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The Impact of E-Hailing on Traditional Taxi Operations and Strategies for Adaptation in Melaka Sentral, Malaysia

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Abstract: The rise of e-hailing services has dramatically disrupted the traditional taxi industry, particularly in Melaka Sentral, Malaysia. This study investigates the challenges faced by traditional taxi drivers and explores strategies for their adaptation to the digital mobility era. Using a mixed-method approach, including semi-structured interviews, sentiment analysis, and expert focus group discussions, the research reveals that traditional taxi drivers face declining demand and income, largely due to the growing popularity of e-hailing services. However, the study also identifies opportunities for adaptation through digital training, integration into e-hailing platforms, and regulatory reforms. The findings suggest that the long-term sustainability of traditional taxis depends on embracing technological change, enhancing service quality, and aligning with evolving consumer expectations. This research provides actionable strategies for improving the resilience of the taxi sector, ensuring its competitiveness in the face of ongoing technological disruption.
Keywords: *E-hailing, Traditional taxis, Digital adaptation, Regulatory reforms, Service quality, Transportation innovation*

1. Introduction

The taxi industry in Melaka, particularly in Melaka Sentral, is experiencing significant transformation with the expansion of e-hailing services. As the largest public transportation terminal in Melaka City, Melaka Sentral connects buses, taxis, and e-hailing platforms, playing a central role in the region's mobility ecosystem. However, the increasing reliance on mobile applications for booking rides has disrupted traditional taxi operations, creating significant challenges to their viability. The popularity of e-hailing arises from affordability, convenience, and accessibility, which traditional taxis struggle to match. Reports indicate that the number of operating taxis in Malaysia has fallen dramatically, from about 120,000 to only 40,000, with nearly 80,000 drivers abandoning the industry due to declining incomes following the rise of e-hailing services. Gabungan Teksi Malaysia has highlighted that cheaper e-hailing fares have not only displaced traditional taxis but also reduced earnings for e-hailing drivers themselves, and called for policy reforms such as the adoption of minimum fares to ensure fair competition and sustainable livelihoods (Zaf, 2024; Media, 2024).

The challenges in Melaka Sentral reflect this national trend. Traditional taxi drivers face decreasing passenger numbers, declining revenue, and regulatory constraints that limit their ability to compete. Many drivers, particularly older ones, struggle with digital technology and remain unfamiliar with e-hailing applications, which their capacity limitation to adapt to technological shifts. Service quality is another concern, as passengers increasingly expect cleanliness, punctuality, and comfort, attributes more strongly associated with e-hailing

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platforms. Consequently, traditional taxis are often perceived as less professional, leading to a loss of consumer confidence and reinforcing negative stereotypes (Ridzuan, 2023).

At the same time, the infrastructure supporting e-hailing services in Melaka continues to expand. Recent initiatives such as the establishment of one-stop centres for e-hailing drivers in Pulau Melaka, Masjid Tanah, and Bandar Jasin Bestari reflect policy support and growing demand, offering convenience to more than 1,000 drivers across the state (Farah, 2023). Research on urban mobility in Melaka also highlights that e-hailing alleviates pressure on traditional public transport systems by providing affordable, flexible, and accessible options for residents and tourists, strengthening its role in the city's transportation network (Jais et al., 2018).

The differences in regulatory action between traditional taxis and e-hailing platforms contribute to perceptions of unfair competition. Taxi drivers face stricter fare structures and licensing rules, while e-hailing operators benefit from more flexible frameworks, creating imbalances in market dynamics. Some drivers resist integrating with e-hailing platforms due to concerns over losing their conventional identity and fear of disruptive change, yet this reluctance prevents them from capturing potential benefits of digital adaptation. The sustainability of taxi operations in Melaka Sentral therefore depends on the ability to embrace technological transformation, improve service standards, and implement balanced regulations that ensure fair competition. This research aims to address these issues by analysing the challenges faced by traditional taxi drivers and exploring strategies for adaptation, with the goal of supporting the long-term survival of conventional taxis within the changing mobility landscape in Melaka.

2. Literature review

The emergence of e-hailing services has significantly reshaped the global transportation industry. Traditional taxis, once the dominant mode of urban public transport, now face decreasing the numbers of passenger and declining revenue due to increasing consumer preference for app-based services that offer convenience, affordability, and transparency. In Malaysia, the integration of e-hailing platforms such as Grab has created both opportunities and challenges for the taxi industry. Globally, services such as Uber, Grab, and Lyft have grown rapidly, providing advantages including cashless payments, dynamic pricing, promotional fares, safety features through tracking, and driver ratings. As Shamim et al. (2021) and He and Shen (2015) explain, the adoption of such platforms is driven by their efficiency and cost savings. This global trend has disrupted traditional taxi markets, with Zhou (2017) noting that regulatory inconsistencies have deepened tensions between conventional taxi operators and app-based platforms. Similarly, Lim and Fernandez (2022) emphasize that convenience and speed drive e-hailing's rapid uptake, while Isa et al. (2024) add that in Malaysia, the popularity of platforms such as Grab reflects their unique ability to address commuter needs.

The effects on traditional taxi services have been considerable. Teo et al. (2018) show how passenger ride intention in Malaysia increasingly leans toward e-hailing, a shift confirmed by Ghani et al. (2021), who argue that taxi operators must innovate to remain competitive. Rosli (2025) highlights that service quality in e-hailing, including reliability and affordability, attracts passengers more effectively than traditional taxis. In Johannesburg, Adenigbo et al. (2023) observe similar patterns, while Farooq et al. (2019) and Nur'Najmah et al. (2019) confirm that service quality and trustworthiness shape user choices in Kuala Lumpur and Sarawak. Nonetheless, Ruamchart (2021) stresses that gaps between expectations and perceptions of service remain, pointing to areas for improvement even among successful e-hailing services.

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Globally, traditional taxi drivers face declining income and order diversion, challenges intensified by technological innovations such as autonomous driving. Huang et al. (2025) reveal that the perception of automation as a threat influences risky driving behaviour, while Pakusch et al. (2020) express that Millennials show little concern for the displacement of human drivers, prioritizing affordability and convenience instead. Similarly, Benjaafar et al. (2025) highlight that autonomous vehicles alter wage structures and driver welfare by creating new dynamics between automated and conventional fleets. In Germany, Pakusch et al. (2021) found that taxi drivers anticipate shifting from driving tasks to providing supplementary services, emphasising the resilience but also liability of their profession.

In developing contexts, these challenges are compounded by regulatory and infrastructural constraints. For example, Methu (2018) reported that Nairobi's taxi companies adopted tracking and mobile payment systems to remain competitive. Arora et al. (2022) confirmed that perceived usefulness was the strongest predictor of adoption, surpassing concerns about trust and risk. AbdulKareem and Oladimeji (2024) further emphasize the role of digital literacy, suggesting that the ability to navigate technological platforms significantly affects user behaviour.

In Malaysia, these tensions are evident as traditional taxi drivers express scepticism and resistance towards e-hailing platforms (Teo et al., 2018). Isa et al. (2024) explain that the regulatory environment is growing but continues to present uncertainties, while Zhong et al. (2022) find that ride-hailing services substantially reduce traditional taxi ridership. Ghani et al. (2021) suggest that mobile application adoption by taxis could mitigate demand competition, providing an opportunity for adaptation. Nevertheless, regulatory frameworks remain crucial. Jais and Marzuki (2020) caution that over-regulation could delay growth, whereas under-regulation risks safety and market imbalance. In the same vein, Yıldızgöz and Çelik (2019) and advocate for balanced regulatory approaches that support innovation without disadvantaging traditional operators. Farren et al. (2016) go further, arguing that outdated taxi regulations require fundamental reform in light of technological changes.

The sustainability of both e-hailing and traditional taxis also depends on addressing safety and security issues. Mat et al. (2019) observe that cyber security threats, including fraud and harassment, remain pressing concerns for e-hailing services, while public perceptions of driver credibility influence trust (Isa et al., 2024). Globally, Jha et al. (2018) and Cheng et al. (2018) note that e-hailing pressures taxi operators to innovate technologically, while in Malaysia, Ghani et al. (2021) see the development of taxi-based mobile apps as a potential strategy to revive traditional services.

Future prospects for e-hailing are linked to continuous technological innovation. Khan et al. (2024) point to advancements in artificial intelligence and the Internet of Things (IoT) as drivers of enhanced customer experiences. However, He and Shen (2015) caution that while these technologies improve efficiency, they may also introduce new regulatory challenges. Vega-Gonzalo et al. (2024) show that adoption patterns depend not only on socio-economic factors but also on psychological constructs, suggesting that user behaviour in the digital mobility era is complex and context-dependent. Opportunities for traditional taxis remain viable: by embracing mobile applications, enhancing customer service, and improving digital literacy, they can reduce the competitive edge of e-hailing platforms (Arora et al., 2022; AbdulKareem & Oladimeji, 2024; Ghani et al., 2021).

Despite these perspectives, few studies have focused on localized transport hubs such as Melaka Sentral. Existing literature addresses global patterns and national trends but offers limited empirical evidence on how taxi drivers and passengers in such specific contexts navigate the challenges of e-hailing. Furthermore, research has yet to sufficiently integrate

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perspectives from both groups to identify actionable strategies for sustaining traditional taxi operations. This study therefore addresses the gap by observing the challenges and opportunities for traditional taxis in Melaka Sentral, emphasizing strategies for digital adaptation and service improvement to ensure competitiveness in the e-hailing era.

3. Research methodology

This study employed a mixed-method design to examine the challenges faced by traditional taxis in adapting to the e-hailing era at Melaka Sentral. The approach integrated qualitative findings from interviews and focus group discussions with stakeholders and experts, alongside sentiment analysis to identify prevailing perceptions and emotional tones. This combination ensured both depth and breadth in capturing the complexity of the issue.

3.1 Research framework

The research was structured into two main phases. Phase 1 focused on identifying challenges in the taxi and e-hailing ecosystem, while Phase 2 concentrated on developing strategies for adaptation. The framework is summarized in Figure 1, which illustrates the sequential flow from literature review to data collection, analysis, and strategy formulation.

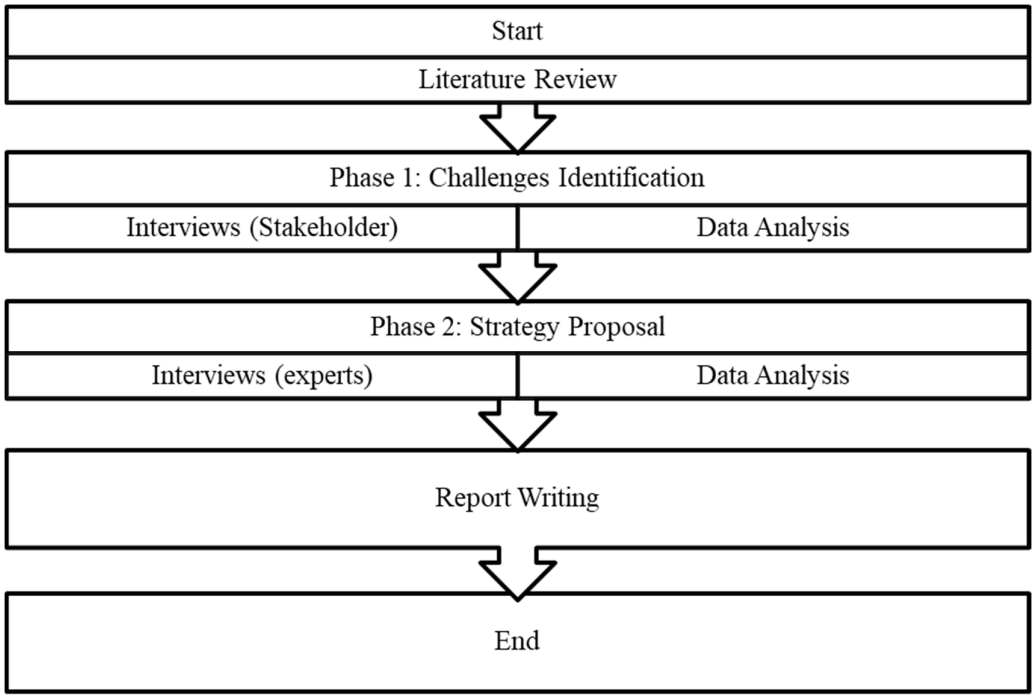

Fig. 1. Research flow framework

Phase 1: Identification of Challenges

Data were collected through semi-structured interviews with three groups directly involved in Melaka Sentral's transport ecosystem: taxi drivers (5 respondents), e-hailing drivers (5 respondents), and passengers (5 respondents). Purposive sampling was used to ensure respondents had direct experience with taxi or e-hailing services. Interviews were conducted face-to-face and online during peak hours over one week in August 2025. The data were collected using semi-structured interviews. The interview questions covered demographics, perceived challenges, and proposed recommendations.

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The data were analyzed using sentiment analysis, a natural language processing (NLP) technique that classifies responses as positive, negative, or neutral (Morshed et al., 2021). The goal that sentiment mining tries to gain is to analyze opinions of the respondent in a way that can help businesses expand. It focuses not only on polarity (positive, negative & neutral) but also on emotions such as happy, sad, and angry. It uses various Natural Language Processing algorithms such as Rule-based, Automatic, and Hybrid.

The sentiment analysis in this study followed a systematic process beginning with data collection from interviews, followed by preprocessing to clean and standardize the text. Relevant features were extracted to capture key linguistic and contextual elements, which were subsequently classified into positive, negative, or neutral categories using natural language processing and machine learning techniques. Finally, the results were synthesized and visualized to provide meaningful insights for interpreting the challenges and perceptions of taxi and e-hailing stakeholders. This approach allowed for a systematic exploration of the emotional dimensions of drivers and passengers, extending the analysis beyond surface-level responses. Figure 2 show sentiment analysis process.

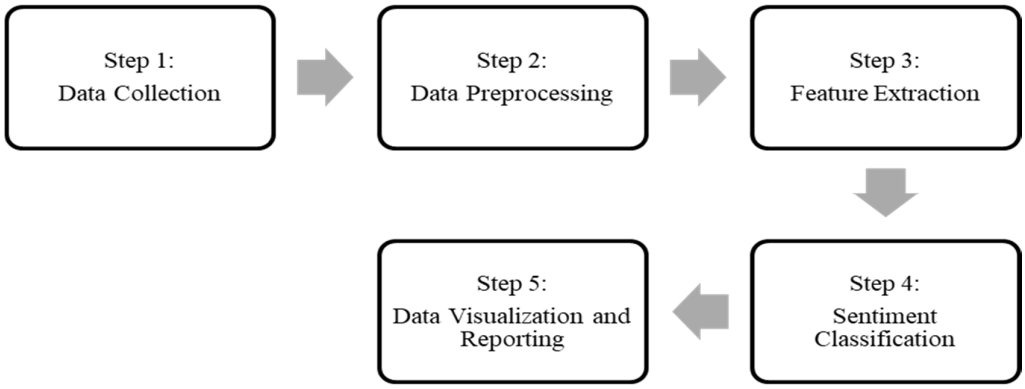

Fig. 2. Sentiment analysis process

Phase 2: Strategy Development

Strategies for improving the resilience of the taxi sector were developed using two primary data sources. First, recommendations were extracted from the interview sessions with drivers and passengers. Second, a focus group discussion was held with regulatory authorities, the experts from the Jabatan Pengangkutan Jalan (JPJ) and Agensi Pengangkutan Awam Darat (APAD). Table 1 shows the profile of these experts. The experts evaluated the feasibility of proposed strategies, responding to two guiding questions: (1) Do you agree with the proposed strategies? and (2) How do you justify your opinion?

Table 1
Expert profile

Organization	Age	Experience	Expertise
JPJ Officer 1	-	-	Transport regulation
JPJ Officer 2	-	-	Road safety & licensing
APAD Officer 1	-	-	Public transport policy
APAD Officer 2	-	-	E-hailing regulation

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3.2 Ethical considerations

All participants provided informed consent, and confidentiality was strictly maintained. Data management followed to ethical guidelines, with anonymized transcripts and secure storage.

4. Results and discussion

This section presents the findings of the study on the impact of e-hailing services on traditional taxi operations in Melaka Sentral, integrating both the perspectives of stakeholders and the perspectives of regulatory experts. The results are derived from semi-structured interviews with taxi drivers, e-hailing drivers, and passengers, as well as focus group discussions with officers from the Road Transport Department (JPJ) and the Land Public Transport Agency (APAD). The analysis combines sentiment evaluation with thematic interpretation to highlight issues, perceptions, and opportunities within the sector. The discussion further contextualizes these results by linking stakeholder experiences to expert recommendations, thereby identifying practical strategies for enhancing the competitiveness and sustainability of traditional taxi services in the digital era.

4.1 Respondent profile

The study involved fifteen participants: five traditional taxi drivers, five e-hailing drivers, and five passengers. Taxi drivers were generally older (43–76 years) with over a decade of experience, while e-hailing drivers were younger (32–41 years) and part-timers with shorter experience. Passengers ranged from 28–43 years, representing active users of both services. This demographic contrast is critical, as age and digital literacy significantly affected perceptions of the industry. Table 2 shows the summary of respondent profile.

Table 2
Summary of respondent profile

Group	Sample Size	Age Range	Experience	Work Nature
Taxi Drivers	5	43–76 years	>10 years	Full-time
E-hailing Drivers	5	32–41 years	6 months–10 years	Part-time
Passengers	5	28–43 years	Users	-

4.2 Sentiment analysis results

The analysis of stakeholder perceptions revealed clear contrasts between traditional taxi drivers, e-hailing drivers, and passengers, with the views of passengers aligning more closely to those of e-hailing drivers. Taxi drivers expressed predominantly negative sentiments, emphasizing declining passenger demand, income reduction, and the perception of unfair competition from e-hailing platforms. Nonetheless, a minority acknowledged the potential of technology, particularly if supported through training and institutional reforms. In contrast, e-hailing drivers carried overwhelmingly positive views, highlighting the flexibility of working arrangements, transparent pricing structures, and the overall efficiency of app-based systems. Despite these advantages, they also raised concerns related to inaccurate GPS signals, growing competition among operators, and the high commission rates imposed by platforms. Passengers were generally favourable toward e-hailing services, citing convenience, safety, cashless payment options, and greater reliability compared to taxis. At the same time, some expressed dissatisfaction with the limited availability of taxis and

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pointed to challenges within e-hailing itself, such as surge pricing, dependence on internet connectivity, and concerns over data security. Figure 3 shows the comparison of sentiment distribution among respondents.

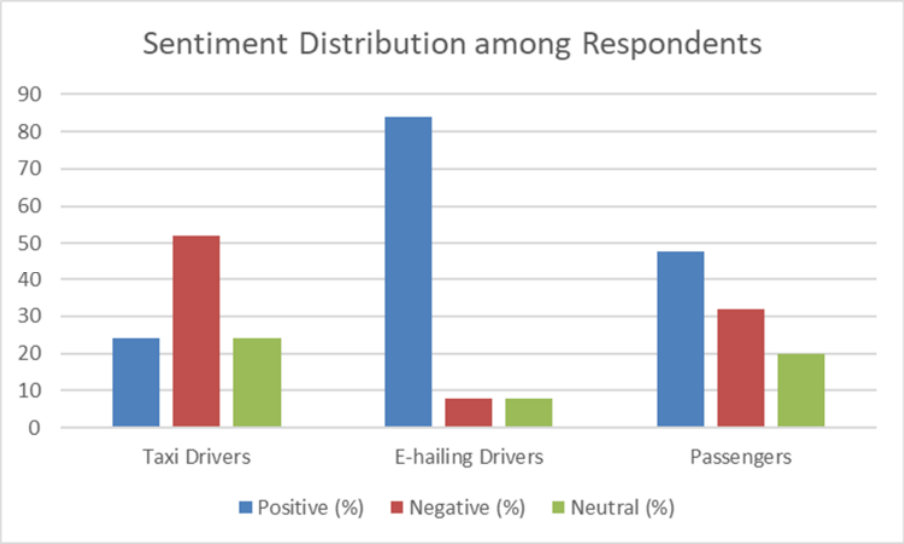

Fig. 3. Sentiment distribution among respondents

The results highlight a divide in perceptions shape by both age and occupation within the taxi and e-hailing sectors. Older taxi drivers struggled with digital literacy, citing affordability and age as barriers to adopting new technologies, while younger e-hailing drivers embraced app-based systems with relative ease. Passengers' preference for e-hailing reinforces the shift toward digital mobility solutions, supported by convenience, safety, and transparent pricing. However, concerns regarding surge fares and cybersecurity risks suggest that regulatory frameworks must evolve to safeguard users while ensuring fair competition.

4.3 Expert recommendations and strategic implications

Experts from the Road Transport Department (JPJ) and the Land Public Transport Agency (APAD), each with more than a decade of experience in transport regulation and policy, contributed to the focus group discussion. Their recommendations provided both regulatory and operational perspectives, leading to the proposal and validation of six key strategies for strengthening the resilience of the taxi sector as shown in Table 3.

Table 3
Expert-proposed strategies for taxi sector adaptation

Focus Area	Expert Recommendation	Strategic Implication
Digital Training	Many taxi drivers remain uncomfortable with apps and cashless systems.	Introduce structured digital literacy and mobile application training programs.

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Platform Integration	Taxis need to be accessible via the same channels as e-hailing services.	Integrate taxis into e-hailing platforms while preserving regulated fares and branding.
Regulatory Reform	Current licensing and fare structures favor e-hailing operators.	Update policies to ensure a level playing field between taxis and e-hailing services.
Service Quality	Customers expect professionalism, safety, and courteous service.	Retrain drivers, enforce regular inspections, and implement customer rating systems.
Public Campaigns	Taxis suffer from negative public perceptions compared to e-hailing.	Launch campaigns to rebuild trust and promote taxis as a reliable mobility option.
Cashless Payment Adoption	Cashless transactions are now the norm in Malaysia's digital economy.	Equip taxis with e-wallet and QR code payment systems to align with consumer preferences.

The findings reveal that e-hailing services have substantially disrupted traditional taxi operations in Melaka Sentral, while also revealing opportunities for renewal. Taxi drivers reported dissatisfaction arising from reduced demand, declining income, and difficulties in adapting to digital tools, whereas e-hailing drivers emphasized the advantages of flexibility, transparent pricing, and wider customer reach. Passengers expressed a strong preference for e-hailing due to its convenience, safety, and reliability, which reinforces the urgency for transformation in the taxi sector. Findings from experts indicate that adaptation is possible through initiatives such as comprehensive digital training, integration of taxis into e-hailing platforms, reforms in regulatory frameworks, and improvements in overall service quality. The long-term resilience of the traditional taxi industry will therefore depend on embracing innovation and aligning operations with evolving consumer expectations rather than resisting technological change.

5. Conclusion

This study investigated the impact of e-hailing services on traditional taxi operations in Melaka Sentral, highlighting significant challenges and opportunities for adaptation. Findings from interviews and sentiment analysis reveal that the introduction of e-hailing platforms has disrupted the traditional taxi market, leading to the income reduction, passenger demand, and a growing sense of unfair competition among taxi drivers. On the other hand, e-hailing services offer advantages such as flexibility, transparency, and convenience for both drivers and passengers. Despite the challenges faced by traditional taxi operators, there remains potential

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Advances in Transportation and Logistics Research
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for their revival by embracing digital technologies, enhancing service quality, and adapting to evolving consumer preferences. The study shows that the future of traditional taxis in Melaka Sentral depends on their ability to innovate and integrate into the modern transport ecosystem, aligning with regulatory reforms and improved service standards.

6. Implications

This study provides valuable understandings for both theoretical understanding and practical applications in urban mobility. From a theoretical perspective, it contributes to the growing body of knowledge on how technological disruption, particularly the rise of e-hailing services, affects established industries such as public transportation. The findings emphasize the importance of digital literacy and technological adaptation in ensuring the survival and competitiveness of traditional taxi services. Practically, the study offers recommendations for stakeholders involved in urban mobility, including regulatory bodies, taxi operators, and e-hailing platforms. By promoting digital training for taxi drivers, integrating taxis into e-hailing platforms, and implementing regulatory changes that ensure fair competition between all service providers, this study proposes ideas for improving the sustainability of both traditional taxis and e-hailing services. These measures can help address challenges related to service quality, consumer trust, and market imbalance, benefiting passengers and improving the overall transportation ecosystem.

7. Research limitations

Although this study provides significant findings into the challenges and strategies for adapting traditional taxi services to the e-hailing era, there are several limitations that should be considered. First, the research focused solely on Melaka Sentral, which may limit the generalizability of the findings to other regions or transport hubs. Additionally, the sample size was small, consisting of only five taxi drivers, five e-hailing drivers, and five passengers, which might not fully represent the broader population of stakeholders in the industry. The reliance on qualitative methods, such as interviews and focus group discussions, also means that the findings may be subject to participant biases or variations in personal experiences. Furthermore, the study concentrated on perceptions and challenges related to digital adoption, without extensively examining the long-term financial implications or broader socio-economic factors that may influence the sustainability of traditional taxis in the face of e-hailing competition. Future research could expand the sample size, explore other geographical locations, and employ quantitative methods to provide a more comprehensive understanding of the issue.

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