

ATM ACCESSIBILITY AND ARTIFICIAL INTELLIGENCE IN INDONESIAN BANKS TOWARD FINANCIAL INCLUSION FOR ALL MODES OF DISABILITY

Mawar Ardiansyah,^a Mutmainah,^b Wahyu Akbar,^c Akhmad Kamil Rizani,^d
Ma Tin Cho Mar^e

^{a,b,c,d} State Islamic University of Palangka Raya, Indonesia, ^eMalaysia University of Science & Technology, Malaysia

e-mail: mawarardiansyah2212@gmail.com,

mutm0447@gmail.com, wahyu.akbar@uin-palangkaraya.ac.id (corresponding author),

akhmadkamilrizani@iain-palangkaraya.ac.id, chomar@must.edu.my

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Abstract

For persons with disabilities, access to ATMs in Indonesia remains far from friendly both physically and technologically, keeping essential financial services out of reach for many. In addition, the use of accessibility technology and Artificial Intelligence (AI) in the banking sector is far from optimal and unable to adequately provide financial inclusion for persons with disabilities. Bank Indonesia plays a leading role in promoting financial inclusion through its policies and regulations. The purpose of this study is to analyse the urgency of implementing accessibility technology for ATMs to support financial inclusion for persons with disabilities in Indonesia, and to explore the role of policy in encouraging its implementation. The research method is qualitative, using a descriptive-analytical approach, and secondary data are collected from relevant literature and analysed using thematic analysis. The results indicate that ATM accessibility, as a prerequisite for financial inclusion, requires a multidimensional approach including regulation, physical access, AI-based technology, services, and collaboration. This study also highlights the need for stricter, mandatory regulatory reform and recommends establishing national technical standards, strengthening inclusive banking services, and collaborating with persons with disabilities.

Keywords: *accessibility technology, artificial intelligence, disabilities, financial inclusion, Indonesian banking.*

I. INTRODUCTION

Accessibility to financial services, particularly automated teller machines (ATMs), is vital to realising inclusivity, especially for persons with disabilities. Persons with disabilities have a right to access financial services without physical or technological barriers,¹ as mandated by Indonesia's Law Number 8 of 2016

¹ Fitri Ana Siregar, "Layanan Jasa Keuangan Perbankan kepada Penyandang Disabilitas di Era Digital Industri 5.0," *Journal of Disability Studies and Research (Jdsr)* 1, no. 2 (2022): 12–22, <https://e-journal.lp2m.uinjambi.ac.id/ojs/index.php/jdsr/article/view/1329>.

concerning Persons with Disabilities.² Globally, more than 15% of the world's population are persons with disabilities,³ and the majority of them face serious obstacles in using digital financial services, including those services at ATMs. These figures make it clear that financial services are not equally accessible to all populations. In fact, one of Bank Indonesia's mandates is financial inclusion. True inclusion is defined as access to financial services that is equitable, fair, and sustainable for all levels of society without exception, including persons with disabilities, through the provision of financial services that are easily accessible, secure, and adaptive to the needs of diverse populations.

Financial inclusion is a condition in which all social strata have equal access to high-quality formal financial services that meet their needs.⁴ The scope of financial inclusion includes access to banking products such as savings, credit, and payments, as well as inclusive digital financial services for all groups of society. Bank Indonesia's financial inclusion mandate plays a crucial role in providing adequate financial services, thereby improving the quality of life of the general population, especially for persons with disabilities.⁵ In reality, however, there are myriad obstacles faced by persons with disabilities in accessing formal financial services, especially in accessing ATM machines.

Persons with disabilities face various obstacles accessing Indonesian ATMs.⁶ These obstacles include the absence of audio guidance on touch screens, machine positions unsuitable for wheelchair users, and the lack of tactile navigation features. In addition, several other obstacles often faced by persons with disabilities include the lack of ATMs with screen reader features, inconsistently raised navigation buttons, limited wheelchair-friendly machine angle, and the absence of barrier-free access. These problems are faced by persons with disabilities nearly everywhere in Indonesia.⁷ According to the Indonesian Financial Services Authority (*Otoritas Jasa Keuangan* or OJK), 80% of persons with disabilities report difficulties in accessing financial services,

² Arie Purnomosidi, "Konsep Perlindungan Hak Konstitusional Penyandang Disabilitas di Indonesia," *Refleksi Hukum: Jurnal Ilmu Hukum* 1, no. 2 (2017): 161, <https://doi.org/10.24246/jrh.2017.v1.i2.p161-174>.

³ "Disability Inclusion," WorldBank.org, 2023, <https://www.worldbank.org/ext/en/topic/social-development/disability-inclusion>.

⁴ Otoritas Jasa Keuangan, "Salinan Surat Edaran Otoritas Jasa Keuangan Nomor 31 /SEOJK.07/2017 Tentang Pelaksanaan Kegiatan dalam Rangka Meningkatkan Inklusi Keuangan di Sektor Jasa Keuangan," Pub. L. No. NOMOR 31 /SEOJK.07/2017 (2017), 2.

⁵ Roberto Akyuwen and Jaka Waskito, *Memahami Inklusi Keuangan* (Sekolah Pascasarjana Universitas Gadjah Mada, 2018), 21, <https://repository.upstegal.ac.id/59/1/buku%20memahami%20inklusi%20keuangan.pdf>.

⁶ Aisyah Maulidatul Haq et al., "Transformasi Digital Perbankan Syariah untuk Penyandang Disabilitas," *J-E-SA Jurnal Ekonomi Syaria'ah* 7, no. 1 (2024): 64–82, <https://doi.org/10.52266/jesa.v7i1.2787>.

⁷ Agus Weda Gunawan, "Ketika ATM Tak Ramah Difabel: Strategi Bertahan di Tengah Ketiadaan Akses," *solidernews.com*, December 10, 2025, <https://solidernews.com/ketika-atm-tak-ramah-difabel-strategi-bertahan-di-tengah-ketiadaan-akses>.

including ATMs.⁸ This confirms the existence of a real gap between the needs of persons with disabilities and the accessibility of financial services.

Previous studies show that accessibility technology for ATMs has been recognised as a clear solution for improving financial inclusion. Providing accessibility technology in ATMs, including Braille displays, voice systems, and easily reachable buttons, would help persons with disabilities access services independently.⁹ Accessibility is no longer limited to providing physical services; it also includes integrating technology that supports ease of use for people with various disabilities.¹⁰ For comparison, several countries have integrated technologies into disability services, such as the United States, which has implemented screen readers. A screen reader is an interface between the computer operating system, its applications, and the user. It provides a Braille display to instruct the speech synthesiser what to say, then speaks automatically when changes occur on the computer screen.¹¹ However, the implementation of this technology in Indonesia remains suboptimal and not yet comprehensively standardised.

On the other hand, the development of digital technology, particularly Artificial Intelligence (AI), offers a significant opportunity to enhance banking inclusivity in ways that are adaptive to user needs. However, studies by Ully Muzakir et al., Sulistyowati et al., and Fanny and Diva show that, to date, the use of AI in the banking sector remains limited to operational and management aspects. Thus, the accessibility aspect for persons with disabilities has not yet become a primary concern. Therefore, there is a gap in the literature on integrating accessibility technology, AI, and financial inclusion for persons with disabilities.

Therefore, this study analyses the urgency of implementing accessibility technology in ATMs to support financial inclusion for persons with disabilities in Indonesia and explores the role of policy in encouraging its implementation. This study argues that implementing accessibility technology in ATMs for all modes of disability would increase financial inclusion for

⁸ Fahmi Ahmad Burhan, “80% Penyandang Disabilitas Tak Bisa Akses Layanan Keuangan, Terhalang Administrasi,” *bisnis.com*, June 15, 2024, <https://finansial.bisnis.com/read/20240615/90/1774309/80-penyandang-disabilitas-tak-bisa-akses-layanan-keuangan-terhalang-administrasi>.

⁹ Daffa Alkafi and Selamat Widodo, “Pemenuhan Hak Aksesibilitas Nasabah Penyandang Disabilitas dalam Pelayanan Perbankan,” *Jurnal Ilmu Sosial dan Humaniora* 4, no. 1 (2024): 1–9, <https://ejournal.amertamedia.co.id/index.php/amerta/article/view/201>.

¹⁰ Bernadete Filyana Putri et al., “Aksesibilitas Fisik bagi Penyandang Disabilitas di Sentra Terpadu Pangudi Luhur Bekasi,” *INNOVATIVE: Journal of Social Science Research* 4, no. 4 (2024): 435–44, <https://j-innovative.org/index.php/Innovative>.

¹¹ “Mengenal Beragam Teknologi Yang Hadir untuk Difabel Netra.” *Republika.id*. September 8, 2023. <https://www.republika.id/posts/45230/mengenal-beragam-teknologi-yang-hadir-untuk-difabel-netra>.

persons with disabilities in Indonesia, in line with Bank Indonesia's objectives of promoting equal access to financial services. This study considers this equal access an obligation of both the government and the financial sector. Given this foundation, financial inclusion is the main objective: ensuring access to financial services for all levels of society without discrimination, while the use of technology, such as AI, is positioned as an instrument that strengthens the quality of accessibility, not as an objective in itself.

This study enriches the study of financial inclusion by placing accessibility technology as a strategic element in banking services, especially for persons with disabilities. In addition, this study offers a policy perspective that can serve as a reference for stakeholders in strengthening regulations and offering financial services that are more friendly to vulnerable, underserved groups. However, this study has limitations due to its reliance on secondary data, so it has not fully captured the direct experiences of persons with disabilities when accessing ATMs. Therefore, future research should use empirical approaches, such as interviews or field studies, to obtain a more comprehensive picture of the effectiveness of accessibility technology implementation in the banking sector. This article is systematically structured, beginning with the introduction, then detailing research methods, results, and discussion, and ending with conclusions and recommendations.

The research method used in this study is qualitative,¹² employing a descriptive-analytical approach and relying on secondary data. The research data were obtained from various relevant sources, including official documents from financial institutions such as Bank Indonesia and the OJK, financial inclusion policy reports, publications from international institutions, and scientific journal articles and books on accessibility technology in ATMs and financial inclusion for persons with disabilities. The publication year range for the sources used is limited to 2016–2026. Sources were selected based on topic relevance, publisher credibility (indexed journals, official institutions, or academic publishers), and the substance of the discussion, which was directly related to accessibility technology and financial inclusion for persons with disabilities. Sources that lacked direct relevance or failed to meet academic standards were excluded from the analysis.

The data were analysed using thematic analysis, in which information was classified into themes, such as the urgency of accessibility technology, challenges faced by persons with disabilities in using ATM services, and the potential impact on financial inclusion policies. This approach identifies gaps in existing policies and provides literature-based recommendations for

¹² Abdul Fattah Nasution, *Metode Penelitian Kualitatif* (CV. Harfa Creative, 2023), 144.

integrating accessibility technology into ATMs as part of a broader effort to improve financial inclusion for Indonesians with disabilities.

II. THE IMPORTANCE OF FINANCIAL INCLUSION FOR PERSONS WITH DISABILITIES AND THE ROLE OF BANK INDONESIA IN PROMOTING FINANCIAL INCLUSION

Financial inclusion is one pillar for creating social and economic justice, especially for vulnerable groups such as persons with disabilities. According to Law Number 8 of 2016 of the Republic of Indonesia concerning Persons with Disabilities (the Disabilities Law), persons with disabilities include every individual who experiences physical, intellectual, mental, and/or sensory limitations over an extended period, who, in interacting with the environment, may experience obstacles and difficulties in exercising their equal rights to participate fully and effectively with other citizens based on equal rights.¹³ The explanation of the types of persons with disabilities referred to is as follows:¹⁴

1. Persons with Physical Disabilities, namely the impairment of movement function. These conditions include amputation, flaccid or rigid paralysis, paraplegia, cerebral palsy, effects of a stroke, effects of leprosy, and dwarfism. The definition also includes muscular dystrophy and other chronic conditions. Persons with physical disabilities face obstacles in accessing and using ATM facilities; therefore, user-friendly machine design is required, including easily reachable and easy-to-use controls and adequate space for ingress/egress and movement.
2. Persons with Intellectual Disabilities, namely the impairment of cognitive function due to below-average intelligence levels, including slow learners, intellectual disability, and Down Syndrome. Persons with intellectual disabilities face difficulties understanding instructions and transaction flows; the required solutions include simplifying displays, using easy-to-understand language, and providing clear visual symbols.
3. Persons with Mental Disabilities, namely the impairment of cognitive, emotional, and behavioural functions, including a) psychosocial conditions such as schizophrenia, bipolar disorder, depression, anxiety, and personality disorders; and b) developmental disabilities that affect social interaction, such as autism and hyperactivity. In persons with mental disabilities, the obstacles that arise are more psychological, including anxiety and

¹³ Republic of Indonesia, Law No. 8 of 2016 on Persons with Disabilities (2016).

¹⁴ Otoritas Jasa Keuangan, *Pedoman Akses Pelayanan Keuangan Untuk Disabilitas Berdaya (Pedoman SETARA)*, 2024, [https://ojk.go.id/id/Publikasi/Roadmap-dan-Pedoman/Perilaku-Pelaku-USaha-Jasa-Kuangan/Pages/Pedoman-Akses-Pelayanan-Kuangan-untuk-Disabilitas-Berdaya-\(SETARA\).aspx](https://ojk.go.id/id/Publikasi/Roadmap-dan-Pedoman/Perilaku-Pelaku-USaha-Jasa-Kuangan/Pages/Pedoman-Akses-Pelayanan-Kuangan-untuk-Disabilitas-Berdaya-(SETARA).aspx).

discomfort during transactions. ATMs need to be designed with non-complex displays, clear instructions, and low-pressure transaction limits and durations.

4. Persons with Sensory Disabilities, namely, the impairment of one or more sensory functions. These conditions include, among others, visual impairment (severe low vision or total blindness), hearing impairment (hard of hearing or total deafness), speech impairment, and/or the inability to feel or interpret certain stimuli. Persons with sensory disabilities face visual, auditory, and/or communicative limitations; therefore, features such as audio, Braille, clear visual displays, and technological support such as AI are needed to assist this group.
5. Persons with Multiple Disabilities are persons with two or more types of disabilities, for example, hearing-speech disabilities and deaf-blindness. Persons with multiple disabilities face more complex obstacles because they combine various types of disabilities; therefore, the integration of accessibility features across a single service system is required.

Table 1.
ATM Accessibility in Supporting Financial Inclusion

Type of Disability	Limitations	Financial Inclusion Solutions (ATM)
Physical Disability	Impairment of mobility, making it difficult to access and use ATM facilities.	ATM design that is easily reachable, adequate space for movement, appropriate machine position, and easy-to-use controls
Intellectual Disability	Difficulty in understanding instructions and transaction flow	Simple display, easy-to-understand language, and the use of clear visual symbols
Mental Disability	Anxiety and discomfort during transactions	Non-complex display, clear instructions, and flexible and non-pressuring transaction time
Sensory Disability	Limitations in seeing, hearing, or communicating	Audio features, Braille, clear visual display, as well as technological support such as AI
Multiple Disabilities	Layered barriers due to a combination of several disabilities	Integration of various accessibility features in one adaptive ATM service system

Source: processed by the researcher, 2026

Based on the table, ATM accessibility plays an important role in supporting financial inclusion for persons with disabilities with diverse needs. Each type of disability faces different obstacles in accessing banking services; specific and adaptive solutions are required.

Persons with physical disabilities have limited mobility and motor function, making it difficult to access and use ATMs. To overcome this, ATM designs that are easily accessible, provide adequate space for movement, have an appropriate machine position, and feature easy-to-use controls are required. This has actually been addressed and implemented by several banks in

Indonesia, one of which is Bank BNI, which has designed ATMs specifically for persons with physical disabilities, such as providing special wheelchair access to ATMs, non-skid flooring surfaces to prevent slipping for wheelchair users, and ATM machine designs that are lower to the ground compared to standard ATMs.¹⁵

For persons with intellectual disabilities, the primary obstacle is difficulty understanding instructions and transaction flows; therefore, ATMs with simple displays, easy-to-understand language, and clear visual symbols are required. This obstacle can be overcome by banking policies that allow such customers to bring a specially trained companion.

Persons with mental disabilities face the obstacle of anxiety and discomfort during transactions. ATMs with simple displays, clear instructions, and flexible, low-pressure transaction times can address these obstacles. This remains a challenge for banking institutions because some ATMs still impose security-related transaction time limits on cash withdrawals, leading to issues such as ATM cards being swallowed or ejected from the machines. For example, in recent years in Argentina, ATMs have been designed that require users to insert the card into a slot, reducing the risk of the card being swallowed and allowing it to be withdrawn at any time during the transaction process. In addition, ATMs provide visual reminders in the form of messages, such as “do not forget your card,” displayed in blinking text when transactions are concluded.¹⁶ This innovation not only increases safety and comfort but can also serve as an alternative solution in supporting financial inclusion, especially for persons with mental disabilities who require more time and less pressure.

For persons with sensory disabilities, the obstacles include limited vision, hearing, or communication; therefore, ATM designs with audio features, Braille, clear visual displays, and technological support such as AI are required. Several banks in Indonesia, including BCA, BNI, and BSI, have implemented this by committing to providing various disability-friendly facilities, ranging from wheelchair ramps to ATMs with Braille.¹⁷ However, although some ATMs already provide Braille, another obstacle is the unavailability of an audio jack or headset, which certainly affects blind users with hearing impairments who require sound interpretation; this can again create difficulties for deaf individuals.

¹⁵ Mohar Syarif, “Tingkatkan Inklusi Keuangan Kalangan Disabilitas, BNI Perkuat Sosialisasi,” *neraca.co.id*, 2023, <https://www.neraca.co.id/article/184515/tingkatkan-inklusi-keuangan-kalangan-disabilitas-bni-perkuat-sosialisasi>.

¹⁶ Juan Lanus, “Why Do ATMs Need to Take Your Card in?,” *stackexchange.com*, 2013, <https://ux.stackexchange.com/questions/40114/why-do-atms-need-to-take-your-card-in>.

¹⁷ Fitriana Dwi Rahmawati, “BSI Perkuat Komitmen Layanan Ramah Difabel Nasional,” *berita.rii.co.id*, 2025, <https://berita.rii.co.id/banjarmasin/regional/2020300/bsi-perkuat-komitmen-layanan-ramah-difabel-nasional>.

Individuals with multiple disabilities experience layered barriers due to a combination of several disabilities; therefore, the integration of various accessibility features into a single adaptive ATM accessibility system is required. This condition requires banking institutions to further improve ATM systems that can combine multiple features, rather than addressing only one category of disability. This integration is very important to meeting the more complex needs of persons with multiple disabilities, so that financial inclusion can be more evenly distributed across all groups. This is certainly in line with the concepts of inclusive design and universal access, which emphasise that public services must be usable by all individuals with various ability conditions.¹⁸

The rights of persons with disabilities are enumerated in Article 18 of the Disabilities Law, which guarantees the right to reasonable accommodation in both public and private spaces. In practice, however, persons with disabilities continue to face significant obstacles in accessing formal financial services for reasons ranging from limited disabled-friendly facilities to a lack of understanding of financial products. ATMs, in general, are not accessible, though in some cases, bank security officers provide assistance. Communication accessibility is an important aspect of inclusive public services, but there is a need for more sign language training and increased awareness of inclusive programs and initiatives. Sometimes, inclusive programs may be developed but not advertised, so persons with disabilities are not aware of their existence.¹⁹

Affordability can also pose a barrier to accessing financial services. Financial inclusion is the effort to increase public access to financial services by eliminating all forms of barriers, both price and non-price. Providing access to affordable financial services and products for the poor directly enables them to participate and become agents of economic growth, thereby reducing poverty.²⁰

As the highest financial institution in Indonesia, Bank Indonesia bears the responsibility to ensure comprehensive financial inclusion. One of Bank Indonesia's main initiatives is to ensure that financial policies and regulations are not only friendly to the majority but also inclusive of marginalised groups, including those with disabilities. This step can be achieved through a regulatory framework that encourages financial institutions to develop inclusive products

¹⁸ Hans Persson et al., "Universal Design, Inclusive Design, Accessible Design, Design for All: Different Concepts--One Goal ? On the Concept of Accessibility--Historical, Methodological and Philosophical Aspects," *Universal Access in the Information Society* 14 (2015): 501-26, <https://doi.org/10.1007/s10209-014-0358-z>.

¹⁹ GDI Hub, "Desain Inklusif dan Aksesibilitas Lingkungan Binaan di Solo, Indonesia," 2022, 1-124, www.AT2030.org.

²⁰ Habibullah, "Inklusi Keuangan dan Penurunan Kemiskinan: Studi Penyaluran Bantuan Sosial Non Tunai," *Sosio Informa* 5, no. 1 (2019): 38-50, <https://doi.org/10.33007/inf.v5i1.1657>.

and services. In addition, Fuady states that in terms of banking regulatory mechanisms, every citizen has the right and obligation to receive equal, non-discriminatory banking services regardless of physical condition.²¹ Thus, every citizen, especially persons with disabilities, can take advantage of financial services, particularly personal banking.

As businesses, banks are obliged to treat consumers without discrimination. Under Financial Services Authority Regulation Number 6/POJK.07/2022 concerning Consumer Protection in the Financial Services Sector (POJK), financial services businesses (PUJK), including but not limited to banks, are prohibited from discriminatory treatment of consumers.²² Article 6, paragraph (1), of the POJK requires banks, as PUJK to promulgate written consumer protection policies and procedures. These written policies and procedures include ensuring equal access for all consumers and providing special services for customers with disabilities and elderly customers.

As stated in Article 35, paragraph (2) of the POJK, special services for consumers with disabilities and the elderly include:

- a. providing forms using Braille;
- b. providing application features that consider persons with disabilities;
- c. providing ramps;
- d. creating priority queues for persons with disabilities and the elderly;
- e. providing trained staff to serve persons with disabilities and the elderly;
- f. making ATMS available specifically for persons with disabilities; or
- g. providing media that consider consumers with disabilities, making it easier for persons with disabilities and the elderly to obtain products and/or services

The existing body of literature shows that not all banks in Indonesia have ATMs specifically designed for people with disabilities. This limitation creates challenges for achieving true financial inclusion, as accessibility is a key element in ensuring that every individual, including persons with disabilities, can access financial services.

Bank Indonesia, as the central bank and stakeholder, plays a strategic role in encouraging broader and more equitable financial inclusion. One step Bank Indonesia can take is to strengthen regulations and policies, requiring all banks to provide facilities that are accessible to persons with disabilities, including ATMs equipped with accessibility features. Such regulations find a legal basis

²¹ Siregar, "Layanan Jasa Keuangan."

²² Otoritas Jasa Keuangan, "Peraturan Otoritas Jasa Keuangan Republik Indonesia Nomor 6 / Pojk.07/2022 Tentang Perlindungan Konsumen dan Masyarakat di Sektor Jasa Keuangan," 2022, 88–100, <https://ojk.go.id/id/berita-dan-kegiatan/siaran-pers/Pages/Peluncuran-Roadmap-Fintech-P2P-Lending-2023-2028.aspx%0Ahttps://www.neliti.com/id/publications/218225/kemajuan-teknologi-informasi-dan-komunikasi-dalam-industri-media-di-indonesia%0Ahttp://leip.or>

in the Disabilities Law.²³ With such regulations, Bank Indonesia can ensure that every customer, regardless of physical condition, has equal access to financial services. The inclusivity of ATMs can also affect customer preferences, especially among people with disabilities, who tend to choose banks that are more attentive to their needs. This can shift interest toward certain banks, which in turn can affect competition in the banking industry. By encouraging all banks to prioritise financial inclusion for persons with disabilities, Bank Indonesia can help create a more equitable financial ecosystem while also promoting the competitiveness of the national banking sector.

In addition, Bank Indonesia also collaborates with the government, the private sector, and civil society organisations to improve financial literacy among persons with disabilities. This literacy program is designed to provide a basic understanding of the importance of financial management, the use of financial products, and how to access available services. This program also aims to raise awareness among institutions about the importance of involving persons with disabilities in the financial ecosystem. Bank Indonesia does not stop at education; it also encourages innovation in financial products that meet the specific needs of persons with disabilities. For example, commercial banks are encouraged to provide supporting services such as Braille facilities in ATMs, companion officers at bank branches, and inclusive customer service. In addition, Bank Indonesia provides incentives to financial institutions that demonstrate a strong commitment to financial inclusion.

Financial inclusion is a fundamental right of all members of society, including persons with disabilities. By providing access to financial services, persons with disabilities can be empowered to become more economically and socially independent. Bank Indonesia, as the main driver of Indonesia's financial system, plays a strategic role in ensuring that no segment of society is excluded from the financial ecosystem. Bank Indonesia promotes financial inclusion, improving the efficiency of financial transactions across all levels of society, including in remote areas.²⁴ Through policies, innovation, and cross-sector collaboration, Bank Indonesia strives to create an inclusive, sustainable financial system that supports equitable development for all levels of society.

²³ Akhmad Kamil Rizani et al., "The Politics of Disability Law in Indonesia: Transformation to Strengthen the Rights of Persons with Disabilities," *Al-Danla: Jurnal Hukum dan Perundangan Islam* 14, no. 2 (2024): 246–80, <https://doi.org/10.15642/ad.2024.14.2.246-280>.

²⁴ Nur Riadiah Rangkuti and Muhammad Irwan Padli Nasution, "Peran Bank Indonesia dalam Pengembangan Transaksi Keuangan Digital," *Jurnal Akademik Ekonomi dan Manajemen* 1, no. 4 (2024): 9–17, <https://doi.org/10.61722/jaem.v1i4.3108>.

III. THE URGENCY OF INTEGRATING AI INTO ACCESSIBILITY TECHNOLOGY AT ATMS FOR ALL MODES OF DISABILITY

The term ATM itself is meaningful in that it demonstrates the intent to serve all customers.²⁵ The mere presence of ATMs is a structural prerequisite for providing access to services for all communities, including persons with disabilities. ATM accessibility is not, however, simply about increasing the number of machines.²⁶ Accessibility includes customers' ability to access, use, and complete transactions easily, safely, and comfortably, supported by strategic locations, adequate physical design, and user-friendly interfaces. For persons with disabilities, such accommodations are not easy to obtain. In practice, persons with disabilities experience obstacles when using ATMs, including physical access, interfaces, and supporting features. Persons with physical disabilities often have difficulty reaching machines or using buttons, while persons with sensory disabilities face limitations in Braille, audio guidance, or other adaptive features. Individuals with intellectual and mental disabilities are constrained by complex instructions and limited transaction times. This shows that increasing the number of ATMs alone is not sufficient; machines must be designed inclusively and adaptively to meet diverse user needs.²⁷

One of the main challenges in realising financial inclusion for persons with disabilities is the inability of conventional ATMs to accommodate the diverse needs of users. Integrating AI is a strategic solution that increases the adaptability and responsiveness of ATMs to various types of disabilities, for example, through personalised automatic audio guidance, intelligent tactile interfaces, and transaction personalisation options. The AI-based approach ensures that inclusive ATMs serve not only one group of persons with disabilities, but also all types of disabilities, including physical, sensory, mental, intellectual, and multiple disabilities. The principle of universal design serves as an important foundation for designing ATM interfaces, enabling every user to access services without barriers and minimising the digital divide. Biometric and AI-based ATM systems that adopt universal design principles such as adjustable screen height, Braille keypads, and audio output ensure equal access to banking services for all users. In addition, AI provides multimodal interaction through voice, tactile, and visual channels, so that if one channel cannot be used, alternative channels still maintain transaction comfort and

²⁵ Didik Eko Rusmanto et al., "Sistem Monitoring Penjadwalan Pengisian Anjungan Tunai Mandiri (ATM) dengan Pendekatan User Centered Design dan Kano di PT.XYZ Jakarta," *Jurnal Sistem Informasi Dan Sains Teknologi* 4, no. 2 (2022): 2, <https://doi.org/10.31326/sistek.v4i2.1269>.

²⁶ Sofiana Zahara Lubis et al., "Analisis Pengaruh Penambahan ATM Bank Syariah Indonesia (BSI) dan Kemudahan Akses terhadap Kepuasan Nasabah," *NISBAH: Jurnal Perbankan Syariah* 11, no. 1 (2025): 89, <https://doi.org/10.30997/jn.v11i1.19784>.

²⁷ Alkafi and Widodo, "Pemenuhan Hak Aksesibilitas."

security; for example, haptic systems convey important information through vibration, allowing users to transact independently without external assistance. Furthermore, AI enables ATMs to learn each individual's preferences and constraints, transforming static machines into responsive personal assistants and aligning with inclusive service, thereby making financial services more inclusive, independent, and comfortable for all persons with disabilities.

The AI-based approach ensures that inclusive ATMs are not for one group alone, but serve all types of disabilities (physical, sensory, mental, intellectual). The principle of universal design serves as an important foundation: designing interfaces that can be accessed by all users will bridge the digital divide for people with disabilities. Sriperumbudur emphasises that implementing universal design in ATM interfaces can reach thousands of underserved individuals at once.

Inclusive universal design, biometric and AI-based ATM systems combined with universal design principles (such as adjustable screen height, Braille keypads, and audio output) ensure that all users, including persons with physical, sensory, mental, and intellectual disabilities, can access banking services equally. Safe and independent multimodal interaction: AI provides multiple channels (voice, tactile, visual) so that if one channel cannot be used (e.g., in noisy environments), others serve as alternatives. This maintains transaction security and comfort. For example, haptic systems ensure that important information is still conveyed privately through vibration, allowing users to transact independently without relying on external assistance. AI supports inclusive services: by utilising AI, ATMs would no longer be static or serve only one type of user. Intelligent AI-powered machines could learn the preferences and constraints of each individual. This aligns with the concept of inclusive service, where services adapt to users' real needs. As mentioned, AI could transform ATMs into responsive personal assistants, making financial services more inclusive, independent, and comfortable for all people with disabilities.²⁸

²⁸ Muni Chandra Sriperumbudur, "Bridging the Digital Divide: An Accessible ATM Interface Featuring Braille Keypad, Audio Guidance System, and Height-Adjustable Screen for Universal Financial Access," *Journal of Computer Science and Technology Studies* 7, no. 7 (2025): 939–40, <https://doi.org/10.32996/jcsts.2025.7.7.103>.

IV. CHALLENGES AND SOLUTIONS IN THE IMPLEMENTATION OF ACCESSIBILITY TECHNOLOGY IN ATMS AND FUTURE STEPS TO REALISE EQUITABLE FINANCIAL ACCESS FOR ALL PERSONS WITH DISABILITIES

Disabled-friendly, ATM-based inclusive finance is a concrete step toward ensuring equal rights to financial services for all members of society, including persons with disabilities. Although this concept is not new, many countries, both developed and developing, are focused on implementing disabled-friendly ATMs. Through inclusive financial services, persons with disabilities can enjoy equal access to banking services, reduce social inequality, and support their participation in the economy. An analysis of five countries, Hong Kong, Malaysia, Jordan, Singapore, and the United States, shows how each country designs policies and implements disability friendly services, each having unique characteristics.

Hong Kong has shown a strong commitment to inclusive finance. Guidelines developed by the Hong Kong Association of Banks (HKAB) ensure that disability-friendly banking facilities are available at bank branches. These facilities include help call buttons, ramps that meet international standards, low service counters, and hearing assistance systems to accommodate users with hearing impairments. In addition, banks in Hong Kong provide information in Braille and large print, allowing visually impaired users to easily understand information necessary to access banking services.²⁹ Another interesting aspect of Hong Kong's accessible banking services is that guide dogs are allowed to enter bank branches, reflecting a high level of inclusivity awareness. Renovations of bank branches also include additional safety features, such as non-skid stair treads, demonstrating attention to the detailed needs of persons with disabilities. This approach illustrates Hong Kong's efforts to create a truly barrier-free banking environment.³⁰

In Malaysia, the central bank, Bank Negara Malaysia (BNM), has taken major steps to create a more inclusive banking environment. Various physical facilities, such as ramps, elevators with Braille buttons, special toilets, designated parking spaces, low counters, and wheelchair availability, have become standard in many banks.³¹ Bank websites in Malaysia have also been developed to be more

²⁹ The Hong Kong Association of Banks, "Second Edition of Practical Guideline on Barrier-Free Banking Services January 2026," 2026, [https://www.hkab.org.hk/files/record/financial-inclusion/1/\(Eng\)_Practical_Guideline_on_Barrier-Free_Banking_Service_2.0-1768960742.pdf](https://www.hkab.org.hk/files/record/financial-inclusion/1/(Eng)_Practical_Guideline_on_Barrier-Free_Banking_Service_2.0-1768960742.pdf).

³⁰ Asyifa Ar'rifqu Hamka Putri and Abdul Halim, "Kebijakan Hukum terhadap Hak-Hak Disabilitas dalam Layanan Jasa Keuangan di Indonesia," *Almaslahab: Jurnal Hukum Islam dan Pranata Sosial Islam*, 2023, 249–72, <https://jurnal.staialhidayahbogor.ac.id/index.php/am/article/view/3474>.

³¹ Abu Hassan Alshari Yahaya, "Encik Abu Hassan Alshari Yahaya: Towards a More Inclusive Financial System," Bank for International Settlements, June 3, 2015, 1, <https://www.bis.org/review/r150603f.pdf>.

friendly to those with disabilities, enabling easier digital access for all users. Malaysia still faces several challenges, however, including limited availability of sign language interpreters and a lack of financial products specifically designed for persons with disabilities. There is widespread encouragement to meet global standards, including those set by the World Wide Web Consortium (W3C).³²

Meanwhile, the Hashemite Kingdom of Jordan took a systematic approach in 2018 by introducing financial consumer protection guidelines. These guidelines require banks with more than ten branches to provide accessibility in at least 10% of their branches. Required facilities include ramps, talking ATMs with Braille keyboards, low service counters, and digital services such as internet and mobile banking. In addition, banks in Jordan are required to provide publications in Braille format, videos with sign language, and text relay services for communication with deaf customers. This policy reflects the country's commitment to meeting the needs of persons with disabilities, taking a clear, measurable approach that creates more inclusive financial services for all segments of society.³³

In Singapore, a survey by the Disabled People's Association (DPA) in 2013 revealed that the majority of persons with disabilities still faced barriers in accessing banking services. Therefore, various improvements have been implemented, including the installation of Braille on bank tokens, automatic voice guidance on ATMs, and low counters for customer services. Training bank staff to serve people with disabilities is also a top priority to ensure they can provide friendly, efficient service. In addition, text-based or email communications, alternative authentication for users with physical limitations, and regular dialogue between banks and disability communities are key to building more inclusive and responsive banking services.³⁴

The United States is a pioneer in requiring accommodations for disabled persons, setting high standards through the Americans with Disabilities Act (ADA). This law requires banks to provide safe access routes to service areas, ATMs accessible to wheelchair users, and other facilities, such as inclusive lobbies. The main principle of the ADA is to eliminate discrimination in access to public services, including banking services. Therefore, banks in the United States have actively adopted new technologies and modern facilities to ensure comfort and ease of access for all customers, including persons with disabilities. This approach reflects how strong regulation can drive innovation and inclusivity in the financial sector.³⁵

³² Putri and Halim, "Kebijakan Hukum terhadap Hak-Hak Disabilitas."

³³ Putri and Halim, "Kebijakan Hukum terhadap Hak-Hak Disabilitas."

³⁴ Putri and Halim, "Kebijakan Hukum terhadap Hak-Hak Disabilitas."

³⁵ Putri and Halim, "Kebijakan Hukum terhadap Hak-Hak Disabilitas."

To better understand best practices for inclusive financial services based on disability-friendly ATM services, an analytical framework is needed to map the various approaches used across countries. A comparative analysis of Hong Kong, Malaysia, Jordan, Singapore, and the United States shows that true inclusivity cannot be implemented piecemeal but rather must be promulgated systematically and methodically. Each country exhibits distinct policy characteristics and strategies, yet has similar objectives, namely ensuring equal access to financial services for persons with disabilities. This pattern can be referred to as the Multidimensional Integrative Pattern of Inclusive Finance, as shown in the following table:

Table 2.
Multidimensional Integrative Pattern of Inclusive Finance

No	Approach Pattern	Implementing Countries	Main Characteristics	Form of Implementation	Analytical Meaning
1	Regulatory-Driven Pattern	United States, Jordan, Hong Kong	Based on formal rules or official guidelines	ADA (US), 10% branch access policy (Jordan), HKAB guidelines (Hong Kong)	Inclusivity is built through binding legal structures
2	Physical Accessibility Pattern	All countries	Focus on basic physical access	Ramps, elevators, low counters, special parking, accessible ATMs	Initial stage of inclusion: removing physical barriers
3	Assistive Technology Pattern	Malaysia, Jordan, Singapore, US	Utilisation of technology for service access	Talking ATMs, audio guidance, Braille keyboards, accessible digital services	Encouraging independence of users with disabilities
4	Service and Human Approach Pattern	Singapore, Hong Kong	Emphasises service quality and human resources	Staff training, assistance services, alternative communication	Inclusion as a humane service experience
5	Collaborative and Ecosystem Pattern	Singapore, Hong Kong	Involves various stakeholders and communities	Dialogue with Inclusion as a participatory and adaptive process disability communities, needs surveys, role of associations	Inclusion as a participatory and adaptive process

Source: processed by the researcher, 2026

Unlike these countries, Indonesia is still in the early stages of developing inclusive financial services. Relevant regulations have been issued by the OJK, including POJK No. 76/POJK.07/2016 and POJK No. 6/POJK.07/2022. These regulations recommend wheelchair access ramps, low service counters,

Braille services, biometric identification systems, and alternative signatures for persons with disabilities. However, implementation of these accommodations remains voluntary, resulting in uneven accessibility to financial services in Indonesia. Some banks have already implemented accessibility initiatives, but gaps in meeting global standards are still evident. Indonesia still needs stricter, mandatory policies to ensure that all banks provide inclusive, disabled-friendly services.

The OJK, through the Guidelines for Financial Service Accessibility for Empowered Persons with Disabilities (SETARA), provides a strategic foundation for promoting financial inclusion for persons with disabilities, covering all aspects of physical, digital, and documentation accessibility.³⁶ The SETARA Guidelines consist of several sections, each designed to support the multiple stages for implementing disability inclusion in financial services. The first section, the Overview, explains the benefits of and urgent need for inclusive financial services for persons with disabilities, including recent data, challenges, best practices, and the economic development potential of increased financial inclusion. The Implementation Framework section outlines a step-by-step approach, from building commitment to applying accessibility and making appropriate investments. The Practical Guide or Toolkit section provides technical steps, accessibility feature guidelines, universal design implementation guidelines, and contact information for disability organisations to enhance participation. This section also serves as a quick reference for financial service providers in field implementation. Furthermore, the Self-Assessment section helps financial service providers realise disability inclusion implementation through key performance indicators across the financial services sector. OJK expects the SETARA Guidelines to accelerate the achievement of the National Financial Literacy Movement (GENCARKAN) target by 2025 by increasing financial product usage by 30% among persons with disabilities, as well as supporting the achievement of a national financial inclusion index of 98% in Indonesia Emas 2045.³⁷

The SETARA Guidelines launched by the OJK provide comprehensive guidance for Financial Sector Business Actors in implementing disability inclusion,³⁸ including accessibility in ATMs. In these guidelines, one emphasised aspect is physical infrastructure accessibility, including disabled-friendly ATM design, such as voice features for the visually impaired, Braille displays, and

³⁶ “OJK Luncurkan Pedoman Setara bagi Difabel,” *Metrotvnews.com* December 7, 2024, <https://www.metrotvnews.com/play/NleCpZ5r-ojk-luncurkan-pedoman-setara-bagi-difabel>.

³⁷ Hari Widowati, “OJK Terbitkan Pedoman Akses Pelayanan Keuangan untuk Disabilitas Berdaya,” *katadata.co.id*, December 6, 2024, <https://katadata.co.id/finansial/keuangan/6752fe01f2270/ojk-terbitkan-pedoman-akses-pelayanan-keuangan-untuk-disabilitas-berdaya>.

³⁸ Ototitas Jasa Keuangan, *Pedoman SETARA*.

user-friendly interfaces. Under these guidelines, financial services providers are expected to ensure that all banking facilities, including ATMs, are easily accessible to persons with disabilities, providing equal opportunities for them to conduct financial transactions independently and inclusively. This aligns with the main objective of the SETARA Guidelines: ensuring equal financial access for all segments of society, including persons with disabilities.

The concept of SETARA is a comprehensive approach to realising a system for inclusive financial services through the integration of several main elements, namely accessible facilities in the form of SETARA ATMs, featuring voice guidance, Braille tactile controls, wheelchair friendly design, and high-contrast graphical user interfaces. Empathy and understanding can be realised through increased awareness and training of banking staff to better serve persons with disabilities with sensitivity and dignity. Inclusive technology, such as screen readers and mobile applications that accommodate disabled persons' needs, facilitates access to services; service accessibility is ensured by providing disability-friendly ATMs in strategic locations to encourage independent transactions. Education is provided through financial literacy and technology-use training so that persons with disabilities can manage their finances independently. This also includes active participation, namely the involvement of persons with disabilities in the development and evaluation of financial services, ensuring that the resulting solutions truly match their needs.

ATM cards, according to the SETARA guidelines, must be equipped with leading edges and/or tactile features, which are an important accommodation that facilitates use by consumers with visual impairments, and are supported by accessible building infrastructure, both inside buildings and in minimarkets and special kiosks. This infrastructure includes: the availability of safe, independently usable ramps; easy-to-open doors with an adequate width (minimum 90 cm); sufficient space for wheelchair mobility (approximately 2x2 square meters); flat, obstacle-free pathways; non-skid floors without thick carpeting; and adequate lighting, including screen protection from glare. In addition, ATM design must accommodate various types of disabilities, such as machine height that is friendly for wheelchair users with a minimum empty space of 75 cm under the screen, sufficient button placement, flexible transaction time features, the presence of talking ATMs with specific instructions and audio jacks, universal button layouts with Braille symbols and raised markers, as well as screen displays with clear colour contrast and readable font sizes in accordance with Web Content Accessibility Guidelines (WCAG).³⁹

³⁹ Otoritas Jasa Keuangan, *Pedoman SETARA*.

However, implementing the SETARA Guidelines for ATM accessibility for persons with disabilities is not necessarily smooth. Various challenges are faced in realising this innovation. One of the main challenges in implementing accessibility technology in ATMs is the lack of disabled-friendly infrastructure.⁴⁰ Although efforts are underway to make ATMs more inclusive, not all financial service providers have ATMs with features accessible to persons with disabilities.⁴¹ This is in addition to the main obstacle: the absence of integrated, uniform regulatory standards across all banks. Although normatively there are various regulations, such as the Disability Law, POJK Number 6/POJK.07/2022 concerning Consumer Protection in the Financial Services Sector, and Law Number 4 of 2023 concerning Financial Sector Development and Strengthening, practices in the field still largely depend on the internal policies of each bank, resulting in uneven levels of service accessibility.⁴²

Implementing the SETARA Guidelines for ATM accessibility for persons with disabilities in Indonesia requires an approach that is not only normative but also operational and transformative. Through the Multidimensional Integrative Pattern of Inclusive Finance, derived from integrating global approaches, there are five steps (patterns) for realising the SETARA Guidelines inclusively. In the regulatory-driven pattern framework, theoretical realisation is grounded in the principles of equality before service and distributive justice, which require that access to financial services be guaranteed equally through binding legal instruments. In practice, this requires the Financial Services Authority to establish national ATM accessibility standards that must be implemented by all banks in Indonesia, accompanied by compliance indicators, periodic audits, and administrative sanctions. Banks should no longer be allowed to treat accessibility as optional; it must be part of basic service obligations. This approach must be integrated with the physical accessibility pattern, which is theoretically based on the concept of universal design: designing environments that can be used by all people without requiring additional adaptation. In practice, banks in Indonesia need to ensure ATM designs that are wheelchair-friendly, have safe access paths, tactile buttons, high-contrast screens, and ergonomic layouts. This implementation must begin at the planning stage, not as an adjustment after services are already running.

⁴⁰ Windy Nur Fitriani, “Tinjauan Siyasa Dusturiyah terhadap Pemenuhan Hak Hukum Aksesibilitas Bagi Penyandang Disabilitas Berdasarkan Pasal 37 dan 38 Peraturan Daerah Kota Bandung Nomor 15 Tahun 2019” (PhD Dissertation, UIN Sunan Gunung Djati Bandung, 2024).

⁴¹ Khairunnisa Etika Sari, “Aksesibilitas Masa Pandemi Covid-19 bagi Difabel Netra di Perpustakaan Mardi Wuto Yogyakarta,” *Jurnal Adabiyat* 22, no. 2 (2020): 15, <https://doi.org/10.22373/adabiya.v22i2.8137>.

⁴² Dewi Atriani and Anisa Yustikaningtiyas, “Pemenuhan Hak Aksesibilitas Pelayanan Jasa Perbankan bagi Penyandang Disabilitas Tunanetra dalam Membuka Rekening Bank di Yogyakarta,” *Jurnal Hukum Bisnis* 12, no. 3 (2023): 168–80, <https://doi.org/10.47709/jhb.v12i03.3291>.

The third pattern, the assistive technology pattern, is theoretically grounded in the inclusive innovation approach, in which technology is developed to address access limitations and increase user independence. In practice, banks in Indonesia can integrate AI into ATMs and digital services through features such as voice guidance, voice recognition, automatic screen reading, and multimodal interfaces that adapt to various types of disabilities. This technological innovation must be balanced with a service and human-approach pattern, which theoretically refers to the concept of human-centred service, namely services that place user experience and needs as the core. In practice, banks need to conduct intensive training for frontliners regarding disability service ethics, alternative communication, and non-discriminatory assistance procedures. At a broader level, the collaborative and ecosystem pattern becomes an integrative approach, theoretically grounded in the concepts of co-creation and participatory governance. Its implementation in Indonesian banks can be achieved through partnerships with disability communities in service design processes, accessibility testing, and periodic policy evaluation. This cooperation among regulators, the banking industry, and society is key to ensuring that SETARA does not remain a policy framework but develops into a financial service system that is adaptive, responsive, and socially just.

The implementation of inclusive finance through disability-friendly ATM services cannot be achieved by a single factor alone; it requires the integration of robust regulation, adequate infrastructure, technology, service quality, and multi-stakeholder collaboration. In Indonesia, the application of the SETARA Guidelines is relevant when the Multidimensional Integrative Pattern of Inclusive Finance is not only understood conceptually but also implemented simultaneously and consistently through cooperation between the OJK and Bank Indonesia as the main authorities, supported by the commitment of the banking industry and the active participation of disability communities.

V. CONCLUDING REMARKS

ATM accessibility is a structural prerequisite for financial inclusion, which can only be realised through a multidimensional integrative inclusive pattern that includes five main dimensions: regulatory-driven, physical accessibility, assistive technology based on AI, service and human approach, and collaborative ecosystem. In this pattern, AI serves as a key enabler, enhancing accessibility and making ATM services adaptive and responsive to various types of disabilities, including automatic audio guidance, intelligent tactile interfaces, transaction personalisation, and the ability to accommodate individual user preferences. The use of AI in ATMs enables adaptive services for people

with various types of disabilities. Accessibility is a systemic obligation that binds the entire banking ecosystem and becomes an operational standard integrated into the formulation of regulations, technological design, and financial service practices for persons with disabilities. The legal framework in Indonesia must be immediately transformed from a weak, compliance-based approach to a firm, binding, mandatory regulatory framework by establishing specific, measurable national standards for ATM accessibility, accompanied by monitoring mechanisms, performance indicators, and clear sanctions for all banks in Indonesia. This transformation must be carried out so that the SETARA Guidelines are not aspirational, but function as an effective regulatory instrument to drive systemic change in financial inclusion.

The concrete recommendations arising from this study's synthesis include three levels of intervention. First, at the regulatory level, OJK and Bank Indonesia need to establish national technical standards for inclusive ATMs that include minimum specifications (audio guidance, tactile interface, transaction time flexibility, ergonomic design, and AI integration), accompanied by periodic audits and incentive-disincentive schemes. Second, at the banking industry level, a reorientation of service design toward universal design and human-centred service is required, including mandatory training for human resources and the integration of AI-based accessibility technologies that are adaptive to various types of disabilities. Third, at the ecosystem level, it is necessary to build a participatory, collaborative model by involving disability communities in the design, testing, and evaluation of services, so that the resulting innovations are grounded in real needs rather than institutional assumptions.

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