How new technology is creating opportunities — and challenges — for women customers

How technology is shaping and changing how women are using financial products

Across the globe, technology is dramatically transforming the financial landscape. It is reshaping the way individuals, especially women, access, use and benefit from financial services. The proliferation of mobile phones, digital platforms and artificial intelligence (AI) has opened doors to new products and services, from instant payments to biometric authentication, that can address longstanding barriers to financial inclusion. For women, these advances have the potential to redefine economic participation and resilience.

Yet, as innovation accelerates, so do inequalities. While more women than ever before are connected to digital networks, gaps persist in account ownership, digital literacy and access to formal financial systems. For example, data from the 2025 Global Findex Database finds that despite high mobile phone ownership at 86 percent of adults globally, 1.3 billion adults - 700 million of them women - still lack financial accounts.[i]

Although promising, the rapid evolution of financial technology risks reinforcing these divides if not paired with inclusive infrastructure, targeted regulation and products designed to meet women's needs. Supportive financial sector infrastructure and policies, such as interoperable fast payment systems and consumer protection frameworks, respectively, are essential to help strengthen future initiatives for financial inclusion.

Overview of technology trends

Artificial intelligence

What is it? AI uses algorithms and machine learning (ML) to analyze data and make decisions.

How is it used? In financial services, AI is used to assess creditworthiness, provide customer service through chatbots and personalize financial products.

How is it making a difference for women? AI helps unlock credit and insurance for women who often lack collateral or credit records.

What's the policy angle? If not designed carefully, AI-powered chatbots and other AI recommendations for personalized financial products could result in the wrong advice/ unsuitable products. Policies should ensure AI systems are audited for biases and include safeguards to prevent algorithmic discrimination and deliver suitable outcomes for consumers.

AI is revolutionizing financial services and holds enormous promise for women's financial inclusion. AI-based algorithms can analyze nontraditional data like mobile phone records, social networks or shopping history to assess creditworthiness for borrowers who have little to no data footprint. This technology has potential to be particularly beneficial for women, who often lack collateral or credit records.

For example, India fintech Kaleidofin, together with Women's World Banking, built an AI model that integrated climate and weather data into credit scoring. **The model improved prediction accuracy to 82 percent (versus 75 percent using traditional models), enabling a lender to extend more loans to customers**. By leveraging alternative data that reflects women's realities, such as daily mobile payments or community group transactions, AI can help unlock credit and insurance for millions of women who were previously deemed "unscorable."[ii]

AI-powered chatbots and digital advisers are also emerging to provide direct feedback to women entrepreneurs and customers. Chatbots can provide 24/7 customer service, answer questions in local languages, and guide women through onboarding or product usage. For instance, a notable example of this approach is DataKind and Fundación Capital's Con-Héctor chatbot, which provides financial recommendations in rural Colombia. In this collaboration, an AI model that generated personalized financial recommendations based on user goals was integrated within their digital financial education platform.

Delivered through the Con-Héctor virtual assistant, these insights aimed to reinforce savings habits and demonstrated how AI can enhance financial education and inclusion for those with low financial literacy, even in remote areas. Overcoming challenges associated with internet connectivity issues, user hesitancy and low digital literacy led to promising results, **with nearly 81 percent of users participating and an overall positive shift in their financial behavior. 38.7 percent of participants actively using Con-Héctor refined their savings plan, and 32.1 percent of users explored banking options, demonstrating interest in formal financial products.** Furthermore, AI tools can be used to detect fraud and misuse of funds and accounts by cross-checking large datasets with reference values, and making sure that transactions seem plausible.[iii]

Although AI-aided onboarding can provide substantial value, it carries some inherent risks. One of the main risks is large language models (LLMs) generating incorrect information, referred to as "hallucinations."

While this risk can be crucial in some LLMs, many methods exist to reduce the LLM's hallucinations, and the current trajectory shows that in the near future, this problem will likely be resolved significantly.[iv]

AI personalization can likewise tailor financial products to women's needs. An algorithm might detect that a woman uses her savings account mostly for school fees and household emergencies, and then proactively offer a microsavings plan or insurance product that fits her cash flow pattern.

Advanced ML models can analyze transaction patterns, flagging anomalous activities and potential fraud with greater speed and accuracy than traditional systems. These capabilities are especially vital as more women engage with digital financial products.
In essence, AI can enable a shift from one-size-fits-all finance to women-centric design, at scale. However, recent research by Women's World Banking reinforced AI's double-edged potential. On one hand, AI and big data can reduce costs and increase efficiency, making it more viable for providers to serve low-income women. Automated processes mean lower transaction fees and predictive analytics can mean better targeting of products that women will use. On the other hand, if not carefully managed, AI can inadvertently perpetuate gender biases. Algorithms trained on biased historical data might, for example, favor men over women in credit decisions, underscoring the importance of responsible design and deployment to ensure safeguards are in place to address risks and maintain trust. Financial services must be available, accessible, affordable, appropriate and aligned to women's needs - and supported by inclusive policy - to truly close the gender gap.

Cryptocurrency

What is it? Cryptocurrency or crypto refers to digital currencies that use blockchain technology for secure and transparent transactions.

How is it used? Cryptocurrencies provide financial services without traditional bank accounts.

How is it making a difference for women? It bypasses traditional barriers to financial services, providing women with direct access to financial tools.

What's the policy angle? One policy issue is the lack of robust regulatory frameworks and education programs to protect consumers from fraud and scams.

Women, particularly in developing regions, often face significant barriers to accessing financial services. Traditional banking systems may be inaccessible due to geographic, economic or social constraints. Cryptocurrencies and blockchain technology may offer a way to bypass these barriers, providing women with direct access to financial tools and services.
One of the key advantages of cryptocurrencies is their ability to provide financial services without the need for a traditional bank account. This is particularly important for women in regions where banking infrastructure is limited or where cultural norms restrict women's access to financial institutions. By using cryptocurrencies, women may be able to save, invest, and transact securely and privately, without the need for intermediaries. For example, in India, the number of women investing in cryptocurrency grew tenfold in 2024–25, with women aged 25–30 now representing 53 percent of the platform's investors.[v]

Moreover, blockchain technology can enhance transparency and trust in financial transactions. This is crucial for women who may be wary of traditional financial institutions due to past experiences of discrimination or exploitation. Blockchain's immutable ledger ensures that all transactions are recorded and cannot be altered, providing a level of security and trust that is often lacking in traditional financial systems.

Tokenized contracts - a digital agreement represented by tokens on a blockchain- can transform both personal and community savings for women and microentrepreneurs, converting funds into digital assets that earn yield, automate payouts and reside securely in mobile wallets. For savers, this creates real value by offering interest-bearing products that are often safer and more transparent than holding cash. For providers and investors, these models unlock scalable access to a large, underserved segment. By setting up digital savings pools with predictable fees, providers and investors can generate returns while tapping into a market that has historically been difficult to serve. This creates a mutually reinforcing cycle: Women gain safer, growth-oriented savings tools, and investors access new channels for scale and profitability.

Stablecoins are cryptocurrencies that are designed to maintain a consistent value by pegging to reserve assets like the U.S. dollar, gold or algorithmic mechanisms.[vi] For remittances, stablecoin payment rails can reduce the time and cost of cross-border transactions, ensuring more funds reach households while allowing providers to compete in a massive transaction market. The total supply of stablecoins grew by roughly 28 percent year over year, with transfer volumes reaching an estimated 27.6 trillion US dollars in the past year.[vii] Realizing this value depends on design safeguards: clear communication on fees and risks, custody and recovery options, and user support adapted to diverse levels of digital literacy.

While the potential benefits of cryptocurrencies for women's financial inclusion are significant, there are also substantial risks that need to be addressed. One of the primary concerns is the volatility of cryptocurrency markets. The value of cryptocurrencies can fluctuate wildly, which can pose a risk to women who may not have the financial literacy to navigate these markets effectively. Additionally, the lack of regulatory oversight in the cryptocurrency space can expose women to fraud and scams. Without proper regulation, it can be difficult to ensure the safety and security of cryptocurrency transactions, which is particularly concerning for women who may already be vulnerable due to their socioeconomic status. To mitigate these risks, it is essential to implement robust regulatory frameworks that protect consumers while fostering innovation. Education and training programs are also crucial to equip women with the knowledge and skills they need to use cryptocurrencies safely and effectively. By addressing these challenges, we can unlock the full potential of cryptocurrencies as a tool for women's financial inclusion.

Embedded finance

What is it? Embedded finance integrates financial services like payments into non-financial platforms, like ride-hailing apps or e-commerce sites.

How is it used? It allows users to access savings, credit or insurance within their daily workflows.

How is it making a difference for women? It offers women convenient access to financial services within platforms they already use and trust.

What's the policy angle? Policies should ensure embedded finance services are inclusive and protect users from predatory practices.

Digital platforms have become gateways to finance for women in the informal economy. For example, in Indonesia, 52 percent of female informal workers started using mobile banking or digital payments for work through platforms, far above the 15 percent national average.[viii] By integrating financial tools into apps like Gojek and Grab, embedded finance offers women convenient, trusted access to savings, credit or insurance within their daily workflows.

Common forms of embedded finance include:

- **In-platform payments:** For example, a seller on an online marketplace uses the platform's wallet to receive payments.
- **Buy Now, Pay Later and microcredit:** Small loans or installment plans are provided at checkout on e-commerce sites, or working capital loans are offered inside merchant apps.
- **Insurance embedded in services:** A ride-hailing app automatically provides accident insurance for drivers, or a crop marketplace bundles weather insurance for farmers, while making the additional coverage transparent for the user.
- **Savings and investment tools within apps:** Users are able to invest or save part of their earnings in the same app in which they earn or spend money (for instance, a gig platform letting workers direct a portion of their income into a savings account without leaving the app).

The promise of this integration is a seamless user journey. For women who are new to formal finance, this can be a gentle introduction. They might sign up to sell handicrafts on a platform and, during onboarding, get offered a basic account or wallet for payments. Over time, as they transact, the platform may offer them a small amount of credit based on their sales data. All this happens without the woman having to visit a bank branch or fill out complex paperwork. The platform leverages rich user data (transactions, ratings, work hours, etc.) as alternative credit information, and uses it to tailor financial offerings.[ix]

Notably, embedded finance is growing in regions like South and Southeast Asia, Africa and Latin America. For example, Grab and Gojek in Southeast Asia have evolved from providing ride-hailing services to multifaceted apps that offer "GrabFinancial" and "GoPay" suites, which include loans and insurance for drivers and merchants. In Indonesia, where an estimated 66 percent of the 84 million informal workers are women, platforms onboarded roughly 20 million microentrepreneurs by 2022 (building on the government's 2020 Go Digital Vision for micro, small and medium enterprises (MSME)).[x]

Many women distrust traditional banks or feel unwelcome there. But if the financial service is offered by a platform they already trust (for example, a farming cooperative's app or a social commerce site they frequent), they may be more willing to try it. Embedded finance thus piggybacks on existing user-platform trust. It also often reduces costs: Onboarding and service delivery are digital, and easily added onto existing platform operations, which can make microloans or microsavings economically viable where they wouldn't be if offered as standalone services.

For many women, especially those in informal employment or microentrepreneurship, embedded finance can be a game changer, as it often comes with lower barriers that help familiarize new or hesitant users into digital finance. The process is integrated and often simplified through one-click sign-ups and no separate Know Your Customer (KYC) process if the platform shares verification. This ease is critical for women who juggle multiple responsibilities and may not have the time or freedom to go to banks.

Furthermore, women often lack traditional credit history or collateral, which is a significant reason why banks have historically underserved them. Embedded finance generates alternative data, such as transactions, customer ratings, delivery times, and sales volume, that can be mined to gauge a woman's reliability or creditworthiness.

Using such nontraditional data can expand credit access for women without formal histories. For example, Grab's merchant loan (GrabModal Mantul) uses a merchant's order history on GrabFood to approve loans with rapid disbursement.[xi]

Because embedded services are context specific, they can be fine-tuned. For example, gig platforms have observed that vehicle repairs were disrupting drivers' income, so they offered emergency loans for that exact purpose. E-commerce sites saw small vendors struggling with upfront inventory costs, so they launched inventory financing. This kind of tailoring is particularly beneficial for women, who often face life events (like childbirth, health crises of family members, etc.) that disrupt income. Platforms can design microinsurance or advanced pay features to mitigate such challenges. Moreover, since platforms often engage communities of women (e.g., networks of craft producers or care workers), they sometimes bundle group-based financial products, such as group savings options or community lending circles, into the platform - leveraging social bonds to encourage uptake.

Embedded finance often works hand-in-hand with broader digital infrastructure. In Peru's case, a mobile wallet for street vendors (Billetera Móvil) benefitted from a regulatory environment that allowed interoperability and digital ID verification, helping these women link to the formal system more easily. As a result, Peru saw an increase in formal saving by women microentrepreneurs after such solutions were introduced.[xii]
Embedded finance works best as part of such an ecosystem, and where it exists, women can leapfrog multiple barriers at once: ID, connectivity and access. A 2021 survey by the International Finance Corporation (IFC) found that women entrepreneurs using e-commerce platforms with built-in credit grew their revenues significantly more than peers offline.[xiii]

However, despite the potential, realizing the full benefits of embedded finance for women faces several hurdles. Embedded services often presume ownership of or access to a smartphone, or at least a basic phone with connectivity. Yet women in low- and middle-income countries are 14 percent less likely to own a smartphone than men (230 million fewer women), and 14 percent less likely to use mobile internet (235 million fewer).[xiv] This gap limits which women can even access app-based financial features.

Many women informal workers share phones with family or use older models, which constrains their usage of new services. While some platforms offer unstructured supplementary service data (USSD) or SMS-based solutions (e.g., M-Pesa in Kenya supports basic phone transactions), not all embedded finance offerings are available in those formats. This limited access means that embedded finance could actually deepen digital inequalities if not designed for low-tech access as well. Women who are new to digital finance may not trust or even notice the financial features on platforms. Moreover, some women might fear hidden charges or scams in these embedded services, especially if they've heard of predatory lending elsewhere. Building user literacy both in-app and externally is necessary.

As highlighted, there is concern that the algorithms powering these services may inherit gender biases. Algorithmic bias in digital credit scoring can result in women with comparable creditworthiness to men being offered lower credit limits or higher interest rates, as models often reflect gender disparities embedded in historical data.[xv] Furthermore, women's relative lack of digital data means models might flag them as "thin file" or risky simply due to sparse information.

Women borrowers on platforms might face pressure or unclear recourse if something goes wrong, as many embedded finance offerings lack transparency and operate in a gray zone of regulation if the platform isn't a bank. Women may not know their rights or have formal avenues to resolve disputes. For example, in some countries, digital lenders (partnering with platforms) were found to harass borrowers for repayment - practices that a regulated bank would be penalized for. Women, who often have less experience with formal credit, are particularly vulnerable to intimidation or over-indebtedness.

Many popular platforms still do not offer embedded finance, or do so only partially. A woman might use three different apps for work and commerce, but only one of those apps may have a wallet or loan option. If the services she needs aren't on the platform where she's most active, the potential is lost. This missing availability means we're not yet at a stage where any woman joining any major platform will be financially included by default. Overcoming this requires broader industry adoption; potentially, smaller platforms could link up with third-party fintech providers to embed services without having to build their own from scratch. Also, multi-platform interoperability and portability (if a woman's data from one gig app could help her get credit on another commerce app) is an area to explore, although it raises concerns around competition and data privacy.

On the supply side, platform companies may hesitate to dive into finance because of regulatory uncertainty. In some markets, only banks can hold deposits or decide credit approvals. Fintech partnerships can circumvent this, but the legal and regulatory frameworks often lag behind.

Digital ID and e-KYC

What is it? Digital IDs and electronic Known Your Customer (e-KYC) use biometric data to verify identities.

How is it used? They enable remote account opening and reduce the cost of onboarding clients.

How is it making a difference for women? Digital IDs empower women by providing the legal identities essential for accessing financial services.

What's the policy angle? Policies should support the rollout of digital IDs and e-KYC, ensuring they are accessible and secure.

A fundamental barrier that has kept many women out of formal finance is the lack of official identification. In many emerging markets, women are less likely than men to possess government-issued identification (such as national ID cards, passports, voter IDs, etc.). Without an ID, opening a bank account, getting a SIM card or registering property can be impossible. Digital IDs are an electronic record that uniquely identifies individuals and allows their identity to be authenticated remotely over digital channels. Digital ID systems and e-KYC processes have emerged as powerful tools to overcome this barrier. Many digital IDs use fingerprints, iris scans, or face photos to ensure uniqueness and prevent fraud. A central database can instantly verify a person's identity via biometric match or a one-time password to their phone. Authentication might happen by scanning a QR code on an ID card or by the user submitting a fingerprint on a device.

Some countries allow tiered KYC: Very basic accounts can be opened with minimal information (name, phone, ID number) up to certain financial limits, which greatly helps women who might not have utility bills or other documents to verify their identity. More account functionality is unlocked when full KYC is completed.

Such tiered approaches to KYC lead to greater financial inclusion for marginalized groups, shown by the fact that countries with stricter or "standardized" KYC requirements tend to have larger financial inclusion gender gaps.[xvi] Another benefit is increased onboarding speed for new customers, as basic accounts can be opened quickly. For example, India's Aadhaar-based e-KYC allows small accounts to be opened instantly, reducing costs significantly and verification time from days to seconds.[xvii] Furthermore, institutions can focus resources on higher-risk customers and apply more rigorous checks only where necessary, therefore reducing the burden on low-risk customers, and saving time and money in the process. Tiered KYC also supports remote onboarding and digital channels, which are more cost-effective than traditional in-person verification.

The World Bank notes that lack of documentation is cited as a reason for not having an account by disproportionately more women than men globally, thus having direct implications on the financial inclusion of women. Additionally, women often have less free time to navigate bureaucratic tasks. Evidence shows that countries that enable remote account opening see more uptake by women because it fits into their schedules. For instance, Kenya introduced in-app e-KYC for mobile wallets, which boosted registrations, notably among young women who may have been uncomfortable dealing with (usually male) agents in person.[xviii]

Digital ID and e-KYC drastically reduce the cost for financial providers to onboard and serve low-income clients. Instead of manual verification and paper storage, verification is automated. According to India's government, Aadhaar e-KYC brought the cost of verifying a customer down from around INR 500–700 (US$7–10) to as low as INR 3 (just a few cents).[xix] This near elimination of cost made it viable for banks to open zero-balance accounts for the poor, and for mobile operators to sell SIM cards with slim margins.

When costs drop, providers no longer avoid low-income women customers. This is partly why private banks in India, which had previously ignored rural women due to cost, joined the Jan Dhan drive once e-KYC was available. Similarly, fintech startups can scale: A digital lending app can sign up a woman and give her a small loan without ever meeting in person, because e-KYC handles identity and fintechs can lean on alternative credit scoring thereafter. The result is a proliferation of services targeting populations that were once "not worth it" to serve.

Having one's own legal identity can be empowering psychologically and practically. It affirms citizenship and rights. To make this process easier, for instance, Senegal simplified ID procedures by no longer requiring a marriage certificate or spouse's presence for a married woman. This legal change, coupled with a digitized ID issuance, led to many more women obtaining identification in recent years.[xx]

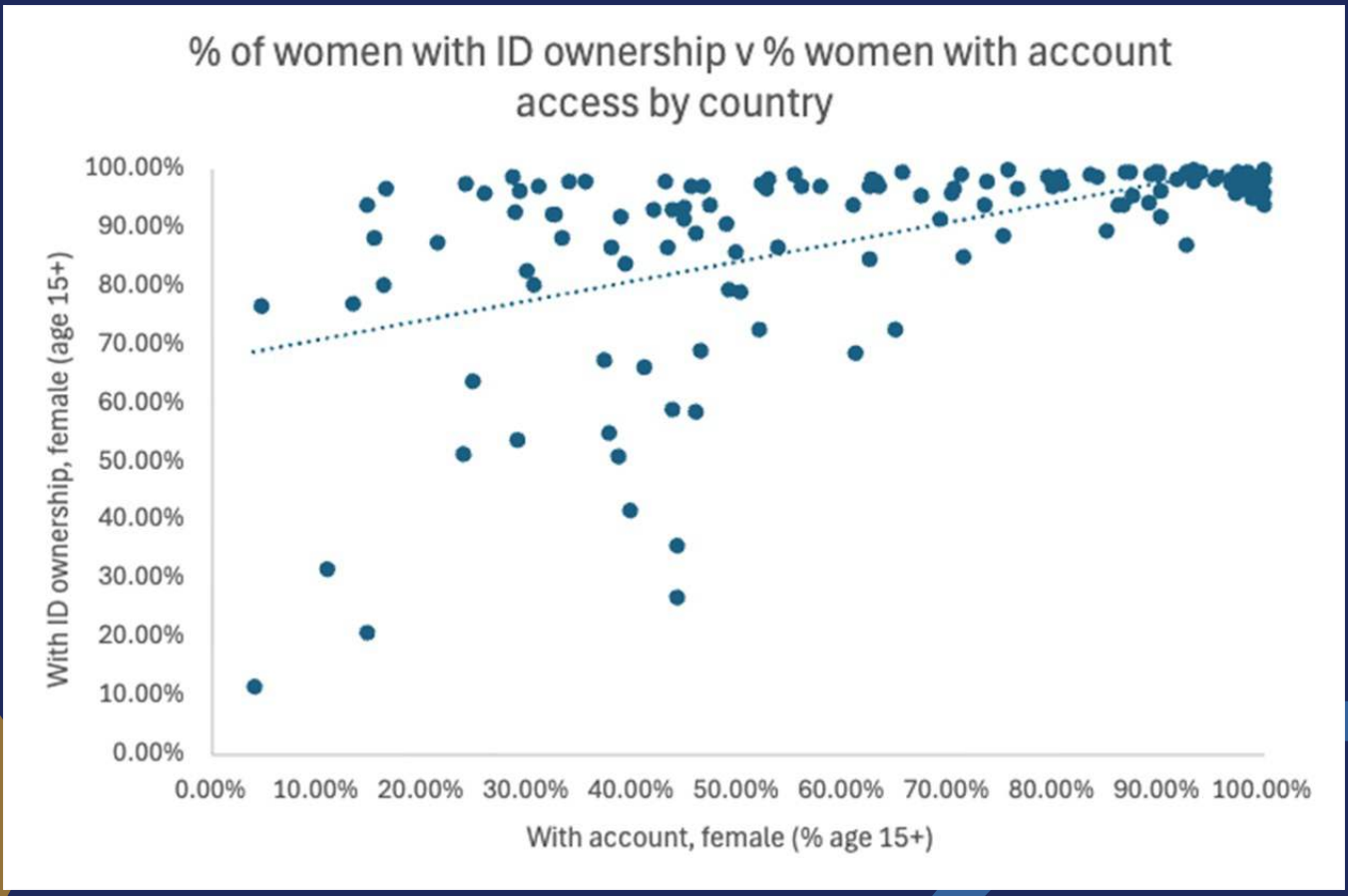
A big practical challenge is making sure the ID system works smoothly. If women sign up but then the system fails to authenticate them, their experience sours. This often happens due to network issues, or fingerprints worn out by manual labor. Solutions include multi-modal biometrics (e.g., if a fingerprint fails, use the iris or face) and offline authentication methods (e.g., smart cards that store data to verify even without a network connection). Ensuring that married women's name changes or other life events are easily updated in the system is also important, as otherwise women might end up with an ID that doesn't reflect their current status, causing confusion when they try to use them. The ID authority must have women-friendly update processes - for example, allowing a woman to update her surname after marriage via a simple phone OTP verification instead of requiring her to travel to an office.

Some women (and men) might hesitate to get a digital ID due to privacy or surveillance concerns. It's important that data protection laws accompany digital ID rollouts. Also, allowing a degree of pseudonymous usage can help; for example, a digital ID could allow a "yes/no" verification (proving a user is over 18 without revealing birthdate or name). If women know that using their ID to get a SIM card won't mean their calls are monitored, they'll be more willing to sign up.

To ensure women are benefitting from an adjusted digital ID system, we also recommend deploying mobile registration units in rural areas to reduce travel time and costs for women seeking to obtain IDs. Furthermore, policymakers should encourage the development of digital technology; revise regulatory ID standards that act as explicit or implicit barriers for women; strengthen data protection laws to build trust in digital ID systems; establish policies and strategies that support women to stay online; and leverage digital ID as a path to complementary financial inclusion initiatives. For more recommendations and information about digital ID, also check out our policy brief on the topic.

However, getting an ID is step one; using it to open accounts is step two. Our own analysis has shown that even after obtaining IDs, women didn't immediately go on to open bank accounts, either due to inertia or lack of nearby financial services.

Building a strong foundation of easily accessible digital IDs means that that all people can access financial services and products more quickly, and in a safer way for both customers and financial service providers alike.



Source: Women's World Banking analysis of Clark et al. (2022). ID4D Global Dataset 2021. Washington, DC: World Bank Group; and Demirguc-Kunt et al. (2022). The Global Findex Database 2021. Washington, DC: World Bank Group.

Interoperable systems and open finance

What is it? Interoperability links different financial systems, while open finance allows data and transactions to flow freely between these systems.

How is it used? This interconnectivity enables seamless transactions and data sharing across platforms.

How is it making a difference for women? It helps ensure women are not excluded from financial services by providing broader opportunities and increased access.

What's the policy angle? Policies should promote interoperability and ensure systems are inclusive and secure.

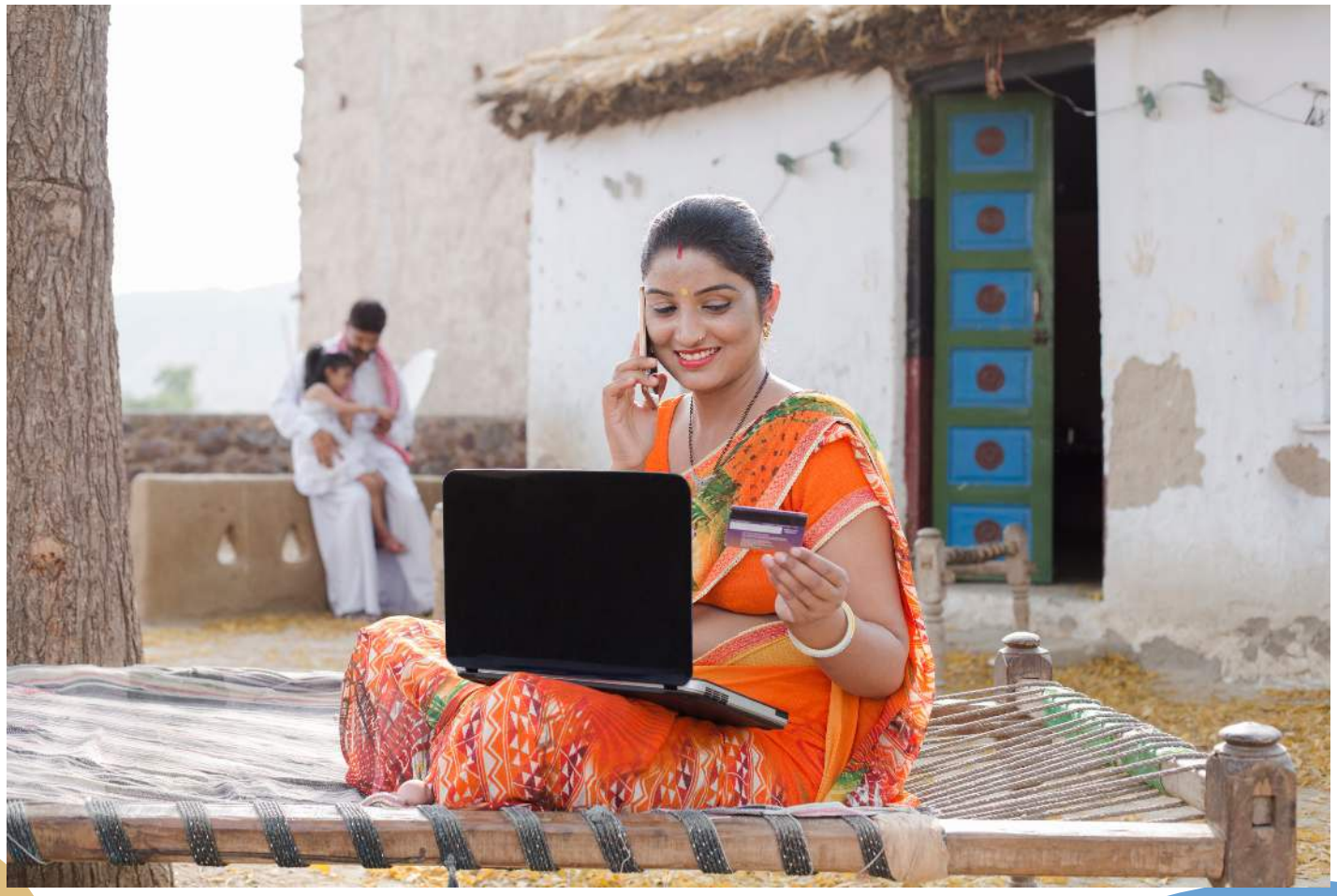
Interoperability refers to the seamless linkage between different players and systems in the financial sector: banks, mobile money providers, fintechs, payment switches, credit bureaus, etc. This interconnectivity serves as a fundamental foundation, analogous to roads or telecommunications networks. In the same way that transportation infrastructure facilitates mobility and commerce for women, financial "roads" establish connections among services, thus enabling women to participate fully in the economy. Through these channels, women are able to access and utilize financial instruments without impediments that have historically restricted their involvement in formal financial systems. Open finance allows a customer to conduct transactions or share data across interoperable platforms without friction. For women, who are often customers of smaller institutions or only have a mobile wallet but not a bank account, interconnectivity ensures they are not stuck in a limited corner of the financial world. Instead, they can send or receive money to anyone, use any agent and have their financial history recognized across institutions.

Payments interoperability enables seamless transfers between different providers, such as moving funds from Tigo to Airtel or a bank account, via central switches or bilateral agreements, avoiding closed systems. Agent interoperability allows agents to serve multiple mobile money services, increasing user convenience. Data interoperability, or open finance, let users share financial data across providers, supporting easier loans and unified account views, while credit bureaus aggregate repayment histories. Integrated digital public infrastructure, like India Stack, combines digital ID, payments and data sharing for cohesive access. This is especially important for women, who often use nontraditional financial services; without interconnectivity, they are excluded from services like international remittances or e-commerce. Linking systems ensures broader opportunity and access for all users.

Interoperability enables women to utilize a single account for a broad range of transactions, thereby minimizing the necessity for multiple accounts and reducing associated costs. In developing countries, reduced fees have incentivized greater adoption of digital financial services among women,[xxi] while integrated systems facilitate access to products, such as savings applications, as well as enhanced credit assessment.[xxii] Open networks stimulate competition, permitting smaller institutions to serve women more efficiently while expanded access by local banks and fintech companies increases opportunities for women to engage with mainstream financial services, as demonstrated in Mexico. Furthermore, cross-border interoperability expedites and lowers the cost of international remittances, providing additional benefits to women. Ultimately, interoperability provides women increased flexibility, affordability and inclusion within the financial system.

However, interoperability faces challenges across business, technical, regulatory and social domains, and is often hindered by competitive concerns and differing industry incentives. Achieving integration requires neutral facilitation, government or regulatory support, common standards, and investment in infrastructure, particularly for smaller institutions. Regulatory measures can boost inclusivity, but equitable benefits, especially for women, demand gender-responsive design, robust data protection and accessible interfaces.

While direct evidence on the effects of interoperable systems on financial inclusion is scarce, successful interoperability can increase usage and decrease gender gaps, highlighting the importance of monitoring gender-disaggregated data. Human collaboration through forums and peer learning remains crucial for stakeholder engagement. Ultimately, interoperability underpins women's financial inclusion and broad-based access to financial services, making comprehensive connectivity essential for advancing equity.



Case studies

Country	Innovation	Details	Impact (especially on women)
Nigeria	Stablecoin and Sandbox	• Sandbox was introduced by the Central Bank of Nigeria (CBN) through the Framework for Regulatory Sandbox Operations in 2021. • Compliant Naira or cNGN, the first stablecoin in Nigeria, was developed by Africa Stablecoin Consortium in 2024.	• Between 2023 and 2024, Nigeria recorded US$22 billion worth of stablecoin in transactions. • 25.9 million Nigerian people (11.9 percent of the population) use stablecoin. • Stablecoin transactions cost less than 1 percent and allow for almost instant transfers at any time.
India	MuleHunter.AI (AI/ML fraud detection)	• Reserve Bank of India introduced MuleHunter.AI in 2024. • MuleHunter.AI monitors a large volume of transaction data in real time, using 19 distinct patterns of mule account activities. • MuleHunter.AI is a free tool that banks can choose to adopt voluntarily. • Out of more than 120 commercial banks in India, 15 were at different stages of integrating MuleHunter.AI into their systems.	• One of the banks that adopted MuleHunter.AI reported 95 percent accuracy in detecting mule accounts. • Indian government recorded a 61 percent drop in bank frauds in FY 2024–25 compared to the previous year.
Vietnam	VNeID (Vietnam electronic Identification)	• VNeID was developed by the Ministry of Public Security and the National Population Data Center and launched in 2021. • Level 2 VNeID account holders can apply online and receive cards within 15–30 minutes. • By mid-2024, 22 banks and 13 payment intermediaries adopted VNeID for account opening and transaction authentication. • By August 2025, over 120 million customer records were biometrically validated via VNeID.	• Since 2024, fraud cases against individuals dropped 59 percent, and accounts receiving illicit funds fell by 52 percent. • The biometric verification for 113 million individuals and 711,000 organizations covers 66 percent of all organizational payment accounts active digitally. • Over 62 million citizens registered and activated VNeID accounts, with daily usage in 2024–early 2025 averaging three to six million, three to four times higher than in 2023.
Brazil	Pix (Instant Payment)	• The Central Bank of Brazil launched Pix in 2020. • Pix's transaction costs average about 0.33 percent, far lower than typical debit card fees (1.13 percent) or credit card fees (2.34 percent).	• By 2025, Pix usage reached 76.4 percent of the population, surpassing debit cards (69.1 percent) and cash (68.9 percent). • In 2024, Pix processed 64 billion transactions, a 53 percent increase from the previous year.

Nigeria: Expanding digital finance through sandbox and stablecoins

The global stablecoin market reached approximately US$234 billion by March 2025[xxiii] and, under optimistic conditions, could soar as high as US$3.7 trillion by 2030,[xxiv] driven by demand for fast, accessible and reliable digital payments in economies with unstable fiat systems. As of mid-2025, stablecoins facilitated nearly US$5.7 trillion in transactions over 2024, a volume surpassing that of Visa and Mastercard, highlighting their rapidly growing role in global finance.[xxv] Adoption has been strongest in Nigeria in Africa, where about US$59 billion in crypto transactions flowed in 2024, with stablecoins accounting for 40 percent of the market, largely driven by remittances.[xxvi]

In February 2021, CBN prohibited banks and financial institutions from handling cryptocurrency transactions in an effort to curb risks, such as money laundering and terrorism financing.[xxvii] The ban, however, did not work as it intended. Rather than halting activity, it pushed crypto trading underground, cutting off freelancers, small businesses, and families from essential remittances and payments. Many startups were forced to shut down or suspend operations.[xxviii] Faced with these consequences, regulators gradually shifted course. In 2022, the Nigeria Securities and Exchange Commission introduced digital asset regulations that require virtual asset service providers (VASPs) to be licensed, marking a transition from prohibition to regulatory oversight.[xxix]

To promote safe financial innovation, CBN set up a regulatory sandbox in 2021, which allows new financial technologies to be tested under supervision to protect consumers and maintain stability.[xxx] The initiative aims to foster fintech innovation, deepen financial inclusion and ensure consumer protection within a controlled environment. It is open to both existing CBN licensees (like banks and payment service providers) and other local technology or telecom companies introducing new payment solutions not covered by current regulations.[xxxi] This effort has started to show innovative products of different stages of development for the Nigerian market. In 2024, two Nigerian crypto platforms, Busha and Quidax, received a provisional crypto license.[xxxii] Both now sell and list cNGN, Nigeria's first stablecoin tied to the value of the Nigerian naira, on their exchanges. Unlike unregulated cryptocurrencies, cNGN is managed by private companies that must comply with strict rules.[xxxiii]

Cryptocurrencies are volatile, whereas stablecoins combine the stability of traditional money with the efficiency of blockchain to enable faster, cheaper and more inclusive transactions. This is especially relevant for remittances: Africa receives over US$92.2 billion annually, but with an average transaction cost of 7.9 percent, the highest globally.[xxxiv]

Stablecoins can cut these costs to below 1 percent while providing near-instant 24/7 transfers through mobile wallets or basic phones, even for recipients without bank accounts.[xxxv] Inflation pressures, such as Nigeria's 33.2 percent rate in 2024,[xxxvi] also push people toward stablecoins as a store of value.

Between 2023 and 2024, Nigeria recorded US$22 billion worth of stablecoin in transactions and is now the world's leading country for stablecoin adoption. The country ranks second in overall digital asset usage, with 25.9 million users, accounting for 11.9 percent of the population.[xxxvii]

With over half the population in countries like Nigeria, South Africa, Vietnam, the Philippines and India owning crypto wallets, and 93 percent of Nigerians expressing interest in investing in crypto,[xxxviii] stablecoins are becoming a mainstream financial tool, blending currency stability with digital accessibility.

India: Leveraging AI for fraud detection and consumer protection

Despite significant progress in financial inclusion, India still faces persistent gender disparities in access and usage. Lower digital literacy, limited financial autonomy, and cultural constraints make women susceptible to online scams and fraud. At the same time, digital banking in India has grown rapidly, bringing new opportunities and risks. In the first nine months of 2024, India reported losses of about INR 11,000 crore (US$1.32 billion) to cyber scams.[xxxix] Cybercrime, including the use of "mule accounts" to launder illicit funds, has become increasingly common. According to India's National Crime Records Bureau, fraud makes up the largest category all cybercrime with 68.9 percent of total cases in 2023.[xl] Fraudsters often use mule accounts as intermediaries to receive illicit proceeds before moving money across borders or into other accounts.

Recognizing the threat to both consumers and the banking system, the Reserve Bank of India (RBI) introduced MuleHunter.AI in 2024, an AI-powered and ML solution designed to identify and prevent mule-account fraud.[xli]

This AI/ML-based solution was conceptualized and developed by the RBI Innovation Hub, a subsidiary of RBI, to address the limitations of traditional rule-based systems in detecting complicated fraudulent activities. Employing ML and data analytics, MuleHunter.AI can monitor a large volume of transaction data in real time, using 19 distinct patterns of mule account activities,[xlii] and thus allowing financial institutions to preemptively and rapidly detect suspicious activities.[xliii] The patterns reviewed include transaction volume and timing, dormancy of account, and the number of credit lines.[xliv]

The tool was pilot-tested in two major public sector banks, yielding promising results in real-time fraud detection.[xlv] This collaborative approach ensured that MuleHunter.AI was tailored to meet the specific needs of the Indian banking ecosystem. The RBI and Ministry of Finance encouraged banks to adopt MuleHunter.AI,[xlvi] which is a complimentary tool that any banks and financial institutions can adopt.[xlvii] Beyond traditional banks, RBI aims to encourage uptake of MuleHunter.AI by smaller banks, cooperative institutions and digital-only banks.[xlviii]

The launch of MuleHunter.AI represents a system-wide upgrade for India's financial sector, particularly benefiting smaller banks with limited resources and weaker fraud detection capabilities. Unlike large banks equipped with robust IT infrastructure that can flag mule accounts quickly, cooperative and regional rural banks often identify them too late, enabling fraudsters to act before detection.[xlix] As a free tool available to all financial institutions, MuleHunter.AI offers a crucial advantage in closing this gap and strengthening industry-wide fraud prevention.

The deployment of MuleHunter.AI has had significant implications for financial inclusion and consumer protection in India. As of August 2025, 15 out of more than 120 commercial banks in India were in varying stages of adopting MuleHunter.AI. Since then, many fraud cases reported to the RBI date back several years, sometimes as many as five, highlighting a considerable delay in detection by banks.[l]
In contrast, MuleHunter.AI allows almost real-time detection of mule accounts. One of the participating banks, Canara Bank, reported a 95 percent accuracy rate in detecting mule accounts.[li] As a result, the Indian government reported a 61 percent decline in bank frauds in FY 2024–25 compared to the previous year, attributing the drop, based on RBI data, to stronger digital security, improved monitoring and better coordination with law enforcement.[lii]
On the consumer side, MuleHunter.AI aids in safeguarding those who may be more susceptible to exploitation, such as women, who tend to have lower financial capabilities than men. Money mules are often recruited from vulnerable populations, including women, who may be persuaded to open or lend accounts for easy compensation without fully understanding the legal implications.[liii] Fraudsters lure these victims with small commissions, which are then misused for illicit transactions.

Many first-generation internet users, particularly in rural and small-town areas, lack awareness of online scams, making them easy targets for phishing or fake-app schemes. Economic pressures further increase vulnerability, as unemployed youth or those in precarious jobs may view "renting" accounts as quick income.[liv] The AI system helps prevent these individuals from inadvertently becoming involved in fraudulent activities, thereby reducing both financial and legal risks.

AI-driven detection, such as MuleHunter.AI, appears to be a promising tool for mitigating mule-account fraud. However, prevention remains equally important, including raising public awareness and addressing the broader network of recruiters who target vulnerable individuals. Collaboration among regulators, financial institutions, and technology developers is essential to create an inclusive and accurate system. Crucially, such systems should be designed to protect those most at risk of exploitation, ensuring that digital financial services remain safe and accessible to all.

Vietnam: Strengthening trust and security through digital ID

Vietnam's financial sector has rapidly digitalized, with 70 percent of people holding bank accounts and 63 percent of people having digitally enabled accounts.[lv] Yet this shift has also fueled rising cybercrime: Hackers stole VND 100 billion (US$4 million) from one bank, and online fraud caused losses of VND 19 trillion (US$743 million) in 2024.[lvi] In this environment, secure digital identification is essential. A government-recognized ID not only enables individuals to meet KYC requirements for financial access, but also protects consumers by making verification more reliable and fraud detection more effective.

Launched in September 2021, VNeID is a government-backed digital ID developed by the Ministry of Public Security and the National Population Data Center with the initial purpose of checking health and travel declarations during the COVID-19 pandemic.[lvii] VNeID is part of Project 06 (2022–2025), which aims to issue digital IDs and authentication to all citizens in Vietnam to securely access public services, healthcare, education, banking, insurance and others.[lviii] Originally designed to store IDs like driver's licenses and passports, VNeID now serves as a single gateway to a wide range of services, from applying for official documents and accessing healthcare records to managing social benefits, taxes and education portals, all within one app.[lix]

By 2030, Vietnam aims to incorporate biometric authentication, such as facial or iris recognition and fingerprints, for adults to own digital signatures and digital identity accounts, and to gradually reduce use of traditional paperwork on online public services. The VNeID app stores electronic versions of key IDs, citizen ID, driver's licenses, health insurance, and birth certificates, and will soon include e-wallet and utility payment functions.[lx]

The rollout of VNeID has been phased and rapidly scaled across Vietnam's financial sector:

- **Bank integration:** By mid-2024, 22 banks and 13 payment intermediaries had adopted VNeID for authentication in account openings and transactions. Vietcombank, the first mover, verified more than 600,000 accounts alone.[lxi]
- **Credit card issuance:** VNeID also streamlines credit card applications. Individuals with Level 2 VNeID accounts can now apply online and receive cards within 15–30 minutes. In the first month of adoption in 2024, the Vietnamese International Bank issued 800,000 credit cards using this process.[lxii]
- **Biometric validation:** By August 2025, over 120 million individual customer records had been biometrically validated via VNeID. The State Bank of Vietnam (SBV) requires biometric authentication for transfers exceeding VND 10 million (US$380.60) per transaction or VND 20 million (US$761.30) daily. Since the authentication requirement in 2024, fraud cases targeting individuals have dropped 59 percent, while accounts receiving illicit funds declined 52 percent.[lxiii] Digital ID verification effectively protects individuals, helping prevent misuse of accounts and enabling safer access to financial services.
- **System-wide coverage:** According to SBV, more than 113 million individuals and 711,000 organizational customer profiles have undergone biometric verification, representing 66 percent of all organizational payment accounts active on digital channels.[lxiv]
- **Adoption:** Over 62.4 million citizens have registered and activated VNeID accounts, with daily usage in 2024/early 2025 averaging three to six million, three to four times higher than in 2023.[lxv]

Together, these measures strengthen trust in digital finance, reduce fraud and create a more secure environment, all of which are key steps toward broadening financial inclusion - especially for women and other vulnerable groups.

Brazil: Accelerating financial inclusion through instant payments

In November 2020, the Central Bank of Brazil launched Pix, a government-led instant payment system that has since transformed the country's financial landscape. Before Pix, Brazil lacked a single interoperable instant payment platform. Payments often involved noticeable merchant fees or required consumers to navigate fragmented systems. Previously, the primary electronic payment systems were DOC (Documento de Crédito) and TED (Transferência Eletrônica Disponível) wire transfers. TED transfers, for example, had to be initiated before 5 p.m. to be processed, creating strict time constraints for users.[lxvi] DOC transfers were limited to a maximum of BRL 4,999.99 (approximately US$1,000) and typically required a day or more to settle.[lxvii]

Pix addressed these inefficiencies by introducing a payment system that was designed to be both affordable and accessible to a broad range of users. Transactions are completed 24/7 in under 10 seconds and, importantly, individuals do not pay fees for using the service.[lxviii] The platform also reduced barriers to participation by simplifying transfers. Instead of requiring detailed banking information, users can initiate payments with only a Pix key, such as a phone number or email address.[lxix] Its reach extends across different sectors. Beyond individuals and businesses, government agencies also use Pix to disburse pensions, retirement payments and salaries, as well as collect fines and fees.[lxx] For merchants, the benefits are equally compelling: Transaction costs are roughly 0.33 percent, a fraction of the fees charged for debit (1.13 percent) or credit card payments (2.34 percent),[lxxi] thereby reducing operational costs and encouraging digital adoption.

By lowering barriers for unbanked and underbanked populations, Pix encouraged first-time engagement with digital finance and helped formalize parts of the informal economy, giving financial institutions and regulators greater visibility into economic activity. Transactional data from Pix also enables alternative credit assessment, which allows many previously excluded individuals to access credit and other financial services for the first time.[lxxii] Furthermore, the services are free of charge for individuals. Firms may incur a small percentage fee for transactions that varies among financial institutions, but some of the most important financial institutions in Brazil still do not charge fees for Pix transactions.[lxxiii]

The adoption of Pix was both rapid and extensive. Within just two days of its launch, over 10 million Brazilians had registered their Pix keys.[lxxiv] Its popularity continued to grow, and by 2025, approximately 76.4 percent of the country's population was using Pix, surpassing debit cards at 69.1 percent and even cash at 68.9 percent.[lxxv] The volume of transactions also expanded dramatically; in 2024 alone, Pix processed 64 billion transactions, representing a 53 percent increase compared with the previous year.[lxxvi]

While Pix's speed, low cost and accessibility have driven its popularity, these same features also introduce certain risks, particularly related to fraud. Because transfers are instantaneous, transactions cannot be canceled once executed, and refunds are not always guaranteed. To address these vulnerabilities, the Central Bank of Brazil has implemented safeguards that allow financial institutions to hold transactions for up to one hour if suspicious activity is detected.[lxxvii]

Additionally, Pix requires multifactor authentication combined with a PIN, password, or biometric verification, to reduce the risk of unauthorized payments.[lxxviii] Participating banks must also comply with KYC regulations, verifying user ID and ensuring proper oversight, which helps mitigate systemic risks and maintain the integrity of the platform.[lxxix]

For women, this system reduced barriers to entry, supported entrepreneurship, and opened pathways toward broader financial participation. While challenges remain, including ensuring equitable access to smartphones and internet connectivity, Pix illustrates how central banks can use public digital infrastructure to close financial gaps.

Timeline	Milestone
2018	Central Bank of Brazil mandates all banks to offer instant payments.[lxxx]
2019	Cash accounts for approximately 77 percent of retail transactions in Brazil.[lxxxi] Around 30 percent of Brazilian consumers do not have access to a bank account.[lxxxii]
2020	Pix officially goes live in November 2020.
2021	Over 70 percent of users aware of Pix sign up for keys in the first 100 days of launch.[lxxxiii] Pix processes approximately 9.5 billion transactions, with 395 million keys registered (111M individuals, 8.2M businesses).[lxxxiv]
2022	By December 2022, approximately 72 million individuals who had never used any form of electronic credit transfer prior to Pix's launch adopted the system.[lxxxv] Pix processes 24 billion transactions in 2022.[lxxxvi]
2023	Pix processes 42 billion transactions in 2023.[lxxxvii]
2024	Pix processes 64 billion transactions in 2024, a 53 percent increase from 2023.[lxxxviii]
Mid-2025 Plans	Pix Automático for recurring payments launches in June 2025.[lxxxix] Launch of Pix Parcelado for installment payments planned for October 2025.[xc]

Conclusion

When digital innovation is intentionally designed for inclusion, it can transform lives and reshape economies, especially for women and those historically excluded from formal finance. The new technologies presented in this policy diagnostic are just some examples of progress in the space of financial inclusion that have the potential to change the landscape, especially for women.

The progress seen in Vietnam's widespread adoption of biometric verification and Brazil's game-changing Pix payments system are powerful examples, but they are part of a larger global movement. From India's MuleHunter.Ai making transactions more secure , to Nigeria's stablecoin initiatives, countries around the world are harnessing digital public infrastructure to unlock opportunities and advance financial inclusion. These solutions work best when they are designed carefully to prioritize accessibility, security and trust, while giving people not just safer ways to save and pay, but real pathways to build their futures.

For policymakers, thoughtful policy design not only advances financial inclusion but also builds trust and resilience in the financial sector. Supporting inclusive digital financial solutions has the potential to foster economic growth, reduce gender gaps, and strengthen consumer protection frameworks. By supporting interoperable systems, digital IDs, and targeted regulation, governments can ensure that innovation benefits all citizens, especially women.
For FSPs, adopting these advances position them for sustainable success in a rapidly evolving financial landscape. Inclusive digital financial technologies enable FSPs to reach new customer segments, especially women, driving growth and expanding their market share. By leveraging innovations like AI-driven onboarding, embedded finance, and instant payment systems, providers reduce operational costs, enhance security, and deliver tailored products that boost customer satisfaction.

Women, in particular, benefit as traditional barriers to financial inclusion fall away: They are able to gain new tools to support their families, launch businesses and invest in their goals. With thoughtful design and a commitment to equity, these new technologies can drive resilience, innovation, and empowerment for women and communities everywhere.

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@womensworldbanking

230 Park Avenue, Second Floor West | New York, NY 10169 | USA
Phone +1.212.768.8513 • www.womensworldbanking.org