

Studies on digital public infrastructures and fast payments systems

Study 1 - DPIs: definitions and world map

I. Introduction

In recent years, there has been growing discussion on “digital public infrastructures” (DPIs), or technological systems that are publicly owned or managed by government entities and implemented at national scale, typically to promote inclusive digital development and delivery of public services to citizens. This study defines DPIs, maps DPI adoptions around the world, discusses the differences among the various DPIs used to promote and enable payments, and reviews selected services that have been built on DPIs.

II. Defining DPIs

DPIs are digital tools, platforms, and infrastructure supported by the public sector to enable interactions between citizens, businesses, and the government. DPIs are not solutions or services, but rather the infrastructure on which solutions can be built. Thus DPIs have been likened to the digital economy’s roads, railways, and bridges.

DPIs are commonly taken to include one or several of the following components (table 1):

- Digital identity: Systems that enable individuals and businesses to establish and authenticate their online identities, to access public services.
- Digital payments: Real-time payments systems that enable citizens to transfer money instantly from one bank account to another.
- Data exchanges: Data infrastructure that enable the transmission of digital data among citizens and the government.

Some definitions of DPIs have also included:

- Corporate registries: online platforms that provide information on companies’ vitals such as address, date of establishment, board of directors, and more; and
- Open government data: Platforms that provide access to government-owned data sets and information, typically in a standardized and machine-readable format that enable the development of new applications, analytics, and data-driven policymaking.

Table 1 – Typology of DPIs vs. digital public services and Govtech solutions

Type	Definition	Examples
DPIs layers	Fundamental national building blocks for delivering public services at scale Are not solutions or services	<ul style="list-style-type: none"> • Digital identity • Instant payments • Data exchanges
Public services leveraging DPIs	G2C and B2C services built on DPI blocks	<ul style="list-style-type: none"> • Card networks (RuPay in India) • E-invoicing (Chorus in France) • Financial data exchange (SGFINDEX in Singapore).
Other Govtech	Whole-of-government approach to public sector modernization A wide range of technologies provided to governments to increase the efficiency of their internal operations	<ul style="list-style-type: none"> • Government payroll management platform

III. DPI models and world map

DPIs have to a great extent been motivated by governments' desire to promote digital and financial inclusion, and promote transactions and economic growth. The world's most famous DPI system is the India Stack, which has the following features:

- **Identity:** Aadhaar, the biometric identification database, provides residents and citizens a 12-digit identity number linked to a photograph, fingerprint and iris scans. A card is issued with these details, which can be linked to a mobile phone. It enables banks, telecom companies and others to verify a new customer's identity and payments to Aadhaar-linked bank accounts. The Aadhaar database is administered by the Unique Identification Authority of India.
- **Payments:** The Unified Payments Interface (UPI) connects Indians' to banks and mobile money apps developed by India's fintechs, enabling small businesses to accept mobile payments for goods and low-cost remittances.
- **Data:** DigiLocker is a storage for citizen's data, such as Aadhaar card information, driving licenses, vehicle registrations, academic qualifications and medical documents,

and certificates and academic records.¹ In the past, identity could be confirmed by a myriad of physical documents such as driver's licenses and voter ID cards; now there is essentially one depository of all these data.²

Several countries have adopted some elements of DPIs (table 2). For example, Brazil's Central Bank has recently unfolded two real-time payment models, Pix and SITRAF, Nigeria's Central Bank has promoted the Nigeria Inter-Bank Settlement System (NIBSS) Instant Payment (NIP), and the Bank of Thailand has promoted the PromptPay instant payment system and its interoperability with other real-time payment systems in Southeast Asia. The United States has in 2023 rolled out the FedNow real-time payment infrastructure to complement and enhance the existing interbank Automated Clearing House (ACH) payment network.

Numerous governments have also put in place digital identities. For example, Singapore pioneered in 2003 with the SingPass that enables citizens to access several services offered by government agencies and businesses online to utilize digital services, prove their identity, and digitally sign documents.³ The Philippines has the PhilSys ID that enables Philippine citizens and residents to have access and application for eligibility to social welfare programs and government benefits.⁴ Turkey's Digital ID for E-Devlet enables citizens alternative forms of identity authentication to access online public services.⁵ Colombia's Cédula Digital Colombia enables Colombians to verify their identity when traveling to eight other South American countries, acting as a digital ID for contactless cross-border travel in those countries.⁶

Some countries have also promoted the data exchange layers that enable open-source data exchange layer solution that enables organizations to exchange information over the Internet. Such a layer was pioneered and branded by Estonia as "X-Road". It has been implemented in the Faroe Islands, Finland, Iceland, Japan, Kyrgyzstan, Brazil, Mexico, Argentina, Vietnam, and Cambodia; similar models have been used in El Salvador, Namibia, Ukraine, Azerbaijan, and Georgia.⁷

Table 2 – DPIs’ features and examples

Features	Definition	Examples
Instant payments – deferred settlement	Money exchanges and payment processing that for immediate transfer of funds between bank accounts: Transactions are transmitted, confirmed, and notified to the PSPs involved in close to real time, but the inter-PSP settlement takes place after the payee’s PSP has credited the funds.	<ul style="list-style-type: none"> • PromptPay, Bank of Thailand • NPI, Central Bank of Nigeria • UPI, India • CoDi, Mexico*
Instant payment – real-time gross settlement	Immediate transfer of funds between bank accounts transactions are cleared and settled in real time or close to real time. Settlement of funds is made on an order-by-order basis (that is, on a gross basis).	<ul style="list-style-type: none"> • The Clearing House (TCH), USA • SCT Inst, EU • Pix, Central Bank of Brazil
Digital ID for individuals	An electronic file utilized by computer systems that contains personal identifiable information.	<ul style="list-style-type: none"> • Diia, Ministry for Digital Transformation of Ukraine • E-ID, National Identity Management Commission of Nigeria • SingPass, Government Technology Agency
Data exchange layer	A standardized method for exchanging information between information systems.	<ul style="list-style-type: none"> • X-Road, Information System Authority of Estonia • DigiLocker, Ministry of Electronics and Information Technology/Unique Identification Authority of India • Government Interoperability Exchange (GIX), State Services Commission of New Zealand

There are altogether over 100 DPIs in the world, especially in South and Southeast Asia (figures 1-3). The development community is also financing the development of DPIs especially in Africa.

Figure 1 – Total number of national digital public infrastructure features by region

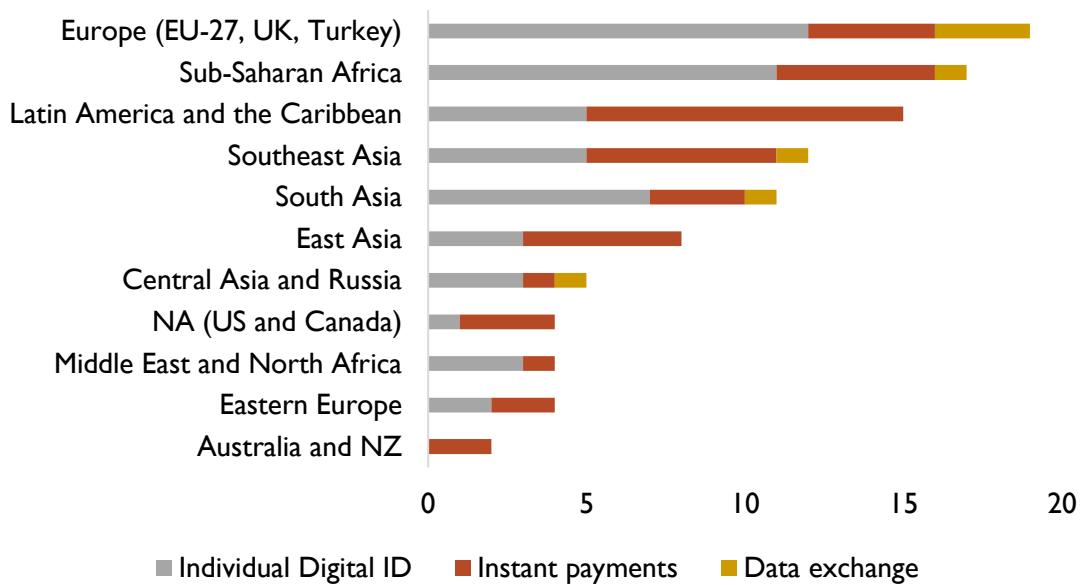


Figure 2 – Average number of national digital public infrastructure features per country in a region

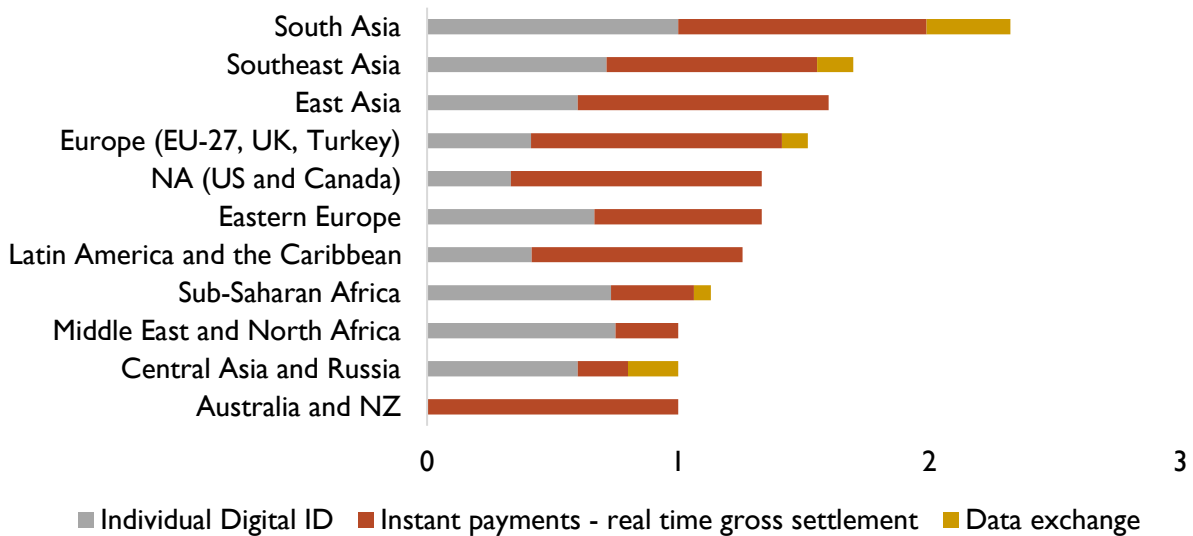
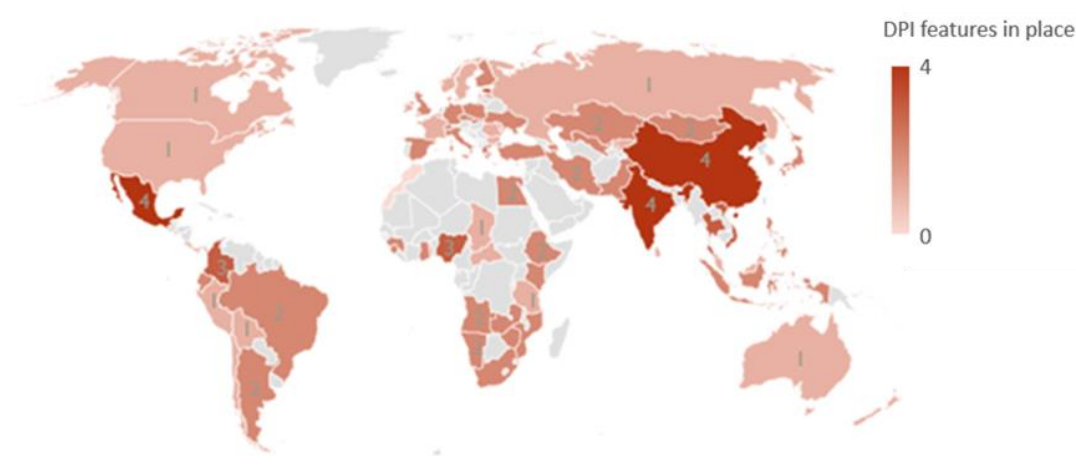


Figure 3 – Digital public infrastructure features in place, by country



Countries have adopted different combinations of DPIs, with Estonia, Singapore and India leading the way with encompassing DPI models to public-private partnership models used for example in the Nordic region and more purely private sector-led models (table 3).

Table 3 – Types of combinations of DPI features, by adopter country

Type	Examples	Individual Digital ID	Instant payments	Data exchange
Superadopters	Singapore, Estonia	√	√	√
	India	√	√	√
Advanced	Philippines, Thailand, Brazil	√	√	
Nordic-style	Finland, Denmark, Norway	√	√	√
Intermediate	El Salvador, Costa Rica, Panama		√	
Basic	Sierra Leone, Ecuador	√		
	Kyrgyzstan, Togo	√		
Undigitized	Mauritania, Algeria			

III. How DPIs interact with private payment networks

While many countries around the world have some types of DPIs, these solutions vary in their robustness and, in particular, how they interact with private sector solutions. In payments for example, some DPIs that are fast payment systems such as Brazil's Pix are explicitly aimed to substitute private credit cards, others like UPI are offered for free and thus can challenge cards as a method of payment, while still others like the U.S. FedNow complements card and especially the ACH systems, improving banks' customer service.

There is in effect a continuum of how complementary DPIs are for private payments networks, shaped by the following governance and business model questions:

- Is the DPI owned and operated by the government?
- Is the owner of the DPI also the regulator of the payment system?
- Is the system peer-to-peer and app-based?
- Is the system offered for free (as opposed to market setting the price)?
- Does the DPI's business and governance model risk crowding out credit cards?
- Is the DPI explicitly aimed to substitute credit cards?

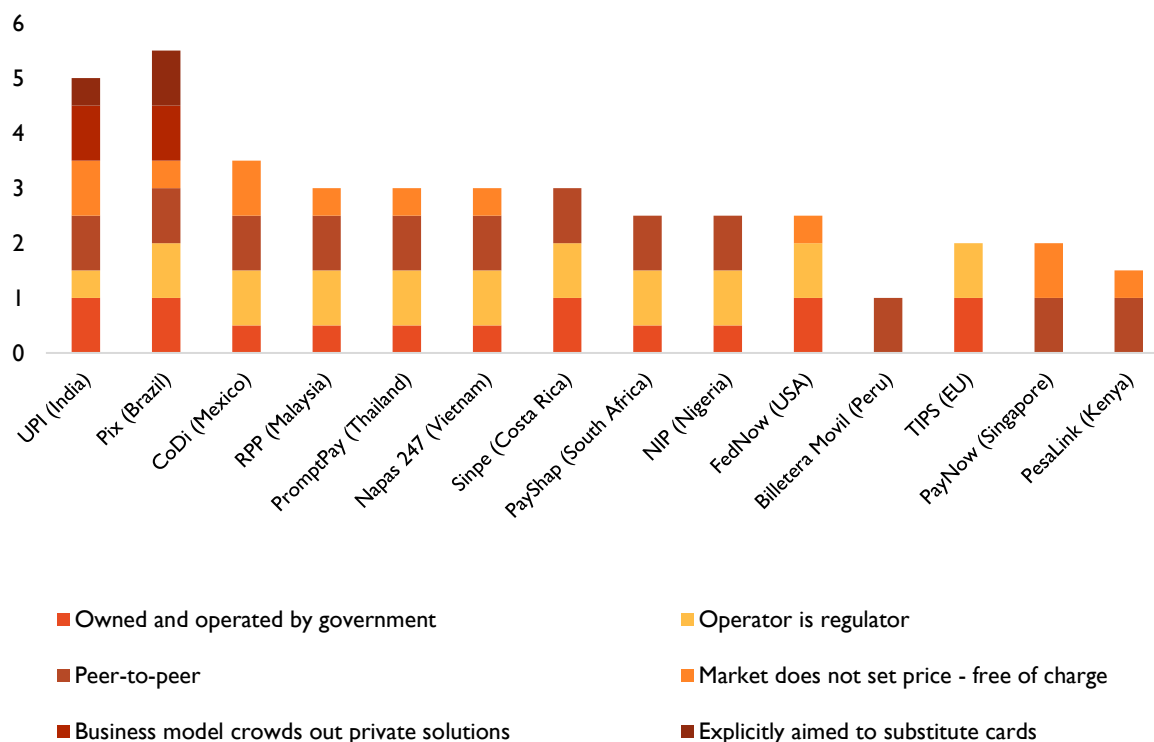
Assigning each affirmative answer a point would result in ranking of the complementarity vs. substitution of DPIs with private payment networks, with UPI and Pix being most direct substitutes to private payment networks, and real-time payment systems like PesaLink in Kenya and PayNow in Singapore most complementary (figure 4). As examples:

- The Brazilian Central Bank created Pix as a way for people, companies, and governmental entities to send or receive payment transfers instantly, at any time.⁸ It is free for individuals to use, but financial institutions like banks are able to set their own fees for merchants.⁹ According to economists at the Brazilian Central Bank, Pix is much cheaper than card payments. While Pix transactions cost an average of 0.22 percent of a transaction's value for merchants, debit cards are over 1 percent and credit cards reach up to 2.2 percent.¹⁰ The adoption of Pix has been explosive: in 2023, the number of Pix transactions surpassed those made with debit and credit cards combined.¹¹
- In the other extreme, the Kenyan real-time payment system PesaLink is owned and operated by the Kenya Bankers Association. While there is no specific app for consumers to use PesaLink, users can send money to their peers or other businesses if they have a mobile number linked to their bank account. Users can use apps from participating banks to send and receive money.¹² PesaLink has signed a Memorandum of Understanding with Mastercard to boost adoption and usage of digital payments in Kenya.¹³ PesaLink leverages Mastercard's technology and solutions to enhance its digital payments services. Rather than competing, the two services are collaborating to accelerate Kenya's transition to a cash-lite economy.

There are also notable competition policy challenges in countries such as Brazil and Costa Rica where the Central Bank both manages a national payment system and regulates the payment market. There is more work ahead to ensure DPIs promote competition in the payments market

and avert conflicts of interests.

Figure 4 – Extent to which DPIs substitute for private payment networks (higher value = likelier to risk substituting)



IV. Building on DPIs

DPIs have been enabled by a number of parallel technological developments, such as mass access to devices, expanding Internet connectivity, increasingly sophisticated biometrics, open banking and open finance practices and policies that have socialized service providers into sharing data with each other, and company registries that is increasingly readily available in machine-readable electronic format around the world.

In turn, once in place, DPIs are building blocks that enable solutions riding on the ID, payments, and data exchange solutions, such as (table 3):

- **Payment cards:** With the government's financial backing, India's card network RuPay has issued more than 600 million cards, most of the debit cards that connect to simple savings accounts opened by the government.¹⁴ India has also created a RuPay payment platform that enables the card holders of the private SBI credit card to make UPI transactions and link their cards to third-party UPI applications.
- **E-invoicing.** The French Chorus Pro e-invoicing platform based on the corporate identity numbers SIREN (9-digit identifier) and SIRET (14-digit identifier that maps company's

location in addition to the SIREN vitals) enables B2G, B2B, and B2C transactions creates efficiencies in tax payments and reduces fraud.

- **Visibility into financial data use:** Singapore’s Financial Data Exchange (SGFINDEX) is built on Singapore’s digital ID SingPass and ensures integrity and user protection by enabling people to access and understand how their financial data is used by government agencies and private service providers.
- **Healthcare services:** DPIs can support the development of digital health records, which in turn can improved the efficiency of healthcare delivery, making it easier for patients to access their medical history and receive appropriate treatment.¹⁵ For example, India’s ABDM serves to connect previously isolated digital health systems by establishing a healthcare ID registry for both healthcare practitioners and facilities. The initiative empowers public and local digital healthcare providers to give patients remote access to precise information and healthcare services. Another example is France’s Health Data Hub that gathers administrative data across different sources and platforms to improve interoperability.

Table 3 – Selected services built on DPIs

Name	Country	Enables
e-KYC	Indonesia	All citizens to have a Resident Identification Number to easily transact with government agencies and businesses both online and in-person
Chorus Pro e-invoicing platform	France	B2G, B2B, and B2C transactions creates efficiencies in tax payments and reduces fraud
Open Finance Framework	Philippines	Financial institutions can participate on a voluntary basis in a pilot that will cover public information, subscription and account opening, account information, payment initiatives, and more
OpenCerts Digital academic certificate	Singapore	Bolsters the robustness of education systems and delivers fair practices for employment by enabling accurate, low-cost qualification checks
Singapore Financial Data Exchange (SGFINDEX)	Singapore	Ensures integrity and user protection by enabling people to access and understand how their financial data is used by government agencies and private service providers

Study 2:

DPI readiness: infrastructure, regulations, and government capacity to make DPIs work

I. Introduction

For DPIs to be sustainable, as well as ensure inclusion, secure users' privacy, cybersecurity, rights, ideally countries that adopt them would have a number of preconditions in place, such as digital infrastructure and wide-spread internet connectivity, government capacity to adopt and operationalize DPIs, and an enabling legal and regulatory frameworks such as data privacy and cybersecurity laws. These elements were highlighted by the G20 in 2023 as essential for DPIs' adoption, In addition, regulatory frameworks surrounding DPIs need to encourage level playing fields between public and various private solutions. This paper develops two DPI readiness indices to gauge how prepared various countries are in adopting and managing DPIs.

II. DPI readiness index – first iteration

What then is various countries' readiness for adopting and managing DPIs? We explored this in the eTrade Alliance through a pioneering DPI Readiness Index in 2023. Since then, the G20 published a position paper on DPIs.¹⁶ The paper emphasized three elements as important for DPI development:

- Enabling financial and digital infrastructures, such as mobile penetration and broadband connectivity;
- Ancillary government support systems, such as G2P digital payments; and
- Conducive legal and regulatory frameworks, such as data protection and privacy laws.

In light of this paper, we developed a refined “version 2.0” DPI readiness index with five indicators for each of the three elements. The data are as follows:

Enabling financial and digital infrastructures:

- **Internet connectivity:** Provision of high-speed internet through broadband, for example through fiber-optic cables, wireless towers, and satellite systems and a telecom infrastructure facilitate the uptake of DPIs. We use here data from the United Nations on internet connectivity through the Online Service Index in 2022, which measures a country's level of sophistication in online presence.
- **Telecommunications network.** UN on Telecommunications Infrastructure Index in 2022. The Telecommunication Infrastructure Index is a weighted average of six primary infrastructure-related indicators that define a country's ICT infrastructure capacity.¹⁷

- **Access to devices:** Access to devices, most fundamentally phones and smartphones, is key to full benefits from DPis. Access is here proxied with data from Newzoo in 2019 on smartphone users.¹⁸
- **Cost of devices:** Cost of devices also shapes access; we use here smartphone and feature phone cost data for 2022 from the Alliance for Affordable Internet.¹⁹
- **Fintech ecosystem:** A robust fintech ecosystem enables the development of the technology that underlies and complements DPI. We use the 2021 Global Fintech Rankings Index from Findexable.²⁰
- **Digital skills and literacy:** Promoting digital skills and literacy is necessary to enable citizens to effectively use digital services. Digital literacy is here proxied by the World Bank's Human Capital Index from 2020.²¹

Ancillary government support systems, such as G2P digital payments

- **E-participation:** Measures the use of information and communication technologies (ICTs) that allow citizens to participation in government-related processes. The E-participation Index is supplementary to the United Nations E-Government Survey and acts as a framework composed of three core components: e-information, e-consultation, and e-decision-making.²²
- **E-Government:** The E-Government Development Index is a composite measure of three important dimensions of e-government: provision of online services, telecommunication connectivity, and human capacity. It seeks to reflect how a country is using information technologies to promote access and inclusion of its people. This data is from the UN 2022 E-Government Development Index.²³
- **Government effectiveness:** Captures the perceptions of the quality of public and civil services, its independence from political pressures, and the government's commitment to high quality policies and implementation, essential for DPI. This data is from World Bank Worldwide Governance Indicators.²⁴
- **Taxes as % of GDP:** Collecting taxes is a fundamental way for governments to generate public revenues that make it possible to finance investments in infrastructure such as DPI. This data comes from World Bank Indicators.²⁵
- **Public-private partnerships:** Readiness to develop public-private partnership should aide economies in creating DPis that promote rather than crowding out DPis. We use here as a proxy for public-private partnership readiness by the Infrascoppe Index Ranking that measures the enabling environment for public-private partnerships in infrastructure development and consists of five components: enabling laws and regulations, the institutional framework, operation maturity, investment and business climate, and financing facilities for infrastructure projects.²⁶

Conducive legal and regulatory frameworks, such as data protection and privacy laws

- **Privacy regulations:** We leverage our mapping of data privacy rules around the world. Countries with complete legislation are scored as 1, countries that do not have a data privacy law are scored as 0.²⁷
- **Cybersecurity capabilities:** DPIs should and do include cybersecurity technologies and measures to safeguard sensitive information, protect against cyber threats, and ensure data privacy. Estonia's National Cybersecurity Index provide multiple data points on the characteristics of cybersecurity readiness for 2021, which also correlate heavily with legal frameworks for cybersecurity.
- **Government data governance:** Data governance frameworks to ensure the security, privacy, and ethical use of data. This was found through the World Justice Project's Rule of Law Index. Factor 4 covers fundamental rights, and government data governance was found through right 4.6: Freedom from arbitrary interference with privacy is effectively guaranteed, where police or government officials conduct physical searches without warrants or intercept electronic communications of private individuals without judicial authorization.²⁸
- **Transparency:** Measures the availability of free and accessible information on public websites by showing what governments commit to sharing, and what they actually share. This data comes from CorruptionRisk.org and is updated as of June 2023.²⁹

Normalizing each variable to a 0-100 continuum and averaging the data by the three groups yields an index with North America as the most DPI-ready region, followed by Europe and Central Asia and Latin America and the Caribbean, while Sub-Saharan Africa lags behind (figures 1-2). The top three regions outperform particularly by government capacity such as tax collection and transparency (figure 3). Brazil and India remain in the top-tercile (figure 5). They also outperform peers at the same level of development, along with Thailand, Indonesia, Uruguay, among others (figure 4). The first and second iterations of the index are highly correlated, unsurprising given the use of similar variables (figure 5).

Figure 1 – DPI Readiness Index, by main element and region

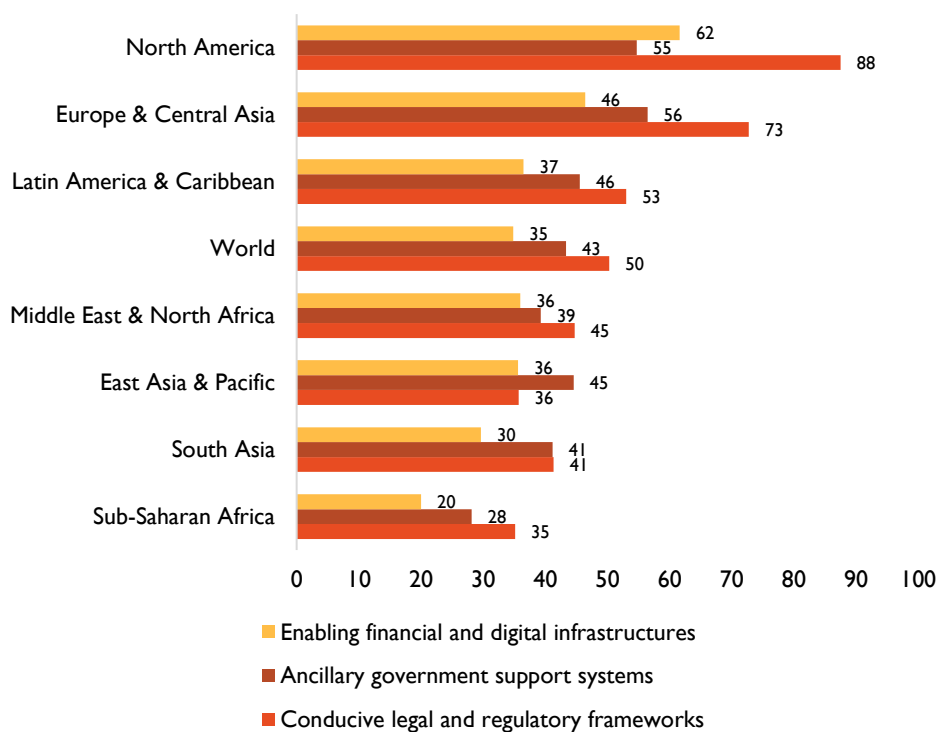


Figure 2 – DPI Readiness Index, by main element and region

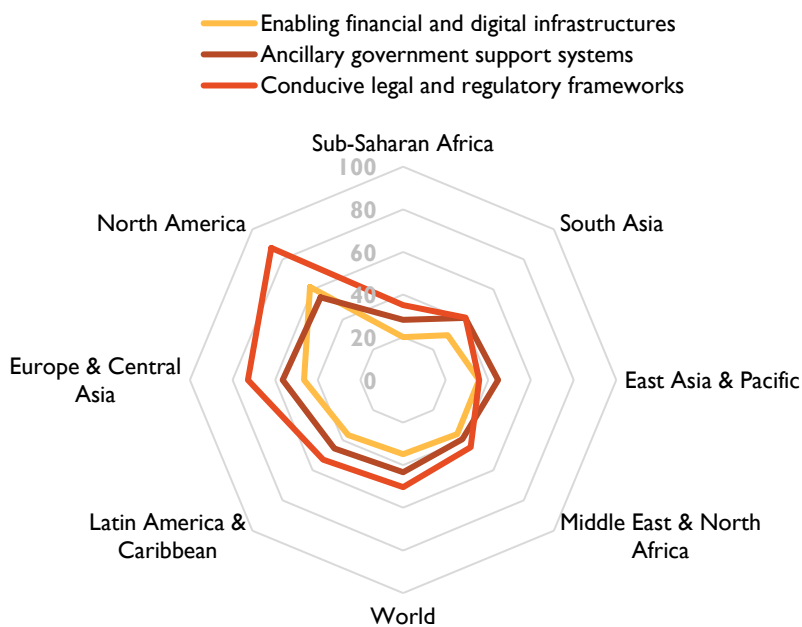


Figure 3 – DPI Readiness Index, by detailed element and region

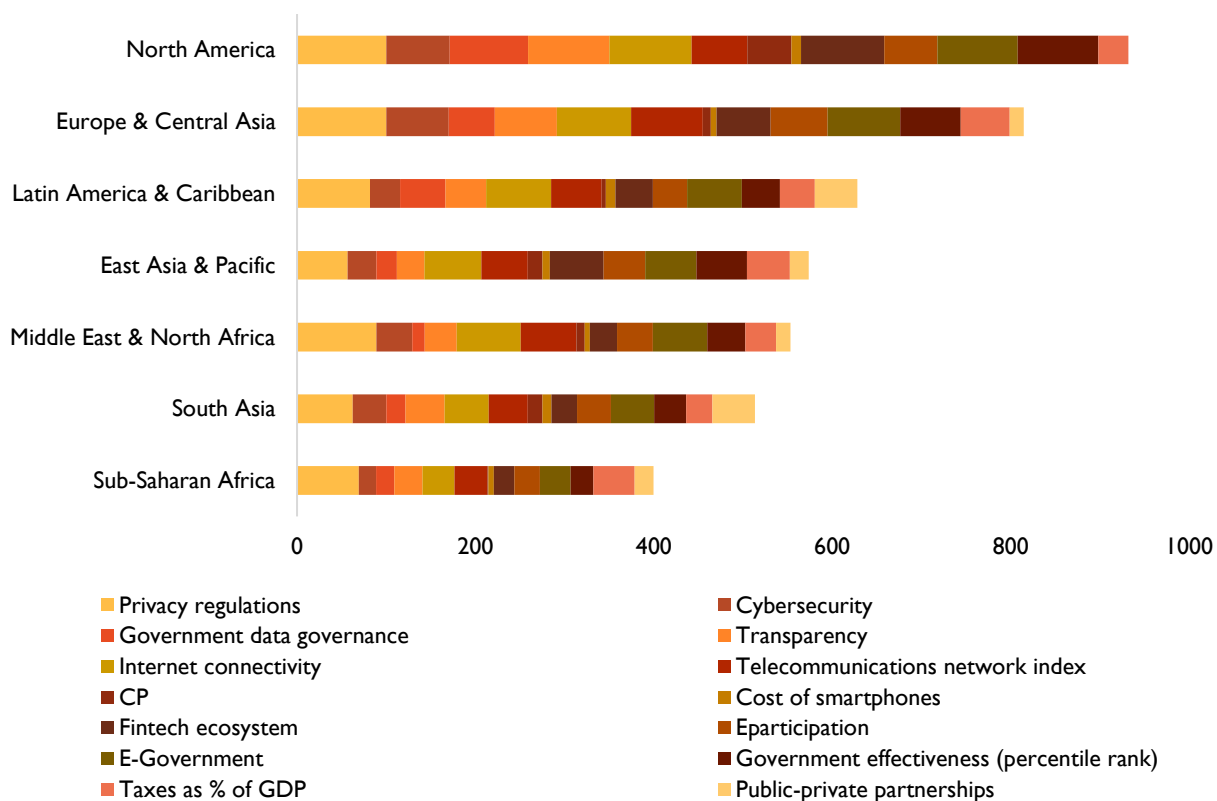


Figure 4 – DPI Readiness Index, by country (dark blue=readier)

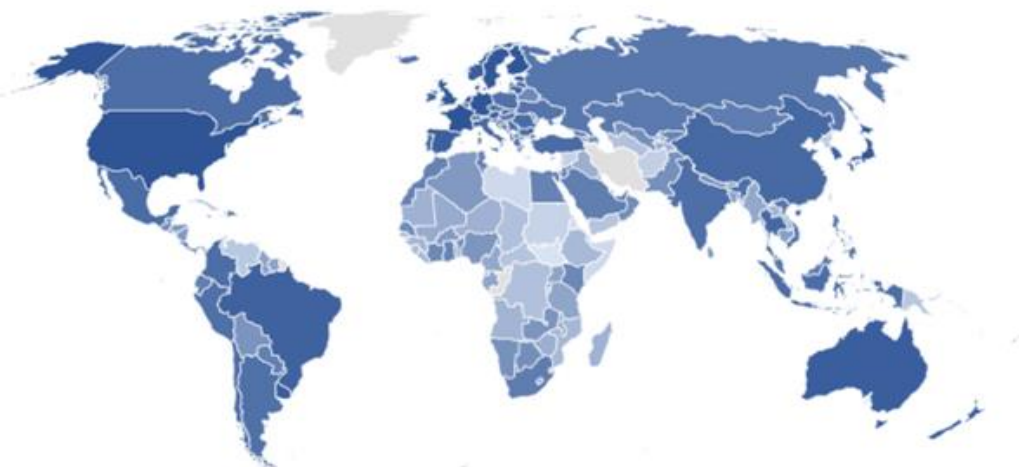
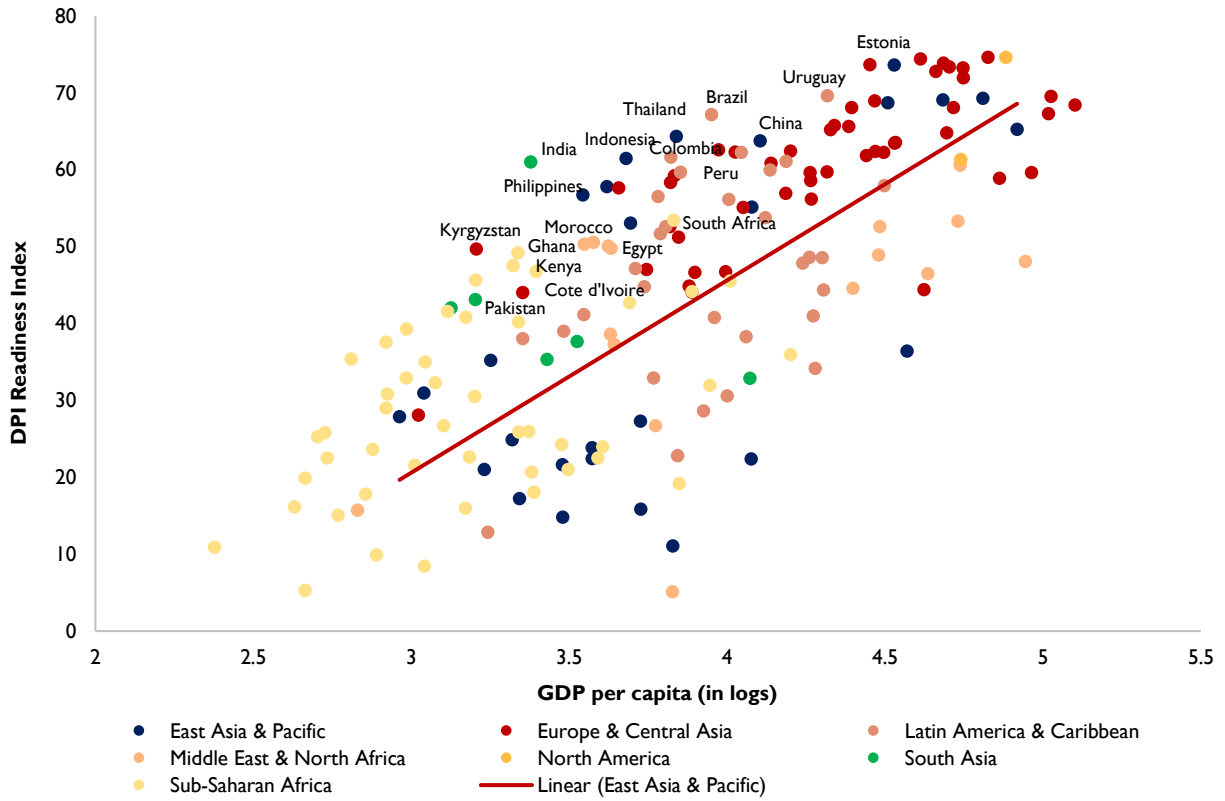


Figure 5 – DPI Readiness Index and GDP per capita



Study 3:

Uptake, use and inclusion gains from fast payment systems: early comparative data

I. Introduction

In recent years, there has been growing discussion on “digital public infrastructures” (DPIs), systems such as identity, alternative payment methods, and data exchanges that are backed by governments through ownership, operation, or through direct or indirect control or support. DPIs are often aimed to promote financial inclusion at scale. One central element in the DPI revolution is government-backed fast payment systems (FPS) that enable instant transfers between bank accounts on a specific payment rail.³⁰ There are by now some hundred FPS systems in the world; some prominent examples of government-backed FPS include India’s Unified Payments Interface (UPI) and Brazil’s Pix. These payment systems have generated a great deal of interest around the developing world and the development community as a means to promote financial inclusion.

However, the analysis of FPS’ inclusion gains and other benefits is still nascent. FPS have typically been analyzed in a case study format, without comparisons to each other — when there are many types of FPS and not all FPS are government-led, but rather, like Sweden’s Swish and UK’s Fast Payments, led by the private sector or, like Thailand’s PromptPay, co-led by the public and private sectors. In addition, FPS is only one potential payment system to promote outcomes governments are interested in, such as digital payments use, access to finance, and crossborder trade – comparisons to other models are required to assess the relative contributions of FPS on these elements.

The purpose of this brief, based on a longer Nextrade Group study, is to promote data-driven, policy-relevant discussion on the impacts of different types of FPS and other payment systems on inclusive development.³¹ The paper explores various types of data to start shedding light on the role of FPS on consumers and small and medium enterprises’ (SMEs) digital payments use, access to finance, and participation in trade; raises questions for future research, and provides recommendations to policymakers interested in building FPS.

The following section reviews the wave of digital payments adoption and use over the past decade. Section three assesses the role of FPS in these developments and the impact of FPS both for SMEs and consumers’ ability to pay, access financing, and engage in ecommerce and trade. Section four concludes with policy recommendations.

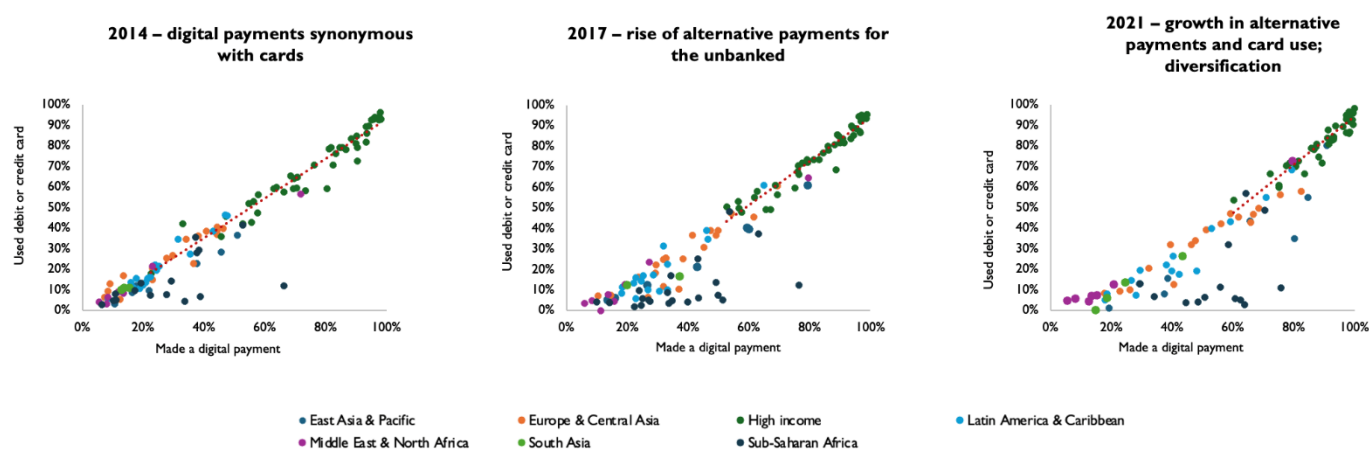
II. A decade of digital payments adoption

Multiple types of payment systems and methods have emerged around the world just over the past decade. If in 2014 using digital payments typically meant using debit and credit cards, by 2017 many countries especially in Africa started experience a striking growth in mobile payments through systems created by telecommunications companies, whereby an unbanked

user could top up a wallet on their mobile phone by paying an agent in a kiosk with cash, and then transact digitally with their peers (figure 1). The pioneer in this mobile payments revolution was Kenya’s M-PESA launched in 2007; since then, companies like MTN Mobile Money and Tigo Pesa have enabled mobile payments in multiple African markets. Similarly, in Bangladesh, mobile payment bKASH developed by a Fintech enabled millions of unbanked to transact.

By 2021, the rise of new payments systems had become even more visible, with many African countries featuring high digital payments use but low card use and bank account ownership rates. There also appeared countries that seemed to “have it all” – that grew the users of card and noncard payments simultaneously. These included, for example, China with fintech Alipay and Kazakhstan with superapp Kaspi, both of which also promoted card payments as the users could link their cards to them. In Thailand, e-wallet TrueMoney and FPS PromptPay grew popular amid rapid rise in bank account ownership and card use.

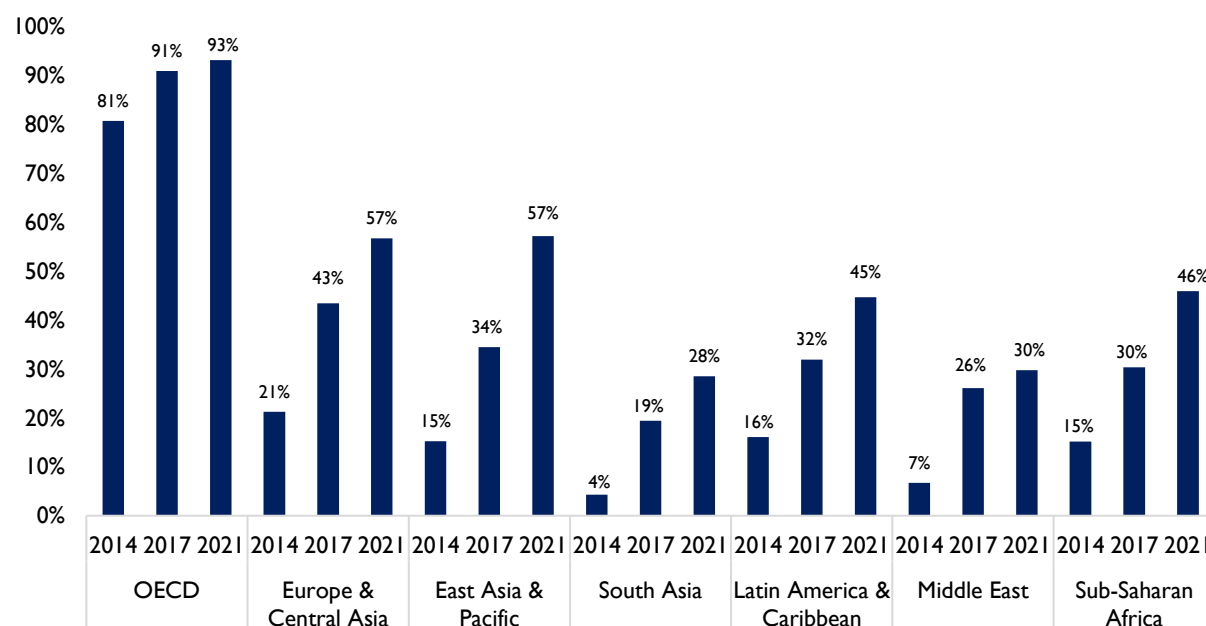
Figure 1 – Growth in the use of card payments and overall digital payments



Source: Nextrade Group on the basis of the World Bank’s Findex, 2014, 2017, 2021, <https://www.worldbank.org/en/publication/globalfindex>.

These trends have helped expand the share of individuals over 15 years of age that report using digital payments from 36 percent in 2014 to 59 percent in 2021 globally (figure 2). Also expanding was the use of different types of instruments. According to Findex, card use expanded in 115 economies between 2014 and 2021, from 28 percent to 40 percent of individuals over 15 years of age, while the share of individuals using non-card digital payments more than doubled from 8 percent in 2014 to 19 percent in 2021. Digital payments adoption has been robust even in the poorest quintile, raising from 10 percent in 2014 to 28 percent in 2021 in Latin America, 8 to 33 percent in Sub-Saharan Africa, 2 to 18 percent in South Asia, and, especially remarkably, 9 percent to 49 percent in East Asia. Overall, over the past decade, various types of digital payments have enabled the majority of mankind to transact digitally, and also enabled the poor to start entering the digital economy.

Figure 2 – Growth in the use of digital payments by region (share of people over 15 years using at least once a year), 2014-2021



Source: Nextrade Group on the basis of the World Bank's Findex, 2014, 2017, 2021, <https://www.worldbank.org/en/publication/globalfindex>.

Today, FPS are widely discussed the next breakthrough technology that could close the remaining gap in digital payments adoption especially among the poor. What then has been the role of FPS in the digital payments revolution? And how have FPS promoted other trends such as access to finance and trade? The next section explore answers.

III. Fast payment systems' use and inclusion gains: early data and hypotheses

Have fast payment systems promoted inclusion – here, digital payments use, access to finance, and trade inclusion, across different segments of societies? This question is still quite unexplored. Indeed, to date, reviews of FPS' impacts on digital payments inclusion have focused largely on total transactions or transactions per capita, not on the number of users, or users in different income segments.³² FPS' impacts on access to credit and trade are also unexplored.

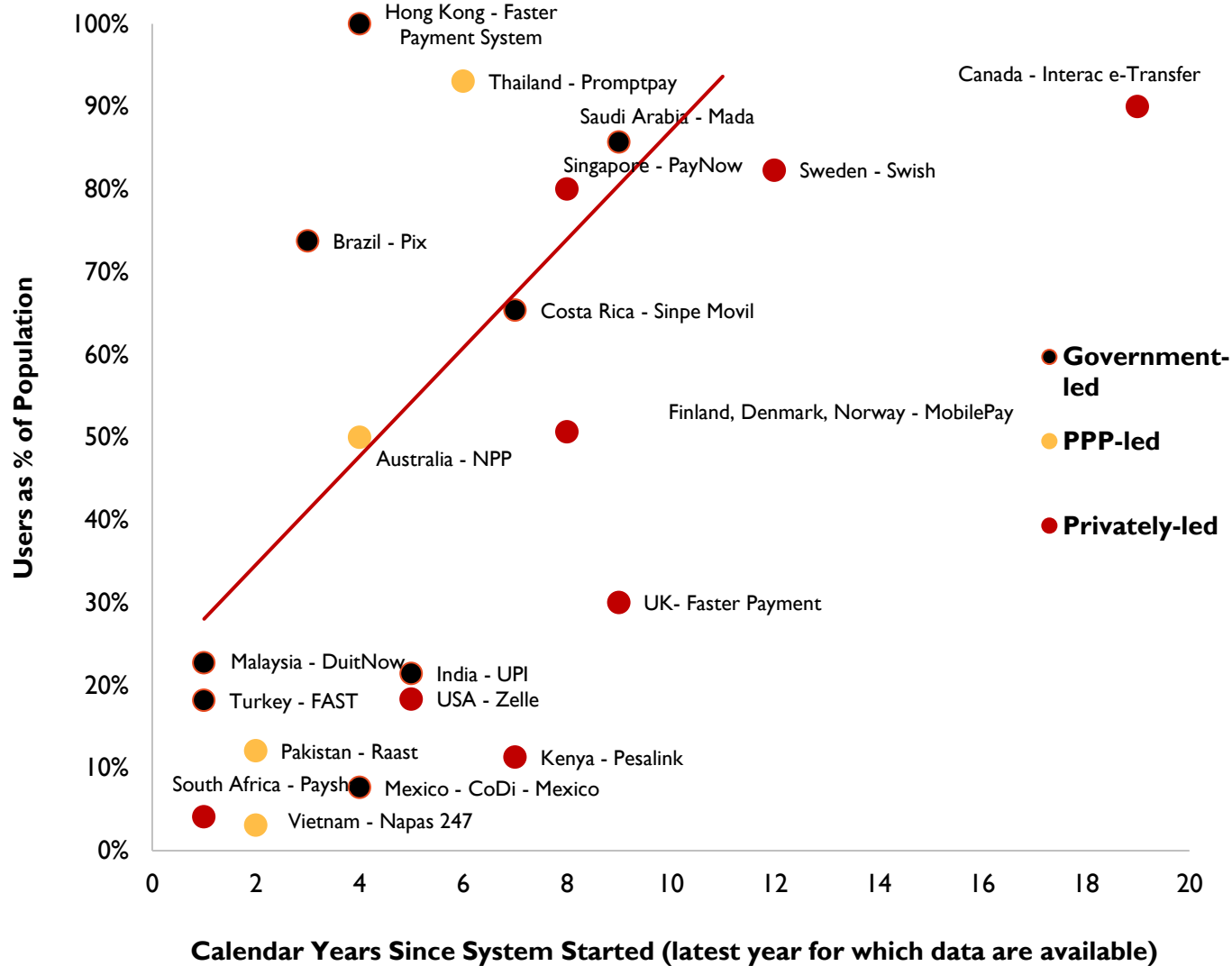
This section seeks to provide initial answers to these questions through data on the number of FPS users in different countries with government- and private sector-led FPS models; survey data on consumers and firms' frequency of using FPS; and different types of FPS users' views on the relative value of FPS, compared for example to credit cards, for engaging in trade and on improvements in accessing loans. The data are based on World Bank's Findex surveys of a total

of 445,498 individuals around the world in 2014, 2017, and 2021, central bank and third party data on FPS adoption and use, and a Nextrade Group surveys on 24-27 November 2023 and 15-19 January 2024 with 1,480 consumers and 840 businesses in Brazil, India, Costa Rica, and Thailand that asked the respondents about how they used various digital payments, and how the different types of users, including purely FSP users, accessed financing, participated in trade.

There are four main conclusions:

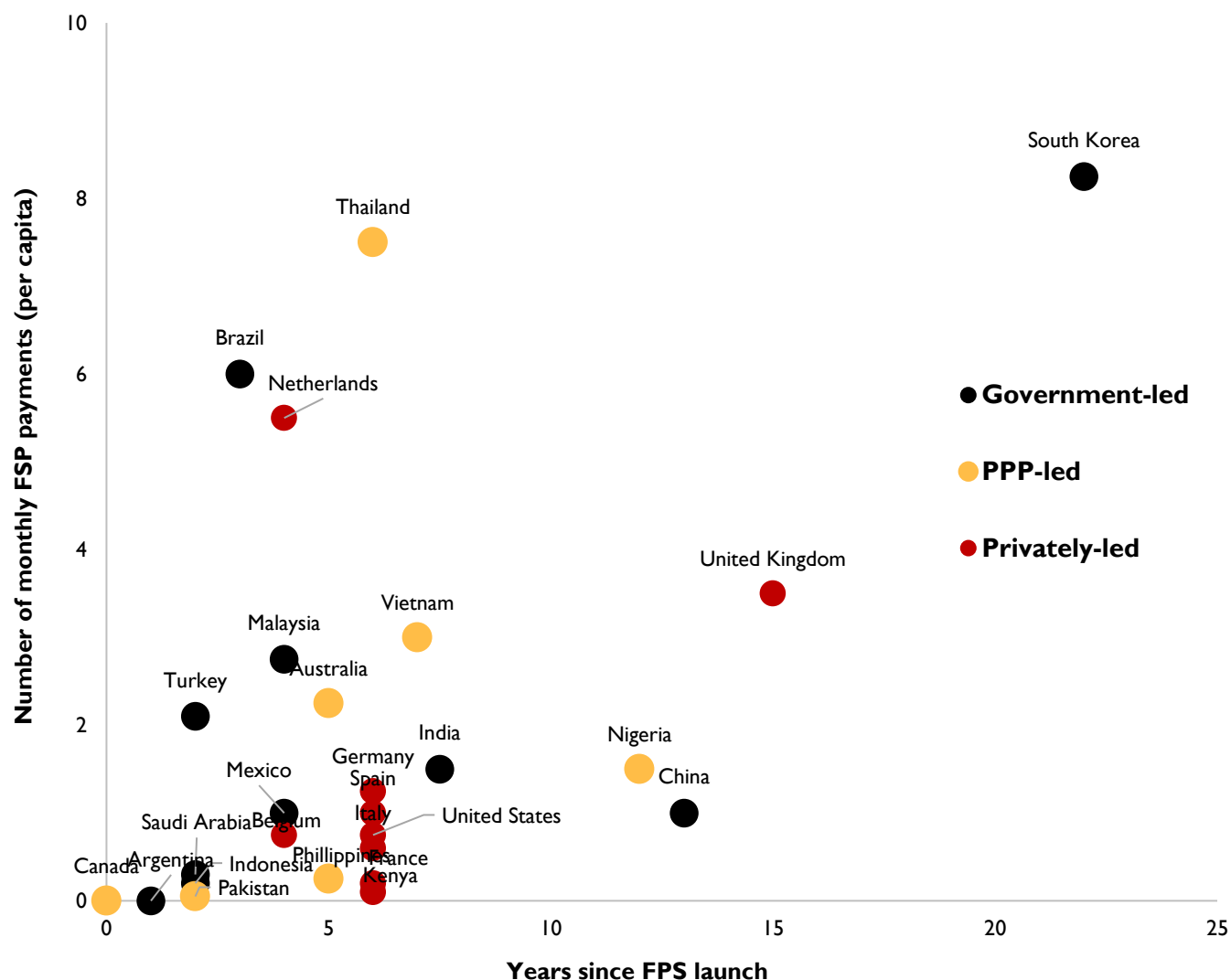
FPS adoption and use appears to be especially robust in countries with substantial pre-existing and rapidly growing use of digital payments. Among FPS systems, according to latest year for which data is available, government-led systems such as Brazil's Pix and Costa Rica's Sinpe Móvil, public-private models like Thailand's PromptPay, and private sector-led models like Singapore's PayNow and Sweden's Swish have had strong adoption rates in a relatively short period of time, while government-led systems such as Mexico's CoDi, and India's UPI, and private-led UK Faster Payments have been slower to take off (figure 3 and 4). While India's UPI was by its fifth year used by over 300 million Indians, this is still fewer than 22 percent of the population, well below 74 percent use of Pix in Brazil by year three, or 50 percent for Australia's NPP or over 90 percent for Thai PromptPay by year six.³³ The countries with mass adoption of FPS have also had strongest monthly per capita payment transactions.³⁴

Figure 3 – % of population using FPS and time since FPS introduction



Source: Nextrade Group (2024) on the basis of central bank and third party data. The data for each country is the latest year available since launch. For example, a system that was started in 2019 and for which latest user data was for 2022 would here be at 3 years since started.

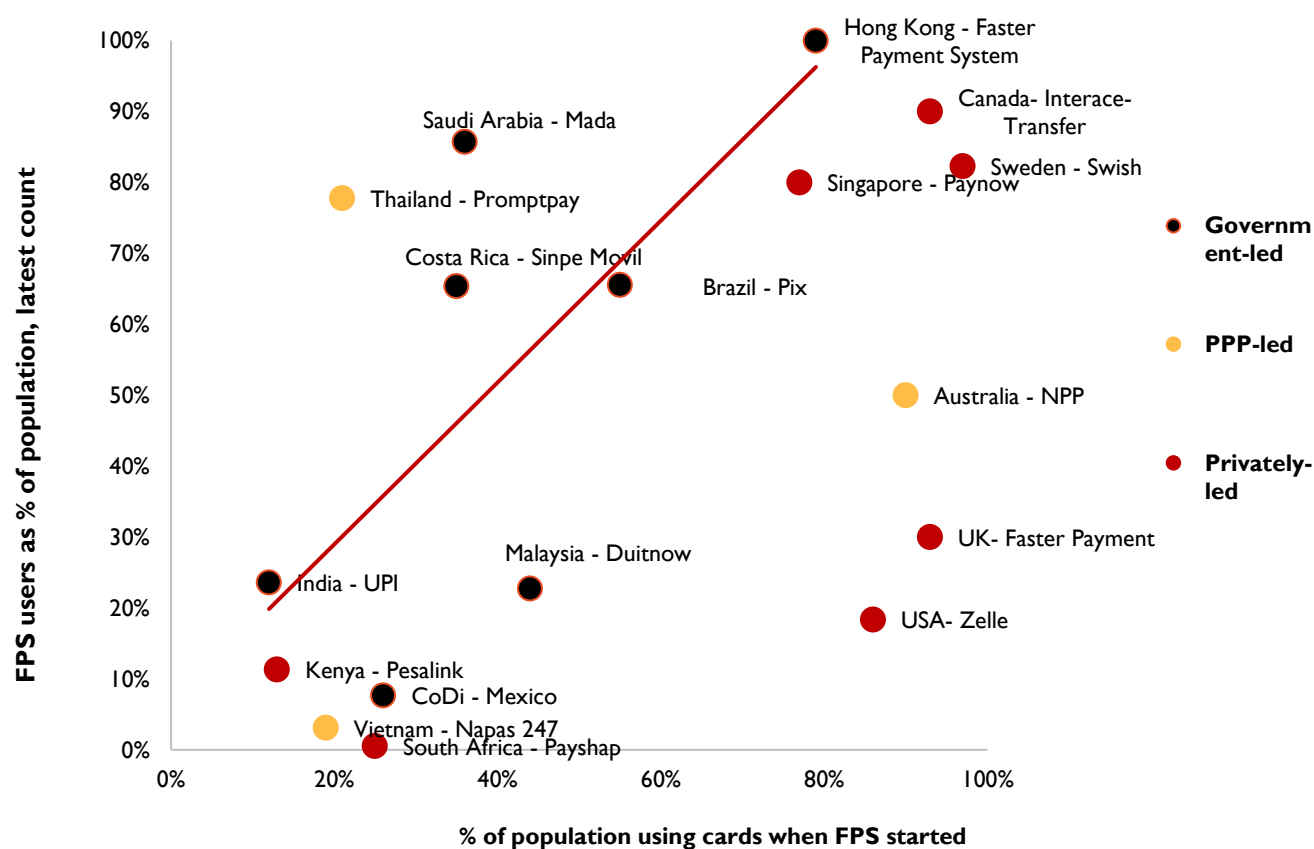
Figure 4 – Per capita transactions using FPS and time since FPS introduction



These data point to two potential conclusions. One, government-led FPS do not appear to have been more successful than privately run FPS in gaining users: private-sector-drive models such as Sweden’s Swish and Singapore’s PayNow, and public-private system PromptPay have been wildly popular. And two, FPS with government involvement appear to have gained users typically in countries where digital payments use had already started and was growing when an FPS was introduced. For example, Brazil, Costa Rica, and Thailand had rather robust debit and credit card usage rates in 2017, around the time their FPS were introduced, and strong growth in card adoption concurrently with FPS adoption: 39 percent of Brazilians reported using cards in 2017 and 55 percent did in 2021, and the share of card users grew from 35 to 40 percent in Costa Rica and 21 percent to 35 percent in Thailand in 2017-21. These three countries also had relatively fast growth in monthly FPS transactions per capita.³⁵

Meanwhile, in countries with slower FPS adoption, India (UPI launched in 2016) and Mexico (CoDi launched in 2019), card use was still in the teens in 2017 at 12 and 16 percent, respectively, growing only to 13 percent in India and 26 percent in Mexico by 2021. The widely different adoption rates between Brazil and Costa Rica, on the one hand, and India and Mexico, on the other, may suggest that a government dropping an FPS in the market will unlikely lead to mass adoption without pre-existing digital payments use and ecosystem.

Figure 5 – % of population using cards at the time of FPS introduction and latest FPS usage rates

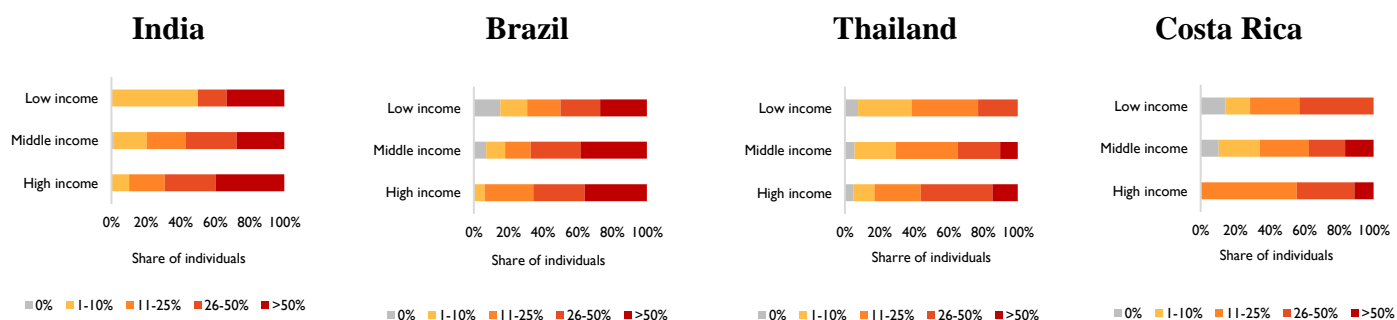


FPS adoption appears to be strongest and FPS valued most among SMEs and consumers that already use some other digital payment system. There is to date little analysis of FPS adoption by income segments, to substantiate the notion that FPS enable the poor in particular to transact digitally. Our survey data indicate that poorer consumers, even ones that are banked, use FPS less intensively than their wealthier counterparts and still often opt for cash – and also value FPS less than wealthier segments do. For example, in Brazil, 15 percent of the poorest segments do not use Pix at all, 15 percent use it only 1-10 percent of their transactions, and 27 percent use it intensively, while all surveyed in the wealthier segments use Pix, only 6 percent use it for 1-10 percent of transactions, while 36 percent use it intensively (figure 6). Across countries, FPS appears to be adopted and more intensively used among wealthier segments that typically also use cards – but adopt FPS as another convenient way to pay, and thus possibly substitute for some card payments.³⁶ Wealthier segments also value FPS more: for example in India, 85

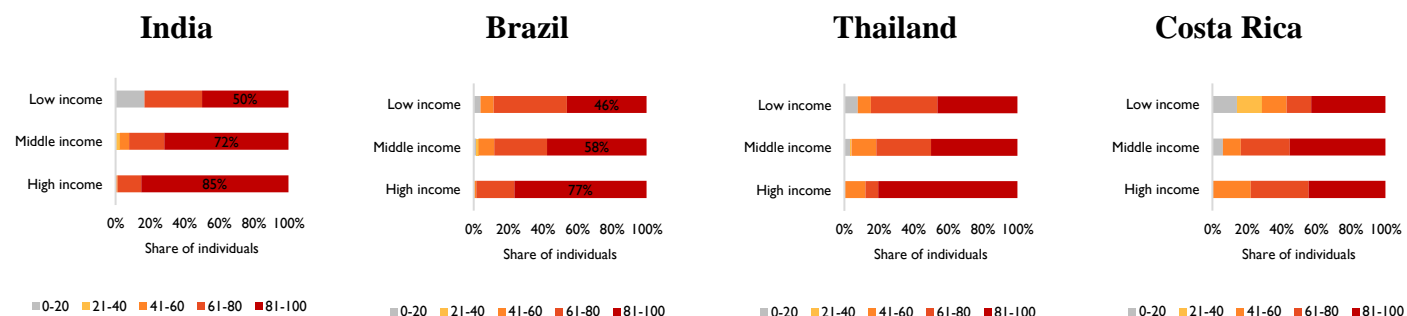
percent of UPI users rate it 81-100 on a scale of 0 to 100, while only 50 percent of poorer segments do.

Figure 6 – Intensity of FPS use and value assigned to FPS, by income segment and country

Frequency of FPS usage as % of daily transactions (from 0% of transactions to >50% of transactions)



Perceived value of FPS (0= not at all valuable; 100 = extremely valuable)



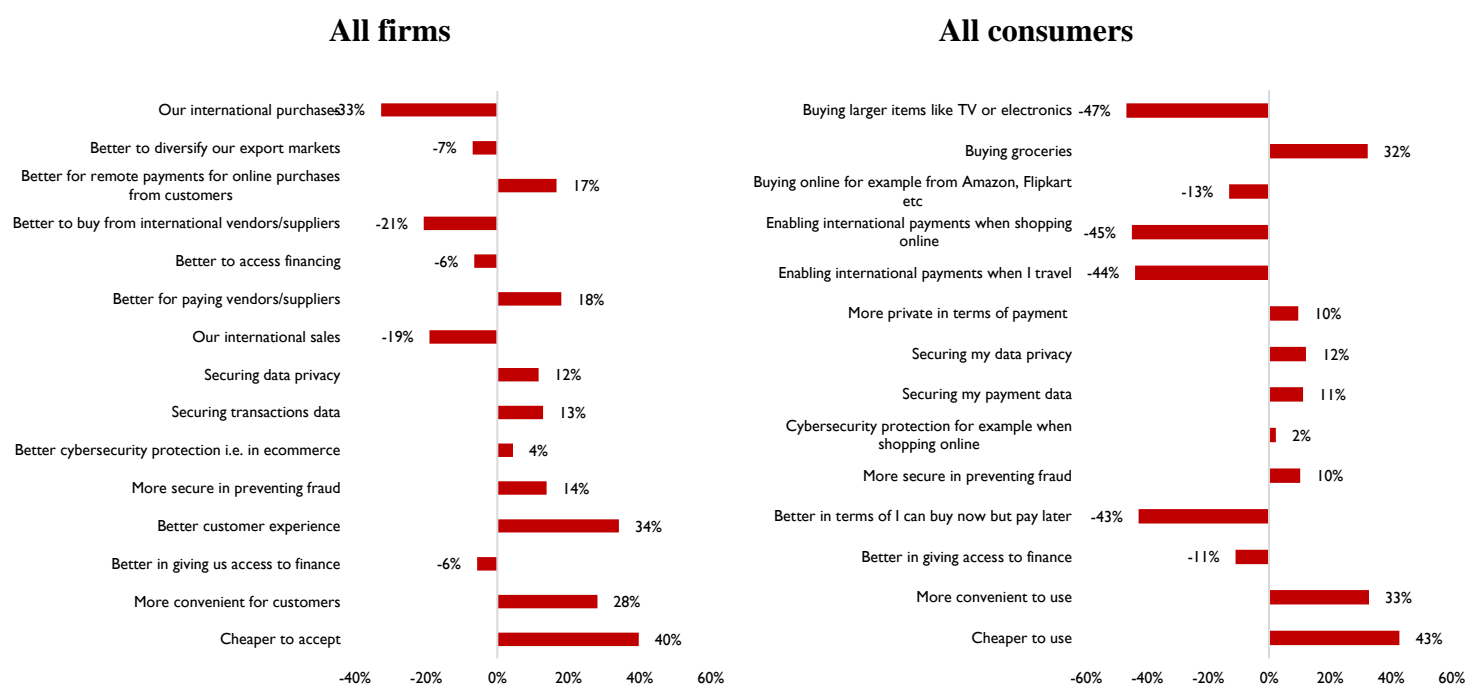
Source: Nextrade Group surveys on 24-27 November 2023 and 15-19 January 2024 with 1,480 consumers.

The patterns are similar among SMEs. The surveyed SMEs that use and accept credit card payments are likeliest accept FPS intensively, and are also most prepared to pay for card and FPS acceptance. These SMEs are typically digitized and successful multimarket exporters often found outside urban areas who and whose customers habitually use digital payments. Meanwhile, FPS are used less intensively by SMEs that do not accept cards or export, are often retailers found in major urban areas, and that struggle to grow. These firms are also typically unwilling to pay for digital payments acceptance, reflecting both their low profit margins and, likely, use of cash by their customers.

Surveys in the four countries suggest that FPS and credit cards have distinct comparative advantages: FPS are perceived as providing convenience at moderate cost, while cards are seen as conducive to access to credit and crossborder payments. Across countries, firms that accept and use FPS report positive impacts from FPS, such as increased sales, improved

customer experience, and efficiency gains. However, credit card users see similar gains from the use of credit cards. More interesting are the relative benefits: on balance, for both SMEs and consumers surveyed in this research, FPS are seen as competing on cost, convenience, and customer experience – but cards are seen as critical for crossborder payments, ecommerce sales and purchases, and accessing credit (figure 7). FPS and cards are also used for different types of purchases: among consumers, FPS are used especially for smaller payments like groceries, while credit cards are used for larger purchases, such as electronics and appliances – where the financing that cards offer is also especially valuable.

Figure 7 – Perceptions of the net benefits of cards vs FPS for firms and consumers in Brazil, Costa Rica, India and Thailand (positive value = FPS is net positive, negative value = card is net positive)



Source: Nextrade Group surveys on 24-27 November 2023 and 15-19 January 2024 with 840 businesses in Brazil, India, Costa Rica, and Thailand.

The data also indicate what could be expected: FPS do not support SMEs' trade, as, barring some mostly bilateral interoperability pilots, FPS do not interoperate well with each other. Among surveyed SMEs, when asked whether they would rather give up FPS or credit cards, 70 percent of exporters in India would rather give up UPI (and only 30 would give up card) and two-thirds of exporters in Brazil would give up Pix (and only a third would give up card).

There is also a clear correlation between firms' export participation and willingness to pay for digital payments and especially card acceptance: firms that export and export are more likely to pay for both UPI and for cards (figures 8-9). In India, one-half of firms that export would pay at least a one percent fee to use UPI, compared to a quarter of nonexporters. In Brazil, the numbers

are less striking, but exporters are still somewhat likelier to pay to accept cards than nonexporters. When asked whether they would give up DPI or credit cards if forced to choose, exporters are likelier to give up DPI, again suggesting that cards add particular value to exporters (figures 12-13). Firms that export to many markets are especially likely to give up DPI.

Figure 10 – Indian firms’ willingness to pay to accept payment by UPI and cards, by export diversification

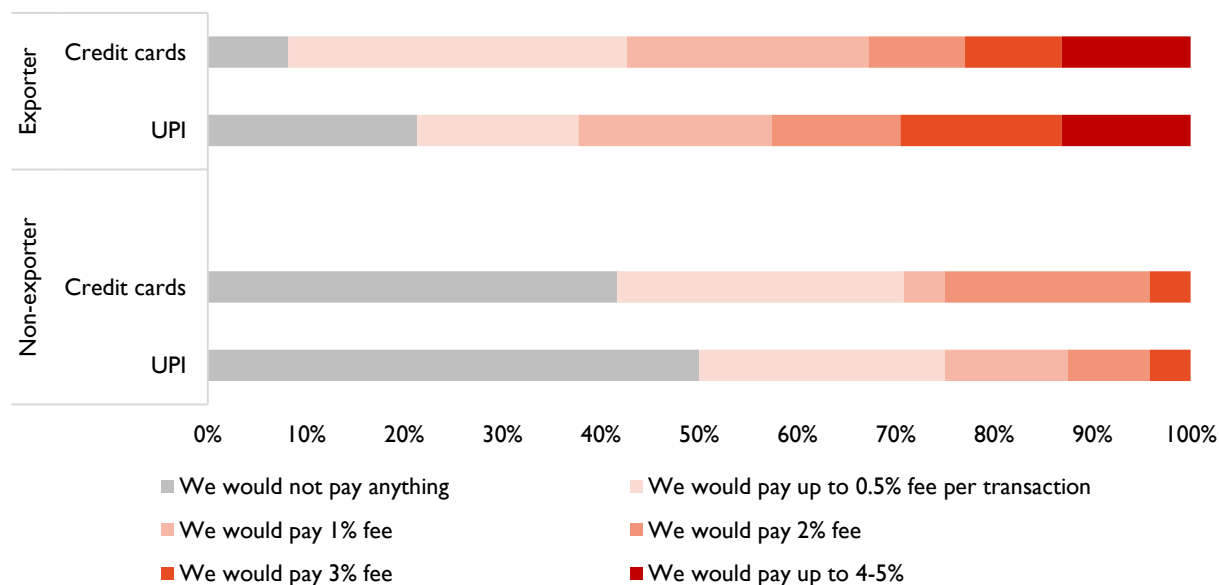


Figure 11 –Brazilian firms’ willingness to pay to accept payment by Pix and cards, by export diversification

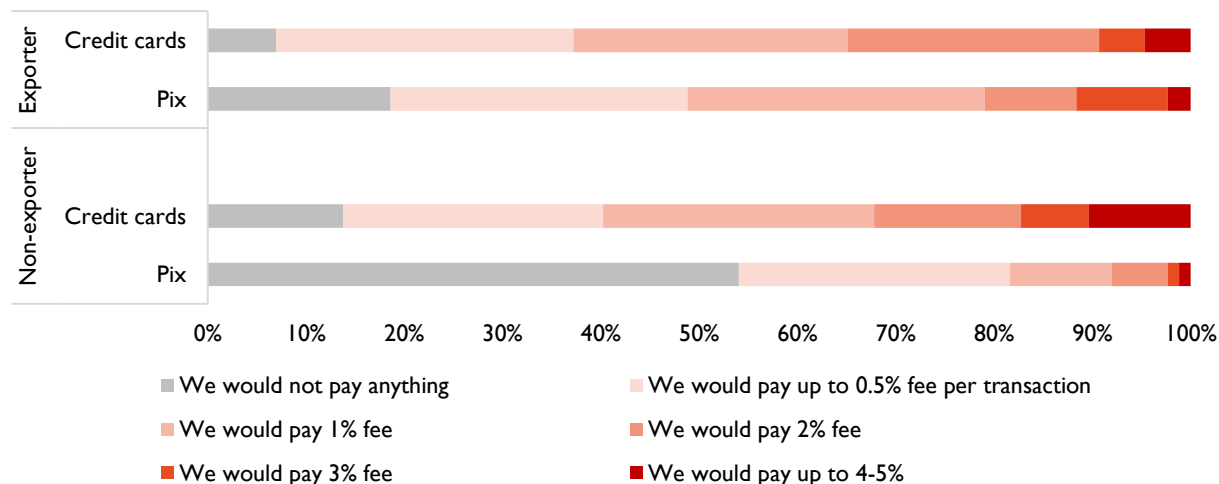


Figure 12 – Indian firms’ readiness to give up UPI vs. card, by export status

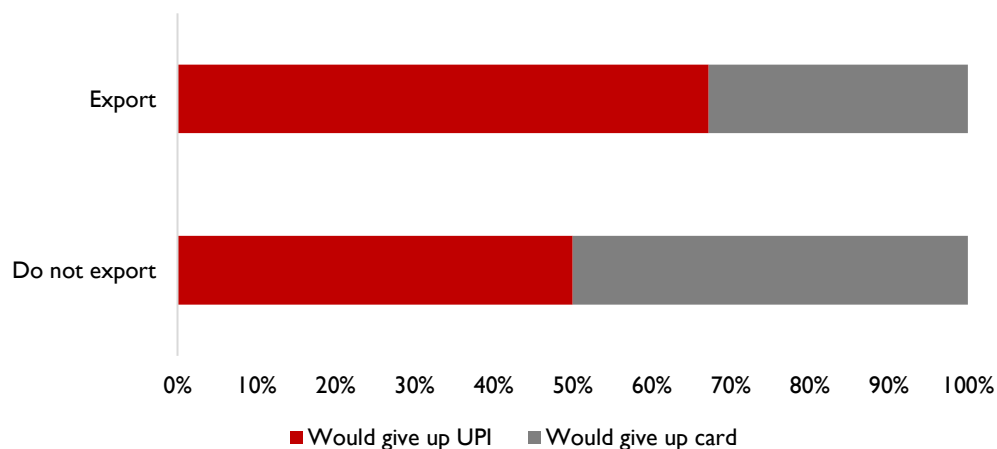
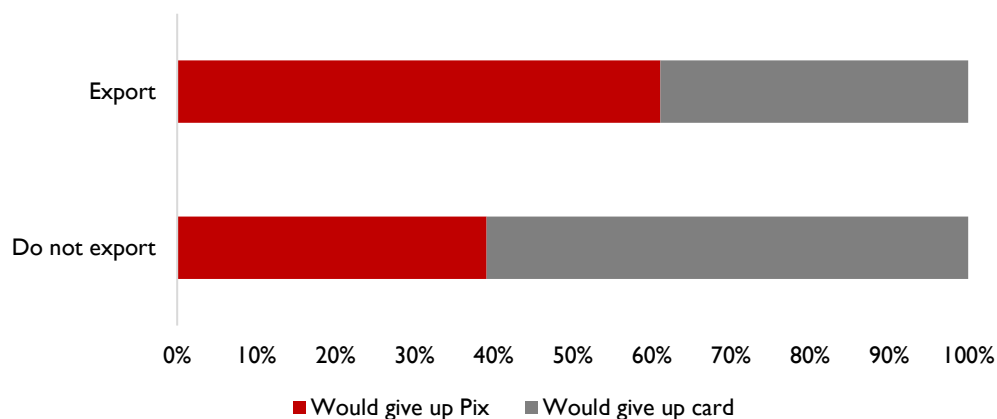


Figure 13 – Brazilian firms’ readiness to give up Pix vs. card, by export status



IV. Characteristics of firms of different levels of willingness to pay for DPI and card acceptance

Tables 1 and 2 provide a view on the characteristics of firms that use DPIs and cards and have different levels of willingness to pay for these instruments. Firms that are particularly willing to pay for both cards and DPIs are export-driven B2B sellers likelier to be found in suburbs. These firms are successful multimarket sellers with limited credit constraints. Meanwhile, firms that are unwilling to pay for DPIs are likelier to be B2C sellers within major cities that only sell to domestic markets and generally struggle to access financing. In Brazil in particular, these are micro enterprises and early in their digital transformation journey. There is a notable correlation between willingness to pay for DPIs and cards – firms that are willing to pay for one instrument would also pay for the other, suggesting these firms value the ability to transact digitally with their customers. Overall, these data, while still a small sample, indicates that FPS and cards are especially valuable to advanced digitizers that export – and that cards are especially valuable to export-driven firms.

Table 1 - Characteristics of Indian firms by different levels of willingness to pay for DPIs and cards

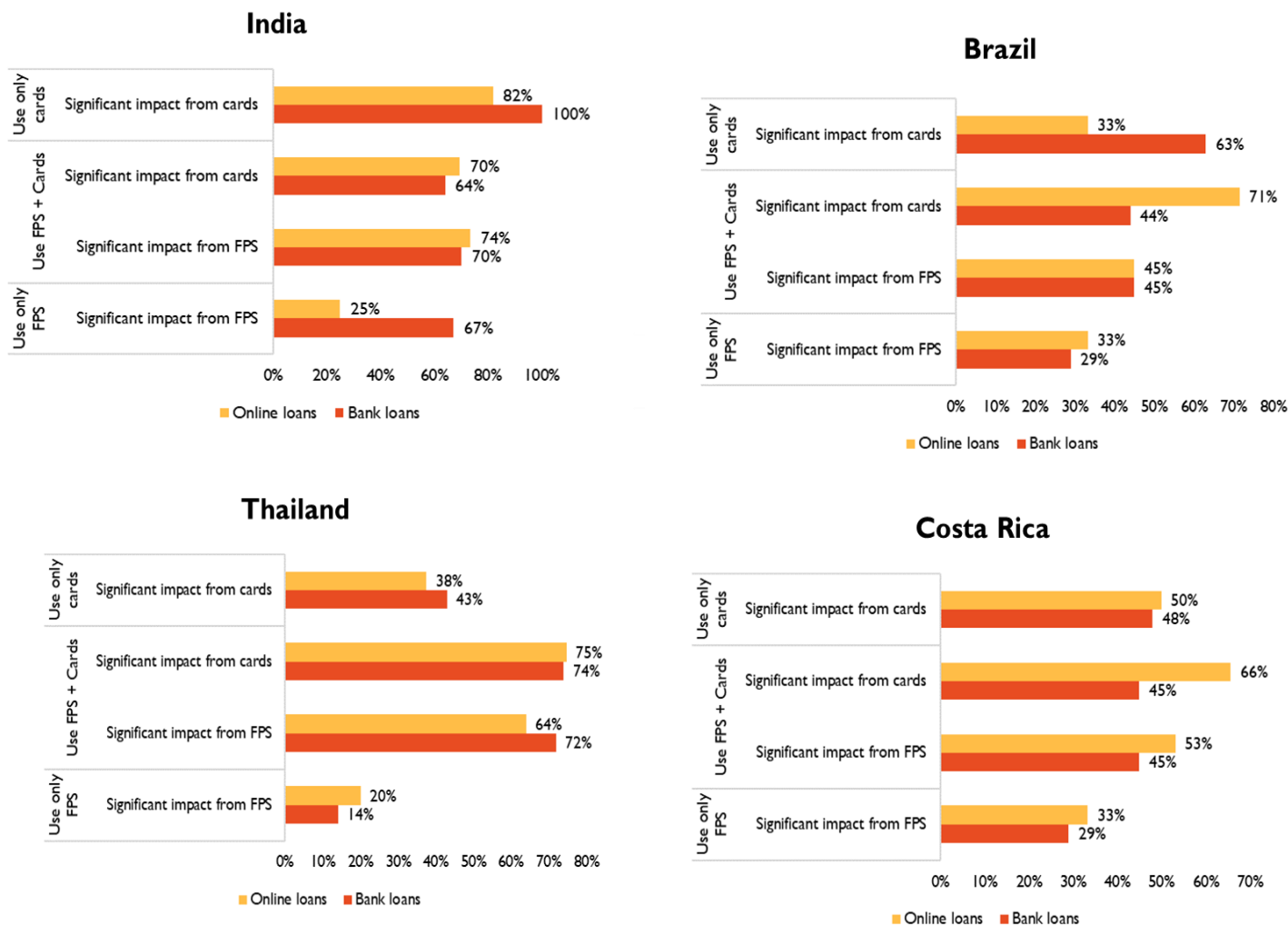
India	Do not want to pay for UPI	Ready to pay 2%+ for UPI	Ready to pay 3%+ for UPI	Ready to pay 4%+ for UPI	Do not want to pay for cards	Ready to pay 2%+ for cards	Ready to pay 3%+ for cards
Size	Micro: 84% Small: 16%	Micro: 76% Small: 24%	Micro: 83% Small: 17%	Micro: 89% Small: 11%	Micro: 75% Small: 25%	Micro: 77% Small: 23%	Micro: 92% Small: 8%
B2C vs B2B seller	B2C: 44% B2B: 71%	B2C: 45% B2B: 86%	B2C: 50% B2B: 87%	B2C: 44% B2B: 94%	B2C: 39% B2B: 73%	B2C: 48% B2B: 86%	B2C: 50% B2B: 89%
Export participation	Non-exporter: 45% 1-3 markets: 40% 4+ markets: 15%	Non-exporter: 14% 1-3 markets: 42% 4+ markets: 43%	Non-exporter: 13% 1-3 markets: 35% 4+ markets: 52%	Non-exporter: 6% 1-3 markets: 50% 4+ markets: 44%	Non-exporter: 61% 1-3 markets: 30% 4+ markets: 9%	Non-exporter: 17% 1-3 markets: 37% 4+ markets: 46%	Non-exporter: 11% 1-3 markets: 31% 4+ markets: 58%
Location	Large city: 50% Suburbs: 24% Second tier city: 11% Third tier city: 5% Small town/rural: 10%	Large city: 42% Suburbs: 28% Second tier city: 5% Third tier city: 1% Small town/rural: 24%	Large city: 35% Suburbs: 35% Second tier city: 4% Third tier city: 2% Small town/rural: 24%	Large city: 33% Suburbs: 44% Second tier city: 6% Third tier city: 0% Small town/rural: 17%	Large city: 55% Suburbs: 25% Second tier city: 11% Third tier city: 0% Small town/rural: 9%	Large city: 44% Suburbs: 24% Second tier city: 7% Third tier city: 1% Small town/rural: 24%	Large city: 31% Suburbs: 33% Second tier city: 6% Third tier city: 0% Small town/rural: 31%
Years using DPI	>4 years: 31% 2-3 years: 39% 1 year or less: 26% Do not use: 3%	>4 years: 49% 2-3 years: 28% 1 year or less: 18% Do not use: 0%	>4 years: 46% 2-3 years: 26% 1 year or less: 22% Do not use: 0%	>4 years: 56% 2-3 years: 22% 1 year or less: 22% Do not use: 0%	>4 years: 32% 2-3 years: 32% 1 year or less: 34% Do not use: 0%	>4 years: 44% 2-3 years: 32% 1 year or less: 15% Do not use: 3%	>4 years: 47% 2-3 years: 25% 1 year or less: 22% Do not use: 6%
Years using credit card	>4 years: 44% 2-3 years: 15% 1 year or less: 11% Do not use: 18%	>4 years: 39% 2-3 years: 22% 1 year or less: 17% Do not use: 11%	>4 years: 35% 2-3 years: 26% 1 year or less: 15% Do not use: 13%	>4 years: 39% 2-3 years: 28% 1 year or less: 11% Do not use: 22%	>4 years: 41% 2-3 years: 14% 1 year or less: 11% Do not use: 25%	>4 years: 45% 2-3 years: 18% 1 year or less: 17% Do not use: 10%	>4 years: 44% 2-3 years: 25% 1 year or less: 17% Do not use: 8%
Number of digital services and technologies adopted	Early: 44% Emerging: 26% Advanced: 31%	Early: 53% Emerging: 13% Advanced: 34%	Early: 54% Emerging: 13% Advanced: 33%	Early: 67% Emerging: 11% Advanced: 22%	Early: 54% Emerging: 13% Advanced: 33%	Early: 45% Emerging: 18% Advanced: 37%	Early: 56% Emerging: 14% Advanced: 31%
Share that would pay nothing for...	Card: 45%	Card: 5%	Card: 7%	Card: 11%	UPI: 67%	UPI: 6%	UPI: 6%
Has improved access to finance using UPI	100%	100%	100%	100%	100%	100%	100%
% reporting very easy to access finance from bank	34%	41%	50%	67%	34%	48%	61%

Table 2 - Characteristics of Brazilian firms by different levels of willingness to pay for DPIs and cards

Brazil	Do not want to pay for Pix	Ready to pay 2%+ for Pix	Ready to pay 3%+ for Pix	Do not want to pay for cards	Ready to pay 2%+ for cards	Ready to pay 3%+ for cards
Size	Micro: 71% Small: 29%	Micro: 57% Small: 43%	Micro: 37% Small: 63%	Micro: 68% Small: 32%	Micro: 64% Small: 36%	Micro: 62% Small: 38%
B2C vs B2B seller	B2C: 66% B2B: 57%	B2C: 43% B2B: 73%	B2C: 42% B2B: 74%	B2C: 50% B2B: 68%	B2C: 57% B2B: 69%	B2C: 57% B2B: 65%
Export participation	Non-exporter: 74% 1-3 markets: 21% 4+ markets: 5%	Non-exporter: 43% 1-3 markets: 41% 4+ markets: 16%	Non-exporter: 32% 1-3 markets: 47% 4+ markets: 21%	Non-exporter: 73% 1-3 markets: 20% 4+ markets: 7%	Non-exporter: 52% 1-3 markets: 39% 4+ markets: 9%	Non-exporter: 62% 1-3 markets: 30% 4+ markets: 8%
Location	Large city: 47% Suburbs: 8% Second tier city: 17% Third tier city: 20% Small town/rural: 8%	Large city: 43% Suburbs: 11% Second tier city: 30% Third tier city: 14% Small town/rural: 2%	Large city: 37% Suburbs: 21% Second tier city: 21% Third tier city: 16% Small town/rural: 5%	Large city: 52% Suburbs: 7% Second tier city: 14% Third tier city: 23% Small town/rural: 5%	Large city: 50% Suburbs: 9% Second tier city: 19% Third tier city: 16% Small town/rural: 6%	Large city: 46% Suburbs: 11% Second tier city: 19% Third tier city: 14% Small town/rural: 11%
Years using DPI	>4 years: 34% 2-3 years: 39% 1 year or less: 18% Do not use: 3%	>4 years: 34% 2-3 years: 39% 1 year or less: 23% Do not use: 0%	>4 years: 58% 2-3 years: 32% 1 year or less: 11% Do not use: 0%	>4 years: 41% 2-3 years: 32% 1 year or less: 18% Do not use: 2%	>4 years: 36% 2-3 years: 36% 1 year or less: 23% Do not use: 1%	>4 years: 49% 2-3 years: 35% 1 year or less: 14% Do not use: 0%
Years using credit card	>4 years: 64% 2-3 years: 11% 1 year or less: 4% Do not use: 12%	>4 years: 75% 2-3 years: 14% 1 year or less: 2% Do not use: 2%	>4 years: 89% 2-3 years: 0% 1 year or less: 0% Do not use: 0%	>4 years: 59% 2-3 years: 5% 1 year or less: 5% Do not use: 20%	>4 years: 68% 2-3 years: 16% 1 year or less: 6% Do not use: 3%	>4 years: 70% 2-3 years: 16% 1 year or less: 5% Do not use: 3%
Number of digital services and technologies adopted	Early: 50% Emerging: 25% Advanced: 25%	Early: 45% Emerging: 32% Advanced: 23%	Early: 32% Emerging: 42% Advanced: 26%	Early: 61% Emerging: 25% Advanced: 14%	Early: 39% Emerging: 30% Advanced: 32%	Early: 35% Emerging: 35% Advanced: 30%
Share that would pay nothing for...	Card: 36%	Card: 7%	Card: 5%	Pix: 81%	Pix: 32%	Pix: 34%
Has improved access to finance using Pix	84%	93%	100%	82%	88%	86%
% reporting very easy to access finance from bank	28%	34%	42%	11%	34%	35%

FPS adoption has helped some consumers and firms access financing, but card users still report better access to finance. FPS could provide users that previously transacted in cash new opportunities to develop credit histories through data on digital payments. Do FPS then improve users' access to finance? And do FPS improve users' access to finance more than for example mobile payment or card payments would? An analysis of the Findex database suggests that borrowing from banks is higher among card users than non-card users that have bank accounts in a vast majority of markets and across income segments. Our survey echoes some of these findings. For example, while 25 percent of Indians and 33 percent of Brazilians that do not use cards see the use of FPS as having promoted their access to online loans, 70 percent of card users report improved access to online loans. Among firms, 44 percent of SMEs in Brazil that accept cards and Pix report "significant" improvement in access to finance after adopting these instruments, compared to 29 percent of firms that accept Pix only. In Thailand, 74 percent of firms that use both cards and PromptPay report "significant" improvement in access to finance, versus only 14 percent of firms that only use PromptPay.

Figure 12 – % of card users, card and FPS users and FPS-only users that report significant increase in the access to bank loans and online loans as a result of starting these systems



These data are indicative, but they raise useful hypotheses for research. For example, they for now suggest that FPS adoption and use can promote, but does not necessarily revolutionize, consumers and firms' access financing. The data may also indicate that card users have characteristics that make them more credit-worthy, as opposed to the FPS-only users that are likelier to be the poorer "thin-file" borrowers. In addition, as the above section indicates, FPS-only users may still use FPS less frequently and amass less data on which credit decisions can be made than segments that use also other digital payments.

V. Conclusions and recommendations

Hundreds of millions of individuals and SMEs have started using digital payments over the past decade, thanks to the mass uptake of bank accounts, debit and credit cards, and various payment systems created by telecom companies, fintechs and, often more recently, fast payment systems. This brief has explored the adoption and gains from FPS, reaching three main conclusions:

- Countries around the world have promoted digital payments use through various pathways, such as through bank- and card-driven solutions for the banked populations, telecom-driven solutions for the unbanked, and fintechs that have services diverse segments. Mass-adoption of a payment system, when it has occurred, has resulted from a strong product-market fit – for example, Kenya’s M-Pesa and Bangladesh’s bKash gained tens of millions of users thanks to being introduced at a time when millions of unbanked gained access to mobile phones.
- FPS systems led by the government do not appear to have an edge over privately-operated FPS systems in terms of adoption and use. In addition, in our surveyed markets, FPS adoption and use appear to be correlated with prior and growing digital payments use: FPS have gained mass adoption in emerging markets and segments with an affinity and appetite for digital payments. This suggests that merely introducing an FPS into a market does not necessarily catalyze digital payments use or promote financial or trade inclusion; rather, the ecosystem needs to be ripe for using FPS.
- In today’s world with multiple types of payment systems and methods, users often choose a method fit for purpose. FPS have various comparative advantages: they are especially conducive to smaller local transactions and stand out by the ease and efficiency of transacting. Card networks meanwhile are valued for crossborder payment capabilities, enabling online shopping, and providing access to finance. There is no “silver bullet” payment solution that would solve for payments, financial, and trade inclusion, but a mix of various solutions that firms and consumers should have access to and use as they see fit.

What then should policymakers seeking to promote digital payments and inclusive development do in light of these conclusions? There are four recommendations:

- **The North Star for governments seeking to promote digital payments should be user choice, for firms and consumers to be able to leverage the comparative advantages of different systems such as FPS, cards, and other instruments.** A system of complementary payment methods and free and fair competition among them is the best of all worlds. When governments decide to back an FPS, ensuring that private sector solutions are built into FPS’ business models from the start is key to ensuring financial inclusion, consumer choice, and innovation.
- **Governments do not have to own and operate FPS.** Indeed, many widely adopted FPS are run by banks or a public-private consortium. This is a sound choice especially given that the deployment, maintenance, governance, and sustainability of FPS is challenging –

and can be expected to require a solid enabling environment with data privacy regulations, cybersecurity capabilities, and internet connectivity. Governments can also risk pursuing coercive tactics and unsustainable business models to drive adoption.³⁷ When making decisions about building and operating FPS, governments should also consider the burden and risks of operating FPS systems.³⁸

- **Card-based payments are still critical to enable SME participation in trade: FPS is not a tool for crossborder trade.** Governments around the world are increasingly interested in promoting SMEs' participation in trade, for example through ecommerce. SMEs that engage in trade need both fluid crossborder payments and access to working capital to manage their supply chains. FPS are domestic payment systems that do not enable SMEs in trade. Meanwhile, card-based payments not only enable SMEs to pay and accept payments worldwide, but they also enable SMEs to access financing and thus fuel their supply chains.
- **Governments and researchers seeking to understand the inclusion gains from FPS should focus first and foremost on the number and share of users and intensity of usage in different income segments,** instead of only measuring total transactions or transactions per capita. The number of transactions is not necessarily a good indicator of digital payments inclusion – the number of users and intensity of usage is. Also critical are analyses that examine the extent to which FPS developed to move the poor to digital payments actually do substitute for cash vs. existing digital payments. Similarly, there is a need to measure the broader gains from FPS, for example on access to credit and participation in trade, and do so by comparing FPS' impacts (a) across countries, to understand impacts for example in government-led versus privately-led FPS; and (b) in any one market, vis-à-vis the impacts of other payment systems and methods.

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³⁶ Similar substitution is discovered at country level by Tanai Khiaonarong and David Humphrey, “Instant Payments: Regulatory Innovation and Payment Substitution Across Countries, IMF Working Paper wpp/22/228, November 2022, <https://www.imf.org/en/Publications/WP/Issues/2022/11/18/Instant-Payments-Regulatory-Innovation-and-Payment-Substitution-Across-Countries-524032>. See also Glowka, M, A Kosse and R Szemere (2023): “Digital payments make gains but cash remains”, CPPI Briefs, no 1, January.

³⁷ See Smriti Parsheera, “Stack is the New Black?: Evolution and Outcomes of the ‘India-Stackification’ Process,” *Computer Law & Security Review*, Volume 52, April 2024, 105947 <https://www.sciencedirect.com/science/article/abs/pii/S0267364924000141>

³⁸ A number of studies point to public sector capabilities and risks of managing DPIs and FPS, such as Gerardo Uña, “Digitalization of Public Finance and Digital Public Infrastructure: Opportunities and Challenges,” December 12, 2022, <https://blog-pfm.imf.org/en/pfmblog/2022/12/digitalization-of-public-finance-and-digital-public-infrastructure-opportunities-and-challenges>; and World Bank (2021): Considerations and lessons for the development and implementation of fast payment systems, September, https://fastpayments.worldbank.org/sites/default/files/2021-11/Fast%20Payment%20Flagship_Final_Nov%201.pdf; and Bank for International Settlements, “Fast payments –Enhancing the speed and availability of retail payments,” November 2016, <https://www.bis.org/cpmi/publ/d154.pdf>.