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What influences people to choose ridesharing? An overview of the literature

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ABSTRACT

Ridesharing is a shared mobility service in which passengers and drivers with similar origins and destinations are matched to travel in the same vehicle. This service utilises unused seats in vehicles and multi-passenger rides to reduce the cost of travel. To promote ridesharing, both service providers and policymakers should carefully analyse passenger adoption behaviour to support future decision-making and planning. In this paper, 80 studies on passenger ridesharing behaviour published since 2004 are reviewed. The motivating factors and barriers are analysed and classified in terms of demographic factors, psychological factors, and situational factors, and boundary conditions are included. The work provides a corresponding research framework on ridesharing behaviour. Finally, the current literature gaps are summarised and research recommendations are provided. This study provides a comprehensive and systematic research basis for ridesharing studies, and presents important theoretical and practical contributions to guide sustainable ridesharing behaviour.

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ridesharing; ridesharing behaviour; user factors; shared mobility; text analysis

1. Introduction

Shared mobility is an innovative transportation strategy that covers a wide range of modes, including public transportation, taxis, shuttles, carsharing, bikesharing, ridesharing, and delivery services (Cheng et al., 2022a, 2022b; Shaheen et al., 2020). Shared mobility offers a variety of environmental, social, and transportation-related benefits. In 2016, the report of the U.S. Department of Transportation defined shared mobility as "an innovative transportation strategy that enables users to gain short-term access to transportation modes on an as-needed basis" (Shaheen et al., 2016). Several studies have documented the transformative impact of shared mobility on many cities by improving

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accessibility, increasing multimodal transportation, reducing vehicle ownership and vehicle miles travelled in certain cases, and providing new ways to access goods and services (Cheng et al., 2020; Shaheen et al., 2015; Tokey et al., 2022; Wang et al., 2022a; Yan et al., 2019). Nonetheless, further research is needed to better understand the impact of various shared mobility modes on people at both city and regional levels.

Mature online ride-matching platforms became available in the 1990s. Since 2004, ridesharing, grounded in technology support, has entered a high growth phase (Chan & Shaheen, 2012). In ridesharing, drivers share empty seats in their vehicles and users access instant rides via Internet-connected mobile applications (Shaheen & Cohen, 2021a). Therefore, certain scholars put forward the view that ridesharing can improve the utilisation of vehicle resources, decrease traffic congestion, and reduce both the cost of rides and energy consumption (Si et al., 2022a; Standing et al., 2019). Current realities affecting city traffic are dense urban populations, increasing parking space constraints, and the increasing demand for comfortable travel experiences. The current and potential market for rideshare highlights the need for research to guide transportation planners and providers to plan at the macro level.

Research on ridesharing behaviour has yielded mixed results. In a previous literature review, Neoh et al. (2017) divided the factors that encourage passengers to participate in ridesharing into internal factors (i.e. socioeconomic characteristics of passengers) and external factors (i.e. policy measures and location). This provided a comprehensive factor list for research and delivered evidence for the application of a meta-analysis. However, their study was limited by the low availability of literature and a relative lack of attention to the psychological factors of ridesharing behaviour. Julagasigorn et al. (2021) subsequently presented a review of the psychological factors that motivate drivers and passengers to share rides with others, providing a conceptual framework of psychology suitable for research. Their proposed framework contributed to a better understanding of the decision-making mechanisms underlying ridesharing behaviour and enriched the theoretical foundation. However, while their study focused on the facilitators of ridesharing, it did not fully address negative factors, such as psychological barriers. Mitropoulos et al. (2021) reported on the user factors and barriers that influence ridesharing behaviour, and categorised them into socio-demographic, location-based, and systematic factors. This is now one of the most comprehensive reviews on ridesharing behaviour available. However, because of its wide scope across three perspectives (i.e. platform, driver, and passenger), the analysis of each specific subject was not very detailed. Further, the study did not develop a systematic framework for analysing ridesharing behaviour. Finally, the selected reviews all excluded grey literature; therefore, certain information related to ridesharing services may have been omitted (De Vos & El-Geneidy, 2022).

Based on the identified gaps in existing literature reviews, in this paper, the motivating factors, barriers, and boundary conditions that affect ridesharing behaviour are examined from the passenger perspective. An overview framework of the current research is then constructed. Compared with previous studies, the innovations of this study are summarised as follows: First, the existing literature reviews on ridesharing behaviour have mainly focused on the period before 2019. However, between 2019 and 2022, the field has developed and expanded rapidly and the latest research has reached a certain scale. As such, there may be many novel and innovative research findings that should be collated.

Second, this study analyzes the motivating factors, barriers, and boundary conditions of ridesharing behaviour. The first two can be classified in terms of demographic factors, psychological factors, and situational factors, and boundary conditions are also included overall. This provides both a new research framework and a comprehensive summary of factors that can inform future studies. Third, the analysis is supplemented with relevant grey literature to provide a more complete collection of information.

This paper is organised in the following way: Section 2 presents the methodology by identifying the scope of the review and presenting the systematic literature selection strategy. Sections 3–5 present the motivating factors, barriers, and boundary conditions of passenger ridesharing behaviour, respectively. Section 6 provides the research framework and future research directions.

2. Methodology

2.1. Definition of ridesharing

In their review, Castellanos et al. (2022) mentioned that there is currently a lack of a unified definition of shared mobility or ridesharing. Therefore, in this study, existing research is synthesised to define ridesharing. As one of the typical modes of shared mobility, ridesharing is highly dependent on technical infrastructure and digital platforms. With the aid of smartphones, big data, cloud computing, and the Internet of Things, strangers can publish and exchange real-time traffic and co-ride information (Castellanos et al., 2022). Multiple passengers with similar itineraries and destinations make transportation requests on the platform (Shaheen et al., 2018). With the support of positioning technology and algorithm matching, passengers are matched with private car drivers who then complete the instant ridesharing process together (Shaheen & Cohen, 2019). The services drivers provide in ridesharing usually include two types: (1) Part-time shared ride services provided by individual drivers with travel plans, where drivers and passengers share the cost through shared travel. (2) Ridesharing services provided by full-time drivers. This second type of service is fully commercialised to help drivers earn income (Li et al., 2021; Zhu et al., 2020). To distinguish, we mention ridehailing as a comparison. Ridesharing and ridehailng are both ridesourcing services provided by Transportation Network Company (Chen et al., 2021), and they both need to use technology matching to realise a riding journey. But ridehailing is a non-shared service, and only provides a driver and a passenger matching service. Because of the efficient use of idle resources, ridesharing can provide cheaper travel costs for passengers compared with ridehailing and other shared mobility modes (Ahmed et al., 2021; Si et al., 2022b).

In their definition of shared mobility, Shaheen et al. emphasized that ridesharing is an on-demand and short-term transportation use mode that is characterised by convenience and immediacy (Shaheen et al., 2015). A common feature of all shared mobility services, including ridesharing, is that these services share the facility of the vehicle, rather than owning the vehicle itself (Machado et al., 2018; Santos, 2018). As an important complement to public transportation, ridesharing reduces both the private and social costs of motorised transportation by increasing car seat occupancy. This mode avoids the inconveniences of the chance for drunk drivers driving on the roads and the need to

find parking for passengers because they can share a ride, and provides comfortable, safe, and secure travel services (Tirachini, 2020; Wang & Yang, 2019).

To summarise, in this study, ridesharing refers to a travel mode in which passengers and drivers use the same platform to post information about "on-demand ride requests" and "vacant seats available for service" respectively, and use the platform to match ride requests and travel service. Passengers whose origin and destination are adjacent are paired with the same car and then travel together, sharing both the itinerary and fare. The driver either shares the cost or realises commercial profit through shared travel. Ridesharing is a high-occupancy mobility mode that has emerged from shared mobility and is a sustainable way for improving traffic efficiency and reducing both traffic congestion and air pollution.

2.2. Keyword selection

This research focuses on the ridesharing behaviour of passengers, and keywords are selected based on authoritative research in the associated field. Combined with the analysis of definitions above, the following two sets of keywords are identified.

(1) Carpooling, carpool, ride-sharing, ridesharing, rideshare

The classification of pooling by Shaheen & Cohen, "Information Technology-Based Casual Carpooling", fits the scope of the present study (Shaheen & Cohen, 2019). As carpooling and ridesharing have similar meanings, both keywords are adopted.

(2) Ride-splitting, ridesplitting, ride-pooling, ridepooling

Shaheen & Cohen's classification of on-demand ride services includes ridesplitting (Shaheen & Cohen, 2021a). Other scholars have referred to the "hitch and express pool" in the DiDi platform as ridesplitting (Wang, Chen, et al., 2019), which has a similar connotation to ridepooling (Zwick & Axhausen, 2022). Both terms are consistent with the definition of this study.

2.3. Search strategy

Scopus and the Transportation Research International Database (TRID) are used to gather research data on factors influencing the ridesharing behaviour of passengers. Scopus is a literature database that provides greater overall coverage of scholarly journals compared with other authoritative databases, such as the Web of Science and Dimensions. This makes Scopus more comprehensive for academic research (Thelwall, 2018), and Scopus has been effectively used for bibliometric analysis and has been adopted by many scholars (Zhu & Liu, 2020). In this study, to complement the existing literature and to search for grey literature, TRID is also used, which is an integrated database that combines books, technical reports, conference proceedings, journal articles, and theses in the field of transportation research (Bowen et al., 2020). This literature database is widely used in the transport field.

Scopus was searched using the "Article title, Abstract, Keywords" function, using the search formula: "ride-sharing OR ridesharing OR rideshare OR carpooling OR carpool OR ride-splitting OR ridesplitting OR ride-pooling OR ridepooling". Only peer-reviewed articles are included in the selected literature, and the publication type is limited to journal articles. Because this study is about "technology-enabled ride matching" (Chan & Shaheen, 2012), publication dates are restricted to 2004–2022. An initial screening returned 1750 results.

The suitability of each article was assessed by reading the title and abstract first (Van Wee & Banister, 2016). The inclusion criteria are as follows: (1) The study topic is related to factors influencing ridesharing behaviour, (2) the study is about platform-based ridesharing, and (3) the study focuses on the role of the passenger in the ridesharing process. After reviewing titles and abstracts, articles that did not align with the theme of ridesharing, did not correlate with ridesharing behaviour, or were not based on passenger perspectives were removed. This procedure led to the exclusion of 1539 results and yielded 211 results. Then, the criteria above were reapplied to a review of the full text of journal articles, which lead to the exclusion of a further 141 studies. The excluded studies include 81 that did not fit the ridesharing theme, 29 studies that focused on ridesharing drivers, 23 studies related to uncommon keywords (such as bus ridesharing, tricycle ridesharing, and vanpooling), and 8 unpublished or uncopyrighted papers that are not available online. In case of disagreements regarding the eligibility of a publication during the selection process, the authors discussed each paper until an agreement was reached. After the full-text reading review, 70 publications were obtained from Scopus. Using the same search strategy, TRID was searched and a further 10 publications were added. A total of 80 publications met the review criteria. Figure 1 shows the specific selection and exclusion processes.

2.4. Text analysis and framework construction

The literature is systematically studied and summarised. By reading the source material line by line, codes are created for common themes and valuable information is extracted and concluded (O'Neill et al., 2018). First, primary codes are extracted directly from the raw material and conceptual categories are generated. Then, secondary codes are extracted from primary codes and links between categories are established. Finally, tertiary codes are used to generate core categories. Following this process, an organised structure for the literature review is created that is related to passenger ridesharing behaviour. The logic of the data is clarified and insights into the existing literature are presented.

3. Motivating factors driving ridesharing behaviour

There is a rich body of research on passenger ridesharing behaviour, particularly concerning motivating factors. The selected literature is coded into three factor groups: demographic, psychological, and situational factors. Among them, demographic factors consist of comprehensive categories that involve demographics, personal traits, residential environment, and multiple other factors related to demographics. Table 1 shows the coding results. The 62 primary codes taken directly from the original text are refined into

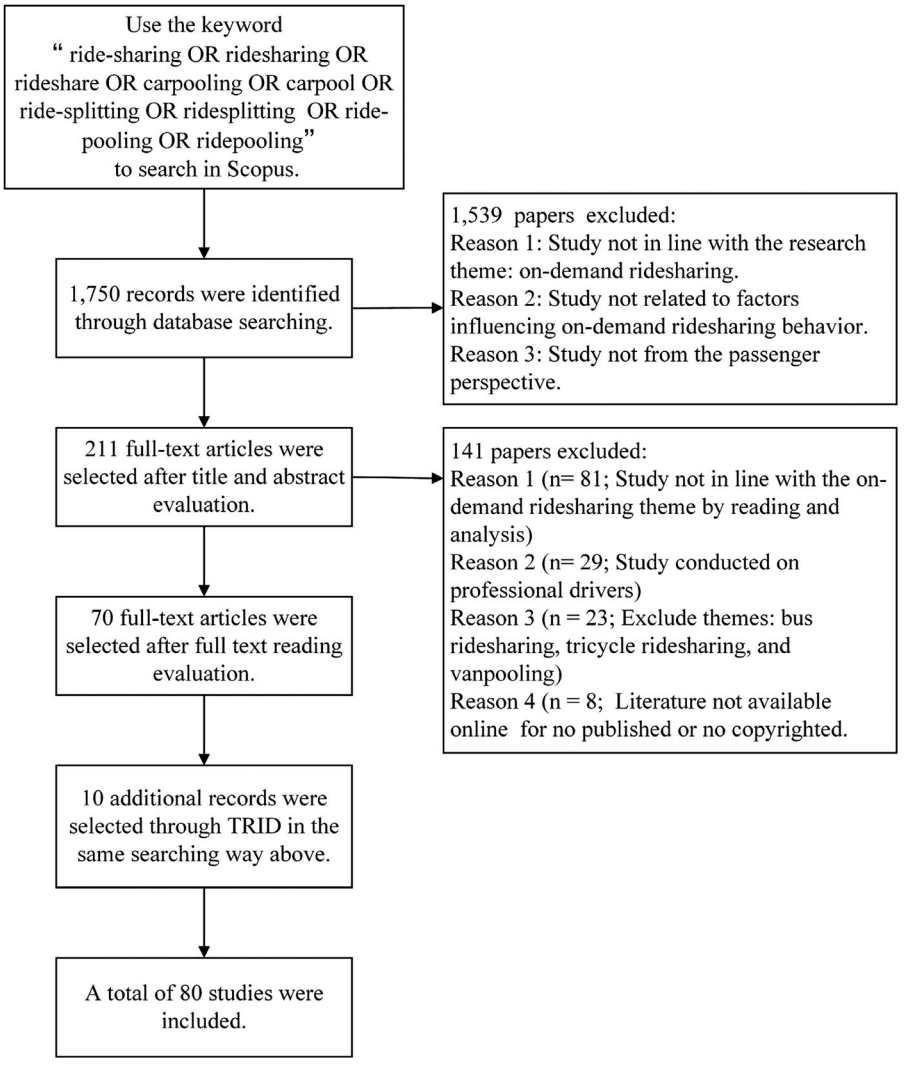

Figure 1. Literature selection process.

30 secondary codes across 11 categories. These 11 categories include the following: four core categories of demographic factors, which are socio-demographic characteristics, social roles, external transport conditions, and neighbourhood environment; three core categories of psychological factors, which are positive attitudes, utilitarian values, and hedonic values; and four core categories of situational factors, which are sustainability, technological progress, incentives, and practical applications.

3.1. Demographic factor motivators

3.1.1. Socio-demographic characteristics

Coding results showed that certain groups have a higher intention to share a ride. These include young people, women, single-parent families, low- to middle-income people, and

Table 1. List of motivating factor codes for ridesharing behaviour.

Research levels	Primary codes	Secondary codes	Core categories
Demographic factors	Young people are more likely to share a ride Lack of car access for young people Low enthusiasm about car ownership	Young people	Socio-demographic characteristics
	Women are more likely riders Reducing stress when transporting children	Women	
	Single-parent families need more ridesharing support	Single-parent families	
	Low- and middle-income groups are more likely to share a ride	Low- and middle-income groups	
	Highly educated people are more likely to share a ride	Highly educated people	
	Ridesharing for educational purposes Commuting to work and school are common uses	College students	Social roles
	Immigrants without a driver's license The financial burden of immigration	Immigrants	
	Share a ride based on a common identity Share a ride based on a group identity Share a ride with colleagues or classmates	People with a common identity	
	Public transport users are more likely to share a ride The substitution effect of ridesharing on public transport and taxis	Public transport users	External transport conditions
	Taxi users are more likely to share a ride	Taxi users	
	High percentage of non-owners using ridesharing Low car ownership generates more ridesharing trips	People without cars	
	Many changes in travel plans	Changes in travel plans	
	High building density in the residential environment Low land use diversity	Neighbourhood environment	Neighbourhood environment
Psychological factors	Positive attitude towards new technologies Innovative personality traits	Personal innovation traits	Positive attitudes
	A strong perception of ridesharing Influenced by family and friends	Positive perceptions	
	Information sharing between passengers and drivers Fixed amount of travel Reliable digital platform	Trust in service	
	Lower price per mile to share a ride Economic benefits are a great advantage of ridesharing	Cost saving	Utilitarian values
	Passengers can save commuting time Save travel time with high occupancy vehicle (HOV) lanes	Time saving	
	Passengers carrying heavy items are not comfortable travelling on public transport More flexible than public transport Easy to use ridesharing applications	Convenience	
	Increased comfort of travelling by car Relieves commuting stress	Comfort	Hedonic values
	Getting a good emotional experience Gaining psychological comfort as a passenger	Pleasure	

(*Continued*)

Table 1. Continued.

Research levels	Primary codes	Secondary codes	Core categories
	Sharing a ride with like-minded people Making new friends on trips	Social experience	
	Sharing a ride out of altruism Building a good personal image	Altruism	
Situational factors	Contributing to sustainable development Reducing carbon emissions Strong environmental awareness	Sustainability concept	Sustainability
	Popularity of mobile devices Use of GPS, cloud computing, and other technologies	Information technology development	Technological progress
	Large Internet user base Large market size of the sharing economy	Large user base	
	HOV lanes available Tax incentive policy Positive publicity from the transport sector	Policy incentives	Incentives
	Issuance of point rewards and discounts from the service provider	Discount incentives	
	High demand for vehicles during peak hours Relieving road congestion	Optimizing the matching of supply and demand	Practical applications
	One-stop service in extreme weather Third-party platforms to regulate driver behaviour Avoids haphazard charges and detours	Overcoming the drawbacks of traditional transport	

people with a high level of education. Young people have a higher demand for ridesharing because of their lack of car ownership and low enthusiasm for owning one (Alyavina et al., 2020; Lee et al., 2020; Mattia et al., 2021). Income and fares are important incentives driving the use of ridesharing (Zwick & Axhausen, 2022). According to Indeed (the world's largest job search engine), Uber fares per kilometre are approximately 70% of those of traditional taxis (CICC, 2021), which increases the popularity of ridesharing in low- and middle-income groups. It seems that people with less income use ridesharing more often (Brown, 2020; Conway et al., 2018).

One study mentioned that people with good education can more easily afford to use ridesharing, leading them to become ridesharing users (Lee et al., 2021; Wang et al., 2019). However, another study has found that the effect of education level on ridesharing behaviour is not significant, and those without a degree are even more likely to share a ride (Mitropoulos et al., 2021). This incongruity in results may be related to income (Julagasigorn et al., 2021).

In terms of gender, Ayaz et al. (2021) found that women are more inclined to use ridesharing services than men. Specifically, Monchambert (2020) found that women are approximately three times more likely to use ridesharing than men. This may be because women usually have more responsibility for childcare than men, and ridesharing helps to transport children (Gheorghiu & Delhomme, 2018; Malodia & Singla, 2016; Neoh et al., 2018). In single-parent households, parents often need ridesharing support because of their children (Zhao, 2017). However, as with the education factor, scholars have reached differing conclusions when discussing the effect of gender on ridesharing behaviour. Chen et al. (2022) argued that women are less likely to use ridesharing than men. In addition to differences in samples, the explanation for differences in the gender effect

across studies is interesting. When assessing ridesharing behaviour, men tend to take a rational approach to service consumption, meaning that functional values impose a stronger impact on male ridesharing behaviour. In contrast, women place a higher value on the experience and their enjoyment, meaning that emotional incentives impose a stronger impact on female ridesharing behaviour (Chen et al., 2022).

3.1.2. Social roles

Social role theory posits that the role people play impacts their attitudes and behaviour. In ridesharing scenarios, students commonly take the co-rider role. Students' departure locations and schedules are relatively consistent (Ma & Hanrahan, 2020; Malodia & Singla, 2016), and their shared sense of identity helps to build trust (Ashraf Javid & Al-Khayyat, 2021). Similarly, ridesharing is more likely to be used when the associated pick-up or drop-off locations are concentrated near a company. Supported by their shared group identity, co-workers build connections during a trip by chatting about similar topics. In addition, migrants commonly use ridesharing, and the combination of pressures from lacking driving qualifications (e.g. they may not have a driver's license) and financial strain may increase their dependence on ridesharing (Carol et al., 2019).

3.1.3. External transport conditions

External transport conditions affect users' ridesharing choice. These conditions include public transport availability, taxi availability, and car ownership (Shaheen & Cohen, 2021b). Substitution effects impose an important influence on ridesharing behaviour. Heinitz (2020) argued that co-riders are mostly not those who drive regularly, but rather, those who use public transport. Similarly, frequent taxi riders are more likely to use ridesharing than infrequent taxi riders (Mohamed et al., 2020).

In addition, ridesharing can serve as a supplementary transport mode for *ad hoc* trips. Ghaffar et al. (2020) found that ridesharing services are used more between 10 pm and 4 am, a time when public transport is out of service in many areas. Low household car ownership also generates more sharing trips. Ridesharing increases the efficiency of household travel when there is only one car, when a second car is only needed occasionally, or when travel plans are unpredictable (Huang et al., 2021).

3.1.4. Neighbourhood environment

Residential density is positively correlated to ridesharing use. Specifically, people living in higher-density neighbourhoods use ridesharing more frequently than people living in other areas (Brown, 2020; Ghaffar et al., 2020). Furthermore, ridesharing demand is higher in areas with higher employment density, lower land use diversity, and longer distances to city centres (Tu et al., 2021; Zwick & Axhausen, 2022). This may be because areas with high population density offer more options for matching trips. People can share rides to go further and thus meet more of their commuting, dining, and leisure needs (Li et al., 2019). However, another study has found a relatively weak association between rideshare trips and the neighbourhood environment (Brown, 2020).

3.2. Psychological factor motivators

Social psychological theories are increasingly being applied to transportation research to describe how individuals make travel choices (Julagasigorn et al., 2021). The theory of planned behaviour (TPB) (Ajzen, 1991), the theory of customer perceived value (CPV) (Zeithaml, 1988), the expectation confirmation model (Oliver, 1980), and the technology acceptance model (TAM) (Venkatesh et al., 2003) are basic theoretical models commonly used in ridesharing research. In the present study, TAM is applied to group the motivating factors at the psychological level into three areas: positive attitudes, utilitarian values, and hedonic values.

3.2.1. Positive attitudes

In TPB, attitudes are positive or negative opinions held about a certain behaviour (Ajzen, 1991; Chakravarti et al., 1997). Consumers' positive attitudes are a reasonable explanatory factor for predicting their ridesharing behaviour (Abutaleb et al., 2021; Sofi et al., 2021). People with high levels of personal innovation tend to focus on the benefits of innovative technology, are less likely to consider associated risks, and have more positive attitudes towards ridesharing choices (Jie et al., 2021). However, another study found that personal innovation factors exert a slightly weaker influence compared to convenience and practicality (Ashrafi et al., 2020). Similarly, a person is more likely to use ridesharing if he or she perceives it to be convenient, time-saving, environmentally beneficial, safe, or money-saving (Jie et al., 2021). As a culturally-specific example, many Arab people are influenced by collectivism, making them prone to choose ridesharing under the influence of family, friends, and colleagues (Rasheed Gaber & Elsamadicy, 2021). Other studies have found that passengers' perceptions of the usefulness of ridesharing play a more important role than financial factors in the decision-making regarding transportation modes (Gheorghiu & Delhomme, 2018; Malodia & Singla, 2016).

Trust is defined as a positive expectation based on the assessment of a certain situation (Tsai et al., 2021). For passengers, highly transparent information includes peer ratings, members' personal information, and trip amounts (Fhwa, 2021; Gargiulo et al., 2015; Mattia et al., 2021). Measures such as monitoring the ridesharing process, securing private information, and planning for emergencies (Mas-Machuca et al., 2021; Mattia et al., 2021) demonstrate the trustworthiness of the transaction and the platform. Consequently, consumer willingness to choose ridesharing services increases (Shao et al., 2020; Wu & Neill, 2020).

3.2.2. Utilitarian values

In CPV, utilitarian value refers to consumers' perceptions of the usefulness and functionality of a product. Scholars have studied the functional characteristics of ridesharing services, which include cost savings, time savings, and travel convenience. In ridesharing, passengers save money by sharing costs with other passengers and receiving subsidised rides from the service provider. Wang and Noland (2021) found that ridesharing trips can save an average of $1.57 to $2.13 per mile throughout the year compared to non-ridesharing travel.

Time savings form a further important factor that attracts commuters to ridesharing (Ayaz et al., 2021; Julagasigorn et al., 2021). Riders do not have to wait for public transport to arrive based on their fixed timetables, and drivers can use high occupancy vehicle (HOV) lanes, if available, for faster passage (Ahmed et al., 2021). When travelling with heavy loads, users can reach their destination aided by easy-to-use ridesharing applications (Mohamed et al., 2020).

3.2.3. Hedonic values

Hedonic values refer to emotional experiences an individual perceives when using a certain service. In this study, the hedonic value of ridesharing services is categorised into four areas: comfort, pleasure, social experience, and altruism.

Ridesharing makes people feel relaxed during their journey. Riders do not have to worry about driving fatigue or limited parking spaces (Malodia & Singla, 2016). Instead, they can use their commute time to rest, read, or talk to fellow riders, thus generating the psychological comfort of being a passenger (Neoh et al., 2018; Nielsen et al., 2015; Raza et al., 2021). The emotional experience individuals perceive when using ridesharing services is considered to be an integral part of the journey (Ashrafi et al., 2021; Sharma, 2019).

However, cost-sharing and mutual social benefits are not the only motivations for ridesharing. People may engage in ridesharing for purely altruistic reasons, for example, to protect the environment. Also, ride-sharing allows passengers to build a pro-social or altruistic image, thus increasing their social status and popularity (Ashrafi et al., 2021). However, existing studies have not found social engagement and altruism to be significant influences in explaining ridesharing behaviour (Amirkiaee & Evangelopoulos, 2018).

3.3. Situational factor motivators

The situational factors of this study include external objective factors, such as policies, institutions, and social realities related to ridesharing behaviour. The literature-coding process identified the following four facilitators of ridesharing: sustainability, technological progress, incentives, and practical applications. These factors are detailed in the following.

3.3.1. Sustainability

The three main dimensions of sustainable development are economic, environmental, and social. As a typical model of the sharing economy, ridesharing is a way to travel in a sustainable way (Alyavina et al., 2020). Ridesharing can reportedly save each commuter nearly $8,500 per year, while reducing both carbon emissions and traffic congestion (Delhomme & Gheorghiu, 2016; Wang et al., 2022b). In a survey, the majority of students believed that sharing with other people to protect the environment while reducing energy consumption and traffic congestion fulfilled the environmental obligation of sustainable development (Lee et al., 2020). Therefore, people who are more concerned about environmental issues are more likely to adopt ridesharing out of a sense of environmental responsibility (Cui et al., 2021; Malodia & Singla, 2016). However, another study has shown that the sustainability concept does not affect people's attitudes toward ridesharing. One reason is that participants do not perceive ridesharing as a solution to achieve sustainable possibilities (Raza et al., 2021). Similarly, research has refuted the potential of ridesharing

as a climate change mitigation tool in Denmark. Ridesharing is not a part of the greenhouse gas reduction strategy of the local transportation department (Nielsen et al., 2015). Wang et al. (2020) also noted that passengers tend to be more concerned with individual issues rather than community and societal issues. Furthermore, individual environmental awareness is not sufficient to support their decision to share a ride. Instead, the social and economic attributes of ridesharing, such as saving money or travel comfort, appear to be more prominent (Nielsen et al., 2015).

3.3.2. Technological progress

The growing popularity of Internet-enabled mobile devices has allowed everyone to participate in ridesharing (Hootsuite, 2021). The resulting large user base facilitates the matching of supply and demand. Drivers and passengers meet each other via applications and GPS, and cloud computing makes trip scheduling easier and more flexible (Abutaleb et al., 2021; Agatz et al., 2012; Chen et al., 2020). This has accelerated a shift in consumers towards ridesharing services (Wu & Neill, 2020). However, it must be acknowledged that the application of matching technology for multi-person ridesharing is not universal. By far, most on-demand trips are individual trips. The reason is that the probability of the successful matching of multi-person ride travel is still relatively low, and the price discounts and incentives associated with ridesharing are insufficient. The low rate of ridesharing requests (i.e. the bulk of Uber/Lyft/etc. requests remain for solo, non-shared rides) also plays a role. This may explain the low adoption of ridesharing currently observed in practice (Alonso-González et al., 2021).

3.3.3. Incentives

Germany, the United Kingdom, the United States, and Canada have developed policies to encourage ridesharing. These policies include increasing the availability of ridesharing lanes, providing differential pricing in case of congestion, and altering fuel taxes on ridesharing vehicles (Ashrafi et al., 2020; Shaheen et al., 2018). Other incentives to encourage ridesharing use include increased positive publicity from the transportation sector. In turn, ridesharing service providers offer users positive feedback on their rides through point rewards and discounts. For example, the ridesharing company Nuride provides online coupons to encourage continued use by previous consumers (Abutaleb et al., 2021; Agatz et al., 2012).

3.3.4. Practical applications

Ridesharing enables the matching of supply and demand between drivers and passengers by utilising idle service capacity to share resources and optimise resource allocation on a societal scale (Ahmed et al., 2021; Alyavina et al., 2020). In addition, ridesharing can supplement or even replace public transportation. Application scenarios for ridesharing include one-stop services for extreme weather scenarios, where passengers are transported to and from public transport stations to avoid waiting and having to walk exposed to bad weather (Ciasullo et al., 2018; Ghaffar et al., 2020; Shaheen et al., 2021). Also, platform monitoring can circumvent illegal or speculative behaviours consumers may encounter in traditional taxis, such as unfair pricing and detours (Raza et al., 2021; Shao et al., 2020; Wang et al., 2017). These practices may convince consumers that their transaction is safe and secure, so that they choose on demand ridesharing (He et al., 2021).

4. Barriers to ridesharing behaviour

Studies have identified three main barriers to consumer participation in ridesharing: socio-demographic characteristics of riders, availability of alternative options, and concerns about possible information, performance, safety, and regulatory risks. As with the motivating factors mentioned above, factors that create barriers to ridesharing are coded into the three groups of demographic, psychological, and situational factors. Table 2 lists 31 primary codes and 9 secondary codes.

4.1. Barriers created by demographic factors

4.1.1. Socio-demographic characteristics

Older people are generally more indifferent to ridesharing than young people, which may be related to difficulties older people have with using applications (de Almeida Correia et al., 2013; Dosen & Rosolen, 2016). In general, older people prefer to communicate with people they know, which makes ridesharing unattractive to them (Alyavina et al., 2020; Neoh et al., 2018; Nielsen et al., 2015). Shaheen et al. (2017) found that high income earners and people living alone are less likely to adopt ridesharing services. In addition, passengers' attitudes towards ridesharing are influenced by both gender and marital status. Both single and married women are less inclined to share rides with

Table 2. List of barrier codes for ridesharing behaviour.

Research levels	Primary codes	Secondary codes
Demographic factors	Old people have difficulty using ridesharing apps	Socio-demographic characteristics
	Old people prefer to communicate with people they know	
	People who live alone are less likely to adopt ridesharing	
	Married people do not prefer to share a ride with someone of the opposite sex	
	High income earners are less likely to share a ride	
	Owning a private car	Alternative options
	College students can take the school bus	
	Families with children tend to prefer car sharing	
Psychological factors	Aversion against being disturbed by others	Personal concerns
	Lack of knowledge about ridesharing	
	Experiences of racial discrimination	
	Unpleasant ridesharing experiences	
	Fear of misuse of personal information	Privacy risks
	Users' real time and location information may be compromised	
	Cyber security attacks	
	Reasonableness of surcharge	Performance risks
	Increase in travel time	
	Detouring to pick up extra passengers	
	Driver unfamiliar with road conditions	
	Concerns about potential illegal behaviour	Security risks
	Robbery and traffic accidents	
	Experience of ridesharing safety incidents	
	Harassment of women	
Situational factors	The special positioning of intermediary platforms	Regulatory risks
	Regulatory ambiguity	
	Inadequate accident compensation mechanism	
	Female ridesharing is unlikely in Islamic societies	Cultural differences
	Restrictions on private cars are not accepted	
	Ridesharing is associated with social exclusion	
	Reduce the frequency of trips	Impact of COVID-19
	Shift to separate ride services	

men. Similarly, married men do not tend to share rides with women. However, one study found that unmarried men are more willing to share rides with women (Ayaz et al., 2021).

4.1.2. Alternative options

Alternative options, such as availability of private cars, school buses, and car-sharing, can influence ridesharing behaviour. People who have a private car at home generally prefer to use it themselves instead of sharing it (Alonso-González et al., 2021; Alyavina et al., 2020). School buses may be more convenient for students than ridesharing. When there are children in the household who need care, it may be a more appropriate choice to rent a car and drive themselves than ridesharing (Zhao, 2017).

4.2. Barriers created by psychological factors

Perceived risk – the main barrier to consumer adoption of a new technology or service– consists mainly of uncertainty (i.e. the possibility of adverse consequences) and loss (i.e. the severity of consequences). The literature is coded into four groups according to the following psychological perception barriers: personal concerns, privacy risks, performance risks, and safety risks.

4.2.1. Personal concerns

Personal concerns are significantly correlated with ridesharing behaviour. Ashraf Javid and Al-Khayyat (2021) found that certain respondents did not want to be disturbed by other people while riding, or they indicated that they are not or only partially aware of the existence of ridesharing services. Moody et al. (2019) found that service experience influences ridesharing behaviour. For example, riders who have experienced race or class discrimination while sharing a ride have a lower intent to use ridesharing again (Brown, 2020; Cui et al., 2021). Moody et al. (2019) also noted that the issue of discrimination in ridesharing also includes discriminatory attitudes of people not wanting to share rides with others who are not of the same race/class as themselves. Respondents have also pointed out that their willingness to continue to use ridesharing would be reduced by disrespect for privacy and rude behaviour by fellow riders (He et al., 2021).

4.2.2. Privacy risks

Ridesharing services require users to register with a platform using their real names and provide real-time location information to establish ridesharing connections. Using such a platform also enables identification and information traceability after the journey. However, while platforms can create value from personal information, they may also create privacy risks for users (Wang, Gu, et al., 2019). Passengers have shown distrust of digital platforms following cases of fraud and cyber-attacks resulting from information breaches (Alyavina et al., 2020; Ciasullo et al., 2018; Tsai et al., 2021).

4.2.3. Performance risks

Performance risks relate to the failure of the service to meet users' performance expectations. The performance risks of ridesharing mainly relate to lost time and property

damage (Krauss et al., 2022). For example, Ashrafi et al. (2020) found that unreasonable surcharges on rides can create problems for users. Further, ridesharing takes time. Experimental simulations have shown that while passengers have a psychological expectation of a 3-minute waiting time for ridesharing, the actual average waiting time is around 10 min (Alonso-González et al., 2021; Wang, Chen, et al., 2019). Moreover, ridesharing drivers are not always as experienced as taxi drivers. They may not know their routes well and may sometimes take detours to pick up additional passengers (Amirkiaee & Evangelopoulos, 2018; Krauss et al., 2022).

4.2.4. Security risks

Malignant incidents, including rape and kidnapping, occur every year during rides arranged through ridesharing platforms. People often feel that the situation is more serious than what actually happened (Ashrafi et al., 2021). In a survey conducted between early October 2016 and the end of October 2017, 767 tweets were published on Twitter expressing concerns about safety risks when sharing a ride with a stranger. However, these data need to be analysed in greater depth, as ridesharing is a much more popular option than traditional travel services (cabs, buses, and trains) with lower crime rates (Ciasullo et al., 2018).

Multidimensional perceived risk has a significant negative impact on the intent to engage in ridesharing (He et al., 2021). Before establishing a ridesharing connection, passengers cannot determine whether the stranger they will share a ride with poses a safety threat, nor can they determine whether the driver may cause an accident and irreparable damage (Ciasullo et al., 2018; Huang et al., 2019). Consequences of ridesharing safety incidents can be very serious. Passengers are unlikely to trust or continue to use ridesharing services if they have experienced a safety incident during a ride as they may fear a recurrence of a similar incident (Barrios et al., 2018; Chen et al., 2022). In addition, women's concerns regarding verbal harassment during a trip may discourage their use of ridesharing services (Ashrafi et al., 2021).

4.3. Barriers created by situational factors

4.3.1. Regulatory risks

The companies that operate ridesharing platforms do not own vehicles. Instead, they act as an intermediary for all parties involved. The specificity of the platform's positioning and regulatory ambiguities put users at a disadvantage in the service relationship (He et al., 2021; Mitropoulos et al., 2021). Inadequate accident compensation rules may lead consumers to feel that the quality of ridesharing services and expectations are not fully aligned (Wu & Neill, 2020). Users fear that a satisfactory resolution may not be reached in the case of a future incident, which reduces the willingness to use ridesharing (Wang, Gu, et al., 2019).

4.3.2. Cultural differences

Cultural backgrounds can also influence ridesharing behaviour. For example, Italians generally do not accept restrictions on private car use (Mattia et al., 2021). In Denmark, ridesharing is associated with social exclusion (Nielsen et al., 2015). In Islamic societies, female

ridesharing is less likely because of the low status women have in that culture (Ashraf Javid & Al-Khayyat, 2021). These factors increase resistance to using ridesharing services.

4.3.3. Impact of COVID-19

COVID-19 has increased uncertainty associated with trips, and research has shown that the potential risk of virus transmission may lead people to travel less (Xu et al., 2021), or to shift from ridesharing to a contact-reduced solo ride service (Burghard & Scherrer, 2022). However, Rasheed Gaber and Elsamadicy (2021) reached a different conclusion, noting that protective measures imposed by ridesharing companies, such as mandatory mask wearing, cashless payment methods, and the provision of alcohol-based hand sanitiser, have succeeded in persuading passengers to continue using the service. Separate spaces and better hygienic conditions associated with the ridesharing service, particularly compared to traditional public transport buses, may contribute to its continued use by passengers (Dolins et al., 2021; Rasheed Gaber & Elsamadicy, 2021; Wang & Noland, 2021).

5. Boundary conditions of ridesharing behaviour

The concept of boundary conditions emerged from operations research in management science. Boundary conditions refer to the terms that need to be satisfied for a decision that reaches a minimum goal. In the context of this study, boundary conditions refer to the trade-off conditions that lead users to choose to ride together. Table 3 shows the coding of the boundary condition factors that influence rider participation in ridesharing. There are 12 primary codes, which are first distilled into six secondary codes, and then classified into the two core categories of cost-time trade-offs and perceived risk-perceived value trade-offs.

5.1. Cost-time trade-offs

Participation in ridesharing requires additional travel time, which is compensated through fare sharing. When passengers decide whether to share a ride, they usually

Table 3. List of boundary conditions coded for ridesharing behaviour.

Primary codes	Secondary codes	Core categories
Spending extra travel time	Time loss	Cost-time trade-offs
30–40% cost benefit	Cost benefits	
Time-sensitive vs. cost-sensitive Long-term customers care about time while new customers care about price Declining demand for ridesharing may be related to narrowed price gap	Losses and gains	
Security of privacy Security of personal property	Perceived risks	Perceived risk-perceived value trade-offs
Time saving than public transport Cost reduction Social acceptance	Perceived values	
Young people are less concerned about perceived risk and more interested in value Trade-off between price paid and access to services	Risks and values	

weigh the time loss against the cost benefit (Alonso-González et al., 2021; Krauss et al., 2022; Zwick & Axhausen, 2022). Time-sensitive passengers are willing to accept higher travel costs to save time. In contrast, cost-sensitive passengers are less concerned about the increase in travel time. One study found that long-term customers of ridesharing care more about time, while new customers are more price-sensitive (Kostorz et al., 2021). 2019 ridesharing data from Chicago (USA) showed that an increase in the supply of ridesharing services narrowed the price gap between ridesharing and non-ridesharing trips. As a result, ridesharing became less attractive to users (Wang & Noland, 2021).

5.2. Perceived risk-perceived value trade-offs

Ridesharing may create risks or threats associated with personal privacy and property security, but it also offers positive values, such as time saving than public transport, cost reduction, and the provision of a sense of social identity. Perceptions of potential risks may reduce users' willingness to use ridesharing (Shao et al., 2022; Tsai et al., 2021); however, perceived benefits, such as convenience and low cost, may increase the intent to use services. The trade-off between perceived risk and perceived value is an important influencing factor in the decision of whether to engage in ridesharing. Tsai et al. (2021) found that perceived risk exerts less impact on young people's willingness to share a ride, whereas perceived value plays a decisive role in ridesharing behaviour. In addition, the psychological trade-off between paying a price and receiving a service also influences ridesharing behaviour (Sharma, 2019; Wang et al., 2019).

6. A research framework and future research directions

Based on this analysis, a framework is presented for studying ridesharing behaviour at the levels of secondary codes and core categories. The motivating factors and barriers to ridesharing behaviour are classified in terms of demographic factors, psychological factors, and situational factors, and boundary conditions are also included. Figure 2 depicts the research framework.

The analyses presented in Sections 3–5 highlight instances where different studies obtained different results concerning the impact of a specific factor (such as the degree of influence, or positive and negative directions). Examples of such factors include gender, education level, social network, altruism, sustainability awareness, and the impact of COVID-19. The reasons for these differences were analysed and discussed above. Ridesharing has many characteristics that are similar to other shared mobility modes. For example, research showed that well-educated people, young people, and people living in areas with higher residential density are more willing to use shared mobility services, while performance risks and privacy risks hinder people's adoption of the shared-mobility mode (Malik et al., 2021). Also, people who are willing to spend money to reduce travel time are more willing to choose ridesharing services, while people who own a car are less willing to use it (Alemi et al., 2019). Because ridesharing is the only model in which multiple people are paired with the same car and travel together, related economic factors (e.g. saving money for passengers), altruistic factors, and sustainable advantages are more apparent (Machado et al., 2018; Shaheen et al., 2015). However,

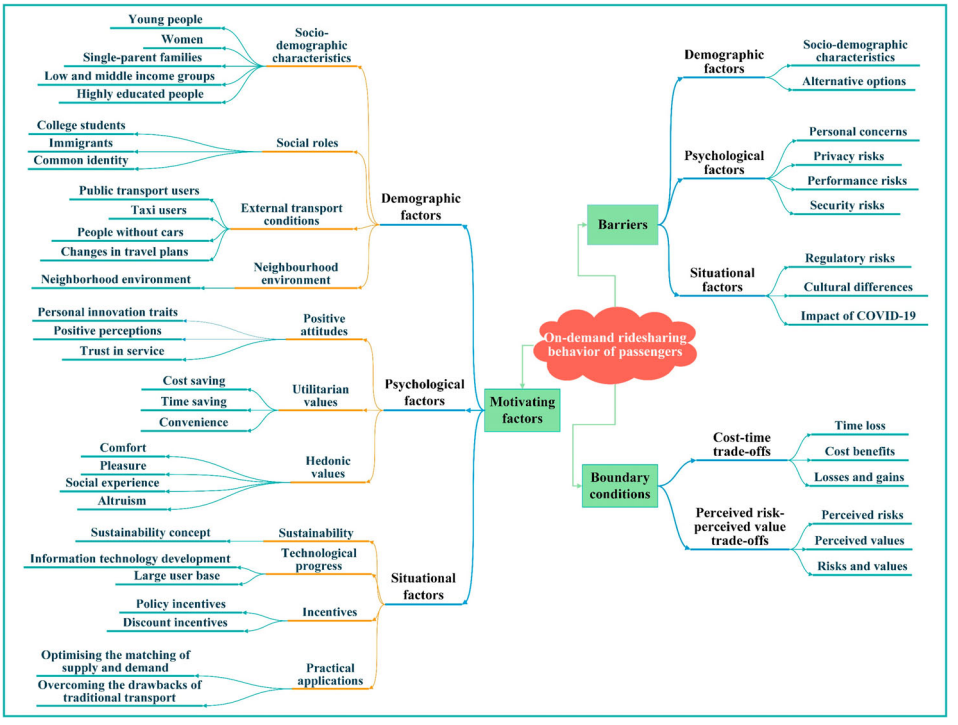

Figure 2. Research framework for passenger ridesharing behaviour.

at the same time, ridesharing also yields more safety risks, multiplayer match failure, and regulatory risks because of the multi-person factor (Santos, 2018).

Moreover, the collation identified several limitations across existing studies concerning models, contextual heterogeneity, sample selection, ridesharing intentions, and behavioural transformations. First, while basic theoretical models such as TPB have been effectively used to study ridesharing behaviour, existing models should be extended when more considerations emerge that need to be addressed. For example, Bachmann et al. (2018) extended the TPB to include personal norms. Other studies have expanded TAM to analyse and improve ridesharing behaviour frameworks. The factors incorporated into TAM in this way include environmental benefits (Raza et al., 2021), perceived risk, and personal innovativeness (Wang et al., 2020). These extensions should be further expanded in more ridesharing research.

A second limitation of existing studies is that most research has been conducted with selected populations in specific countries or regions. However, economic conditions, population composition, industrial structure, and transportation options differ from city to city. As another example, users' fear of COVID-19 has had different degrees of impact on ridesharing behaviour in different countries. Results and recommendations may become inaccurate if the time-place heterogeneity of the research context is not fully analysed. Furthermore, it is important to recall that all individuals participating in a research survey through a web-based questionnaire or face-to-face interview are initially and systematically screened. Certain studies reported relatively low effective response rates, meaning that the representativeness of the study samples could be improved.

Finally, ridesharing behaviour is often analysed from the perspective of the intention to use ridesharing services. However, such an intention does not always translate into actual behaviour. Past studies have generally not examined the relationship between potential intentions and actual behaviour.

Given this analysis, the following possible directions for future research are proposed. First, future studies should extend existing models to incorporate more factors. TPB, TAM, and CPV are commonly used theoretical frameworks for explaining ridesharing behaviour. However, integrating additional models may be an interesting starting point when additional considerations and factors need to be incorporated. Other influencing factors can also further extend existing models by assessing mediating and moderating effects between factors.

Second, future research should focus on the heterogeneity of research contexts and comparative studies should be conducted. It is useful to focus on city-level attributes and the actual situation of a region. However, it is also useful to conduct similar experiments in more countries or regions to verify the generalizability of results. Another option is to conduct further comparisons between countries or regions with different cultural backgrounds and that are at different development stages. For example, a comparison between developed and developing countries could help to determine how ridesharing behaviour changes in different social contexts and to revisit the findings of previous studies.

Third, future research should avoid selection bias when sampling and conducting behavioural experiments. Further studies are needed to address the problem of sample representativeness. This could include the recruitment of more actual ridesharing users from different ridesharing platforms to increase the sample size for future research. Surveys should cover a diverse group of people across society to collect more representative data. Further, measures should be taken to increase the effective response rate of questionnaires. As ridesharing services continue to develop and spread to more cities, it may become possible to collect more valid evaluation results.

Fourth, future research should compare potential intentions and actual behaviour. To guide practical applications, it is important to examine the gap between users' intentions and actual behaviour. In the future, more data should be collected directly from ridesharing service platforms so that the impact of actual ridesharing behaviour can be analysed in conjunction with real travel data. The driver's perspective on ridesharing intentions and actual behaviour would be a useful research extension. In addition, we cannot ignore the fact that users prefer non-shared rides with lower rates of ridesharing requests. The aforementioned non-technical barriers to ridesharing intentions and behaviours can be studied in future research.

Last, future research should assess the impact of COVID-19, which emerged in December 2019. Most of the data reviewed for this research were collected before that date. Ridesharing services were heavily influenced by policy mandates, as most national and regional governments imposed lockdowns to ensure that citizens stayed at home to slow the spread of the virus. The uncertainty and constraints on travel, quarantine requirements, and potential transmission risks have inconvenienced travellers and reduced the demand for rides. However, ridesharing companies have implemented precautionary measures to persuade customers to continue using their ridesharing services. Consequently, people's behaviour may have changed as a result of the pandemic. Repeating

certain surveys and comparing results conducted before and after the outbreak may obtain interesting conclusions.

The current study provides a possible research framework for studies on factors influencing ridesharing behaviour, and opens up new avenues for further research. In practice, related findings can help both policymakers and service providers to better understand the factors influencing ridesharing, thus guiding them to better promote their service and develop policy recommendations. For example, regarding the demographic characteristics of motivating factors, service providers can offer coupons for young people or single-parent families to stimulate their ridesharing behaviour. Providers can also address the shortcomings of ridesharing services and continuously improve the quality of their service. Policymakers can formulate targeted regulatory measures around identified barriers.

There are certain limitations to this study. First, the literature studies used in this study were only obtained from the Scopus database and TRID. Although Scopus is considered the most authoritative data source for most publications, certain literature contained in other databases may have been overlooked. TRID and Scopus generally do not contain government reports, and the information of certain government departments may not be included. Moreover, this paper uses an entirely manual method of analysis for the research content of the existing literature, and certain factors may have been missed.

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