Impact of Carpooling Applications on Sustainable Mobility

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Abstract---*Carpooling has gained significant attention as a sustainable transportation option. With the emergence of carpooling applications, the potential for increased efficiency and convenience has increased. This paper aims to review the existing literature on carpooling applications and their impact on sustainable mobility. The review examines the benefits and challenges of carpooling applications and the factors that influence their success. It also assesses the impact of carpooling applications on congestion, air quality, and greenhouse gas emissions. Finally, the paper provides insights on the future of carpooling applications and their potential to support sustainable mobility.*

Keywords: **Carpooling, Transportation, Ride-sharing, sustainability, Applications, Android**

1. INTRODUCTION

The increase in urbanization and motorization has resulted in several negative impacts on the environment, including air pollution, congestion, and greenhouse gas emissions. As a result, sustainable mobility has become a key focus for policymakers and researchers. Carpooling has emerged as a promising solution to reduce the negative impacts of single-occupancy vehicles. The development of carpooling applications has provided new opportunities for carpooling to become a more efficient and convenient transportation option. However, despite the potential benefits, there are still challenges to the widespread adoption of carpooling applications. These applications allow individuals to share rides with each other, leading to reduced traffic congestion, decreased carbon emissions, and increased social interaction. The impact of carpooling applications on sustainable mobility is significant. With more people sharing rides, there are fewer cars on the road, which means less traffic congestion and fewer emissions. This can lead to reduced air pollution, improved air quality, and reduced carbon emissions, which are all critical components of sustainable mobility.

This paper is organized as follows: Section 1 Introduction to carpooling applications wrt sustainable mobility, section 2 dealing with state of arts and statistical analysis of India's most popular carpooling applications, section 3 dealing with power of carpooling in daily life, section 4 dealing with factors influencing the success, section 5 discuss the impact of carpooling applications on sustainable mobility, section 6 discuss the benefits and challenges of

applications, section 7 deals with future of these applications and finally conclude the impact of these application towards sustainable mobility.

2. STATE OF ARTS

Several studies have analyzed the impact of carpooling applications on sustainable mobility. A study by Aguilera et.al, [1] found that carpooling applications have the potential to reduce traffic congestion, air pollution, and energy consumption. The study also found that carpooling applications can encourage more sustainable transportation habits among individuals. Similarly, a study by Carrese et al. [2] analyzed the impact of carpooling applications on the mobility patterns of commuters. The study found that carpooling applications can significantly reduce the use of single-occupancy vehicles, which results in reduced traffic congestion and greenhouse gas emissions. The study also found that carpooling applications can improve accessibility to public transportation and increase the use of active transportation modes such as walking and cycling.

Another study by Bruck et al. [3] analyzed the effectiveness of carpooling applications in reducing the carbon footprint of transportation. The study found that carpooling applications can significantly reduce the carbon emissions of transportation by encouraging the sharing of rides among passengers and drivers.

Furthermore, a study by Gebresselassie, et al, [4] found that carpooling applications can improve the social and economic sustainability of transportation. The study found that carpooling applications can improve social interactions among passengers and drivers, reduce the cost of transportation, and increase the efficiency of transportation.

Carpooling applications are increasingly popular in recent years as a means of reducing traffic congestion and improving sustainability. These apps connect drivers with passengers who are traveling in the same direction, allowing them to share a ride and split the cost of transportation. There were several carpooling applications available in India, with some of the most popular ones being [5-10]:

- **Quick Ride:** Quick Ride is a popular carpooling application in India, launched in 2015. It operates in Bangalore, Chennai, Delhi-NCR, Hyderabad, Mumbai, and Pune. The app connects car owners with passengers heading in the same direction, allowing them to share a ride and split the cost of fuel. Quick Ride has over 3 million registered users and claims to have saved 1.2 billion km of travel distance and 32,000 tonnes of carbon emissions.

- **Ola Share:** Ola Share is a carpooling service launched by Ola, one of India's largest ride-hailing companies. It operates in Bangalore, Chennai, Delhi-NCR, Hyderabad, Kolkata, Mumbai, and Pune. Ola Share connects passengers traveling in the same direction, allowing them to share a ride and split the cost of the fare. Ola claims that its carpooling service has reduced 12 million kg of CO2 emissions and saved over 5 million liters of fuel.

- **BlaBlaCar:** BlaBlaCar is a French carpooling service that launched in India in 2015. It operates in over 22 cities in India, including Bangalore, Chennai, Delhi-NCR, Hyderabad, Mumbai, and Pune. BlaBlaCar connects car owners traveling long distances with passengers heading in the same direction, allowing them to share a ride and split the cost of fuel. The company claims to have over 10 million registered users in India and has saved over 100,000 tonnes of CO2 emissions. Since its launch in India in January 2015, over three million seats have been put up on ride-sharing startup BlaBlaCar's application. To put that in context, 145 million km of shared rides have been offered - a tad less than the distance between the earth and the sun [15]

- **sRide:** sRide is a carpooling application launched in 2015. It operates in Bangalore, Chennai, Delhi-NCR, Hyderabad, Mumbai, and Pune. The app connects car owners with passengers heading in the same direction, allowing them to share a ride and split the cost of fuel. sRide has over 1.5 million registered users and claims to have saved over 28,000 tonnes of CO2 emissions.

- **UberPOOL:** UberPOOL is a ride-sharing service offered by Uber, which operates in major cities across India. It allows users to share rides with other passengers traveling in the same direction, and is available in cities such as Bangalore, Mumbai, Delhi-NCR, Hyderabad, and Kolkata.

Carpooling apps are gaining popularity in India as they offer a cost-effective and sustainable alternative to traditional modes of transportation. However, the COVID-19 pandemic has impacted the usage of these apps, and it is uncertain how the trend will evolve in the coming years.

As per data provided by Statista, around 174 million people will use carpool services in India in 2019 which is a clear 24.1 % YoY increase as compared to last year. The revenues will amount to $30,360 million in 2019, and the segment is expected to show an annual growth rate (CAGR 2019-2023) of 15.5%.
The biggest hurdle faced by these ridesharing apps has been onboarding users throughout India. Applications such as Wunder Mobility, Tripda, Sharedcab and Lifto shut down after they failed to make a mark in the Indian market. The current market penetration rate stands at 12.7%, but it is expected to hit 20.3% by 2023.

2.1 Statistics on Carpooling Application in India

There are some statistics on carpooling applications in India

- **Market Size:** The Indian carpooling market is estimated to be worth around $1.5 billion and is expected to grow at a CAGR of around 16% between 2021 and 2026.
- **User base:** Carpooling services in India have seen a significant increase in users in recent years, with more than 15 million users currently using carpooling services.
- **Popular carpooling platforms:** Ola, Uber, BlaBlaCar, Quick Ride, and sRide are some of the most popular carpooling platforms in India.
- **City-wise usage:** Carpooling is more popular in metro cities such as Delhi, Mumbai, Bangalore, and Hyderabad.

- **Benefits of carpooling:** Carpooling helps in reducing traffic congestion, air pollution, and fuel consumption, which makes it an eco-friendly and cost-effective mode of transportation.
- **Challenges:** The major challenges faced by carpooling platforms in India include safety concerns, lack of trust among users, and regulatory issues.

Carpooling is gaining popularity in India, and with the increasing awareness of environmental issues and the need for sustainable transportation options, carpooling is expected to grow further in the future.

According to a report by RedSeer Consulting [11], the Indian carpooling market was estimated to be worth $1.5 billion in 2018 and was projected to grow at a CAGR of around 15% between 2019 and 2025. The report also states that the market is largely dominated by four players: BlaBlaCar, Quick Ride, Ola Share, and UberPOOL.

- BlaBlaCar [6], a France-based long-distance ride-sharing platform, is one of the leading players in the Indian carpooling market. The company claims to have over 4 million registered users in India and operates in more than 100 Indian cities.
- Quick Ride[7], an Indian ride-sharing platform, claims to have over 10 million registered users and operates in eight Indian cities, including Bengaluru, Chennai, Hyderabad, Mumbai, and Pune.
- Ola Share and UberPOOL[10], both owned by ride-hailing giants Ola and Uber respectively, allow users to share rides with other passengers traveling in the same direction. Both platforms are available in multiple cities in India and offer discounted fares for shared rides.

3. POWER OF CARPOOLING

- Carpooling is a straightforward yet effective way to tackle the growing problems of traffic jams and pollution in our cities. By sharing rides, we can cut down the number of cars on the road, save money, reduce pollution, and even build stronger bonds within our communities. This section explores the power of carpooling and how it benefits people, society, and the environment.
- One of the biggest perks of carpooling is saving money. When people share fuel and toll costs, each person spends less. For example, if four neighbors carpool to work instead of driving separately, they can divide the costs and save a lot. The money saved can then be used for other important needs or future plans.
- Carpooling also helps reduce parking problems. Parking fees are often very high, and finding a spot can be stressful. Carpoolers can split parking costs or even qualify for discounted rates. This saves money and makes the daily commute less of a hassle.
- Beyond money, carpooling is also great for the environment. Fewer cars mean lower fuel use, less pollution, and fewer greenhouse gases. For example, a car with one person emits about 1.5 pounds of CO2 per mile, while a carpool reduces that to only about 0.6 pounds. This difference plays a big role in improving air quality and fighting climate change.
- Carpooling also brings social benefits. Sharing rides gives people a chance to talk, make friends, and create support systems. It’s especially helpful for those new to an area or looking to expand their social circle. At work, colleagues who carpool can even use the commute time to discuss projects, share ideas, or simply enjoy each other’s company.

- Real-world examples show how powerful carpooling can be. In Seattle, a carpool program cut downtown traffic by 20% during peak hours. This saved commuters time, improved traffic flow, and reduced the need for costly road expansions. Similar success stories are seen worldwide, proving how carpooling can change the way cities move.
- To make carpooling work smoothly, a few simple practices help. Good communication between carpoolers is key for planning. Apps and online platforms make it easier to find partners and schedule rides. Sharing costs fairly—whether by rotating drivers or splitting expenses, keeps things balanced. Finally, being flexible and open-minded helps everyone overcome small challenges and keep the system running well.

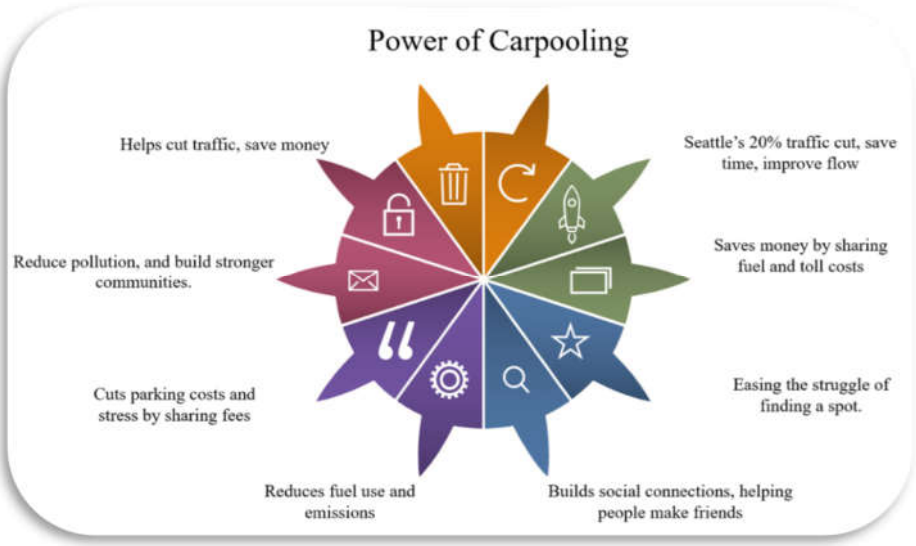

Figure 1. Power of Carpooling

4. FACTORS INFLUENCING THE SUCCESS

Several factors influence the success of carpooling applications, including user preferences, network effects, pricing strategies, and government policies. User preferences play a significant role in determining the success of carpooling applications. For example, users may prefer applications that provide flexibility in scheduling and route planning. Network effects are also critical to the success of carpooling applications. As more users join the platform, the value of the application increases, making it more attractive to new users. Pricing strategies can also influence the success of carpooling applications. For example, dynamic pricing can encourage users to share rides during peak hours. Finally, government policies, such as incentives and regulations, can play a significant role in promoting carpooling and supporting the development of carpooling applications.

Carpooling applications have the potential to significantly reduce traffic congestion, lower carbon emissions, and save users money. However, the success of these applications is influenced by several factors, including:

- **User Experience:** The success of a carpooling application is heavily dependent on its user experience. Users should find the app easy to use and navigate, with clear instructions for carpooling options, ride sharing requests, and scheduling. The app

should also offer features like real-time updates, GPS tracking, and in-app messaging to enhance the user experience.

- **Trust:** Users need to trust that their carpooling partners are safe, reliable, and responsible drivers. Therefore, carpooling applications must have robust verification processes to screen and authenticate users. Verification measures such as driver's license validation, background checks, and identity verification will build user trust and confidence.
- **Network Size:** The more users a carpooling application has, the more viable and convenient it becomes. A large network means users have more options for carpooling partners and more routes available. Therefore, app developers must prioritize expanding the user base to ensure a more extensive and efficient carpooling network.
- **Cost-Effectiveness:** One of the main reasons people choose carpooling is to save money. Therefore, carpooling applications must offer competitive pricing and cost-saving options. The app can offer incentives for carpooling, such as discounts, rewards, or loyalty programs, which encourage more people to use the service.
- **Integration with Public Transport:** Integrating carpooling applications with public transport services enhances the convenience and flexibility of users. Users can choose to combine carpooling with public transport for more sustainable and affordable travel. Therefore, carpooling applications must integrate with public transport services and offer seamless connections.
- **Marketing and Promotion:** A successful carpooling application requires effective marketing and promotion strategies to reach and attract users. The app developers must create brand awareness, engage users through social media and other digital platforms, and partner with local businesses and communities to promote the service.
- **Government Support:** Government support and initiatives can significantly impact the success of carpooling applications. Governments can provide incentives such as tax credits, subsidies, and infrastructure development, to encourage more people to use carpooling services. They can also promote carpooling through campaigns, awareness programs, and partnerships with app developers.

A carpooling application's success is determined by multiple factors, including user experience, trust, network size, cost-effectiveness, integration with public transport, marketing and promotion, and government support. Therefore, app developers must prioritize these factors to create a robust and sustainable carpooling ecosystem.

5. IMPACT ON SUSTAINABLE MOBILITY

The carpooling applications have the potential to significantly reduce the negative impacts of single-occupancy vehicles on the environment. By reducing the number of cars on the road, carpooling applications can reduce congestion, improve air quality, and lower greenhouse gas emissions. However, the impact of carpooling applications on sustainable mobility is dependent on several factors, including the mode of transportation, the distance traveled, and the number of users. In some cases, carpooling may not be the most sustainable transportation option. For example, if the alternative is public transportation or active transportation, carpooling may not provide significant environmental benefits.

Figure 2. Indian carpooling market size (₹, 2019–2025)

Table 1. Indian carpooling market size (₹, 2019–2025)

Year	Market Size (INR crore)
2019	592.2
2020	718
2021	824.7
2022	1009.7
2023	1221.5
2024	1425.4
2025	1692.5

Carpooling applications have had a significant impact on sustainable mobility. These applications, such as UberPOOL, Lyft Line, BlaBlaCar, and Waze Carpool, enable drivers and riders to share rides and split the cost of travel. Here are some ways carpooling applications have contributed to sustainable mobility:

- **Reduced carbon emissions:** Carpooling reduces the number of vehicles on the road, which decreases carbon emissions and air pollution. By sharing rides, carpoolers can reduce their carbon footprint and help combat climate change.
- **Reduced traffic congestion:** With fewer cars on the road, carpooling reduces traffic congestion and travel time. This not only benefits the carpoolers themselves but also reduces the amount of time commuters spend on the road, which in turn reduces emissions from idling vehicles.

- **Increased access to transportation:** Carpooling applications have made it easier for people to access transportation, particularly in areas with limited public transportation options. This can reduce the need for individual car ownership, which can be expensive and contribute to traffic congestion and emissions.
- **Increased social interaction:** Carpooling can also promote social interaction and a sense of community among riders. This can help build stronger social ties and promote a sense of shared responsibility for sustainable mobility.
- **Economic benefits:** Carpooling can save money for both riders and drivers by splitting the cost of fuel and tolls. This can make transportation more affordable for low-income individuals and families.

The carpooling applications have had a positive impact on sustainable mobility by reducing emissions, traffic congestion, and individual car ownership, while also promoting social interaction and economic benefits. However, there is still a need for continued investment in public transportation and other sustainable mobility solutions to reduce our reliance on individual cars and further mitigate the impact of transportation on the environment.

Carpooling applications have had a significant impact on sustainable mobility by encouraging people to share rides and reducing the number of cars on the road. This has several benefits for the environment, such as reducing greenhouse gas emissions, lowering air pollution, and reducing traffic congestion.

Here are some ways carpooling applications have impacted sustainable mobility:

- **Increased car occupancy:** Carpooling applications have made it easier for people to find others to share rides with, increasing car occupancy and reducing the number of cars on the road. This reduces traffic congestion and improves air quality.
- **Reduced emissions:** Carpooling applications can reduce the amount of emissions released into the atmosphere by encouraging people to share rides instead of driving alone. This helps reduce the overall carbon footprint of transportation.
- **Improved access to transportation:** Carpooling applications can provide more affordable and accessible transportation options for people who may not have access to their own vehicle or public transportation.
- **Reduced parking demand:** With more people carpooling, there is less demand for parking spaces, which can reduce the amount of land needed for parking lots and help to preserve green spaces.
- **Increased social interactions:** Carpooling applications can also provide opportunities for people to socialize and build community connections, which can contribute to a more sustainable and connected society.

This application have had a positive impact on sustainable mobility by encouraging people to share rides, reducing the number of cars on the road, and lowering emissions. They have also provided more affordable and accessible transportation options while fostering social interactions and community connections.

6. BENEFITS AND CHALLENGES OF CARPOOLING APPLICATIONS

Carpooling applications offer several benefits, including increased convenience, reduced travel costs, and reduced carbon emissions. They also provide a platform for social interaction and can help to build social capital[12-14]. However, there are also several challenges that need to be addressed, including privacy concerns, trust issues, and the need for a critical mass of users. Carpooling applications are platforms that facilitate ride-sharing between individuals traveling to the same destination. These applications have become increasingly popular in recent years, and they offer several benefits and challenges.

5.1 Benefits of Carpooling Applications

- **Cost savings:** Carpooling applications enable passengers to split the cost of travel, reducing the cost of transportation for everyone involved.
- **Environmental benefits:** Carpooling reduces the number of cars on the road, resulting in less traffic congestion and lower carbon emissions.
- **Reduced traffic congestion:** By reducing the number of cars on the road, carpooling applications can help reduce traffic congestion, especially during peak travel times.
- **Social connections:** Carpooling applications can provide opportunities for people to meet new people and make new social connections.
- **Reduced parking requirements:** Carpooling reduces the number of cars that need to be parked, reducing the demand for parking spaces.

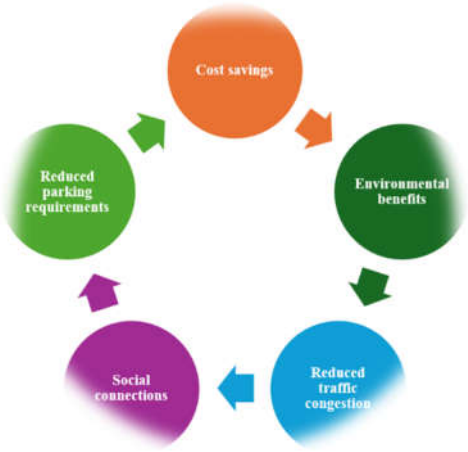

Figure 3: Benefits of Carpooling Applications

5.2 Challenges of Carpooling Applications

- **Trust and safety concerns:** Carpooling applications require passengers to share personal information and ride with strangers, raising trust and safety concerns.
- **Schedule coordination:** Carpooling requires coordination between multiple individuals, making it challenging to coordinate schedules and travel plans.
- **Limited availability:** Carpooling applications may not be available in all areas, limiting access for some users.

- **Incentives:** Incentivizing drivers to participate in carpooling can be challenging, especially if they are not able to recoup their costs.
- **Unpredictable situations:** Carpooling applications may not be able to handle unpredictable situations, such as sudden cancellations or route changes.
- **Driver availability:** The success of carpooling applications is heavily dependent on the availability of drivers. If there are not enough drivers in a particular area, users may have to wait longer for a ride, which can be frustrating and may discourage them from using the service in the future.
- **Payment and pricing:** Carpooling applications need to develop a fair and transparent payment and pricing system that benefits both drivers and passengers. Pricing models such as surge pricing can be controversial, and carpooling applications need to be transparent about how prices are calculated to avoid any misunderstandings.
- **Regulations:** Carpooling applications need to comply with local regulations and laws, which can vary from region to region. These regulations may include insurance requirements, driver licensing requirements, and tax regulations, which can be complex and time-consuming to navigate.
- **User adoption:** Carpooling applications need to attract a critical mass of users to be successful. This can be challenging in the early stages, as users may be hesitant to adopt a new service, or there may not be enough users in a particular area to make the service viable.

Figure 4: Challenges of Carpooling Applications

It has the potential to offer many benefits, including cost savings, environmental benefits, and social connections. However, they also pose some challenges, such as trust and safety concerns, schedule coordination, and limited availability. Addressing these challenges will be key to realizing the full potential of carpooling applications.

7. FUTURE OF CARPOOLING APPLICATIONS

The future of these applications is dependent on several factors, including technological advancements, user preferences, and government policies. Technological advancements, such as the integration of real-time data and artificial intelligence, can improve the efficiency and convenience of carpooling applications. User preferences will also play a critical role in the future of these applications. As more users become comfortable with sharing rides, the demand for carpooling applications is likely to increase. Finally, government policies can play a critical role in promoting the adoption of carpooling applications and supporting sustainable mobility. Carpooling applications have gained a lot of popularity in recent years due to their ability to reduce traffic congestion and improve sustainability by encouraging people to share rides. The future of carpooling applications looks promising, with several developments and trends that are likely to shape the industry.

The future of carpooling looks promising as it is a sustainable solution to reduce traffic congestion and carbon emissions. Here are some potential developments that could shape the future of carpooling:

- **Increased use of technology:** Carpooling platforms will continue to integrate more advanced technologies like artificial intelligence, machine learning, and big data analytics to improve the matching process and make it more efficient. This will help to increase the number of people using carpooling services.
- **Autonomous cars:** The rise of autonomous cars will also have a significant impact on carpooling. With autonomous cars, people can use carpooling services without the need for a human driver, making it more convenient and accessible for everyone.
- **Integration with public transportation:** Carpooling services could be integrated with public transportation, allowing people to use a combination of carpooling and public transit for their daily commute. This could provide a more seamless and efficient transportation system.
- **Flexible arrangements:** Future carpooling services may offer more flexibility in terms of pick-up and drop-off locations, making it more convenient for users. Additionally, carpooling services may offer different pricing models depending on the level of convenience or flexibility desired.
- **Environmental awareness:** There is a growing awareness of the environmental impact of transportation, and this could lead to more people choosing carpooling as a sustainable alternative to driving alone. As more people adopt carpooling, it could become a mainstream transportation option in the future.
- **Integration with other modes of transportation:** Carpooling applications are likely to be integrated with other modes of transportation such as public transit, bike-sharing, and ride-hailing services. This will enable users to plan their journeys seamlessly and choose the most efficient and sustainable mode of transportation.
- **Artificial Intelligence and Machine Learning:** Carpooling applications are likely to use artificial intelligence and machine learning algorithms to improve their matching algorithms, route optimization, and safety features. These technologies can help to

optimize the routing and scheduling of carpools to minimize detours, reduce travel time, and improve safety.

- **Focus on Sustainability:** Carpooling applications are likely to focus more on sustainability by encouraging users to adopt environmentally-friendly practices. This may include offering incentives for using electric or hybrid vehicles, or for reducing the number of single-occupancy vehicles on the road.
- **Increased Safety Measures:** Carpooling applications are likely to focus more on safety by implementing additional safety measures such as driver background checks, real-time vehicle tracking, and safety ratings for both drivers and passengers. This can help to build trust among users and encourage more people to use carpooling applications.
- **Expansion to Rural Areas:** Carpooling applications are likely to expand to rural areas, where public transportation options are limited. This will help to connect people in rural areas with urban centers and improve their access to education, employment, and other essential services.

The future of carpooling applications looks bright, with several trends and developments that are likely to improve the efficiency, safety, and sustainability of the industry.

CONCLUSIONS

Carpooling applications have the potential to address some of the most pressing problems in transportation, including traffic congestion and environmental pollution. However, their success will depend on their ability to overcome the challenges in their adoption and offer users a convenient and affordable way to share rides. Further research is needed to understand the potential benefits of carpooling applications and how they can be optimized to improve mobility and reduce environmental impact.

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