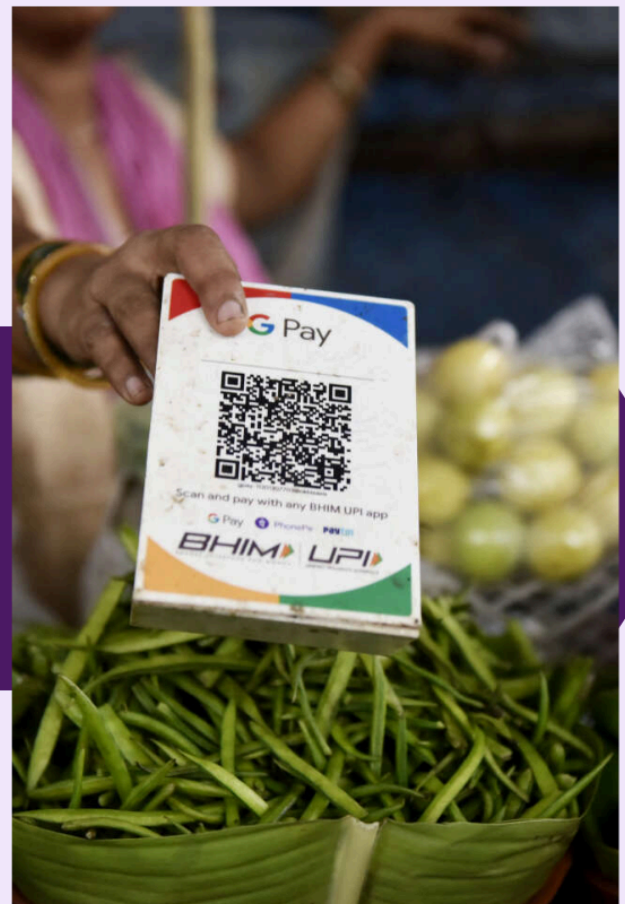




# FROM BRASILIA TO BOMBAY: THE UNLIKELY TWINS LEADING A GLOBAL OPEN FINANCE REVOLUTION

## PART I: INTEROPERABLE PAYMENTS

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# Instant, Inclusive, and Interoperable Payments: Why Pay Attention?

Imagine a world where all financial transactions — from daily grocery purchases to bill splits between friends to tax remittances — could be done instantly from the palm of your hand. Or a world where small businesses and street vendors in emerging economies around the world don't hesitate before accepting digital payments.

**Two countries have led the global movement towards this reality - and they are halfway around the world from each other.**



“

Pix not only increased competition within the Brazilian payments sector but also met the demand for a fast, cost-effective, and secure payment option. Besides that, the wider access to digital payments has been associated with a decrease in informal employment.

”

*Roberto Campos Neto, President, Banco Central do Brasil (BCB)*

In 2022, **India's Unified Payment Interface (UPI)** and **Brazil's Pix** ranked as the first and the second most used real-time digital payment systems in the world, accounting for **46% and 15% of global real-time payments transactions** respectively<sup>2</sup>.

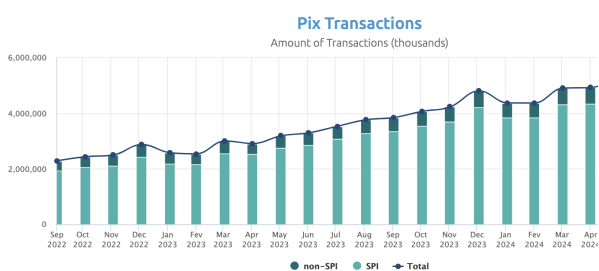
This piece aims to draw out the **similarities and differences** between the countries' technology, governance, and market choices that may inform other countries in the design and build of open finance payments solutions.

<sup>1</sup> <https://www.g20.org/en/news/campos-neto-defends-financial-inclusion-and-well-being-as-priorities-for-the-brazilian-presidency>

<sup>2</sup> ACI report. Available at: <https://www.aciworldwide.com/blog/realtime-retrospective>

# Unprecedented Scale at Unambiguous Speed

Over **330 million individuals** and **70 million<sup>3</sup> merchants** in India use UPI, bringing the network up to **14 Billion transactions per month<sup>4</sup>** in 2024. For perspective, this is higher than the number of global transactions on MasterCard or American Express. In Brazil, since the start of operations in December 2021 to December 2023<sup>5</sup>, the number of transactions on Pix has increased by about **243%** and across all income brackets, bringing in approximately **71 million new users** of digital payments. Currently, **133 million**



individuals and over **11.9 million merchants** use Pix<sup>6</sup>. Pix and UPI were

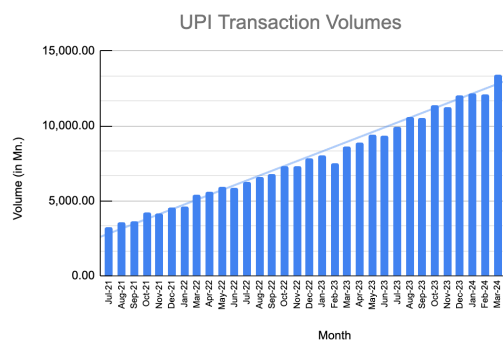
<sup>3</sup><https://www.cnbctv18.com/technology/upi-transactions-payments-10-billion-for-first-time-in-august-digital-npci-17692301.htm>

<sup>4</sup> <https://www.npci.org.in/what-we-do/upi/product-statistics>

<sup>5</sup> <https://www.bcb.gov.br/en/financialstability/pixstatistics>

<sup>6</sup> Pix management report: conception and first years of operation (2020-2022). Available at: [https://www.bcb.gov.br/content/estabilidadefinanceira/pix/elatorio\\_de\\_gestao\\_pix/pix\\_management\\_report\\_2023.pdf](https://www.bcb.gov.br/content/estabilidadefinanceira/pix/elatorio_de_gestao_pix/pix_management_report_2023.pdf)

both designed and deployed in periods of just 2-3 years each and triggered exponential growth after decades of marginal growth in digital payments.



UPI and Pix evince the strong role of a **Digital Public Infrastructure (DPI)**<sup>7</sup> approach in the development of an inclusive open finance network that allows everyone in a society to access real-time digital payments by triggering an innovation ecosystem.

## 💡 What is DPI?

DPI is an *approach* to addressing socio-economic problems at a scale by combining open technology specifications/components with robust governance to encourage public and private innovation. The term is also used to describe *real-world examples* of population-scale infrastructure that abide by the principles of the DPI approach. India's data & credentials sharing ecosystem 'Digilocker'; Singapore's Singpass system, Brazil's payments ecosystem 'Pix', and

<sup>7</sup>[G20 Policy Recommendations for Advancing Financial Inclusion and Productivity Gains through Digital Public Infrastructure \(English\)](https://docs.cdpi.dev/the-dpi-wikipedia/dpi-overview),

<https://docs.cdpi.dev/the-dpi-wikipedia/dpi-overview>

Estonia's data-sharing ecosystem 'X-Road' are all referred to as DPI. Open Finance for both payments and data sharing are one kind of DPI.<sup>8</sup> This article focuses exclusively on the payments side of Open Finance.

### 💡 What is Open finance/ Open Banking?

**Open finance** refers to the availability of open application programming interfaces (APIs) for interactions between regulated financial institutions (banks and non-banking financial institutions such as securities/mutual funds, insurance agencies, tax authorities, and pension funds).

**Open finance for payments** refers to open APIs for the consented movement of money.

**Open finance for data sharing** refers to open APIs for the consented movement of data.

**Open banking** is a subset of open finance, where interactions (of money and/or data) are limited only to the banking sector.

## Payments operates as DPI when it's the best thing since cash: Instant, Interoperable, and Inclusive

Instant payment systems (IPS) have been shown to provide customers with higher security, lower costs, and greater flexibility to indulge in transfers. However many payment systems have evolved to become instant over the years. Crucially, both the UPI and PIX networks adopt a digital public infrastructure approach by being more than just **instant**: they are also **inclusive** and **interoperable**.

**Most legacy digital payments systems fulfill only two of the three criteria above.** Card networks are typically interoperable (cross-bank, cross-card type, and even cross-border) and instant (for users, but sometimes not for merchants who get paid later). However, they are usually not inclusive of the smallest merchants due to the high costs associated with both transaction fees and card readers. These costs disincentivise small businesses from using these methods for low-value but high-volume transactions.

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<sup>8</sup> <https://docs.cdpi.dev/the-dpi-wiki/what-is-dpi>

Similarly, wallets or mobile money systems are typically inclusive of small businesses and instant for users, but usually not interoperable across other wallets whom they consider competition. This fractures the ecosystem, requiring merchants to onboard onto each wallet or mobile money provider separately.

**UPI and Pix transformed the landscape from Instant Payments Systems (IPS) to Inclusive Instant Payments Systems (IIPS), pioneering a shift towards open and interoperable innovative financial infrastructure, accessible to all.**

UPI and Pix allow the transmission of the payment message and the availability of final funds to the payee to occur in real-time, which means that the debit of payers' account and credit of the payee's account is instant. The service is available on a 24-hour, seven-day basis (24/7), it is easy to use, free for individuals, and charged only small fees for merchants. **Crucially, both are designed to be low-cost enough for the smallest micro-merchants to use in place of cash.** Both UPI and Pix filled a vacuum in India and Brazil for the high volume of small ticket transactions that were formerly cash-based. They were also designed to counter the digital divide for inclusion and diversity - for eg; UPI was designed such that users with only a feature phone and users without any device could still send and receive payments.

## Payments designed as DPI has powerful second order effects

The formalisation of digital payments that these systems achieve by combining instant, inclusive, and interoperable payments has **powerful second-order effects**<sup>9</sup> on financial inclusion and economic activity. They:

1. **Foster small business growth** especially in otherwise cash-heavy societies by allowing them to accept remote payments (unlocking e-commerce) and reducing friction in physical commerce transactions<sup>10</sup>
2. **Enhance access to credit** and other financial services for individuals and merchants by creating granular formal financial histories in bank statements, driving financial inclusion;
3. **Increase transparency and security** by improving payment traceability and accountability, reducing corruption and theft; and
4. **Promote local innovation and fintech ecosystems** which start with payments but grow to offer other services

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<sup>9</sup> Some supporting evidence for the above points be found in the following reports - [Open banking & credit](#) (The World Bank), [Digital payments and economic growth](#) (Stephen M. Ross School of Business) and [DPI and Revenue growth](#) (IMF)

<sup>10</sup> Link for reference:

<https://www.betterthancash.org/define-digital-payments>

5. **Improved revenue collection** via formalising the economy and generating social value for citizens

Attempting to achieve these outcomes individually often results in the development of isolated, unsustainable programs (such as credit guarantees, write-offs, and incentives for fintech) that prioritize specific goals without considering the broader ecosystem. While these interventions are impactful, they can be made sustainable by adopting a DPI-based approach to payments, which facilitates ecosystem participation through key unlocks—such as robust data for credit assessment and new roles within the fintech ecosystem.

## Key Design Choices drove the success of UPI and Pix

The widespread embrace and approval of both UPI and Pix can be attributed to certain deliberate design decisions regarding technology, governance, and stakeholder engagement.

### Mobile-native....

Pix and UPI were designed with the primary goal of making digital financial transactions easier, more convenient, and more user-friendly for individuals and consumers. They focus on their end

users by simplifying the process of making digital payments and transfers through more user-friendly interfaces and processes easy to follow for all users.

In contrast to other retail payment methods, UPI and Pix are mobile native rather than card-native, under the premise that payment should be accessible anywhere without the need for a PoS terminal or ATM. This enabled UPI and Pix to strengthen peer-to-peer payments as well, which have been traditionally overlooked. To make UPI and Pix transactions as convenient as a cash payment, the mobile user experience focused on standardization, accessibility, privacy, and integrity of the payments.

**...but a unified network:  
Across any bank, any wallet,  
any app**

However, typically mobile native payment platforms tend to be built in siloes. Interoperability widens the scope for innovation and development, promotes market growth, reduces cash payments, and allows customers to transfer and receive funds from different banking or mobile wallet applications and in the case of UPI from any non-bank fintech apps.

UPI and Pix are designed to work across different banks and payment service providers. Users can link their bank



“

The ability to seamlessly transact across different apps and banks has made UPI accessible to a wide range of users, including those with limited financial literacy or access to traditional banking services.

”

*Nandan Nilekani, Honorary Advisor to NPCI*

accounts to UPI and connect to a single network for various financial transactions, regardless of which bank they have an account with. It eliminates the need to manage multiple apps or accounts for different services.

On the other hand, Pix is designed to work seamlessly across various banks and financial institutions in Brazil. The users are not restricted to use a specific bank's app or platform to make Pix transactions. They can simply add a Pix Key to their bank account on their banking app (a registered email, mobile number, ID number, or random key). To make a transaction, they simply need to input the recipient's Pix Key that is automatically linked to their banking information, read a QR Code or accept a request to pay. Pix Keys are easily transferable to a new account.

Establishing a unified network, across many use cases allowed the free flow of value in an interface, mode, and source account-agnostic fashion. UPI allows bank accounts, wallets, prepaid cards, credit lines, and credit cards as payment

accounts. There are also provisions to initiate voice-based payments (Hello UPI), NFC-based tap'n'pay, and offline payments (UPI Lite) from any source account.

Some financial institutions allow funding Pix transactions via credit card<sup>11</sup> and the BCB is looking at more credit solutions. Currently, Pix allows fintech wallets and bank accounts as source accounts and support for the NFC technology for payment initiation is planned for the future.

**Open to private innovation outside the traditional banking sector, by unbundling user experience and money flows**

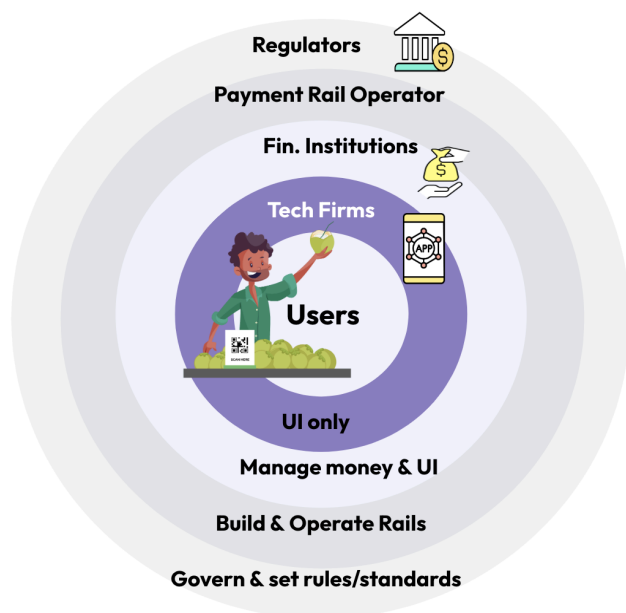
Both UPI and Pix are open to private innovation outside traditional financial institutions. Both systems can be integrated into different apps to receive and apply feedback from private

<sup>11</sup>

<https://paymentscmi.com/insights/comparing-pix-upi-fednow>



partners. Whilst initially Pix did not allow third-party non-banking apps to build front-end interfaces, this changed with the inclusion of the 'Payment Initiation Service Provider' framework introduced in 2023. In both cases, the money flow remains within the banking system (settlement occurs only based on communication between 'issuing' and 'acquiring' banks and the payment switch, whilst opening up the capacity for UX innovation by competing private applications who understand the needs of various consumer and merchant segments and can build inclusive payment experiences (voice enabled, speaker read-alouds of transactions, larger fonts/ colours identifying important steps, different languages, etc). 'Unbundling' as a design principle



means these roles can be played by different actors, and can be enabled in the technology and regulatory architecture design.

UPI is supported by an ecosystem of **32 third-party apps**, in addition to another 10 mobile banking apps<sup>12</sup>. In Brazil, there are 36<sup>13</sup> active Payment Initiators including banks, fintechs, payment gateways, and merchants that Pix users can use to send money via the Pix network.

## Should regulators be concerned about the roles of Tech players in the financial sector?

Traditionally, **tech players have built consumer-facing products at scale** and possess the muscle (dedicated product, engineering, sales, marketing teams) to drive large-scale consumer adoption of innovative and user-friendly flows for accessing services. They can **help reach a larger share** of the population, especially the **underserved**, by building various **diverse consumer interfaces** and taking responsibility for consumer onboarding and education.

**Separating the user interface/user experience (UI/UX) layer from the actual movement of money** allows any country to drive adoption without exposing its financial flows to increased risks. Unbundling these two roles separately as an approach clearly defines boundaries of ecosystem

<sup>12</sup> Source: NPCI, <https://www.npci.org.in/what-we-do/upi/3rd-party-apps>

<sup>13</sup> Information provided by the BCB (February 2024)

players to ensure safe, inclusive innovation - allowing **money flows to stay within the purview of regulated banks**, but enabling user interface innovation to be taken on by fintechs as part of a licensed (and therefore closely monitored) ecosystem of third party apps. Without a proactive framing of these roles by regulators, technology companies increasingly build their own wallets where they also control money flows; this in turn increases the cost and risks associated with PML/AML supervision. For instance, in India a transaction initiated & authenticated by

the Google Pay or Whatsapp third party licensed apps occurs between **existing bank accounts where financial institutions settle the transaction; Google and Meta in India do not operate their own financial wallets** or store of value accounts. Some tech companies such as Amazon or homegrown startup PhonePe chose to be both UPI third party apps and later chose to operate their own wallets; for this they subsequently obtained a separate PPI (Prepaid Payment Instrument) wallet license.

## Much more than Real-Time Payments: Comparing UPI and Pix to a Typical (RTP)

Feature/ Capability	India: UPI	Brazil: Pix	Typical Real-time Payments System
Oversight by the Central Bank	✓	✓	✓
Operated by the Central Bank	<b>No;</b> operated by an umbrella entity (payment system operator) authorised by the central bank	✓	varies
Mobile-first	✓	✓	varies
Instant fund posting and 24/7/365 operation	✓	✓	✓
<b>Interoperability across any stored value</b>	✓	✓	

<b>account:</b> bank accounts, mobile wallets, prepaid accounts			
Support for <b>credit based accounts</b> - credit cards/ credit lines	✓		
<b>Initiation of a payment via fintechs/ third party apps</b> (allowing innovation on user experience)	✓ TPAP license	✓ PISP license	
<b>Approval of a payment on a third party app</b> via a standardised authentication mode <sup>14</sup> ,	✓ UPI PIN SDK for TPAPs		
<b>Timely settlement and clearing</b> infrastructure <sup>15</sup>	✓ Real time settlement	✓ Deferred settlement (with multilateral netting, 10 times a day)	✓
<b>Orchestration</b> of large bank adoption	✓ Encouraged by Ministry of Finance	✓ Mandated by Central Bank	varies
Inclusivity via the <b>ability to withdraw cash</b> using network	✓ UPI ATMs (in progress)	✓ Pix Troco & Saque	
<b>Advanced Security</b> Features	✓ Two factor authentication; Financial network not connected to the internet directly (NPCI Net); Only restricted participants can access database directly; end to end	✓ Two factor authentication, Financial network not connected to the internet, Only restricted participants can access the database directly; end to end	varies

<sup>14</sup>Final payment authorisation (via otp, pin, biometrics) is unbundled from the payment interfaces like third party apps and is securely carried out on switch's end.

<sup>15</sup>[https://fastpayments.worldbank.org/sites/default/files/2023-05/Settlement%20Note\\_Final\\_April%202020.pdf](https://fastpayments.worldbank.org/sites/default/files/2023-05/Settlement%20Note_Final_April%202020.pdf)

	encryption; digitally signed data	encryption; digitally signed data	
Baseline <b>technical standard</b> used	UPI Protocol	ISO 20022	varies
Ability to <b>raise and resolve a dispute</b> across a bank or third party app fully online	✓	✓	
<b>Multi-modal</b> payments	✓ Feature phone (USSD *99#) Smartphone Digital ID-based NFC planned FASTag	✓ Smartphone Kiosk NFC planned	varies
<b>Multi channel</b> payments	✓ P2P, P2M, M2M, G2P, G2B	✓ P2P, P2M, M2M, G2P, G2B	
<b>Multi currency</b> support (single transaction containing multiple currencies)	✓		
<b>Extensibility</b> of added capabilities (automated recurring payments, vouchers, new account types, e- mandates, offline payments etc) <sup>16</sup>	✓ Requires minimal technical updates due to UPI protocol design	✓ Requires some technical re-wiring due to ISO standard limitations	

<sup>16</sup> The full list of expert sources for this table from the Banco Centrale do Brasil and the National Payments Corporation of India are listed in the Acknowledgements. A full tabular comparison of all technical features is available in the Annexure.

## Ensuring security, real time dispute resolution, and fraud minimisation

Both UPI and Pix use a combination of factors to secure the infrastructure and the participants. All transactions require two-factor authentication in addition to any existing device authentication (such as a phone unlock PIN). Additionally, in both countries the financial infrastructure is a closed, protected network only restricted participants can access (the financial network is not connected to the internet) hosted in secure data centers . Transactions are also end-to-end encrypted and digitally signed to ensure auditability and to protect against unauthorised access.

Thanks to these measures, system-level fraud (where an unauthorised individual is able to make a transaction without the consent of the account holder) is relatively low in both countries. However, there have been anecdotal reports of a growing number of individuals being deceived into authenticating transactions triggered by fraudulent parties, due to the newfound convenience and accessibility of making payments. In both countries, managing fraud and security will be ongoing challenges which require constant vigilance and consumer education - both central banks have launched numerous public advertisement campaigns to

increase awareness amongst the public to identify malignant actors.

Pix has established a framework for rapid dispute resolution in case of fraud, including provisions for immediate reversal and blocking of accounts. UPI also has an automated, real time API based, multi-party, and tiered dispute redressal framework where the user can raise the dispute on any licensed third-party app to address issues across any financial institution in the transaction, and then escalate to the payments service provider, NPCI and Banking Ombudsman as required. They have also put in place a 24 hour reversal of transaction policy in cases of disputes.

## Low costs for users, yet financially viable for the innovations to thrive

Both countries had already formalized financial accounts by the time UPI and Pix were launched. Brazil had high bank account penetration, and in India, affordable national identity (Aadhaar) authentication and eKYC and supportive policies (the Jan Dhan Yojana program<sup>17</sup>) enabled the creation of bank accounts for more than 500 million citizens. This reduced the cost of onboarding users to UPI and Pix, allowing both systems to focus exclusively on transactions.

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<sup>17</sup>

<https://pib.gov.in/PressReleaselframePage.aspx?PRID=2049231>

In **UPI**, transfers between **bank accounts** are **not subject to fees**. Other payment modes like wallets, credit

charge fees averaging about **0.22%** of the transaction value. Additional fees apply for dynamic QR code payments



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The operational and payment processing costs are also cheaper because of its infrastructure (Pix), which is more modern and more efficient, which enables the arrival of new players in the sector and gives more options to customers when making transactions.

”

*David Vélez, CEO of Nubank*

cards, and credit lines have different MDRs to give choice to both merchants and users. For example, an interchange fee of 1.1% is applied to transactions over Rs. 2000 when the source is a Prepaid Instrument or Wallet. Similarly, NPCI may impose a nominal Merchant Discount Rate (MDR) on credit card transactions. To support sustainable monetisation, banking apps and fintech companies providing UPI to consumers offer a range of value-added services. For users, this included bill payments, recurring payments and options to purchase insurance, investments or credit products, while for merchants soundboxes, personalized QR codes, and reconciliation services are part of the suite of services.<sup>18</sup>

**Individuals** can use **Pix** for transactions **without any fees**, while **legal entities**, banks, and payment institutions may

initiated by corporate payers and for services like Pix Troco or Saque. Pix's charges are significantly lower than those for traditional payment methods such as credit and debit cards, enabling merchants to pass these savings to users through discounts or offers.

In both cases, fintechs also develop payment gateways for e-commerce platforms, aggregating various payment methods and charging fees for the provision and maintenance of these gateways.

## Orchestrating market adoption via policy nudges

In both Pix and UPI, strategic policy decisions taken by the regulators and governments were instrumental in facilitating an ecosystem of safe, meaningful innovation. The design choices in drafting policies were aimed at supporting the ecosystem and

<sup>18</sup>

<https://www.bloomberglia.com/english/nubank-wants-to-democratize-access-to-investing-in-brazil-david-velez>

increasing adoption whilst protecting the end consumer. **India's Central Bank did not mandate** banks to adopt UPI. Instead, it relied on market growth incentives for banks to join - for example, the reduction of cash handling costs, or the creation of granular data via digital payments that could be used to increase the high-margin lending portfolio. However, the **Ministry of Finance encouraged adoption** across banks through workshops and advocacy across publicly owned banks (particularly in the run-up to the launch by the Prime Minister of the first UPI app 'BHIM'). In UPI, the decision to charge **zero merchant discount rates (MDR)** and no fees<sup>19</sup> from users was key in driving large-scale ubiquitous adoption. Fast settlement cycles also de-risked the system and put adopting financial institutions at ease. The establishment of channel-specific (Feature phone, Smartphone, Kiosk, and Tap and Pay) rules, cool-off period (before making a transaction post onboarding), and bank-level limits were also key in ensuring a seamless, secure experience for the user.

In Pix a key decision taken by the Central Bank was to make the **participation of large banks in the Pix scheme mandatory**, generating a race for registering users. This drove the speed of adoption. Moreover, BCB strived to put user experience at the heart of the development process, generating a

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<sup>19</sup> All debit-to-debit transactions are not charged, MDR may be imposed for credit/ prepaid instruments transactions

**specific regulation to ensure accessibility and non-discriminatory use** mandatory for all interfaces. The regulation assured that the P2P functionality of Pix would be free of charge for users. Similar to UPI, fast settlement cycles and the establishment of network-level transaction limits (which can be changed upon user's request) created a low-risk, secure playground for innovation and economic growth.

## Technology architectures designed for security, scalability and adaptability

The technical architecture of UPI and Pix also reflects different design choices made to fit each country's context. While Brazil adopted ISO 20022, India wrote a novel payment protocol as a baseline technical standard (an XML-based Payments Mark-up Language called the UPI protocol to relay payment instructions conveniently between fintech/third party apps and financial institutions, allowing real time dispute resolution). The adoption of a widely used global standard allowed the Brazilian Central Bank to launch PIX more quickly but does require some technical protocol revision to incorporate extensible new features (such as adding new types of stored value accounts, enabling recurring payments, etc),. In contrast, India took more time to design and launch its protocol between 2013-2016. It was crafted to be flexible (via ease of extensibility- for eg, had

pluggable authentication) to allow 'future-proofing', obviating the need for large technical upgrades for additional capabilities.

For **QR codes standards** to allow payment initiation, Brazil adopted the **EMVco QR Code** standard while India used both EMVco and a **new UPI QR**

**payments** to **purpose-specific vouchers** for end use restricted cash transfers (called e-RUPI) and seamless **trading in securities** (primary & secondary) markets. It also allowed seamless addition of **offline payments** based on a mobile wallet as a stored value account (known as UPI Lite) Pix has also prioritised rapid extension to



“

The share of UPI in digital payments in India has reached close to 80 per cent in 2023. This has been made possible by nurturing diverse payment systems in the country, namely, the bill payments, merchant payments, vendor payments, transit payments, or recurring payments.

”

*Shaktikanta Das, Governor, Reserve Bank of India*

**code** standard. As of December 2022, the total number of Bharat QRs was 4.96 million, while UPI QR stood at 237.94 million<sup>20 21</sup>.

The **flexibility** of the UPI protocol has allowed for programmability and various features to be built on the protocol layer. UPI supports **programmable e-mandates** which can reflect any amount, payee frequency, and purpose of payment. This unlocked multiple use cases ranging from recurring **bill**

additional use cases; its recurring payments solution “**Pix automático**” and offline payments solution are both expected to go live soon.

UPI, based on its programmable protocol, supports multi-currency<sup>22</sup> payments in a single transaction. It also supports CBDC (Central Bank Digital Currency) as an asset class. BCB is working to enable international payments on Pix and has also launched CBDC (DREX) as an independent ecosystem.

<sup>20</sup>[https://www.business-standard.com/finance/news/upi-continues-to-dominate-digital-payments-thanks-to-wide-use-of-qr-codes-123041700492\\_1.html](https://www.business-standard.com/finance/news/upi-continues-to-dominate-digital-payments-thanks-to-wide-use-of-qr-codes-123041700492_1.html)

<sup>21</sup>

<https://m.timesofindia.com/article/142811-80-of-digital-payments-in-india-happen-through-upi-rbi-governor>

*Note: A detailed tabular comparison of technological capabilities is available in the Annexure.*

<sup>22</sup> Live in Singapore, Dubai and France



## Governance: Setting up frameworks for co-creation across fintechs & banks

The UPI payments system is set up to have **regulatory oversight** of the Central Bank and ministerial oversight by the Ministry of Finance. In 2008, RBI and the Indian Banks Association (IBA) created the National Payment Corporation of India (NPCI), a non-profit umbrella entity set up to operate payment systems and develop UPI. UPI also has a four-tier governance structure:

1. National Payments Corporation of India Board (*payment switch operator reporting to RBI*)
2. Steering Council (comprising bank representatives)
3. User Council (including third party applications) and
4. Ecosystem Council

The establishment of a **separate TPAP license (Third-Party Application Provider)** to allow fintech participation (beyond payment initiation) was a key decision that helped in enabling user choice, nano merchant onboarding and more innovative customer experiences.

In October 2013, the Brazilian Congress granted regulatory power over the retail payment systems to the BCB. **Central Bank of Brazil** is the regulator and settler of the rule book for the IPS scheme, operator of the scheme, and system development. The decision of the

BCB to move from the role of the regulator to the settler of the rule book of the IPS scheme was to facilitate smoother coordination among private actors, especially the larger banks and the emerging fintech environment. The **Pix Forum** was a newly created advisory mechanism for over market actors to contribute insights. The Pix governance scheme comprises the BCB, Pix Forum, and temporary working groups with their own set of issue and function-based responsibilities.

## Iterating over time to drive success, rather than perfection on day one

Both Pix and UPI when launched initially faced a number of teething issues - lower success rates of transactions, longer response times, lags in settlement, lower adoption by larger banks at the start, etc. In early days UPI in India struggled with 55% failure rates (technical defaults) in transactions, but corrected this to <1% over time with constant iteration to reach the high provenance system it is today. However, no high scale ecosystem where multiple actors need to build modules of their own launches perfectly on day one. A key design choice was architecting core protocols and standards to be future proof and resilient to scale, while using new committees/forums to enable sharing of information to fix issues in real time (particularly on integrations with existing systems) as they emerged.

## Conclusion & The Journey Ahead

Sharing similar challenges as developing countries, albeit also marked differences, India and Brazil have leveraged technological and governance choices to create the world's most used instant payment systems to date. These choices undoubtedly reflect the country's context but aim at the same ultimate goals: reduce cash dependency, bring efficiency to payment systems, and foster financial inclusion. The comparison between the two countries can enlighten how other nations may respond to their national contexts with the available technological and governance options to build successful digital public infrastructure.

Looking ahead, India is actively working on cross-border acceptance of UPI and the payments system is in use in Nepal, Singapore, and UAE. The formalisation of the economy from cash to digital payments for even low-value high volume payments meant that granular, trusted data was now available to users and their financial institutions. The next question was how could they be empowered to share this data to get access to services including credit. Both countries are looking next to 'open finance' or financial data sharing to complement their instant payments ecosystem; India with the Account

Aggregator<sup>23</sup> ecosystem and Brazil with Open Finance<sup>24</sup>. Account Aggregator has scaled to 100M (2024) consent requests successfully fulfilled while Brazil's open finance has touched 42 M (Dec 2023) in just 3 years since its inception.

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<sup>23</sup> <https://sahamati.org.in/what-is-account-aggregator/>

<sup>24</sup> [https://www.bcb.gov.br/en/financialstability/open\\_finance](https://www.bcb.gov.br/en/financialstability/open_finance)

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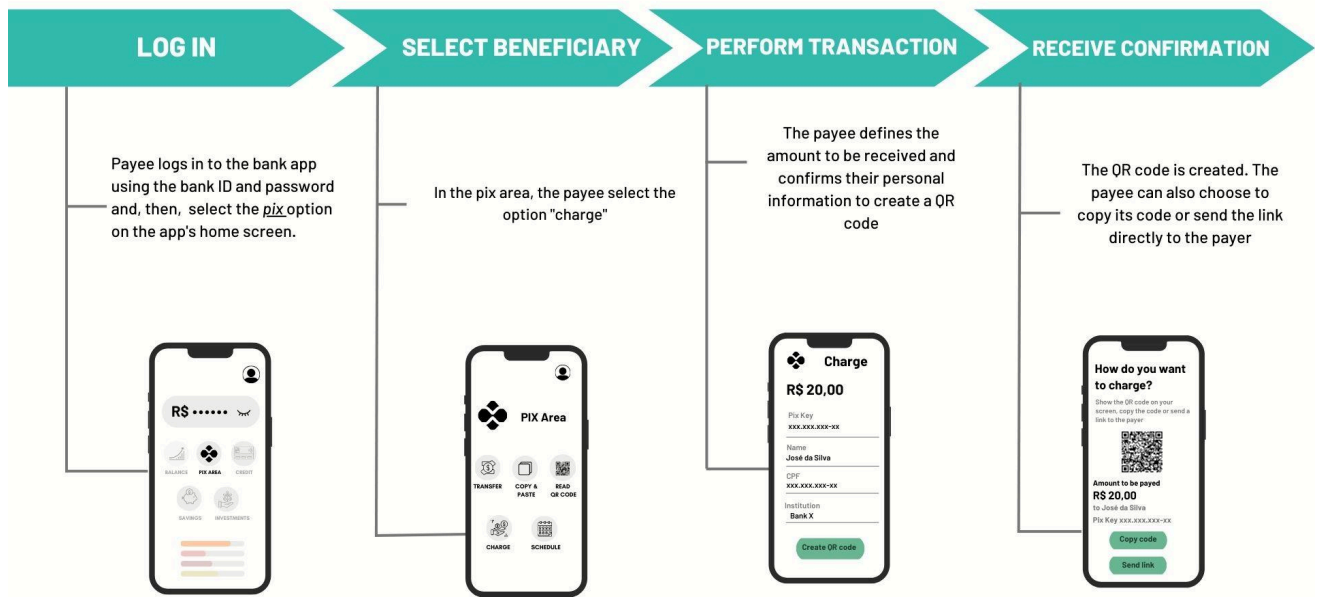
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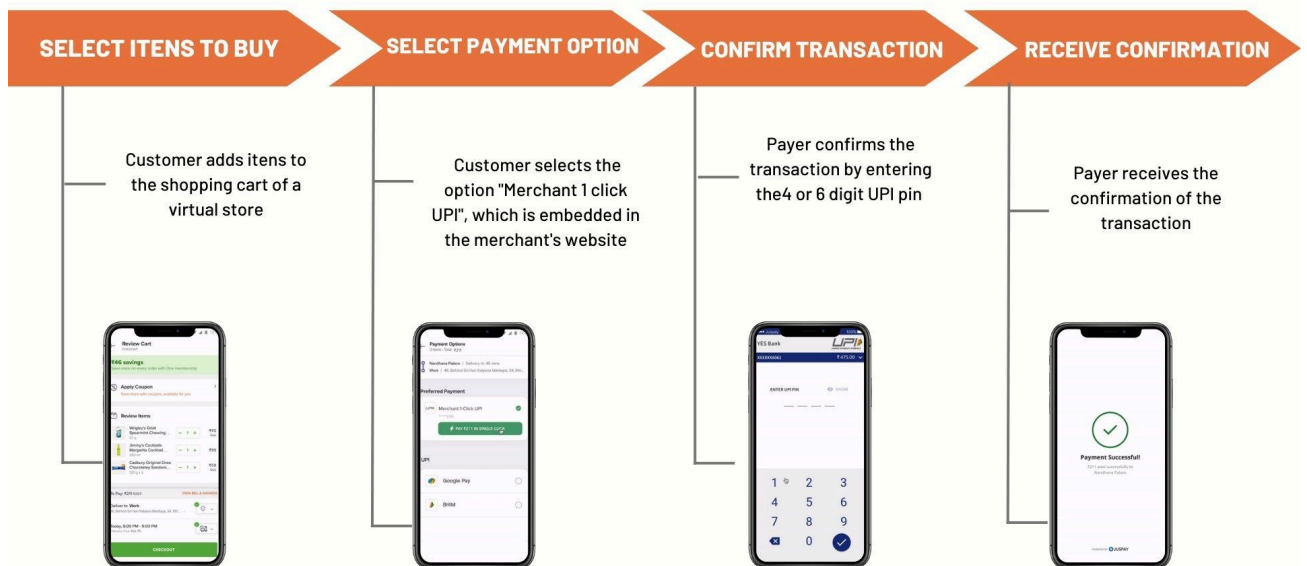
# Annexure

## User experiences: UPI and PIX<sup>25</sup>

### Pix user experience - charge someone



### UPI user experience: In-App UPI payment



Note: UPI & Pix both offer a diversity of user experiences based on the app selected.

<sup>25</sup> Both the payments systems power a diversity of use cases, this are illustrative flows

## Technical Features & Capabilities Comparison: Technology, Governance and Market Architectures of Pix & UPI

### 1. Technology Architecture

Feature/ Capability	Brazil: Pix	IndiaUPI
Number of participants	831 Financial Institutions (banks & neo-banks)	Banks/Wallets Live: 605 Payment Service Providers:72 TPAPs: 32 +10 (banking apps)
Availability	24/7/365 (no maintenance window)	24/7/365 (no maintenance window)
Transaction timings	P50 = 6 seconds, P99 = 10 seconds	P90 = 3 seconds
Capability of the system	6,000 transactions per second (launched with 2,000 tps)	1 billion transactions a day 15,000 tps per node (3 nodes)
Transaction limit	BRL 0,01 – no limit (subject to prudential rules of Financial Institutions)	Decided by PSPs (steering committee, consensus, binding on participants)
Protocols and standards	HTTP, ISO 20022, Capability URIs	Original UPI protocol, allowing programmability of payments including XML (payments markup language), HTTPS, Unified URI (for deeplink and QR)
Payment types	P2P, P2B, B2B, P2G, G2P, G2B	P2P, P2B, B2B <sup>26</sup> , P2G, G2P, G2B
Maximum number of alias keys (user's ID)	5 for individuals 20 for legal entities	There is no limit to the aliases created, it is up to the payment service providers to limit the

<sup>26</sup> There are limits on the transaction size for B2B

		number of aliases their e-bank provides for security reasons.
Types of aliases/ Virtual payment addresses	<ul style="list-style-type: none"> <li>• Randomized aliases</li> <li>• Cell phone number</li> <li>• E-mail address like alias</li> <li>• Tax ID</li> </ul>	<ul style="list-style-type: none"> <li>• E-mail address like alias</li> <li>• Cell phone number</li> <li>• Bank account number with ifsc code</li> <li>• Aadhaar (Identity) Number (discot.)</li> </ul>
Capabilities and benefits	<ul style="list-style-type: none"> <li>• Access to many debit, and prepaid transaction accounts</li> <li>• Multiple apps separated from store of value accounts;</li> <li>• Multimodal access</li> <li>• Push payments</li> </ul>	<ul style="list-style-type: none"> <li>• Access to debit and credit accounts</li> <li>• Multiple apps separated from store of value accounts</li> <li>• Multiple authentication mechanisms</li> <li>• Multi-modal access through smartphones, feature phones, PoS terminals, and ATMs</li> <li>• Pull and push payments</li> <li>• Programmability, including recurring mandates and vouchers</li> <li>• Mandates and voucher management (suspension, revoking) by consumers</li> </ul>
QR-code interoperability	EMVco QR Code standard	EMVco QR Code standard (5 M) + Original UPI QR Code standard (266 M)  Recurring payments also enabled on the QR

## 2. Governance Architecture





Feature/ Capability	Pix	UPI
Regulatory & Oversight Body	Brazilian Central Bank (BCB), an autonomous public entity, backed by regulatory powers over the retail payment system conferred by the National Congress.	Reserve Bank of India (RBI) and Ministry of Finance
Implementation	BCB: settler of the rule book for the IPS scheme, operator of the scheme, and system developer.	National Payments Corporation of India - NPCI (non-profit set up by RBI, owned by commercial banks & other ecosystem players)
Participation of non-banking fintechs (third party apps)	Participation as Payment Initiation Service Provider (PISP).	Live, with a separate license as a Third Party Application Provider (TPAP)
Governance & Stakeholder engagement	<p>Instant Payment Workgroup led by the BCB to discuss the modeling of the Brazilian solution with the participation of circa 130 relevant stakeholders</p> <p>The Pix Forum, also led by the BCB, which serves as a permanent locus of consultation with around 250 relevant stakeholders.</p>	<p>External technical advisors and volunteers who supported the payment switch in the design of UPI. The UPI Steering committee is formed by 23 members that represent a consortium of 430 institutions, including significant issuers, fintech organizations, and well-known acquirers. The committee receives suggestions from the NPCI for discussion topics. Consensus is used to make judgments after thorough debate and discussion. All member banks are required to abide by such judgments. After receiving committee clearance, RBI's permission is sought,</p>

		following which operating circulars are published.
Participation in the scheme	<p>The participation of large banks and non-banks (over 500,000 transactions accounts) is mandatory</p> <p>Businesses are not obliged to accept PIX as a means of payment.</p>	<p>The participation of banks is not mandatory</p> <p>The largest businesses (over Rs. 500 million (about \$6 million) annual sales) are obliged to accept UPI payment</p>
Cost for users	<p>P2P (including micro and small enterprises), G2P: free</p> <p>P2B, P2G: small fee charged to the payee and freely set by the PSP</p> <p>B2B: fee charged to the payer and freely set by PSP</p>	<p>Bank to bank transfers via UPI : free</p> <p>Fee up to 1.1% can be charged on merchant UPI transactions over 2000 Rupees (\$24.28) using prepaid payment instruments (wallets or cards)</p> <p>Merchant discount rate of x% is applicable on transactions &gt; INR 2000 ((\$24.28) if the source account is a credit card.</p>
Threshold for transactions	BRL 0,01 – no limit (subject to prudential rules of PSPs)	Decided by PSPs (steering committee, consensus, binding on participants)








### 3. Market Architecture

#### Pix

Stakeholders	Role	Examples
BCB	Manager of the sole centralized alias/addressing database (DICT) and the Instant Payments System (SPI).	
Transaction account provider/ PSPs (Banks, financial account providers)	A financial or payment institution that provides demand, saving or prepaid payment accounts to end users.	
Special settlement agent	A financial or payment institution that participates of Pix exclusively to provide settlement services to other participants	
Payment initiator/ PISPs	Institution that will carry out payment initiation at the request of a customer who is a transactional account holder in a financial institution or any other institution licensed by BCB.	

#### UPI

Stakeholders	Role	Examples
Front End Apps	Allow users to make money transfers and send payment instructions to the bank	
Acquirer Network of 77 Banks	Partner with front-end apps and merchants for acceptance	
NPCI	Develop and enforce standards for onboarding, authentication, and settlements between multiple providers	
Issuer Network of 535 Banks	Provide the banking account to the end user and generate a UPI PIN	
RBI	Regulation on banking licenses and master directions for interoperability	

## Suggested Further Reading

Title	Why it's worthwhile reading
1. Pix Management Report by BCB   <a href="#">link</a>	This report covers the conception, initial operationalisation and scale-up of Pix
2. How Urban India Pays   <a href="#">link</a>	This report outlines the digital payment modes in use India and the rise of UPI in all types of payments
3. The design of digital financial infrastructure: lessons from India   <a href="#">link</a>	A case study by the Bank of International Settlement on how the Digital Public Infrastructure approach drove financial inclusion
4. Creating Value for Taxpayers   <a href="#">link</a>	An IMF report on how to sustainably increase revenue collection and build trust in the government
5. Three elements that differentiate inclusive instant payment systems   <a href="#">link</a>	A report by AfricaNenda reimagining payments- from only instant to instant, inclusive and interoperable

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