been examined in diverse settings, such as internet and mobile banking (Laukkanen, 2016), smart products (Mani and Chouk, 2017), and the internet of things (Mani and Chouk, 2018). Ram and Sheth's (1989) basic model identifies the drivers that lead to active resistance towards an innovative service, which are outlined below:

***Usage barriers*.** The term "usage barrier" refers to the challenges that may be presented to prospective users in the form of confusion over the operation of a vehicle-sharing concept. This stumbling block may appear if the new concept is difficult to put into practice (Chen and Kuo, 2017). If it is complex to sign up to engage in shared mobility, then NGOs may be unwilling to adopt vehicle-sharing services.

Value barriers. Value barriers are responsible for the financial tradeoff that is associated with vehicle-sharing services. If NGOs are unable to justify a basis for using the new vehicle-sharing services, they may not utilize the facilities. The value barriers have to do with the advantages that a new service has over what is available when viewed from a cost-to-benefit standpoint (Chen and Kuo, 2017).

Risk barriers. Risk barriers emerge when officials of NGOs are hesitant about the potential unintended outcomes of new vehicle-sharing programs. They could be aware of the dangers of vehicles-sharing and be opposed to it, therefore. So, barriers represent the perceived threats, such as breach of privacy.

Tradition barriers. People's views of how a new concept presented to them departs from the accepted standards of industry are tied to the existence of practice-based obstacles (Chen and Kuo, 2017). An NGO is considered to have a “tradition barrier” if it does not want to employ a vehicle-sharing service because the organization does not believe the innovative practice to be part of its culture or custom.

Image barriers. These barriers develop when NGOs have an adverse attitude about sharing a vehicle due to the history of the practice. These may be the result of having interactions with other NGOs. So, image barriers pertain to the degree to which the novelty has a negative image in the minds of the users. To put it differently, the formation of this unfavorable perception is a psychological reaction that emerges as a contrast to an individual's own set of values or convictions, which are shaped by prior adverse encounters within the particular service sector. The prevalence or existence of impediments to forming a positive image within the domain of vehicle sharing can encompass various elements, including perceptions concerning reliability, safety, service quality, reputation, and trustworthiness.

Major contributions of this study

The need for this study becomes evident in the context of existing research on collaboration and coordination within humanitarian logistics. While previous studies have extensively explored various aspects of collaboration between stakeholders in the humanitarian supply chain, two distinct and crucial gaps remain unaddressed. First, this research introduces an innovative perspective by utilizing the innovation resistance theory to investigate why NGOs may be resistant to the idea of sharing vehicles, a concept crucial for enhancing transportation efficiency in the humanitarian sector. This pioneering approach delves into the psychological and functional barriers that might hinder the adoption of vehicle-sharing practices. Second, existing literature has primarily focused on horizontal collaboration among NGOs in terms of resource sharing and mutual support. However, the concept of vehicle-sharing, including the potential challenges and obstacles associated with it, remains largely unexplored. These uncharted territories are vital to comprehend how to improve humanitarian transport operations and better serve stakeholders, including donor organizations, aid recipients, and governments. This study's findings promise to offer valuable insights, not only to NGOs but also to emergency managers involved in humanitarian operations, thereby contributing to more effective relief efforts in disaster-stricken areas, a need highlighted by logistical challenges during events such as the Haiti earthquake.

Research methodology

This study employs an exploratory methodology as the objective is to explore the challenges related to vehicle-sharing. By employing an exploratory methodology, the study obtains rich, real-world insights into vehicle-sharing barriers (Min et al., 2005). A quantitative approach would not have produced this result (Eisenhardt and Graebner, 2007, Saunders et al., 2015). Moreover, a qualitative technique is appropriate for clarifying concerns pertaining to collaborative relationship management (Chia, 2005). In addition, a qualitative approach enables a deeper comprehension of the current social context in which vehicle-sharing initiatives can be implemented. Therefore, many studies, including Richards and Morse (2012), have provided support for the notion that a qualitative research approach can facilitate a greater understanding of human experiences, social meanings, and cultural insights. Finally, the relevance of a qualitative approach is especially noteworthy in this study, as there is limited knowledge regarding the obstacles to implementing vehicle-sharing initiatives. Rubin and Babbie's (2015) research also supports the usefulness of a qualitative approach in situations where there is a need of information.

Research context

The research at hand is situated within the context of Bangladesh, a developing nation that confronts a formidable array of hazards, rendering it among the most disaster-prone nations globally. These perils encompass recurrent occurrences of floods, cyclones, storm surges, earthquakes, landslides, droughts, salinity intrusion, and fires, as documented by Bündnis Entwicklung Hilft (2017). Consequently, Bangladesh grapples annually with the formidable task of mitigating disaster-related losses, as underscored by Haque et al. (2020). This phenomenon is unsurprising, given that nations characterized by elevated population densities in regions susceptible to disasters, substandard housing infrastructure, insufficient early warning systems, and fragile social support mechanisms tend to exhibit heightened susceptibility to the repercussions of such calamities. Furthermore, the country contends with a compounding set of challenges, including a burgeoning population, insufficiencies in access to essential resources such as food, potable water, and adequate housing, as well as notable deficiencies in educational and healthcare outcomes, as corroborated by Shameem et al. (2014) and Murshed et al. (2021). Therefore, it is also essential to note that the civilizations of emerging nations like Bangladesh, which are typically more densely populated and have less developed infrastructure, are more vulnerable to the destructive power of disasters (Bealt et al., 2016). Bangladesh is also home to several NGOs that

work to aid Rohingya refugees. Since August of 2017, more than 700,000 Rohingya people have fled the neighboring Myanmar and sought safety in Bangladesh, resulting in a humanitarian catastrophe on a scale never seen before (Chowdhury et al., 2022). These perils encompass the imminent threats of landslides, tropical cyclones, flash floods, and outbreaks of communicable diseases, as extensively detailed by Zaman et al. (2020). It is within this important and ever-changing context that Bangladesh boasts a dynamic and thriving NGO sector, with a staggering count of over 2,500 registered NGOs, as substantiated by the NGO Affairs Bureau (2018). Most importantly, according to a recent research study carried out by Dappe et al. (2019) with support from the World Bank, the rates of road transportation in Bangladesh are comparatively elevated. This can be attributed to various inefficiencies within the system. One instance of these inefficiencies is that despite the fact that the whole country transports roughly 470,000 tons of inter-district freight daily, about 35% of these trips are typically underutilized (Dappe et al., 2019). Based on these compelling arguments, to summarize, Bangladesh's unique features, such as the rise in frequency and severity of disasters, the prevalence of numerous NGOs that distribute relief aid to disaster-stricken regions, and the significant number of underutilized vehicle trips, provide a promising and ideal context for investigating the research question of this study.

Data collection method

The use of semi-structured interviews enables the collection of valuable information for gaining an understanding of obstacles to vehicle-sharing. Barriball and While (1994:330) describe the advantages of semi-structured interviews, "…they are well suited for the exploration of the perceptions and opinions of respondents regarding complex and sometimes sensitive issues and enable probing for more information and clarification of answers." Therefore, through interviews, logistics and transport managers can offer a detailed narrative of the challenges they encounter, rather than the researcher relying on a generic list of common reasons for non-cooperative behavior. In addition, as suggested by Babin et al. (2003), semi-structured interviews offer an added advantage of being able to ask sensitive questions, such as inquiries related to trust and expectations of NGOs when sharing a vehicle. The most crucial benefit of using semi-structured interviews is that they facilitate the development of trust between the researcher and the interviewee (Davis, 2019). By establishing trust, logistics managers or interviewees are more likely to provide honest and candid responses, leading to a higher quality of data.

Respondent selection criteria

The analysis pertains to logistics or transportation managers who work at NGOs of varying levels, from mid-level to top-level positions. Initially, a convenience sampling method is employed. Based on those initial interviews, additional interviewees are contacted. Therefore, the study utilizes both convenience and snowball sampling techniques. The final selection of respondents follows a three-step procedure as suggested in Islam et al. (2021). (1) The first step involves assessing whether the participant is now responsible for transport planning in disaster relief operations. (2) Then, the participant is asked if they have a minimum of one year of experience in relief operations. (3) Lastly, the participant is asked to describe their understanding of the concept of vehicle-sharing in relief operations to assess their potential resistance behavior. If the participant's responses meet the satisfactory criteria, they are included in the pool of interviewees. The interview process concludes after conducting 15 interviews, which is when data saturation is achieved. Saturation is the point at which data collection ceases to provide relevant information (Dworkin, 2012). However, as a general rule of thumb, researchers often aim for a sample size of 10-15 interviews for qualitative studies, but this can vary depending on the depth of information required, and the variability of the sample population (Guest et al., 2006). The profiles of the interviewees are presented in Table I, which includes information on their age, experience, and background. The table also provides an overview of the NGOs involved, such as their

type, number of employees, and other important information. The performed interviews are approximately 46 minutes long, and whenever possible, they are audio recorded and notes are taken.

As previously elucidated, a meticulous selection process is employed in recruiting participants for our study, particularly drawn from a carefully curated pool of NGOs. This curation is predicated on a multitude of discerning criteria. For instance, our selection criteria entail the inclusion of NGOs that actively engage in disaster relief endeavors, as these entities are presumed to possess a profound reservoir of expertise concerning the challenges associated with vehicle sharing in such contexts. Furthermore, our endeavor strives to encompass a diverse spectrum of NGOs, ranging from modestly sized organizations to larger, more established ones, thereby facilitating the comprehensive capture of a wide array of experiences and perspectives. Additionally, we aim to ensure a balanced representation of both local and international NGOs within our research cohort. This deliberate choice is intended to provide a holistic view of vehicle sharing challenges across various operational contexts. Lastly, our selection process encompasses NGOs led by executives who boast substantial experience in the realm of disaster relief operations and the transportation of relief materials to disaster-affected regions.

Data analysis

The data analysis procedures are derived from Miles and Huberman (1994). To realize a phenomenon, the researcher initially engaged in an audio-visual analysis technique wherein they read the transcript and listened to each audio simultaneously to gauge the emotions present in the data. In other words, the aim is to gain insight into the nature of the participants' experience related to the phenomenon under study. Later, we systematically coded the data by identifying and categorizing meaningful segments, passages, or quotes. These codes were developed based on the content and research objectives. Codes were subsequently grouped together to form broader themes and sub-themes. This process was conducted iteratively, refining and revising themes as needed to ensure they accurately captured the essence of the data. Therefore, by analyzing the qualitative data and developing categories, also known as themes, the researcher can gain a better understanding of the barriers to vehicle-sharing. Thus, the evaluation and categorization of the interview results are presented as the "findings" of the study. Since the categories are known beforehand, it is possible to emphasize (by writing or circling) relevant words, phrases, sentences, and paragraphs in each transcript by sweeping through the available data and highlighting them with a pen. As a result, the highlighted data is assigned codes or labels to represent the meaning conveyed, and it becomes necessary to organize and sort them into appropriate categories. This comprehensive data analysis technique allows for a systematic exploration of the research topic, facilitating the identification of key patterns and insights within the qualitative data.

Identification	NGO type	No of employees in country	Current position	Interview type	Experience in current position	Experience in current organization	Total job experience (years)	Educational background	Interview length
S.01	Local	10,000+	Executive Director	Face-to-face	7	20	20	Postgrad	44 minutes
S.02	International	200 – 500	Logistics Officer	Face-to-face	2	2	2	Undergrad	48 minutes
S.03	International	5,000 – 10,000	Senior Supply Chain Coordinator	Phone-based	5	8	13	Postgrad	90 minutes
S.04	International	10,000+	Deputy Manager (Travel &Transport)	Face-to-face	7	7	10	Postgrad	40 minutes
S.05	International	500 – 1,000	Senior Program Manager	Face-to-face	5	5	5	Postgrad	45 minutes
S.06	International	500 – 1,000	Field Coordinator	Face-to-face	7	10	10	Postgrad	44 minutes
S.07	Local	50 – 100	Chief Coordinator	Face-to-face	8	13	15	Undergrad	45 minutes
S.08	Local	200 – 500	Senior Project officer	Face-to-face	3	3	5	Undergrad	55 minutes
S.09	International	10,000+	Manager (GIS)	Face-to-face	2	2	7	Postgrad	39 minutes
S.10	International	10,000+	Infrastructure & Housing Officer	Face-to-face	5	6	6	Postgrad	44 minutes
S.11	Local	500 – 1,000	Program Manager	Face-to-face	7	8	8	Undergrad	34 minutes
S.12	Local	50 – 100	Project Coordinator	Face-to-face	3	3	3	Undergrad	30 minutes
S.13	Local	100 – 500	Project Coordinator	Phone-based	7	10	12	Undergrad	45 minutes
S.14	Local	5,000 – 10,000	Senior Program Officer	Phone-based	6	7	8	Undergrad	50 minutes
S.15	Local	500 – 1000	Program Officer	Phone-based	3	7	9	Undergrad	40 minutes

Table I: Respondents' profile and NGOs' characteristics

Rigor of the research process

Interviews are useful for confirmation objectives because they provide a comprehensive explanation of previously obtained results (Kamaruzzaman et al., 2018). Consequently, in order to verify the findings of this study, three in-depth expert opinions are obtained through interviews (who are different from the first set of interviewees and have many years of experience). According to their opinions, no adjustments are made to discovered results. In Table II, the profiles of these specialists are displayed.

Current position in company	Experience in current position	Total length of job experience
Logistics Officer	3	6
Program Manager	4	8
Program Manager	3	5

Table II. A profile of the selected experts

In addition to verifying the findings, the authors of this study assess the trustworthiness criteria proposed by Hirschman (1986) for evaluating the quality of exploratory research. Some of the quality criteria for qualitative research or trustworthiness include evaluating credibility, dependability, fit, confirmability, understanding, and generality (Belk, 1989, Mentzer and Flint, 1997). They are used in the assessment of interpretive research and are comparable to the internal validity, external validity, and reliability used in theory-testing research (Davis-Sramek et al., 2007). Interpretive research best practices are strictly adhered to in this study to ensure overall quality, as shown in Figure 2. Moreover, inter-rater reliability for the coding of interview data is assessed using Intraclass Correlation Coefficient or ICC (3,1) to account for the presence of a single target. The ICC value was 0.90 (95% CI: 0.85-0.94), indicating excellent agreement among the three coders (McGraw and Wong, 1996).

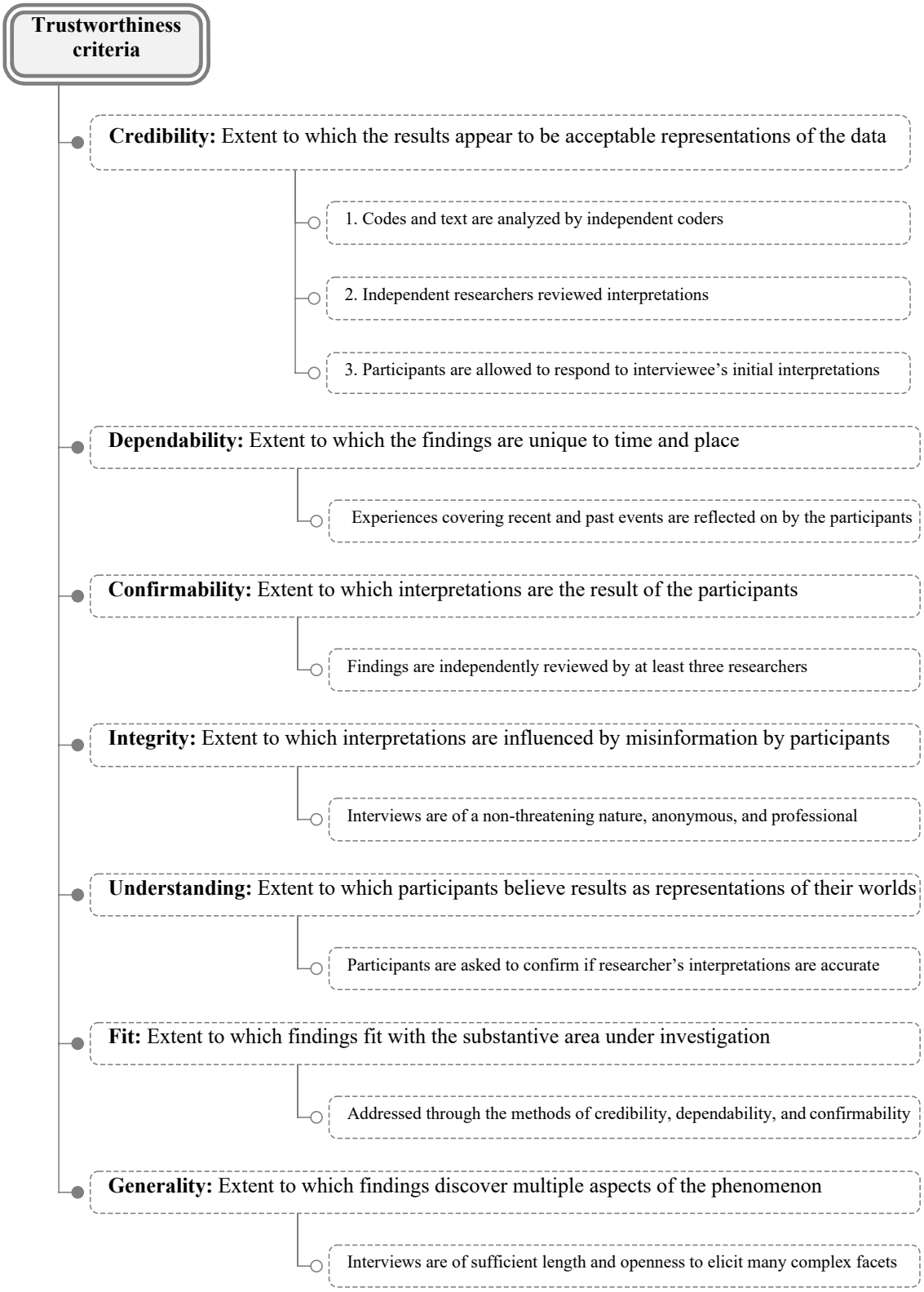

Figure 2: Trustworthiness of the study and its findings

Source: Adapted from Belk (1989), Mentzer and Flint (1997), and Davis-Sramek et al. (2007)

Findings
The discovered barriers are divided into five groups using the innovation resistance theory.

Usage barriers
The following is a description of a list of usage barriers that are explored in this study.

Varying characteristics of vehicles. The physical characteristics of vehicles for transporting relief materials vary depending on the type of items being transported. For instance, an NGO delivering food items (such as sweets, soft drinks, supplements, and other consumables) requires a different vehicle than another NGO delivering shelter items (like tarpaulins, ropes, tools, buckets, cooking sets, blankets, and mosquito nets). So, they cannot collaborate despite delivering relief supplies to the same location.

"Our promise to delivering various relief goods directly to the affected individuals' doorsteps means that we use different vehicles for transportation. Subsequently, sharing these specialized vehicles with other NGOs is not feasible, as their relief goods may significantly differ from ours." **(S.02)**

Fixed transport scheduling. NGOs create transport schedules based on their operational priorities and goals to ensure timely delivery of relief materials. Some other NGOs arrange outbound transportation through their own shipping policies or internal transport management systems (i.e., software) Thus, establishing a desirable schedule of pickups and deliveries for all NGOs involved can be challenging.

"NGOs have unique goals, working objectives, relief requirements, and camp destinations that vary from one another. Their target beneficiaries are often located in dispersed areas, including coastal communities, areas or regions. For instance, an NGO may plan to transport relief goods from the capital city, Dhaka, to Cox's Bazaar, with pre-planned pickup and delivery schedules. Due to this rigidity in scheduling, NGOs are often unable to share transport resources with each other." **(S.07)**

Differing priority locations for relief deliveries. NGOs working to alleviate suffering have varying priorities for selecting distribution sites depending on the nature of the aid they provide. For instance, some NGOs may prioritize bringing food to places with many newborns because they are more sensitive to interruptions, while other NGOs may prioritize giving shelters to areas with a large number of adults. This variation in priorities among NGOs makes it tricky to coordinate transport resources.

"Food, water, shelter, and medical supplies are just some of the disaster relief commodities we specialize in providing. We all have different emergency procedures that are specifically designed for what we do. When it comes to saving lives, we go north, while they head south to provide necessities for making a home. So, it is difficult for us to pool our transport resources for the same location." **(S.08)**

Incompatibility with other relief items. In order to share a vehicle, it is necessary for the items being loaded to be compatible with each other. However, certain items cannot be transported together due to safety concerns. To address this issue, freight units or classifications are created specifically for groups of items that can be safely transported together. For instance, gas tanks cannot be transported alongside flammable substances and must be kept far away from heat sources, fire, acid, and reducible materials.

"Transporting heavy relief items and consumable items together to destinations is not advisable due to the risk of damage to fragile items such as food. This creates a barrier to transport sharing." **(S01)**

Lack of sufficient funding. At the beginning, extra funds may be necessary to kickstart truck-sharing initiatives, such as offering additional compensation to truck drivers for transporting goods from an alternate warehouse. However, the participants expressed apprehension about the challenge of linking adequate funding with facilitating transport collaboration. NGOs face constraints in adjusting their financial resources to arrange transport as per the needs of the situation. The deficiency of funding from local governments and foreign donors inhibits them from building relationships with other NGOs.

"Since the majority of NGOs receive funding from international donors for specific projects, they are required to justify their expenses. Donors are unwilling to accept unnecessary or excessive expenses, making transport collaboration a challenging issue for NGOs due to the liability constraints." **(S.06)**

Fixed project planning. NGOs typically establish a planning horizon for their activities within a given project and allocate an annual budget to be spent from January to December. Comprehensive planning is undertaken prior to commencing the project. However, due to the fixed scope of the project, changes in the environment that could potentially facilitate collaboration opportunities are often overlooked.

"Only via official collaborations with other NGOs do we ever share our resources. But our relief operations budget is set each year and cannot be changed. Since our boss frowns upon working with other NGOs, we have monthly contracts with outside vendors to handle vehicle operations." **(S.08)**

Lack of internal coordination. In a disaster situation, a few vehicles serve many functions, such as transporting office personnel and delivering relief supplies in accordance with priorities. This is beneficial for a small, locally-based NGO. However, relying on a single vehicle can present challenges for the NGO in terms of coordinating the multitude of tasks that need to be completed. The situation gets more difficult when there is poor communication between employees of the same organization,

"In our local NGOs, there is always a huge communication gap between top management and the drivers due to lack of qualification and professionalism and even drivers are also not that much trained. Thus, this sort of communication gap can hinder the relief operation delivery on time." **(S.02)**

Value barriers

The following is a description of a list of value barriers that are explored in this study.

Unawareness of potential important benefits. Local NGOs may not be aware of the potential benefits of participating in vehicle-sharing, especially in regards to the sustainability and cost-saving aspects. There is a possibility that the culture of the industry does not lend itself well to promoting such ideas.

"International NGOs engage in advanced tasks such as bargaining for desired results, establishing sustainability priorities, introducing novel approaches, and establishing credibility in the community. However, local NGOs may not have the expertise necessary to perform these tasks. It's possible that global NGOs may underrate the benefits of shared transport with community-based NGOs." **(S.09)**

Increased vehicle-maintenance costs. Given the constant heavy loads and challenging conditions that come with handling relief items in distressed areas and during calamities, a shared vehicle would require frequent maintenance and repairs. Thus, the cost of vehicle maintenance will increase. The participants are concerned that the heightened expense may outweigh any other advantages of sharing.

"In the absence of an agreement between the collaborating partners, such as a contract, the NGO that owns or rents the vehicle and employs the driver will be solely responsible for the linked costs." **(S.06)**

Risk barriers

The following is a description of a list of risk barriers that are explored in this study.

Unwanted roadblocks and detours. In the aftermath of a major tragedy, a road carrier may be severely hampered in its ability to drive to the warehouses of other NGOs located farther away. Reduced operational readiness of deployed shared vehicles due to obstacles such as fallen trees or dead animals; flooded roads and damaged bridges interfere with drivers' incentives to fulfill vehicle-sharing goals.

"NGOs are discouraged from sharing resources with one another in order to minimize all forms of danger since Bangladesh's road structure continues to be inadequate for constant movement." **(S.03)**

Threat to safety, security, and privacy. Many international NGOs have a significant number of female staff members who may feel uncomfortable sharing a vehicle with unknown drivers due to concerns about their personal safety and security. Additionally, evaluating driving performance and providing feedback for drivers from other NGOs may pose a challenge. Some international NGOs address this issue by implementing their own Transportation Management System (TMS) to track drivers and vehicle positions. Conversely, carrying out such tracking in a shared vehicle would be challenging.

"The government that is in power in Bangladesh right now has put a significant focus on giving women more authority in the non-profit sector. However, maintaining the safety and security of female workers working for non-profits may offer a barrier to programs including vehicle-sharing." **(S.10)**

Lack of trust. A lack of trust among NGOs is proving to be a major obstacle to implementing vehicle-sharing initiatives. Many NGOs are reluctant to share their vehicles with others due to concerns about theft and the loss of relief goods, which could potentially be sold in the local market. This problem is particularly acute when collaborating with unknown, local NGOs. Consequently, some NGOs usually choose to collaborate with international NGOs, where trust does not appear to be as critical an issue.

"Since our goal is to provide the best services possible to the helpless, I have no problem sharing my vehicle with others if there is room. Yet, because of the trust, we are hesitant to offer any assistance to others. We doubt that carriers from other NGOs wouldn't be transporting illegal drugs." **(S.14)**

Reluctance to share other crucial resources. Some participants believe that sharing a vehicle may lead to higher expectations from other NGOs, who may seek additional opportunities for resource-sharing, such as renting unused portions of a warehouse. This could lead to conflicts between the parties.

"We vary greatly in terms of resources. Once smaller ones gain access to our vehicles, they may seek additional resources from us. We cannot share every resource. We have our goals and limits." **(S.03)**

The mixing of aid supplies. Screening relief goods after each trip, before delivering them to recipients or impacted persons, might be difficult if they are mixed together in unclear or considerable volumes. This makes it difficult for NGOs who use shared transportation to keep their belongings separate.

"We are pressed for time and in a hurry. Thus, in such urgent situations, there is often little time for proper packing and storage of relief supplies before they are loaded onto vehicles. As a result, sharing transportation space with other NGOs can become a challenge and time-consuming to prevent the mixing of relief supplies from different groups during delivery to the affected individuals." **(S.10)**

An excessively loaded vehicle. Sharing a vehicle carrying heavy relief items such as kitchen sets, sleeping mats, and construction materials with other NGOs is not advisable, particularly when the relief locations are situated in remote villages with inadequate roads or infrastructure. These roads are not built for commercial vehicles, making it challenging for trucks or vans transporting heavy relief items to reach affected people. Thus, overloading a vehicle can also result in accidents. Also, uncontrolled weight on a shared vehicle may cause damage to the road infrastructure, making it a critical concern.

"A vehicle carrying a heavy load incurs significant stress on its tires and braking system, which can lead to decreased vehicle control. This is particularly relevant for relief vehicles that often operate in villages, where the sharing of loaded relief goods with other NGOs can exacerbate the issue." **(S.04)**

Absence of a neutral third party. The nature of a vehicle-sharing job entails a significant amount of sensitive data exchange, such as identifying the quantity of relief items to transport from warehouses and determining the assignment of vehicles for delivering aid. Such data requires careful handling and custody. To facilitate the exchange of this sensitive data between NGOs, a third party can be involved.

"We have very sensitive information related to donors, employees, and volunteers. If a third party is involved, there is a risk, albeit minimal, that documents and specific donor records may be shared with another party without proper authorization. Everyone desires to safeguard their information. **(S.11)**

Communication of potential legal barriers. Some participants hold the view that there may be legal obstacles in offering vehicle-sharing services. Fear of unknown legal repercussions NGOs are reluctant to take trips together. It is important for the government to offer instructions on how to overcome any obstacles that may exist, allowing NGOs to obtain the knowledge needed to tackle these problems.

"Our NGO has its own policy and code of conduct, which are very strict, and it is imperative that we adhere to government regulations when sharing transportation services with another NGO." **(S.01)**

Accountability of possible accidents. Delivering relief items to beneficiaries through a disrupted network following a disaster always carries inherent risks. Since sharing a vehicle for transport purposes can result in accidental damage, there may be confusion regarding who is responsible for addressing unforeseen problems that may arise during a risky trip in the absence of an agreement.

"*As part of our safety protocol, our organization provides regular in-house training to our drivers on safety procedures, licensing, insurance, and other necessary paperwork. However, our drivers may not feel at ease sharing their vehicle with an unknown NGO. Who is going to be responsible for paying bills and other expenses in the event of an accident? Is it going to be split up into equal halves?*" **(S.05)**

Compliance standard. The goal of the compliance process of NGOs is to encourage agreement with the duties under the donors' protocol. Donors want NGOs to follow the transport plans they've already created. Therefore, NGOs cannot share transport due to the compliance process. If there is a breach in the compliance procedure, there may be impacts for the ability to get more financing from the donors.

"We, local NGOs adhere to global behavioral norms, including those established by organizations like the Red Crescent, which are consistent across countries such as Indonesia and Bangladesh. Failure to adhere to compliance standards would constitute a breach of contract. So, we are cautious about sharing space with other NGOs to ensure that these compliance standards are always upheld." **(S.04)**

Tradition barriers

The following is a description of a list of tradition barriers that are explored in this empirical study.

Unwillingness of top management. Local NGOs may have more flexibility and autonomy in deciding the level of communication necessary for sharing transport vehicles, whereas international NGOs often have more rigid organizational structures and strict policies that can serve as potential barriers. Without support from top management, employees may resist vehicle-sharing initiatives. Unfortunately, many top managers may not prioritize understanding the reasons behind such initiatives, but rather focus solely on meeting donor requirements and ensuring that projects are executed as planned or proposed.

"The top management of our company is the driving force behind our culture, and that culture does not support anything that is new. We continue to operate in the same manner as in the past." **(S.11)**

Severe inter-organizational competition. NGOs often prioritize showcasing their individual efforts and accomplishments, as well as the benefits they provide to communities in need. This emphasis on self-promotion can lead to competition among NGOs to utilize available funds rapidly and secure new resources from donors. Such intense competition poses a significant challenge to grassroots vehicle-sharing initiatives and can hinder mutual cooperation between NGOs. Subsequently, competition among various NGOs has the potential to create inefficiencies within the current transportation system.

"NGOs often view each other as competitors rather than collaborators, even competing for projects. This usual competitive mindset can make NGOs averse to explore vehicle-sharing chances." **(S.13)**

Corruption and unethical behavior. According to a participant, they previously shared their vehicles with other government-registered NGOs. However, they soon discovered that the partner organization was giving rides to their friends or colleagues who were not permitted to use the vehicle. Another issue that may arise is the high level of corruption. The prevalence of corruption is high in many developing countries. For example, sharing a truck may require bribes to be paid to different traffic authorities.

"There are NGOs that may get vast amounts of financing; yet, owing to the high degree of corruption that exists in a country, these monies may not make it to the people who are the most at risk." **(S.15)**

Absence of Government support and incentives. Currently, NGOs lack government support in terms of financial assistance, training, and skill development to encourage, protect, foster, formalize, and commemorate vehicle-sharing initiatives. The goal will be to motivate people to change the standard ways in which they do their jobs or to encourage them to experiment with new ways of doing things.

"If we aim to progress, we require a significant push from behind since we now lack any external supports or rewards. People have an aversion to deviating from their established routines." **(S.12)**

Image barrier

Following is a description of an image barrier that is explored in this study.

Concerns about damaging one's reputation. Participants are concerned that their NGO's reputation could be severely damaged if the other party involved in vehicle-sharing is found to be carrying illegal items such as drugs, mainly if their NGO operates near the country's borders. Thus, NGOs that operate at the border sites have a low level of trustworthiness for collaborative efforts. This fear is a result of experience, and NGOs are not willing to take any chances when it comes to protecting their reputation.

"The fear of ruining their reputation is notably prevalent among international NGOs, which are often more hesitant to share their vehicles with rural organizations because of prior experiences." **(S.05)**

Discussion

This study aims to explore the barriers to collaboration among NGOs in sharing vehicles. Its goal is to enhance transport capacity for relief operations, minimize pollution and traffic congestion, and finally benefit the environment, all without requiring an increase in the number of vehicles. Therefore, the examination of this topic is vital, particularly in the humanitarian aid sector. Also, other industries, like housing and transport, have seen a rise in sharing platforms. However, there is a lack of understanding regarding why users, including those in the humanitarian logistics industry, are hesitant to engage in the useful practices of sharing assets (Möhlmann, 2015, Sutherland and Jarrahi, 2018). A conceptual study by L'Hermitte and Nair (2021) highlighted the lack of research on the sharing concept in disaster management literature. While that was one of the initial studies to propose the use of sharing logistical resources to improve relief operations, it lacked empirical investigation. Thus, there is a shortage of empirical research to explore the applications of the sharing concept in humanitarian logistics (L'Hermitte and Nair, 2021). However, real-life examples exist. For example, after Hurricane Sandy in 2012, Airbnb adapted its system to allow hosts to offer free temporary room to displaced people (Brown, 2014). Similarly, Airbnb and The Ministry of Civil Defence and Emergency Management in New Zealand signed an agreement to provide emergency housing for those affected by disasters in the Pacific region (The Ministry of Civil Defence & Emergency Management, 2018).

This study aims to address the above research gap of sharing vehicles in Bangladesh which faces transport difficulties, including inadequate road infrastructure, and low compliance with traffic rules, leading to pollution, congestion, accidents, and other issues (Verma, 2015). Thus, recognizing vehicle sharing barriers from the point of view of a developing country is crucial because many lives affected in disasters occur there. For instance, between 1991 and 2005, around 90% of disaster-related deaths and 98% of those affected were in developing countries (Zorn, 2018). Factors such as high population concentration in disaster-prone areas, poorly constructed housing, inadequate warning systems, and weak social safety nets make such countries more vulnerable to disasters (Hallegatte et al., 2020).

Here are the key findings (Figure 3) of this study. Firstly, different kinds of barriers are summarized and classified in this study, encompassing barriers related to risk (10 barriers), usage (7 barriers), tradition (4 barriers), value (2 barriers), and image (1 barrier). However, this exploratory study does not assess the relative significance of each barrier, thus precluding the ability to ascertain the comparative importance of individual barriers. As most of the barriers identified are related to risks, therefore, respondents hold the belief that there are many side-effects or uncertainties linked with vehicle-sharing. The risk barrier can be minimized in several ways as described by the interviewees, such as by offering convincing proof of the security, dependability, and efficiency of vehicle-sharing, by lowering the actual or perceived increased costs of implementing the service, or by demonstrating social acceptance or normative influence that a vehicle-sharing service is desirable. These suggested recommendations bear resemblance to the approaches proposed in Chen and Kuo (2017), and Ma and Lee (2019), for facilitating the adoption of innovative services. As suggested, the adaptation of concepts involves knowing the significance of transparently and carefully disclosing safety protocols, insurance coverage, and the dependability of vehicle sharing services as vital components in effectively addressing risk barriers. Also, it entails emphasizing the importance of proactively acknowledging and resolving concerns related to the security of relief goods, driver qualifications, and adherence to regulatory requirements. Lastly, placing importance on highlighting the measures implemented to mitigate potential risks and ensure the preservation of the integrity of transported goods is paramount.

Additionally, this study also identifies a range of barriers related to usage. Usage barriers manifest when users experience hesitation stemming from the shift from their existing operational approach to a more intricate one that entails increased complexity in usage. As indicated by the interviewees, within the vehicle-sharing context, many challenges may be faced. These encompass dissimilar locations of NGOs, unsuitable sites for specific activities such as cargo pickup and delivery, insufficient transport infrastructure, non-standardized vehicle sizes, and issues related to traffic congestion. Many of such problems can be addressed through the utilization of crowdsourcing-based optimization platforms (Zhang et al., 2022). These platforms, for instance, facilitate the matching of specific vehicle characteristics with site-specific locations. Yet, respondents raised concerns regarding the suitability of existing crowdsourcing-based platforms designed for commercial logistics, as they may not be tailored to meet the unique requirements of NGOs. The distinctions feature the need for specialized platforms catering specifically to the needs and objectives of NGOs in this context. These specific needs are depicted in Figure 4. It is reasonable to anticipate the fulfillment of these unique requirements, as many existing frameworks employed for managing commercial supply chains have proved inadequacy in this specific domain given the demanding operational context of disaster response (Schiffling et al., 2022).

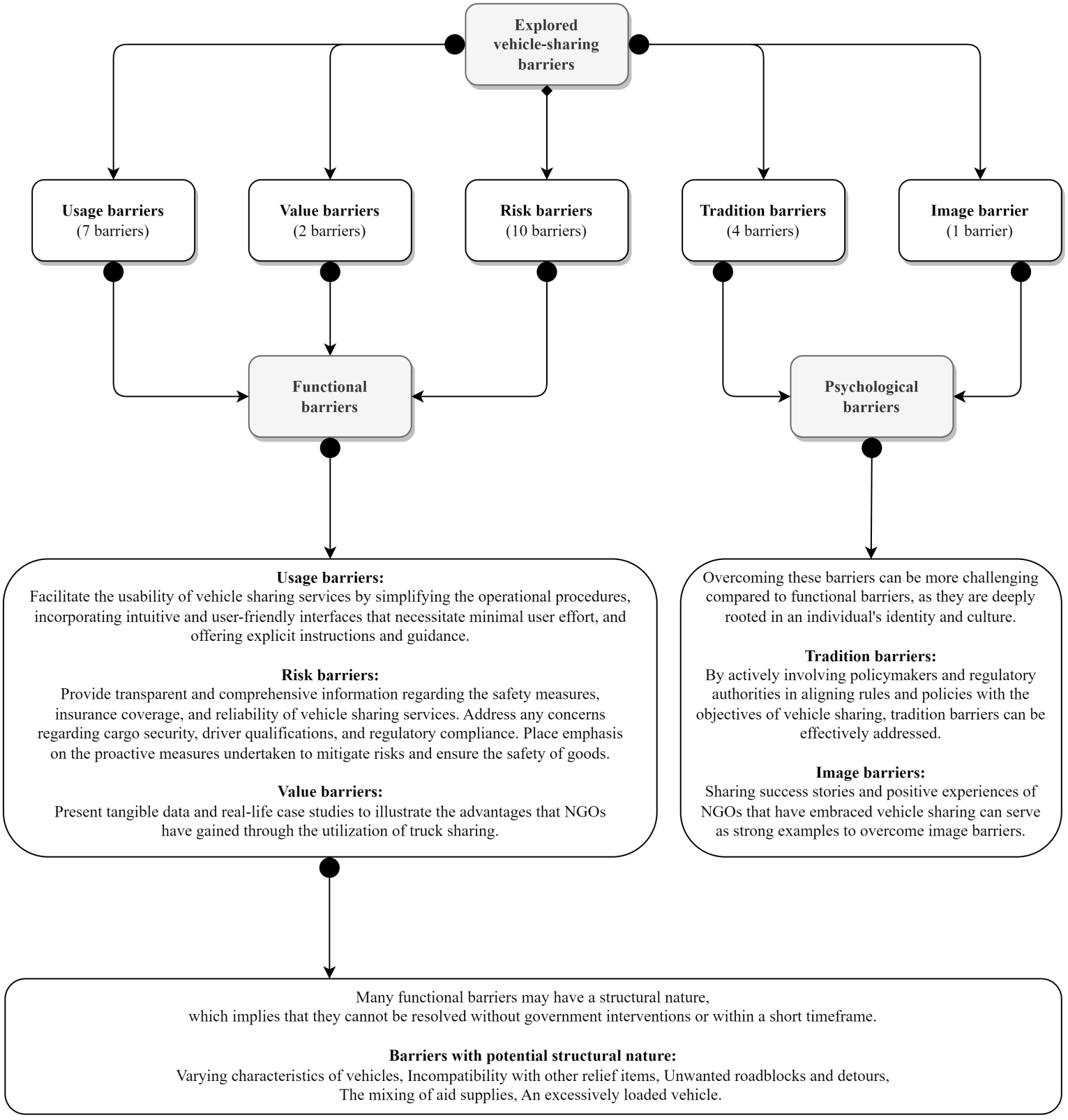

Figure 3: Respondents' perspectives on the characteristics of various types of barriers

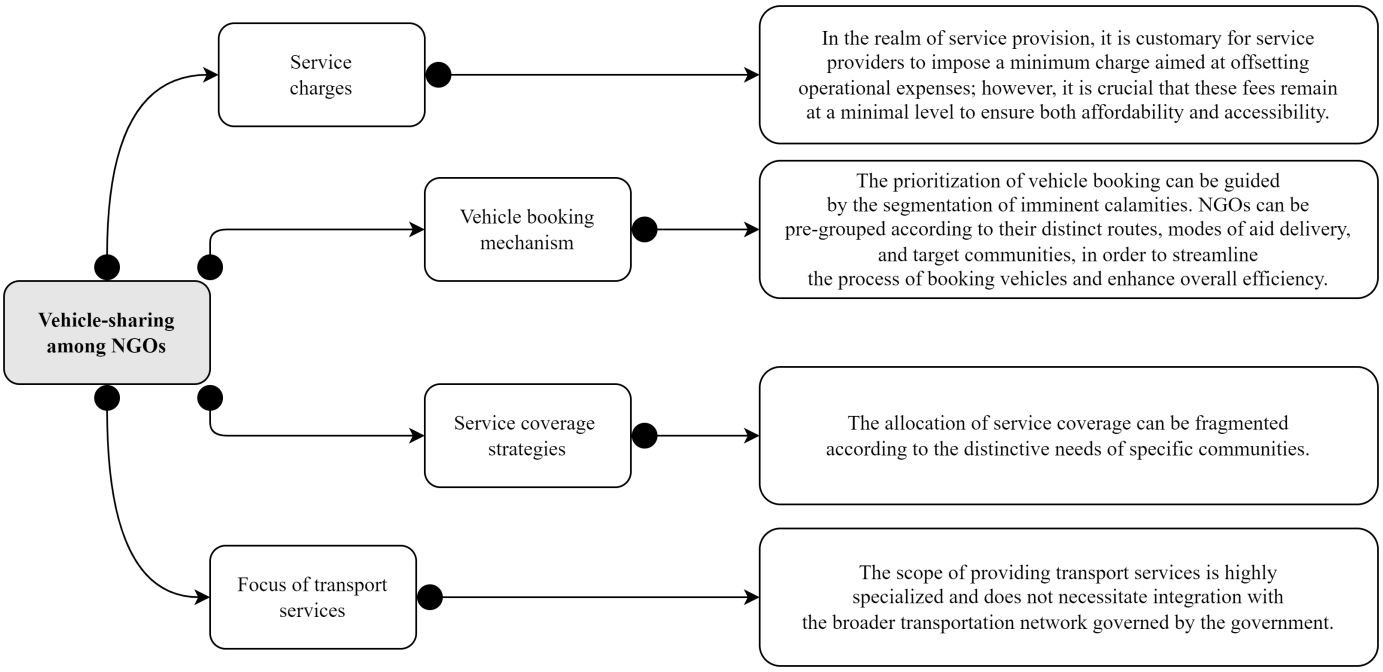

Figure 4: Expected characteristics of a well-customized vehicle sharing platform for NGOs

The list of investigated constraints also includes the identification of value barriers. This obstacle highlights the lack of recognition by NGOs regarding the potential of vehicle sharing to mitigate delivery expenses when compared to conventional transport approaches. Drawing upon the ideas presented by Joachim et al. (2018), essential approaches can be implemented to overcome this hindrance. For instance, service providers can prioritize highlighting the economic advantages, operational efficiencies, and enhanced resource allocation associated with the utilization of shared vehicles. Moreover, it is crucial for service providers to furnish concrete data and practical examples to illustrate the tangible benefits that NGOs have gained through the adoption of vehicle sharing.

It should be also noted that the barriers explored in this study can be categorized into two primary groups (Figure 3): "functional barriers" and "psychological barriers," following the framework of Ram and Sheth's (1989). The functional barriers encompass obstacles that impede the acceptance of a vehicle-sharing job based on its practical, operated, or applied aspects, specifically revolving around the concepts of usage, value, and risk. Conversely, psychological barriers pertain to the challenges that arise from the perceived effects of a vehicle-sharing job on an individual's beliefs, attitudes, habits, and social norms. These psychological barriers involve elements related to image and tradition. These mental barriers are deeply ingrained in an individual's or organization's identity and culture, making them more challenging to overcome compared to functional barriers. Laukkanen's (2016) research, along with other studies on innovation resistance, also supports the said notion. Next, targeting functional barriers appears to offer a relatively more accessible path towards achieving direct success.

The remaining obstacles consist of psychological barriers that are interconnected with challenges stemming from image and tradition. The development of a negative image is a psychological reaction that emerges as a result of conflicting personal values or beliefs, influenced by previous adverse

encounters within the particular service sector (Ma and Lee, 2019). Likewise, surmounting the obstacle of tradition can present significant difficulties, as certain local practices are deeply rooted and may be devoid of impartial assessment. Hence, particular cultural practices may hinder the successful execution of sound policies, thereby creating avenues for critical analysis and evaluation (Laukkanen, 2016). Several strategies, extracted from the existing body of literature, have been recognized for addressing the psychological barriers that have been explored in this study. First, to counteract negative perceptions and cultivate trust among NGOs, it is essential to disseminate comprehensive information and raise awareness regarding the benefits, reliability, safety protocols, and service quality of vehicle-sharing services. Achieving this objective can be accomplished through targeted marketing campaigns, industry events, and educational initiatives. Moreover, presenting success stories and positive experiences of NGOs that have embraced vehicle sharing can serve as compelling testimonials in overcoming image barriers. Sharing testimonials that emphasize the convenience, cost savings, and favorable outcomes associated with utilizing shared vehicles can effectively reshape the attitudes and beliefs of NGOs. These suggestions are adapted from the concepts put forth by Reinhardt (2019). These also exhibit congruence with the suggestions put forth by the interviewees as shown in Figure 3.

Secondly, according to the interviewees, some of the barriers identified (Figure 3) in the study should be temporarily overlooked by policymakers since they are not within the short-term control or influence of NGOs without Government intervention. For instance, “varying characteristics of vehicles” may not be influenced or controlled by the preferences of HOs, resulting in some unavoidable instances of underutilized trips during relief operations. Other similar constraints that contribute to the level of "structural or unavoidable empty running" include "incompatibility with other relief items", "unwanted roadblocks and detours", and "the mixing of aid supplies". All these challenges are classified under the "usage barrier". Similar conclusions were reached by Islam and Olsen (2014), who investigated the existence of "structural empty running" in New Zealand's commercial logistics sector.

Thirdly, HOs face the challenge of building trust with other HOs (Spens and Kovács, 2007). Even the respondents frequently highlighted the importance of trust as a risk barrier when initiating a vehicle-sharing partnership with another NGO. However, in emergency situations, international NGOs often rely on smaller, local NGOs with knowledge of local transportation services. For example, the international NGO may reach out to non-competing local NGOs to inquire about transportation fees and assess costs before establishing a relationship. This type of trust is referred to as "calculative trust" (Ghosh and Fedorowicz, 2008), where the decision to collaborate is based on a cost-benefit analysis. After a few successful trips, if the international NGO recognizes the benefits of working with the local NGO, the volume of work for the local NGO may increase, establishing a "competence trust" (Paul and McDaniel, 2004), where the international NGO has confidence in the local NGO's ability to deliver as promised. As the relationship progresses, the "competence trust" strengthens as shown in Figure 4.

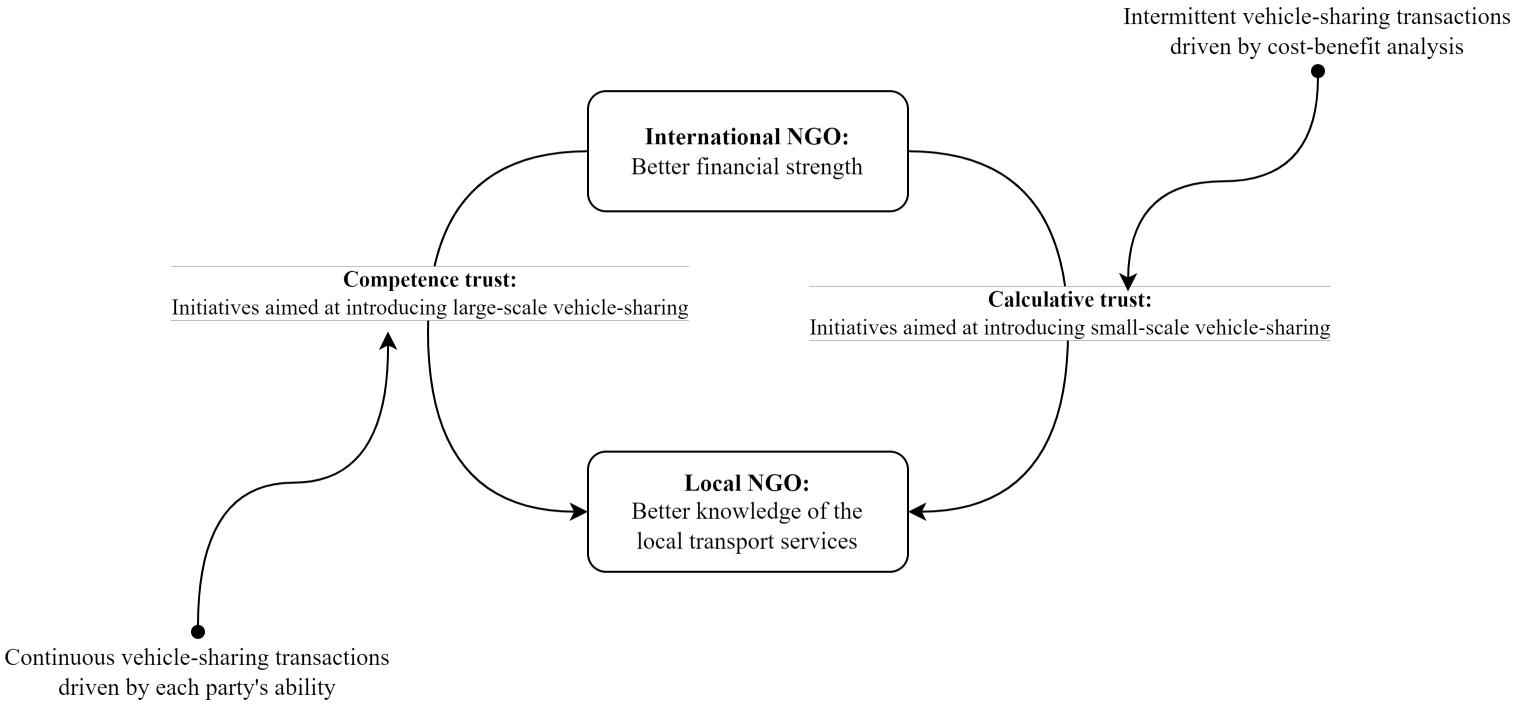

Figure 4: The way of initiating vehicle-sharing practices between local and international NGOs

Fourthly, the interviewees also explicitly articulate the apprehension that several obstacles specific to developing nations may impede the implementation of vehicle sharing initiatives. These barriers encompass a range of factors, such as inadequate funding, concerns regarding safety, security, and privacy, effective communication of potential legal obstacles, instances of corruption and unethical behavior, and anxieties about reputational harm. The interviewees provide additional insights into the underlying reasons or immediate impacts that contribute to each of these distinct barriers. Based on these facts, Figure 5 illustrates the primary barriers unique to developing countries and their associated triggering variables. For instance, there exist accompanying factors that affect the barrier of inadequate funding. One can identify the constraints arising from limited government resources and the reliance on external donors. In other words, NGOs operating in developing countries encounter inadequate financial support from the local government and face uncertainties regarding the willingness of foreign donors to sustain future assistance (Gooding, 2017). Figure 5 offers a complete elucidation of the topic.

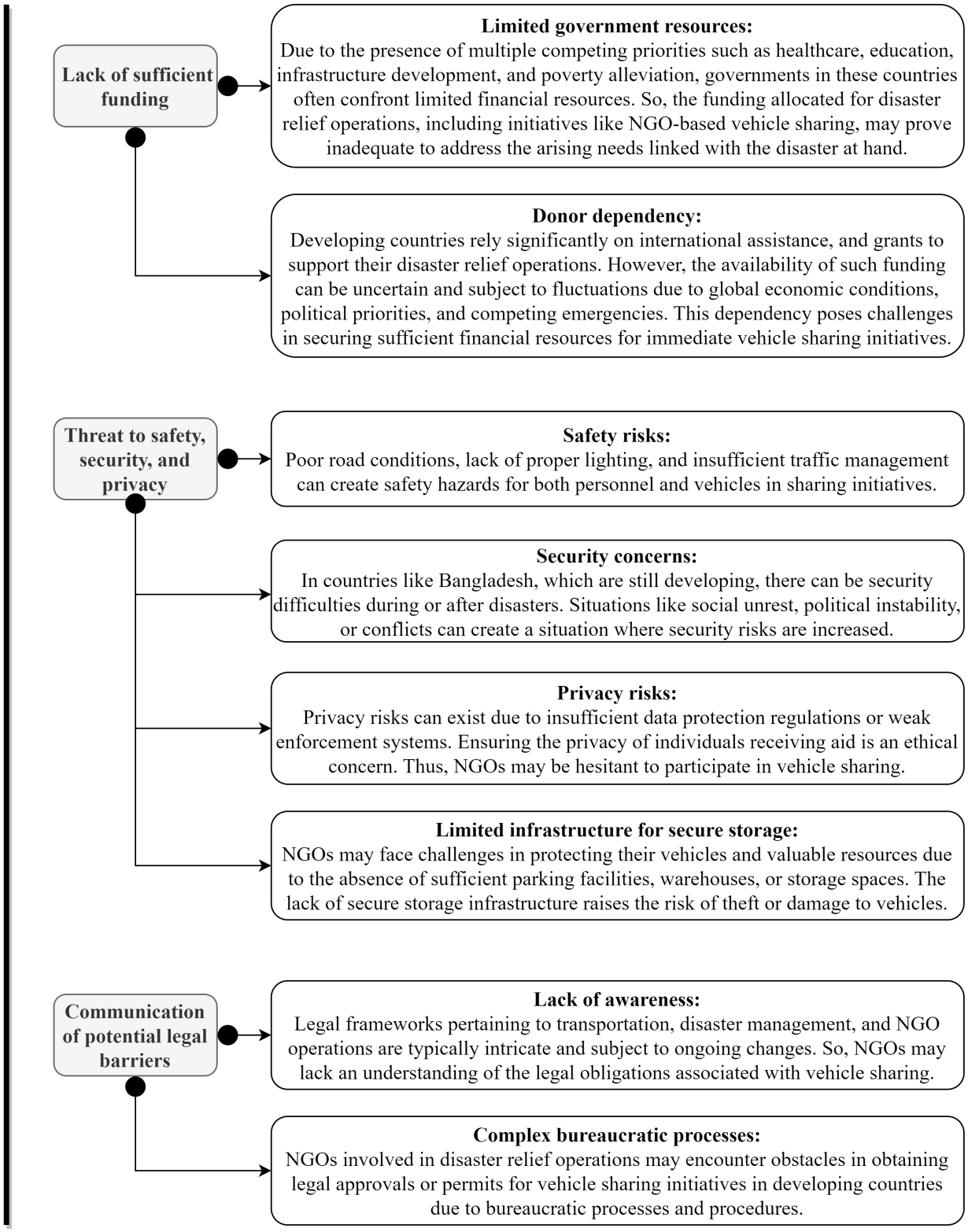

Figure 5: Barriers of specific significance, particularly for developing nations

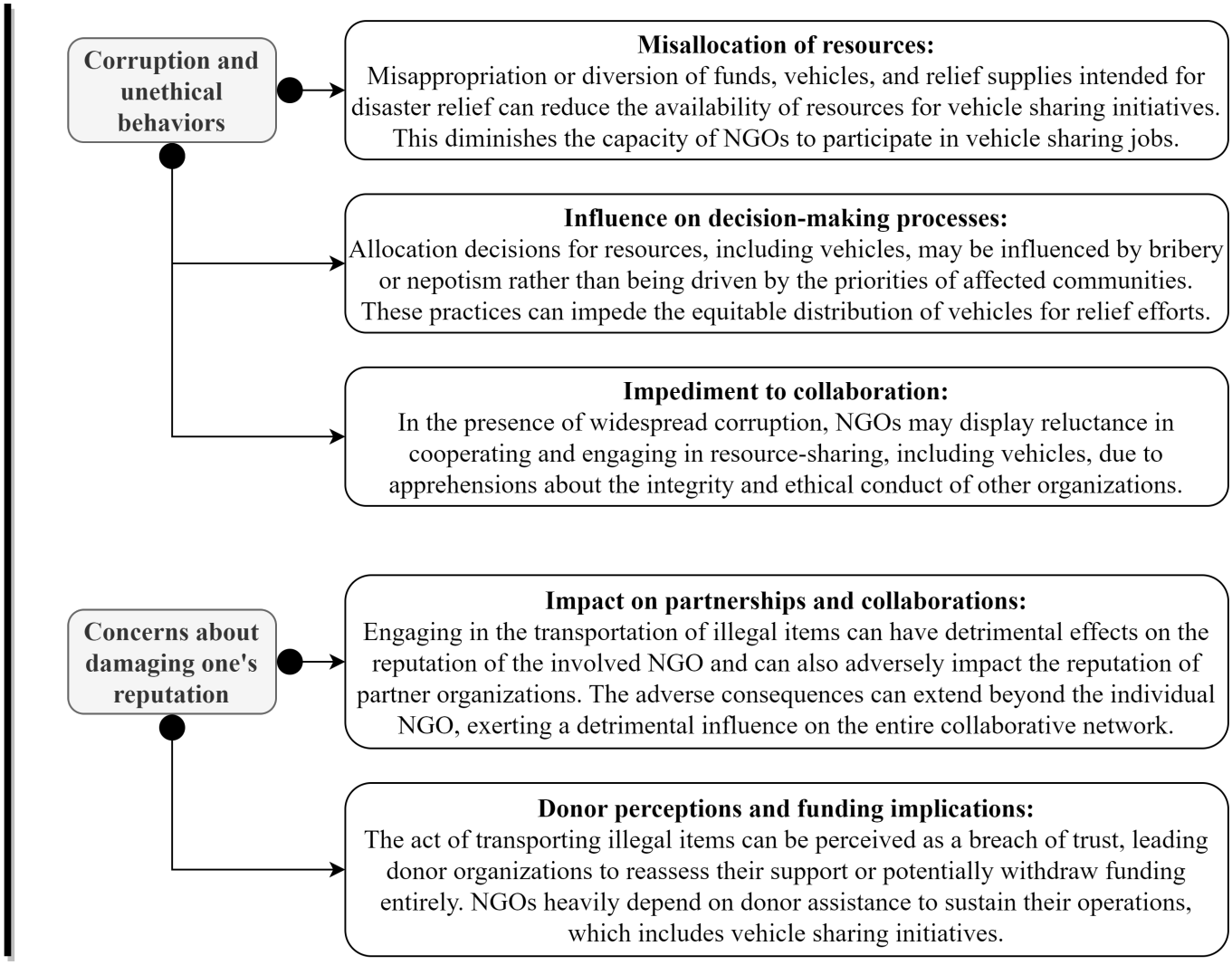

Figure 5 (continued): Barriers of specific significance, particularly for developing nations

This study has identified specific obstacles to vehicle-sharing, some of which coincide with a list of broad collaboration challenges among HOs outlined by Balcik et al. (2010), including diversity among actors, donor expectations and funding mechanisms, funding competitions, media impact, limited resources or excessive supply, and coordination costs. Although the literature does not explicitly mention internal communication as a challenge for HOs, it has been observed that they struggle with sharing information adequately, including tools for cargo tracing and tracking, as well as identifying the needs of affected populations, in comparison to the commercial sector's resource management capabilities (Tatham and Spens, 2011, Tell et al., 2022). When organizations are not fully committed to coordination activities or efforts, these can be referred to as "mandate barriers" (Maitland et al., 2009, Sapat et al., 2019). Furthermore, certain factors, such as the need for greater flexibility in compliance procedures, project planning, and funding options, can be categorized as "structural barriers" in humanitarian logistics. Addressing these barriers requires more extensive changes to the system. For instance, the government may need to intervene to minimize these barriers. According to Maitland *et al.* (2009), structural and mandate barriers are the reasons for the failure of coordination efforts.

Implications for practice

(1) The findings have implications for managers, particularly in the context of creating awareness among potential NGOs regarding the benefits of vehicle sharing. This can be achieved through well-designed communication campaigns, promotional materials, and targeted marketing strategies. The effective dissemination of customized information that aligns with local customs and norms is crucial for addressing information gaps and rectifying misconceptions. These strategies are particularly important for overcoming the psychological barriers related to image and tradition, which present formidable challenges to be overcome. (2) According to the interviewees, the establishment of a platform is deemed indispensable for fostering collaboration. It is recommended that vehicle sharing platforms and services be developed with a user-centric perspective, considering user needs, and cultural intricacies through user research and the incorporation of feedback. Through systematic user research, providers can obtain insights into the specific obstacles encountered by users in diverse contexts. (3) In order to address usage barriers, the implementation of training programs, provision of educational materials, and ongoing support to NGOs are recommended, highlighting the importance of comprehensive preparation initiatives. Therefore, managers should allocate resources to develop and implement training programs that equip users with the requisite skills and knowledge to effectively utilize vehicle sharing services. (4) To address risk barriers, the implementation of risk mitigation strategies should encompass clear communication regarding safety protocols, insurance provisions, and compliance with regulations, alongside the use of written testimonials to foster trust. Risk barriers, which are largely influenced by user perceptions, can be relatively more manageable and can be effectively addressed through appropriate measures. (5) In the context of developing countries, managers must articulate the concerns related to formulating tailored strategies, as they are confronted with a diverse set of obstacles that pose challenges to the implementation of vehicle sharing initiatives. These barriers encompass a broad spectrum of factors, such as inadequate funding, apprehensions regarding safety, security, and privacy, the need for effective communication regarding potential legal obstacles, instances of corruption and unethical behavior, as well as anxieties about reputational harm.

Implications for research

The present study carries academic implications. Firstly, it contributes to the theoretical understanding of innovation resistance within the context of humanitarian logistics, specifically focusing on vehicle sharing. This contribution is particularly valuable to the academic community as it aligns with the findings of Tsakalidis et al. (2020), highlighting the existence of significant barriers that must be adequately identified and addressed before achieving a transformative revolution in transportation innovation. In essence, it sheds light on the fact that many innovative transportation concepts proposed in the literature struggle to gain widespread adoption. Accordingly, this study extends the current body of literature, facilitating the advancement of theoretical frameworks pertaining to barriers encountered in the adoption of innovative transportation practices. Secondly, through the explicit delineation and classification of barriers, this study contributes to comprehending the challenges encountered by potential NGOs. This foundational understanding can serve as a cornerstone for future investigations and facilitate the development of customized strategies to effectively address the most crucial barriers. Consequently, this study responds to the call for additional research put forth by L'Hermitte and Nair (2021), who underscored the insufficient readiness in the humanitarian sector for logistical resource sharing. Thirdly, conducting this research in a developing country like Bangladesh provides a valuable perspective on context-specific barriers, an aspect of particular significance given the substantial impact of disasters in such regions. As evidenced by Zorn (2018), approximately 90% of disaster-related fatalities and 98% of affected individuals occur in developing countries. Moreover, research in

such countries is constrained by the limited availability of data, attributable to the challenges associated with data collection in developing nations (Islam et al., 2021). These challenges encompass residents' limited awareness of the importance of data collection and the insufficient infrastructural support, including deficiencies in transport networks, roads, and telecommunication systems. Hence, the contextual understanding provided by this study can enrich the knowledge base on innovation adoption in challenging settings, further advancing research ideas in this domain of humanitarian logistics.

Conclusion, limitations, and future study

HOs have not embraced sharing key resources, and past research have not fully understood the barriers to shared-transport solutions. This emphasizes the need for policymakers to understand the obstacles to vehicle-sharing, since the problem cannot be remedied without doing so. To the authors' knowledge, this study is the first empirical humanitarian logistics study to suggest NGOs collaborate on transport to reduce duplication and optimize transport resources in disaster zones. This research makes use of an exploratory method to collect feedback from NGOs, and it applies innovation resistance theory lenses.

The research findings indicate that implementing a vehicle-sharing initiative in disaster relief operations can lead to various technical and complex usage issues that cannot be avoided. Some of these problems are caused by the vehicle itself, while others are caused by challenges that cannot be managed. Some of these problems include the physical characteristics of a vehicle, the possibility of a problem arising from mixing relief items that are similar to one another, a vehicle that is overloaded, and the presence of a roadblock along the route. As a result, there will inevitably be some number of "underutilized trips" in existence at all times. However, building a foundation of trust and enhancing internal communication among NGOs are two examples of changes, treatments, or modifications that may be made for improved results related to vehicle-sharing. This means, it is important to highlight that certain obstacles to vehicle-sharing that may seem to be essential can be treated or modified.

The fact that this research is concentrating on Bangladesh, a nation that has a vibrant NGO sector and is often struck by catastrophes, may teach other developing nations such as China, India, and Pakistan important lessons. To clarify, these nations as well are often struck by calamitous catastrophes; therefore, the findings of this study might assist policymakers in those countries in formulating efficient responses to the problem of low vehicle use during times of crisis or emergencies.

The study findings are subject to limitations. One limitation is that the barriers to vehicle-sharing have only been examined from the perspectives of NGOs and not from the viewpoints of road carriers or logistics service providers. Since NGOs are the shippers, they may not consider all the economic aspects of vehicle-sharing. Therefore, it is essential to conduct further research that considers the views of road carriers. Additionally, future research could consider using systematic sampling instead of convenience sampling to include shippers and carriers with varying characteristics. Future studies that address these limitations will enhance the generalizability of the findings from this exploratory study.

NGOs can prioritize their efforts towards enhancing transport capacity and reducing emissions by focusing on the most significant barriers. This process entails evaluating each barrier's potential impact on achieving these goals and assessing its pragmatic feasibility. Specificity is crucial in formulating barriers, including details on their relevance to the transport system, stakeholders involved, and nature of the barrier. Thus, the Best Worst Methodology can be applied to rank the barriers, and the WINGS method (Weighted Influence Non-linear Gauge System) can be used to determine their interrelations. Another plausible avenue for further research entails the utilization of a specific case study to elucidate the potential barriers and advantages of vehicular resource sharing within NGOs. The presentation of a case study derived from authentic real-world scenarios holds the potential to persuade humanitarian entities regarding the prospective challenges and advantages associated with the advocated approach.

Finally, while a qualitative research approach holds the capacity to enhance comprehension of human experiences, social interpretations, and cultural nuances, it is noteworthy that a supplementary quantitative analysis can serve to quantify the effects of potential impediments. It can serve as a means to underscore the magnitude of each impediment, ultimately facilitating the categorization of obstacles. This categorization, in turn, can prove instrumental in devising strategies for mitigation and resolution.

References

ACQUIER, A., DAUDIGEOS, T. & PINKSE, J. 2017. Promises and paradoxes of the sharing economy: An organizing framework. *Technological Forecasting and Social Change,* 125**,** 1-10.

ADEM, S. A., CHILDERHOUSE, P., EGBELAKIN, T. & WANG, B. 2018. International and local NGO supply chain collaboration: An investigation of the Syrian refugee crises in Jordan. *Journal of Humanitarian Logistics and Supply Chain Management,* 8**,** 295-322.

AGARWAL, S., KANT, R. & SHANKAR, R. 2019. Humanitarian supply chain management frameworks. *Benchmarking: An International Journal,* 26**,** 1749-1780.

ALTAY, N. & LABONTE, M. 2014. Challenges in humanitarian information management and exchange: Evidence from Haiti. *Disasters,* 38**,** 50-72.

BABIN, B., MONEY, A. H., SAMOUEL, P. & HAIR, J. F. 2003. *Essentials of business research methods,* Hoboken, New Jersey, John Wiley & Sons.

BAHARMAND, H. & COMES, T. 2019. Leveraging partnerships with logistics service providers in humanitarian supply chains by blockchain-based smart contracts. *IFAC-PapersOnLine,* 52**,** 12-17.

BAHARMAND, H., COMES, T. & LAURAS, M. 2017. Managing in-country transportation risks in humanitarian supply chains by logistics service providers: Insights from the 2015 Nepal earthquake. *International Journal of Disaster Risk Reduction,* 24**,** 549-559.

BAKER, J. 2012. The Technology–Organization–Environment Framework. *In:* DWIVEDI, Y., WADE, M. & SCHNEBERGER, S. (eds.) *Information Systems Theory: Explaining and Predicting Our Digital Society.* New York, NY: Springer New York.

BALCIK, B., BEAMON, B. M., KREJCI, C. C., MURAMATSU, K. M. & RAMIREZ, M. 2010. Coordination in humanitarian relief chains: Practices, challenges and opportunities. *International Journal of Production Economics,* 126**,** 22-34.

BAOU, E., KOUTRAS VASILIS, P., ZEIMPEKIS, V. & MINIS, I. 2018. Emergency evacuation planning in natural disasters under diverse population and fleet characteristics. *Journal of Humanitarian Logistics and Supply Chain Management,* 8**,** 447-476.

BARRIBALL, K. L. & WHILE, A. 1994. Collecting data using a semi-structured interview: A discussion paper. *Journal of Advanced Nursing,* 19**,** 328-335.

BEALT, J., FERNÁNDEZ BARRERA JAIR, C. & MANSOURI, S. A. 2016. Collaborative relationships between logistics service providers and humanitarian organizations during disaster relief operations. *Journal of Humanitarian Logistics and Supply Chain Management,* 6**,** 118-144.

BELK, R. W. 1989. Extended self and extending paradigmatic perspective. *Journal of Consumer Research,* 16**,** 129-132.

BLECKEN, A. & SCHULZ, S. F. 2010. Horizontal cooperation in disaster relief logistics: Benefits and impediments. *International Journal of Physical Distribution & Logistics Management,* 40**,** 636-656.

BROWN, J. 2014. How the sharing economy is changing disaster response and recovery. Folsom, California.

BÜNDNIS ENTWICKLUNG HILFT 2017. World risk report analysis and prospects. Berlin, Germany.

CANGIALOSI, J. P., LATTO, A. S. & BERG, R. 2018. Hurricane Irma. *The National Hurricane Center's Tropical Cyclone Reports.* Miami, Florida: National Hurricane Center.

CAPLICE, C. & SHEFFI, Y. 1994. A Review and Evaluation of Logistics Metrics. *The International Journal of Logistics Management,* 5**,** 11-28.

CENTRE FOR RESEARCH ON THE EPIDEMIOLOGY OF DISASTERS (CRED) 2023. 2022 disasters in numbers. *In:* UCLOUVAIN (ed.) *Climate in action.* Belgium: Centre for Research on the Epidemiology of Disasters (CRED).

CHEN, F., LIU, S. & APPOLLONI, A. 2020. Horizontal coordination of I-LNGOs in the humanitarian supply chain: An evolutionary game approach. *Sustainability,* 12**,** 5953.

CHEN, P.-T. & KUO, S.-C. 2017. Innovation resistance and strategic implications of enterprise social media websites in Taiwan through knowledge sharing perspective. *Technological Forecasting and Social Change,* 118**,** 55-69.

CHIA, J. 2005. Is trust a necessary component of relationship management? *Journal of Communication Management,* 9**,** 277-285.

CHOWDHURY, M., WILLIAMS, N., THOMPSON, K. & FERDOUS, G. 2022. The Rohingya refugee crisis in Bangladesh: An analysis of the involvement of local humanitarian actors. *Third World Quarterly,* 43**,** 2188-2208.

COZZOLINO, A., WANKOWICZ, E. & MASSARONI, E. 2017. Logistics service providers' engagement in disaster relief initiatives: An exploratory analysis. *International Journal of Quality and Service Sciences,* 9**,** 269-291.

DAHAL, K. & NIEMELÄ, J. 2016. Initiatives towards Carbon Neutrality in the Helsinki Metropolitan Area. *Climate,* 4**,** 36.

DAPPE, M. H., KUNAKA, C., LEBRAND, M. & WEISSKOPF, N. 2019. Moving forward connectivity and logistics to sustain Bangladesh's success. *International Development in Focus.* Washington, D.C.: The World Bank.

DAVIS-SRAMEK, B., FUGATE BRIAN, S. & OMAR, A. 2007. Functional/dysfunctional supply chain exchanges. *International Journal of Physical Distribution & Logistics Management,* 37**,** 43-63.

DAVIS, J. J. 2019. *Advertising research: Theory and practice,* London, United Kingdom, Pearson.

DAY, J. M., MELNYK, S. A., LARSON, P. D., DAVIS, E. W. & WHYBARK, D. C. 2012. Humanitarian and disaster relief supply chains: A matter of life and death. *Journal of Supply Chain Management,* 48**,** 21-36.

DEPARTMENT FOR TRANSPORT 2017. Freight carbon review. London, UK.

DESI-NEZHAD, Z., SABOUHI, F. & DEHGHANI SADRABADI, M. H. 2022. An optimization approach for disaster relief network design under uncertainty and disruption with sustainability considerations. *RAIRO Operations Research,* 56**,** 751-768.

DUBEY, R., GUNASEKARAN, A., CHILDE, S. J., ROUBAUD, D., FOSSO WAMBA, S., GIANNAKIS, M. & FOROPON, C. 2019. Big data analytics and organizational culture as complements to swift trust and collaborative performance in the humanitarian supply chain. *International Journal of Production Economics,* 210**,** 120-136.

DULEBENETS, M. A., PASHA, J., ABIOYE, O. F., KAVOOSI, M., OZGUVEN, E. E., MOSES, R., BOOT, W. R. & SANDO, T. 2019. Exact and heuristic solution algorithms for efficient emergency evacuation in areas with vulnerable populations. *International Journal of Disaster Risk Reduction,* 39**,** 101114.

DWORKIN, S. 2012. Sample size policy for qualitative studies using in-depth interviews. *Archives of Sexual Behavior,* 41**,** 1319-1320.

EISENHARDT, K. M. & GRAEBNER, M. E. 2007. Theory building from cases: Opportunities and challenges. *Academy of Management Journal,* 50**,** 25-32.

EUROPEAN COMMISSION DG FOR MOBILITY AND TRANSPORT 2017. An overview of the EU road transport market in 2015. European Commission.

FALAGARA SIGALA, I. & WAKOLBINGER, T. 2019. Outsourcing of humanitarian logistics to commercial logistics service providers: An empirical investigation. *Journal of Humanitarian Logistics and Supply Chain Management,* 9**,** 47-69.

GANGULY, K. K., PADHY, R. K. & RAI SIDDHARTH, S. 2017. Managing the humanitarian supply chain: A fuzzy logic approach. *International Journal of Disaster Resilience in the Built Environment,* 8**,** 521-536.

GATIGNON, H. & ROBERTSON, T. 1989. Technology diffusion: An empirical test of competitive effects. *Journal of Marketing,* 53**,** 35-49.

GHOSH, A. & FEDOROWICZ, J. 2008. The role of trust in supply chain governance. *Business Process Management Journal,* 14**,** 453-470.

GOODCHILD, A., WYGONIK, E. & MAYES, N. 2017. An analytical model for vehicle miles traveled and carbon emissions for goods delivery scenarios. *European Transport Research Review,* 10**,** 8.

GOODING, K. 2017. The role of NGOs' service delivery experience in developing relevant research agendas: Experience and challenges among NGOs in Malawi. *Health Research Policy and Systems,* 15**,** 38.

GOSSLER, T., WAKOLBINGER, T., NAGURNEY, A. & DANIELE, P. 2019. How to increase the impact of disaster relief: A study of transportation rates, framework agreements and product distribution. *European Journal of Operational Research,* 274**,** 126-141.

GUEST, G., BUNCE, A. & JOHNSON, L. 2006. How many interviews are enough?:An experiment with data saturation and variability. *Field Methods,* 18**,** 59-82.

GUO, X. & KAPUCU, N. 2020. Engaging stakeholders for collaborative decision making in humanitarian logistics using system dynamics. *Journal of Homeland Security and Emergency Management,* 17**,** 1-13.

HALLEGATTE, S., VOGT-SCHILB, A., ROZENBERG, J., BANGALORE, M. & BEAUDET, C. 2020. From poverty to disaster and back: A review of the literature. *Economics of Disasters and Climate Change,* 4**,** 223-247.

HAQUE, D. M. E., MIMI, A., MAZUMDER, R. K. & SALMAN, A. M. 2020. Evaluation of natural hazard risk for coastal districts of Bangladesh using the INFORM approach. *International Journal of Disaster Risk Reduction,* 48**,** 101569.

HIRATA, T. & FUKAYA, T. 2020. Potential of truck platooning for transporting empty trucks considering intercity freight demand imbalances. *Logforum,* 16**,** 4.

HIRSCHINGER, M., MOSER, R., SCHAEFERS, T. & HARTMANN, E. 2016. No vehicle means no aid—A paradigm change for the humanitarian logistics business model. *Thunderbird International Business Review,* 58**,** 373-384.

HIRSCHMAN, E. C. 1986. Humanistic inquiry in marketing research: Philosophy, method, and criteria. *Journal of Marketing Research,* 23**,** 237-249.

ISLAM, S. 2018. Simulation of truck arrival process at a seaport: Evaluating truck-sharing benefits for empty trips reduction. *International Journal of Logistics Research and Applications,* 21**,** 94-112.

ISLAM, S., GOERLANDT, F., FENG, X., UDDIN, M. J., SHI, Y. & HILLIARD, C. 2020. Improving disasters preparedness and response for coastal communities using AIS ship tracking data. *International Journal of Disaster Risk Reduction,* 51**,** 101863.

ISLAM, S. & OLSEN, T. 2014. Truck-sharing challenges for hinterland trucking companies: A case of the empty container truck trips problem. *Business Process Management Journal,* 20**,** 290-334.

ISLAM, S., UDDIN, M. J., SHI, Y., SHARIF, T. & AHMED, J. U. 2021. Exploring shippers' motivations to adopt collaborative truck-sharing initiatives. *International Journal of Physical Distribution & Logistics Management,* 51**,** 528-550.

JOACHIM, V., SPIETH, P. & HEIDENREICH, S. 2018. Active innovation resistance: An empirical study on functional and psychological barriers to innovation adoption in different contexts. *Industrial Marketing Management,* 71**,** 95-107.

KAMARUZZAMAN, S. N., LOU, E. C. W., WONG, P. F., WOOD, R. & CHE-ANI, A. I. 2018. Developing weighting system for refurbishment building assessment scheme in Malaysia through analytic hierarchy process (AHP) approach. *Energy Policy,* 112**,** 280-290.

KOVÁCS, G., TATHAM, P. & LARSON, P. D. 2012. What skills are needed to be a humanitarian logistician? *Journal of Business Logistics,* 33**,** 245-258.

L'HERMITTE, C. & NAIR, N.-K. C. 2021. A blockchain-enabled framework for sharing logistics resources during emergency operations. *Disasters,* n/a.

LAUKKANEN, T. 2016. Consumer adoption versus rejection decisions in seemingly similar service innovations: The case of the Internet and mobile banking. *Journal of Business Research,* 69**,** 2432-2439.

MA, L. & LEE, C. S. 2019. Understanding the barriers to the use of MOOCs in a developing country: An innovation resistance perspective. *Journal of Educational Computing Research,* 57**,** 571-590.

MAITLAND, C., TCHOUAKEU, L. M. N. & TAPIA, A. H. Information management and technology issues addressed by humanitarian relief coordination bodies. 6th International Conference on Information Systems for Crisis Response and Management, 2009 Gothenburg, Sweden.

MANI, Z. & CHOUK, I. 2017. Drivers of consumers' resistance to smart products. *Journal of Marketing Management,* 33**,** 76-97.

MANI, Z. & CHOUK, I. 2018. Consumer resistance to innovation in services: Challenges and barriers in the Internet of Things era. *Journal of Product Innovation Management,* 35**,** 780-807.

MCGRAW, K. & WONG, S. P. 1996. Forming inferences about some intraclass correlation coefficients. *Psychological Methods,* 1**,** 30-46.

MENTZER, J. T. & FLINT, D. J. 1997. Validity in logistics research. *Journal of Business Logistics,* 18**,** 199-216.

MEUTER, M., BITNER, M., OSTROM, A. & BROWN, S. 2005. Choosing among alternatives service delivery modes: An investigation of customer trial of self-service technologies. *Journal of Marketing,* 69**,** 61-83.

MILES, M. B., HUBERMAN, A. M., HUBERMAN, M. A. & HUBERMAN, M. 1994. *Qualitative data analysis: An expanded sourcebook,* Thousand Oaks, CA, Sage Publications.

MIN, S., ROATH ANTHONY, S., DAUGHERTY PATRICIA, J., GENCHEV STEFAN, E., CHEN, H., ARNDT AARON, D. & GLENN RICHEY, R. 2005. Supply chain collaboration: What's happening? *The International Journal of Logistics Management,* 16**,** 237-256.

MÖHLMANN, M. 2015. Collaborative consumption: determinants of satisfaction and the likelihood of using a sharing economy option again. *Journal of Consumer Behaviour,* 14**,** 193-207.

MURSHED, S., PAULL, D. J., GRIFFIN, A. L. & ISLAM, M. A. 2021. A parsimonious approach to mapping climate-change-related composite disaster risk at the local scale in coastal Bangladesh. *International Journal of Disaster Risk Reduction,* 55**,** 102049.

NGO AFFAIRS BUREAU 2018. List of Non-Government Organizations (NGO) in Bangladesh. Dhaka, Bangladesh.

NGUYEN, T. H., LE, X. C. & VU, T. H. L. 2022. An extended Technology-Organization-Environment (TOE) framework for online retailing utilization in digital transformation: Empirical evidence from Vietnam. *Journal of Open Innovation: Technology, Market, and Complexity,* 8**,** 200.

PAUL, D. & MCDANIEL, R. 2004. A field study of the effect of interpersonal trust on virtual collaborative relationship performance. *MIS Quarterly,* 28**,** 183-227.

PIECYK, M. I. & MCKINNON, A. C. 2010. Forecasting the carbon footprint of road freight transport in 2020. *International Journal of Production Economics,* 128**,** 31-42.

RAJAKARUNA, S., WIJERATNE, A. W., MANN, T. S. & YAN, C. 2017. Identifying key skill sets in humanitarian logistics: Developing a model for Sri Lanka. *International Journal of Disaster Risk Reduction,* 24**,** 58-65.

RAM, S. & SHETH, J. 1989. Consumer resistance to innovations: The marketing problem and its solutions. *Journal of Consumer Marketing,* 6**,** 5-14.

REINHARDT, R., HIETSCHOLD, N. & GURTNER, S. 2019. Overcoming consumer resistance to innovations – an analysis of adoption triggers. *R&D Management,* 49**,** 139-154.

RICHARDS, L. & MORSE, J. M. 2012. *Read me first for a user's guide to qualitative methods,* Thousand Oaks, CA, Sage Publications.

RIZET, C., CRUZ, C. & MBACKÉ, M. 2012. Reducing freight transport CO2 emissions by increasing the load factor. *Procedia - Social and Behavioral Sciences,* 48**,** 184-195.

RUBIN, A. & BABBIE, E. 2015. *Essential research methods for social work,* Belmont, CA, Brooks Cole.

SALAM, M. A. & KHAN, S. A. 2020. Lessons from the humanitarian disaster logistics management: A case study of the earthquake in Haiti. *Benchmarking: An International Journal,* 27**,** 1455-1473.

SAPAT, A., ESNARD, A.-M. & KOLPAKOV, A. 2019. Understanding collaboration in disaster assistance networks: Organizational homophily or resource dependency? *The American Review of Public Administration,* 49**,** 957-972.

SAUNDERS, M., LEWIS, P. & THORNHILL, A. 2015. *Research methods for business students*, Pearson College.

SAW, L. H., HO, L. W., YEW, M. C., YUSOF, F., PAMBUDI, N. A., NG, T. C. & YEW, M. K. 2018. Sensitivity analysis of drill wear and optimization using Adaptive Neuro fuzzy –genetic algorithm technique toward sustainable machining. *Journal of Cleaner Production,* 172**,** 3289-3298.

SCHIFFLING, S., HANNIBAL, C., TICKLE, M. & FAN, Y. 2022. The implications of complexity for humanitarian logistics: A complex adaptive systems perspective. *Annals of Operations Research,* 319**,** 1379-1410.

SHAMEEM, M. I. M., MOMTAZ, S. & RAUSCHER, R. 2014. Vulnerability of rural livelihoods to multiple stressors: A case study from the southwest coastal region of Bangladesh. *Ocean & Coastal Management,* 102**,** 79-87.

SPENS, K. M. & KOVÁCS, G. 2007. Humanitarian logistics in disaster relief operations. *International Journal of Physical Distribution & Logistics Management,* 37**,** 99-114.

SUTHERLAND, W. & JARRAHI, M. H. 2018. The sharing economy and digital platforms: A review and research agenda. *International Journal of Information Management,* 43**,** 328-341.

TATHAM, P. & SPENS, K. 2011. Towards a humanitarian logistics knowledge management system. *Disaster Prevention and Management: An International Journal,* 20**,** 6-26.

TELL, D., OLDEIDE, O., LARSEN, T. & HAUG, E. 2022. Lessons learned from an intersectoral collaboration between the public sector, NGOs, and sports clubs to meet the needs of vulnerable youths. *Societies,* 12**,** 13.

THE MINISTRY OF CIVIL DEFENCE & EMERGENCY MANAGEMENT 2018. Airbnb agreement to unlock emergency accommodation nationwide. Auckland, New Zealand: The National Emergency Management Agency (NEMA).

THOMAS, A. S. & KOPCZAK, L. R. 2005. From logistics to supply chain management: The path forward in the humanitarian sector. Fritz Institute Publication.

TRAN, L. & ABOUASSI, K. 2020. Local organizational determinants of local-international NGO collaboration. *Public Management Review***,** 1-21.

TRUNICK, P. A. 2005. Special report: Delivering relief to tsunami victims. *Logistics Today,* 46**,** 1-3.

TSAKALIDIS, A., VAN BALEN, M., GKOUMAS, K. & PEKAR, F. 2020. Catalyzing sustainable transport innovation through policy support and monitoring: The case of TRIMIS and the European Green Deal. *Sustainability,* 12**,** 3171.

VERMA, A. 2015. *Public transport planning and management in developing countries,* Boca Raton, Florida, United States, CRC Press.

WADE, M. & HULLAND, J. 2004. Review: the resource-based view and information systems research: review, extension, and suggestions for future research. *MIS Quarterly,* 28**,** 107–142.

WARD, J. W., MICHALEK, J. J., AZEVEDO, I. L., SAMARAS, C. & FERREIRA, P. 2019. Effects of on-demand ridesourcing on vehicle ownership, fuel consumption, vehicle miles traveled, and emissions per capita in U.S. States. *Transportation Research Part C: Emerging Technologies,* 108**,** 289-301.

ZAMAN, S., SAMMONDS, P., AHMED, B. & RAHMAN, T. 2020. Disaster risk reduction in conflict contexts: Lessons learned from the lived experiences of Rohingya refugees in Cox's Bazar, Bangladesh. *International Journal of Disaster Risk Reduction,* 50**,** 101694.

ZHANG, H., LUO, K., XU, Y., XU, Y. & TONG, W. 2022. Online crowdsourced truck delivery using historical information. *European Journal of Operational Research,* 301**,** 486-501.

ZORN, M. 2018. Natural disasters and less developed countries. *In:* PELC, S. & KODERMAN, M. (eds.) *Nature, Tourism and Ethnicity as Drivers of (De)Marginalization: Insights to Marginality from Perspective of Sustainability and Development.* Cham: Springer International Publishing.

Appendix A: Sample interview questions

Questions group 1:

What is the organization's duration of operation within the country?
Can you provide a comprehensive classification of the organization's activities?
How many departments or units constitute the organizational structure?
Could you elucidate the functions and objectives assigned to each of these departments?
Could you furnish instances of past disaster relief initiatives undertaken by the organization?
How many individuals are employed within the organization?
What is the extent of the organization's geographic coverage within the country?

Questions group 2:

What is your official designation within the organizational hierarchy?
Could you elucidate the specific responsibilities and job functions entailed by your role?
Could you identify the top three most critical tasks associated with your position?
Do you engage in collaborative efforts with individuals from other NGOs?
If so, could you describe the collaborative activities or operations you undertake together?

Questions group 3:

Does the organization maintain a dedicated fleet of vehicles for the transportation of relief supplies?
Could you specify the types of relief supplies that the organization typically transports?
What types of vehicles, such as trucks or vans, are utilized by the organization for the conveyance of relief materials?
Does the organization procure vehicles through rental arrangements with external parties or organizations?
What is the procedure for vehicle acquisition, payment modalities, and the associated terms and conditions?
Could you provide insights into the nature of transportation operations conducted by the organization, including details on destinations, quantities transported, and other pertinent information?

Are there opportunities for transportation collaborations with other NGOs? Please provide examples.
Does your organization engage in transportation collaborations with other NGOs, and if so, how?
If not, why does your organization not utilize transportation collaboration opportunities?
Are there any NGOs known for collaborating on transportation with other NGOs?

Do you maximize the use of the vehicles' available space?
If there is unused space, can it be shared with other NGOs?
What obstacles hinder the sharing of available space with other NGOs? Please list and explain these obstacles.

What are the advantages of sharing vehicle space with other NGOs?
Could you elaborate on each of these benefits associated with sharing vehicle space with other NGOs?

Questions group 4:

What are the barriers to transport collaboration, and can you describe them?
Is trust an issue in transport collaboration, and how can it be addressed?
Does relief location affect transport collaboration? How?
Can vehicle capacity hinder transport collaboration?
Do differing NGO operating hours impact transport collaboration?
Is there competition among NGOs, and if so, what for? Does it hinder transport collaboration?
Is documentation required for transport collaboration, and what kind?
Does cost play a role in hindering transport collaboration? How?
Does traffic congestion affect transportation collaboration?
Can corruption be a barrier to transport collaboration, and how?
Is transport safety, particularly the risk of robbery, a barrier? How?
Do road accidents hinder transport collaboration, and how?