



Digital Service Innovation Supports Inclusive Public Transport Accessibility for Persons with Disabilities

Tristania Pangaribuan^{1*}, Oktolina Simatupang¹

¹Research Center for Public Policy, National Research and Innovation Agency, Jakarta Selatan, Indonesia

*Coessponding Author Email: tris020@brin.go.id

Abstract. General Background: The rapid advancement of digital technologies is transforming public service delivery, including public transportation systems, with increasing emphasis on accessibility and social inclusion. Specific Background: In Indonesia, digital platforms have been progressively integrated into public transport to improve operational efficiency, transparency, and user participation, particularly in major cities such as Jakarta, Bandung, Semarang, and Yogyakarta. Knowledge Gap: However, limited empirical understanding exists regarding how digital service innovations support inclusive public transport for persons with disabilities across different regions and systems. Aims: This study aims to examine the application of digital technologies in fostering inclusivity in public transport systems for persons with disabilities in Indonesia. Results: Using a qualitative-descriptive approach based on regulatory analysis, interviews with 18 stakeholders, and 48 participants with physical, visual, and hearing-speech impairments, the findings indicate that digital tools such as e-ticketing, live service updates, integrated payment systems, ride-hailing applications, and trip-planning platforms improve convenience and accessibility. These systems provide features including screen reader compatibility, audiovisual guidance, Braille support, and seamless ticketing, enabling more independent and safe travel. However, accessibility remains uneven due to gaps in cross-operator integration, screen reader compatibility, audiovisual synchronization, and institutional capacity, resulting in regional disparities. Novelty: This study offers a multi-stakeholder analysis of digital service innovation in inclusive public transport across multiple Indonesian cities. Implications: The findings highlight the need for integrated digital systems and strengthened institutional capacity to support equitable and inclusive public transportation for persons with disabilities.

Keywords:Digital service innovation; Inclusive public transport; Disability accessibility; Smart transportation systems; Indonesia public transport.

1 Introduction

Rapid developments in digital technologies are revolutionizing the delivery of public services worldwide. The Indonesian government is progressively adopting digital platforms to boost operational efficiency, enhance transparency, and encourage public participation [1] [2] [3][4]. Public transport is a key sector where digital services are being introduced to enhance user accessibility and facilitate greater mobility. Digitalisation in this area not only improves operational efficiency but also fosters accessibility and social inclusion.

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Digital innovations in public transport can take many forms, including e-ticketing, real-time information, integrated payment systems, mobile applications for tracking vehicle locations, and journey-planning apps [5][6][1][7][8]. However, while these digital innovations have generally enhanced the experience and convenience of public transport for the general population, they have not yet been fully developed to meet the needs of vulnerable groups [9].

Summarizing several studies, Goodman-Deane et al. [10] identify certain groups at higher risk of being marginalized in the use of digital mobility services. This can result from limited digital skills, lack of access to technology, or having specific mobility needs. These groups include older adults, women, people with lower educational attainment, individuals with low income, residents of rural areas, migrants, and persons with disabilities. People with disabilities are often reported to face difficulties when using public transportation and require specialized information and assistance during their journeys.

In Indonesia, the rights of persons with disabilities across all aspects of life are guaranteed under Law No. 8/2016 on Persons with Disabilities. Accessibility criteria for public transportation passengers with special needs are outlined in Minister of Transportation Regulation No. 98/2017, while supplementary rules, such as No. 63/2019 for passenger rail services, provide minimum service standards for various forms of transportation.

Through an examination of legal frameworks and the implementation of technology in four cities—Jakarta, Bandung, Yogyakarta, and Semarang—this study explores how digital innovations in public transportation systems can improve inclusion in Indonesia.

2 Literature Review

2.1 Digital Innovation in Public Transport

Information and communication technology (ICT) plays a crucial role in transportation systems because it can improve mobility. ICT can help provide information that can be accessed by anyone, anytime. Furthermore, ICT can simplify the process of booking and paying for tickets or planning trips. Developing digital technology means increasing the accessibility and efficiency of services [11] [12].

Digital innovation refers to the implementation of new technologies and processes that change the way services are delivered, for example through data integration, automation, or the use of user-centric platforms. In public transportation systems, this innovation can take the form of mobile applications, e-ticketing, or other means, which can increase operational efficiency and enhance the user experience [13], while enabling the provision of adaptive services to accommodate diverse user needs [10]. Many digital technologies are at the trial or development phases, which have potential to improve how transportation information can be made readily accessible to all users [11].

2.2 Inclusive Mobility and Accessibility

Inclusive mobility emphasizes the rights of every individual—including people with disabilities—to fully participate in transportation systems. Accessibility, both physical and digital, is a key aspect of inclusive mobility. Several studies show that although many cities have adopted digital systems, they are not yet optimally usable by people with disabilities due to limitations such as less-than-disability-friendly interface designs, inadequate assistive features, limited digital skills, and other limitations [13][9].

To ensure full inclusion, digital systems should follow accessibility standards and universal design, while integrated, universally designed infrastructure enhances mobility for people with disabilities and reduced mobility [14][15]. Creating accessible emergency systems for people with disabilities requires a combination of regulatory compliance, user-informed design, innovative features, and iterative testing to ensure safety, inclusivity, and practical usability [16].

3 Methods

This study was carried out using a qualitative descriptive approach and took place in four Indonesian cities: Jakarta, Bandung, Semarang, and Yogyakarta. Data were obtained through structured interviews with 18 informants, consisting of representatives from relevant government agencies, transportation providers, disability communities, and academics/practitioners. In addition, interviews were conducted with 48 people with disabilities (physical, deaf-mute, and blind) to identify their needs in using public transportation. Secondary data were obtained from relevant regulatory documents, both national and local (regional regulations).

4 Findings and Discussion

4.1 National and Local Regulatory Framework

Indonesia's commitment to accessible and inclusive public transportation is reflected in its national regulatory framework, which provides solid protections for persons with disabilities. Even so, levels of implementation are uneven across urban areas. Regional governments operationalize national directives through local by laws or gubernatorial decrees, shaping them according to regional conditions and administrative capacities.

Law No. 8/2016 requires all public facilities to be accessible [17], while Permenhub No. 98/2017 specifies minimum accessibility standards for transport infrastructure, including tactile paths, audio-visual information, and digital assistance systems [18]. Permenhub No. 63/2019 further introduces passenger transportation service standards that promote the use of digital platforms for real-time information and complaint resolution [19].

In relation to accessibility rights for persons with disabilities and the minimum service standards for public transportation, regional governments have established their own local regulations. In DKI Jakarta, accessibility in public transport is supported through Regional Regulation No. 33/2017, which sets the Minimum Service Standards for TransJakarta and requires both accessible facilities and the availability of digital information for passengers [20]. This is complemented by Regional Regulation No. 95/2019, which outlines similar service standards for the city's MRT and LRT systems [21]. Bandung places its commitment in Regional Regulation No. 15/2019, a policy that broadly safeguards the rights of persons with disabilities across sectors, including public transport [22]. In Semarang, accessibility provisions are regulated through Mayor Regulation No. 45/2021, which defines the service standards for Trans Semarang [23], along with Regional Regulation No. 9/2021 that ensures the protection of disability rights more generally [24]. Yogyakarta adopts a similar approach through Regional Regulation No. 5/2022, providing a province-wide framework to guarantee respect, protection, and the fulfillment of the rights of persons with disabilities [25].

4.2 Feature Requirements for Persons with Disabilities in Mobile Devices and Applications

Across public transport networks, digital platforms have become a practical aid for many travelers, including those with disabilities. When developers take inclusivity seriously, these technologies can help users with different abilities manage their journeys with more comfort and a greater sense of control. Achieving better accessibility, though, depends on understanding what people actually experience when they use the system.

The interviews carried out with persons with disabilities—especially individuals who use public transport every day—point to the central role digital tools now play in their mobility. The features they depend on naturally differ depending on the type of disability. In Table 1, we lay out the main accessibility features commonly required in mobile apps and devices for users with visual, physical, and hearing disabilities.

Table 1. Digital Feature Requirements for Persons with Disabilities in Public Transportation

Type of Disability	Required Features	Function / Purpose
Visual impairment	Screen reader software	Provides spoken interpretation of all interface elements
	Audio guidance and voice notes	Offers audio instructions, for example for route navigation or information about stations/stops
	Easily accessible buttons	Buttons placed within easy reach allow users to access available features more comfortably
	Call-center services	Enables users to request assistance from a call center whenever needed
	Independent navigation	Allows users to know their current position while inside the vehicle
	Route guidance and real-time information	Provides real-time updates on departure and arrival times, vehicle types, and requests for assistance
Physical Impairment	Accessible ride-hailing applications	Facilitates booking, trip planning, and service selection
	Online ticket booking	Reduces physical barriers when purchasing or reserving tickets
	Assistance request feature	Connects users with staff at stops, stations, or onboard vehicles
	Up-to-date information services	Supplies regularly updated information (including routes and schedules)
	Frictionless ticketing (tap-in/tap-out, face recognition)	Removes the need for physical tapping, making entry and exit more accessible

(continued on next page)

Table 1. (Continued)

Type of Disability	Required Features	Function / Purpose
Hearing impairments	Accessible ride-hailing applications	Simplifies booking, trip planning, and choosing services
	Clear visual information	Provides essential information in visual format
	Easy-to-understand pricing, promotions, and payment options	Helps users access pricing information and complete payments more easily
	Apps with sign-language support	Facilitates communication for deaf users

Source: Primary Data (2024)

4.3 Digital Service Innovation in Public Transportation

Digital technologies adopted in public transport help simplify routine operations, while at the same time expanding the opportunities for passengers with disabilities to access these services. As these platforms become more common, people with different types of impairments are finding it easier to move around on their own, with a greater sense of safety and comfort.

In Indonesia, a number of transport providers have started to broaden their digital offerings in an effort to ensure that these services are easier to access and more inclusive for all users. One example is PT KAI, which now offers the ‘Access by KAI’ application. Through this platform, passengers can buy tickets, look up train timetables, see which seats are still available, and obtain a range of other travel information. In many stations, passengers can also rely on wayfinding aids that help them locate essential facilities, including ticket counters, toilets, and designated waiting areas. Stations also provide audio announcements and scrolling text displays, which help convey important travel information through both sound and visual cues. PT KAI also provides various online payment options through its application.

In Jakarta, PT MRT, which was planned from the beginning with a universal accessibility approach, offers a combination of physical and digital features to ensure that passengers with different needs can use the system with ease. One example is DINA (Digital Intelligent Assistant), which serves as a two-way communication system linking passengers with station staff. The system lets passengers communicate with station staff in several ways—by typing, speaking, or using video—and it also incorporates Braille elements to assist blind and low-vision users. PT TransJakarta has also rolled out its own mobile app, ‘TJ: TransJakarta.’ The platform gives passengers immediate access to service information, including projected arrival times and the bus’s position as it moves along its route. Passengers can also use the app to map out their journeys by selecting routes that fit their travel needs. A recently added feature, ‘Companion Mode,’ provides step-by-step navigation, a chat option for assistance, tools for submitting reports, and even a small built-in radio service.

In Bandung, Metro Jabar Trans provides the Mitra Darat app, which allows users to access information on bus locations, routes, and schedules, complete with real-time tracking. The application was developed by the Ministry of Transportation and is also used for BRT services in several other cities, such as Yogyakarta, Semarang, and Solo.

Current digital innovations in public transport systems, while meeting some of the travel needs of users, remain suboptimal for people with disabilities. This indicates that digital innovations are uneven across transport modes and regions, and they do not yet fully accommodate the needs of disabled passengers. OP3 emphasized that PT KAI has implemented ICT as part of its service delivery to facilitate users, such as through online ticket

booking and purchasing. Yet, some accessibility needs are still lacking, such as the ability for blind or low-vision passengers to make online ticket reservations. Supporting this observation, OP1 explained that although PT KAI has integrated ICT into its services, its use is not yet fully effective and still needs further enhancement. Meanwhile, PT MRT Jakarta has developed technology-based services such as DINA, yet new needs from the disability community—such as a Calm Room for passengers with mental disabilities—are not yet covered by existing regulations (OP6). TransJakarta has equipped its system with ICT facilities and infrastructure, such as passenger information screens, audio announcements, and features designed to support passengers with disabilities (OP5).

Table 2 provides an overview of the needs of people with disabilities in public transportation and the features currently available to meet those needs.

Table 2. Digital Accessibility Needs and Existing Features Across Disability Groups in Indonesian Public Transport

Type of Disability	User Needs	Existing Features	Implemented in the City
Visual Impairments	<ul style="list-style-type: none"> – Screen readers – Real-time audio information – Voice-guided navigation – Chat services compatible with Braille device 	Audio announcements in stations and vehicles; DINA (MRT Jakarta’s digital assistant)	Jakarta, Bandung, Yogyakarta, Semarang
Physical Disabilities	<ul style="list-style-type: none"> – Online ticket booking – Ability to request staff assistance – Accessible ride-hailing applications – Real-time service information – Frictionless ticketing 	Ride-hailing apps (Gojek, Grab, Maxim, InDrive); operator or modal apps (Access by KAI, MyMRTJ, LRTJ, TransJakarta/TJ, JakLingko, Mitra Darat); DINA (MRT); digital information displays at stops and stations; wheelchair-accessible ticket machines in stations.	Jakarta, Bandung, Yogyakarta, Semarang
Hearing Impairments	<ul style="list-style-type: none"> – Accessible ride-hailing applications – Clear visual information – Transparent pricing and promotional information – Simple payment processes – Apps supported by sign-language features 	Ride-hailing apps (Gojek, Grab, Maxim, InDrive); operator or modal apps (Access by KAI, MyMRTJ, LRTJ, TransJakarta/TJ, JakLingko, Mitra Darat); digital payment systems (e-wallets, QRIS, account-based ticketing, NFC, multi-trip cards); visual information through running text and digital screens at stops, stations, and vehicles.	Jakarta, Bandung, Yogyakarta, Semarang

Source: Primary Data (2024)

4.4 Digital Innovation Supports People with Disabilities

Based on the interviews, it was found that although not yet fully optimized, several forms of technological innovation have already been implemented in public transportation, while others are still under development. The following outlines some of the current functions of digital innovations in supporting the mobility and accessibility of people with disabilities.

Assistive Technologies. Several transport operators have provided audiovisual information services that are particularly helpful for passengers who are visually or hearing impaired. Visual information is provided via digital display boards on trains or scrolling text panels on buses, showing route details and destinations. Passengers receive audio information through announcements in stations and inside the transport, covering departure times, destinations, and vehicle specifics.

In addition to audiovisual information, web- or app-based information is also highly valuable for passengers with disabilities in finding the information they need. For example, details about fares, routes and distances, map navigation, or even requesting assistance from staff.

Inclusive Journey Planning. Enhancements in travel preparation can greatly reduce anxiety and uncertainty when traveling. For people with disabilities, having access to apps that provide both guidance and support requests is increasingly essential. For instance, physically disabled passengers can plan their journeys while ensuring that wheelchair-accessible facilities or designated areas are available, and that each transport mode or hub is equipped with ramps or lifts to facilitate mobility.

Real-time information available on websites or apps is also essential for trip planning. People with disabilities can access information on timetables, types of transport, travel and waiting times, routes, and connections, enabling them to pick the safest and most comfortable options. This not only reduces physical barriers but also enhances comfort during travel. With digital ticketing, passengers with disabilities can plan and purchase tickets by themselves, decreasing their reliance on staff support.

Digital Ticketing. Several digital ticketing services have been implemented to date, including payment via digital wallets such as QRIS, multi-trip and single-trip cards (for KRL), and e-ticketing. In Jakarta, Jaklingko has adopted an integrated payment system across several transport modes, including MRT, LRT, and TransJakarta. To further facilitate first- and last-mile mobility, Jaklingko is also connected with Grab (bike and car services), making it easier for users to travel from home to their destination.

In Bandung, Metro Jabar Trans uses e-money that can be tapped directly on the vehicle's payment machine. Trans Semarang buses use Near Field Communication (NFC) for ticket payments, with balance top-ups available either through bus shelter staff or at banks partnered with the government [26]. TransJateng allows cashless payments using the Indonesian Standard Quick Response Code (QRIS) via mobile banking or digital wallets such as OVO, DANA, GoPay, ShopeePay, and others.

In Yogyakarta, TransJogja tickets can be purchased using e-money and digital wallets like GoPay, although cash payments are still available. Ticket purchases can be made both at the bus stop and on board the bus.

Passengers traveling by rail usually book their tickets through PT KAI's Access by KAI app or via online travel agents such as Traveloka. At certain stations, including MRT stations,

ticket machines have been made physically accessible, with adjustments in height to accommodate wheelchair users.

Developing digital payment systems can greatly assist passengers with disabilities. For users with physical disabilities, these systems simplify access to services and help reduce waiting times at ticket counters. For visually impaired users, the absence of staff near ticket machines can make purchases challenging, and not all machines support screen readers. Applications equipped with screen readers allow visually impaired passengers to buy tickets independently and also reduce payment errors caused by difficulties in identifying cash.

For individuals with hearing or speech challenges, digital ticketing makes travel easier by offering instructions and information in text, which limits the reliance on verbal exchanges.

Challenges and Barriers to Digitalization. Efforts to create and implement digital innovations for inclusive mobility are confronted with multiple challenges. The first challenge is that each transport operator has its own digital platform, and not all of them support screen readers or offer information in audio form. Second, integration across operators remains limited, since each one operates its own separate information system. Third, institutional barriers exist, particularly within local governments. The main barriers to inclusive digitalisation include constrained funding, a lack of ICT staff, and limited coordination across government agencies.

5 Conclusion

Indonesia has made significant progress in developing a more inclusive public transportation ecosystem, supported by a solid national regulatory framework and reinforced by regional policies. While existing regulations clearly mandate accessibility, their implementation varies across regions, resulting in differing user experiences—particularly for passengers with disabilities. Jakarta has made the most progress in implementing inclusive digital services, with achievements in intermodal integration, real-time information provision, and more accessible digital payment systems.

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