



International Best Practices in Directory Models

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The Directory Models Work Group (DMWG) of the U.S. Faster Payments Council (FPC) has as its mission the identification of directory capabilities which can drive adoption of faster payments. The DMWG evaluates information, including reports produced by other industry-led work groups, intended to identify, and assess an approach for best practices across directory models and/or dependent platforms for the faster payments ecosystem.

The DMWG undertakes several issues around directories, including:

- Examining best practices related to optimizing directory models to reduce friction in the payment value chain and increase adoption of faster payments.
- Assessing the current state of directory models and building out gap analyses that reflect what is missing/could make them more broadly used.
- Providing summaries of directory implementations in other economies, and including lessons learned and best practices related to their respective experiences.

For this deliverable, the FPC's Directory Models International Best Practices Subgroup researched six directory overlays to faster payments systems across the globe: Bizum, Interac, M-Pesa, Pix, Swish, and Unified Payments Interface (UPI) with the intention of evaluating how they leveraged directories to support efficiency, experience, and security objectives while seeking to fuel adoption of faster payments within their respective markets.

The directories were chosen for investigation because they are all slightly different from one another and potentially have different lessons to be shared. A brief explanation as to why each service was chosen follows:

- **Bizum** is embedded within the bank app rather than as a standalone service, our research intended to gain an understanding, via Bizum, how bank-driven directories could aid faster payments adoption.
- **Interac** leverages a pre-existing non-account-based infrastructure to deliver real-time services, but still has the involvement of the banks.
- **M-Pesa** leverages a pre-existing non-financial institution-based infrastructure to deliver real-time services. M-Pesa is operated by a mobile telephony provider, not a financial institution.
- **Pix** was created on initiative by the national central bank that utilize a real-time rail. The service can be offered via a bank or a payment initiation service provider.
- **UPI** enables both banks and third-party service providers to transact on top of the real-time account-to-account rail in India. There is no "UPI app", but rather a service that many parties can access, comparable to Pix (though UPI is much older than Pix). India's UPI is widely considered to be the most innovative mobile payment service in the world.

- **Swish**, unlike Bizum, is not a service embedded within a bank app but rather a stand-alone app that users connect to their bank account. Swish also enables a third-party app, BankID, to authenticate sending parties prior to payment initiation.

The research was distilled into lessons learned and best practices that can be applied domestically in the United States as faster payments take shape and examined how directories are leveraged behind the scenes in various ways to support similar needs.

Beneficial Characteristics

The DMWG previously released a white paper entitled, “Beneficial Characteristics Desirable in a Directory Service.”¹ The systems researched in this work consistently exhibited the beneficial directory characteristics defined in the white paper, namely:

Beneficial Characteristics Desirable in a Directory Service	
Core (Required)	#1 Validates accuracy of routing information #2 Ensures payment aliases are unique within the directory #3 Supports multiple routes linked to payment alias #4 Minimizes storage of sensitive information #5 Prohibits use of directory to mine payment details #6 Supports end user profiles
Value-Added	#7 Supports some type of confirmation-of-payee #8 Supports request-for-payment transactions

All the directories achieved at least six of these characteristics, while Bizum, Interac, Pix, Swish, and UPI checked seven of the eight characteristic boxes. The ability to support multiple payment routes via an alias was not achieved by any of the directories. It should also be noted that many of the types of payments that fall into the “faster” category in the United States is either considered standard in other countries (such as Same Day ACH as opposed to standard ACH) or are not as common (push-to-card payments), making this beneficial characteristic somewhat unique to the U.S. context.

Attributes

The Beneficial Characteristics paper highlighted three core attributes as foundational to directory capability – Interoperability, Safety, and Governance. The country analysis explores how these attributes have been addressed in the global implementations.

Interoperability – It is difficult to have a conversation around payments that do not touch on the ability of various systems, networks, data flows, etc., to work with each other. There are certainly many layers of variables and complexity that add to this challenge within the United States, but identifying mechanisms for achieving interoperability would serve to enhance the experience and drive adoption.

Safety – There are three key factors identified as safety procedures: (1) what type of payment data is visible to the sending party, (2) sender authentication, and (3) type of directory. All directories investigated revealed similar details to the sending party, including the beneficiary's name. No account-level information was revealed. In terms of sender authentication, there was significant difference, ranging from external authentication via third-party app (e.g., Swish via BankID, to a PIN M-Pesa).

Governance – There are two types of governance structures for directory models, segmented by 1) platform/framework ownership and 2) eligibility rules for participation. All participants should be governed by a common set of rules or guidelines and operate under a set of common business expectations.

Best Practices

Many of the lessons learned from these global implementations will help to shape the development of directory models in the United States. In terms of best practices that should be considered for the United States domestically, the following attributes are noteworthy:

- The Bizum and Swish systems effectively leveraged a federated directory model, whereby financial institutions maintained the sensitive directory databases and relied on proxy services to support routing and integration. Such a model, which also enables access and engagement by end users and third parties alike, may work well in the U.S. market.
- Interac achieved success in part by leveraging existing network architecture. There may be application within the United States as we think about how to leverage existing debit card, ATM, and bank account databases to meet such needs.
- UPI demonstrates the utility of ensuring third parties/value-add service providers can access and leverage the directory to further improve the customer experience, add choice to the marketplace, and drive adoption and innovation.
- Pix developed a model inclusive of non-financial-institution payment service providers which provided increased access for those interested in using faster payments. Pix also developed a standardized way of representing an instant payment instruction via a QR Code that has driven adoption in point-of-sale and e-commerce transactions.

Beneficial Characteristics Desirable in a Directory Service – Directory Comparison

The table below maps out the core and value-added characteristics and the use cases supported for each directory investigated by the Work Group. The X indicates that the directory in question fulfills the characteristic or supports the use case.

The country analysis shows that most directories are similar in terms of core and value-added characteristics they fulfill, despite their differences in governance model and architecture.

A2A payment apps tend to be similar; B2B the next frontier

Beneficial characteristics desirable in a directory service (as defined by the FPC DM WG)		Bizum (ES)	Interac (CA)	MPesa (KE)	Pix (BR)	UPI (IN)	Swish (SE)	
Core characteristics	Validates accuracy of routing information	X	X	X	X	X	X	
	Ensures payment aliases are unique within directory	X	X	X	X	X	X	
	Supports multiple routes linked to payment alias							
	Minimizes storage of sensitive information	X	X		X	X	X	
	Prohibits use of directory to mine payment details	X	X	X	X	X	X	
	Supports end user-controlled profiles	X	X	X	X	X	X	
Value-added characteristics	Supports some type of confirmation-of-payee	X	X	X	X	X	X	
	Supports request-for-payment transactions	X	X	X	X	X	X	
Use cases supported	P2P	X	X	X	X	X	X	
	B2B		X					
	C2B	E-commerce	X	*	X	X	X	X
		Physical POS	X	*	X	X	X	X
	Bill pay						X	
Type of directory		Federated	Centralized	Centralized	Centralized	Federated	Federated	
Alias supported		Mobile phone number only	Mobile phone number or email	Mobile phone number only	Mobile phone number, email, tax number, and random ID	Mobile phone number, Indian SSN, Virtual address, mobile money ID	Mobile phone number only	

*Available but uses card rails instead of A2A rails

The country analysis shows that all six of these directory models reflect industry best practices in that they support all but one of the core and value-added beneficial characteristics. “Lack of support for multiple routes linked to a payment alias” is reflective of the challenges that industry faces in achieving interoperability, particularly on an international basis. One of the only points of difference is that Interac does not enable account-based physical point of sale (POS) or e-commerce payments (Interac does enable card-based POS and e-commerce payments).

There is still development work required to support the myriad of payment use cases. Person-to-person (P2P) and consumer-to-business (C2B) for e-commerce and physical POS are supported by all six services. Swish and Pix are the only directories that enable consumer bill payments, whereas Pix and Interac are the only services that enable business-to-business (B2B) payments including business-to-consumer (B2C). These use cases, along with business-to-consumer disbursements (think refunds, salaries, earned wage pay-outs, etc.) are clearly the “next step” for most directories.

Attributes

The Faster Payments Council (FPC) white paper, “Beneficial Characteristics Desirable in a Directory Service”², published by the Directory Models Work Group in May 2021, references the importance of interoperability, safety, and governance to directories, and more broadly, to the adoption, efficiency, and effectiveness of faster payment schemes.

Interoperability

As faster payments rails, schemes, and solutions accelerate domestically within the United States, broad interoperability does not presently exist as with ACH and cards. For example, P2P solutions such as Venmo and Zelle each have their own supporting proprietary and closed-loop directory, and if a participant wishes to send funds to a non-participant, registration is required. As it relates to directories, interoperability reflects an opportunity that could serve to accelerate adoption, efficiency, and user experience for faster payments.

When discussing interoperability, it can be in reference to a wide variety of variables. For example, interoperability can apply to:

- Payment rails (e.g., FedNow, Real-Time Payments (RTP), etc.)
- Participant type (e.g., financial institution, third-party fintech provider, small business, etc.)
- Payment method (e.g., pay by bank, by card, etc.)
- Money movement solutions (e.g., Zelle, PayPal, Venmo, Cash App, etc.)
- Directory databases themselves (e.g., Early Warning proprietary directory)

None of the international faster payments/directory implementations researched in conjunction with this deliverable reflected broad ecosystem interoperability; however, there were some interoperability characteristics that were identified, which should be considered as it relates to domestic applicability.

The directories researched were predominantly closed-loop systems, which did not enable interoperability with other payment rails or directory schemes; however, the Unified Payments Interface (UPI), Pix, and M-Pesa implementations supported directory access and engagement by both financial institutions and third parties/fintech providers. Additionally, Swish and Bizum reflect federated directory models, whereby financial institutions maintain the actual directory databases, which are then interoperated by proxy services. If interoperability is achieved domestically, this federated model, reliant on financial institution databases may prove worthy of additional consideration.

An important component of interoperable directories is the type of payment alias leveraged, and in the researched implementations, mobile phone number is a common and effectively leveraged alias, which should be considered domestically. Pix went even further and included email, tax identifier, and a randomly generated alias. Any faster payment directory in the United States would need to support various business IDs, such as Data Universal Numbering System (DUNS)³, Legal Entity Identifier (LEI)⁴, Employer Identification Number (EIN)⁵, Taxpayer Identification Number (TIN)⁶, etc.

Though not part of our research, an international development worth monitoring, is the European Mobile Payment Systems Association's (EMPSA) efforts to establish interoperability across mobile payment systems, including Vipps in Norway, Mobile Pay in Denmark/Finland, Twint in Switzerland, and Swish in Sweden (which was part of our research). How they go about achieving interoperability across schemes may provide further best practices for domestic application.

It should be also noted that the international implementations and faster payments schemes researched were more highly concentrated in nature, when compared to the current domestic U.S. landscape of providers, solutions, and rails. This high concentration reduces, to at least some degree, the importance and value delivered from broad interoperability.

Safety

If a directory is not safe, end users will not use it. Rather than digging down into the technical details about how various directories are encrypted or how APIs are structured to protect against hacking, this section on safety provides a high-level discussion of how the various directories analyzed facilitate communication along the payment value chain and how they are secured to ensure safe usage.

Now, the various payment services (e.g., Venmo, Zelle, etc.) each have their own governance systems and safety procedures that secure access to the directory and enable easy payment initiation. That said, fraud is increasingly becoming a problem in the United States, and so any would-be directory needs to be safe as soon as it goes live. The degree to which payment data can be “mined” from a directory, how sending parties are authenticated (via log-in, biometric data, multi-factor authentication, etc.), and which parties have access to a directory’s information are all important aspects of a safe directory.

There are three key factors identified as safety procedures: (1) what type of payment data is visible to the sending party, (2) sender authentication, and (3) type of directory.

What Type of Payment Data is Visible to the Sending Party?

All the directories limited the extent to which payment-related information is visible to the sending party.

- Bizum, for example, only allows the sending party to view the recipient’s first name and the first initial of the last name of the person whose alias (e.g., phone number) has been input by the sender.
- Swish and Pix, on the other hand, returns the person’s full name.
- None of the directories evaluated make the receiving party’s routing and account number visible to the sender.

No market-wide, directory-independent confirmation-of-payee service currently exists in the United States, but a directory that, at the very least, confirms the first name and first initial of the last name of an individual could help prevent some scams from happening (or in the case of businesses, applicable business identifying information).

Sender Authentication

There was no consensus on how best to ensure that the sending party is indeed the person they say they are.

- Swish’s service is linked to BankID, an authentication tool that enables users to verify their identity via thumb print or facial recognition.
- Bizum and Pix rely on each bank’s own app authentication measures (e.g., log-in) to ensure that the sending party is the legitimate.
- M-Pesa relies on control of a mobile device.

Requiring sending parties to use multi-factor authentication, such as a password, biometric tool, or a linked cell phone, could go a long way to prevent unauthorized payment initiation that utilizes directory services.

Type of Directory

The directory models fell into two broad groups:

- A single directory linking a user's payment alias (phone number or email address) to their routing and account number (M-Pesa, Interac).
- A federated directory, whereby the high-level directory routes payment messages to payment service provider (PSP)-held directories (Bizum, Pix, UPI, Swish).

The latter approach, whereby PSPs make their own directories searchable by a third-party directory to enable easy payment initiation, is most likely the best set up for an environment comparable to the United States. This is because the United States is very unlikely to have a "national champion" comparable to M-Pesa in Kenya or Interac in Canada where all users use one system to make payments.

Given the U.S. market's high level of fragmentation, a directory that can query a PSP's directory (e.g., "Is phone number ABC-DEF-GHIJ or business ID XYZ related to an account number at this institution?") could enable a degree of interoperability and safety not currently available.

Of the schemes evaluated, only Pix offered business-to-business (B2B) payments. It is the opinion of the DMWG that B2B payments could highly benefit from the use of a directory for faster payments, even if this will require usage of other alias types other than cell phone numbers. Pix, for example, enables a business to have multiple aliases and supports a "Randomly Generated Alias" that has proven popular for B2B payments. The Business Payments Coalition⁷ uses business IDs such as DUNS and LEI, for unique business to be registered in an interoperable B2B message exchange framework. This directory would also highly benefit from following some of the key lessons learned highlighted in this document.

Governance

All participants should be governed by a common set of rules or guidelines and operate under a set of common business expectations. There are two types of governance structures for directory models, segmented by platform/framework ownership and eligibility rules for participation.

Consortium-led/Bank-owned

In this model, the participating banks can work together to define the governance framework for the directory.

- Swish started as a cooperation between six of the largest banks in Sweden.
- Bizum is owned by 23 banks operating in the Spanish market.

- Interac was founded by a group of banks in Canada.
- Pix was developed by the Central Bank of Brasil.

The largest players in a market can work together to establish the framework for governance. This can quickly gain critical mass given the size of the banks working together. For example, Interac's e-Transfer solution quickly gained traction and critical mass in the Canadian market and has been the de-facto solution for P2P in Canada.

However, any changes to governance may be slow as different stakeholders may have different opinions on the changes. Given the low level of concentration in the United States, this model could be difficult to export. Pix was an initiative by the Brazilian central bank, which was unique among the systems analyzed.

Mobile operator-led

In this model, mobile operators work together to build and define the platform. Banks may join the program, but ownership lies with the mobile operators.

- M-Pesa is owned by Safaricom and Vodacom but is regulated by the central bank and operates under a governing council consisting of both M-Pesa and the banks.

In terms of access, some models are more open to third parties.

- UPI allows banks and non-bank apps to utilize UPI.
- Interac does allow third-party access if there is sponsorship from a member bank.

This mobile operator-led model could be a way for the U.S. market to accommodate non-bank players, increase competition (and thereby promote innovation) and achieve ubiquity. This could also lead to further market fragmentation due to even more players entering the market (in addition to FIs, mobile wallets, apps, etc.). The UPI model of ensuring many different types of players can submit payment messages to the central infrastructure could ensure reach and circumvent fragmentation issues, but it would also require changes to scheme rules, which is unlikely in the short-to-medium term.

Best Practices/Lessons Learned

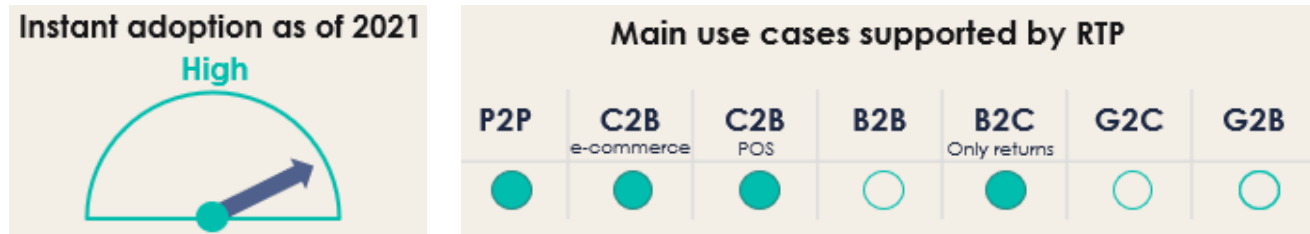
All the directory services analyzed by the Work Group started off with the P2P use case before expanding to C2B POS/POI and e-commerce. It is clear that B2B could offer significant value, especially if the directory enables various types of aliases.

Many of the lessons learned from these global implementations will help to shape the development of directory models in the United States. In terms of best practices that should be considered for the United States domestically, the following attributes are noteworthy:

- The Bizum and Swish systems effectively leveraged a federated directory model, whereby financial institutions maintained the sensitive directory databases and relied on proxy services to support routing and integration. Such a model, which also enables access and engagement by end users and third parties alike, may work well in the U.S. market.
- Interac and M-Pesa achieved success in part by leveraging existing network architecture. There may be application within the United States as we think about how to leverage existing debit card, ATM, and bank account databases to meet such needs.
- UPI demonstrates the utility of ensuring third parties/value-add service providers can access and leverage the directory to further improve the customer experience, drive adoption, etc.
- M-Pesa, UPI, and Pix developed models which were inclusive of non-FIs for access to faster payments.
- Many of the directories, including Bizum, Pix, UPI, and Swish, enable QR code-based payment initiation, demonstrating the importance of convenient initiation, even with a proxy service.

BIZUM

Summary of the System Profile



Bizum⁸ is a payment service embedded within the banking app of participating banks, so users must have a current account at a participating bank to use the service. The Bizum functionality is an option (P2P, request money from an individual, C2B both online and e-commerce) within the app.

Participating banks connect to Bizum via Redsys, the Spanish tech provider that offers gateway services between the banks and Iberpay, the Spanish ACH. The directory is closed-loop, so only users with accounts at participating banks can participate. Bizum does not store any personal data; Bizum connects each phone number to a bank, which then fills in the account information required to process a payment. If users change their phone number or want to change the account to which their phone number is connected, they are responsible for doing so with their bank. Each bank is responsible for securing customer data and for linking phone numbers to IBANs.

All payments go through SNCE's real-time module, the SCT Inst-compliant system operated by Iberpay; no other payment rail or directory is supported or reachable. Users register with the Bizum service using a mobile phone number; other types of aliases are not supported. Each mobile phone number can only be tied to one account.

By 2020 Bizum was used around 10 times per year per user (about four years after going live), and volume in 2020 more was more than double 2019's figure. Volume in 2021 was over 500 million, equating to over 25 transactions per customer. Electronic payments in general are not as heavily utilized in Spain as in other SEPA countries, making Bizum usage even more impressive. After initially being limited to P2P payments, Bizum has expanded to C2B and B2C refunds.

Key Facts & Figures

Population (in millions, 2021)	47.6
Markets where service is active	Spain
Currency	Euro
Year service went live	2016
Number of users	19.1m
Number of merchants onboarded	>26,700 e-commerce merchants & ~5,200 NGOs
Transaction values	EUR 0.50-1,000
Payment rails enabled	Real-time A2A

Comparing Spain and the United States

Spain is still a very cash-heavy economy and has a more concentrated banking market than the United States (in 2017 Spain's CR5⁹ was 85.8 compared to 46.2 for the United States). Bizum is only about a year older than Zelle but was created in conjunction with the large Spanish banks and the general support from Spain's banking sector. That, combined with the high degree of concentration in the Spanish banking industry and the inclusion of Bizum's functionality directly into the banking apps, helps explain the explosion in adoption five years after launching.

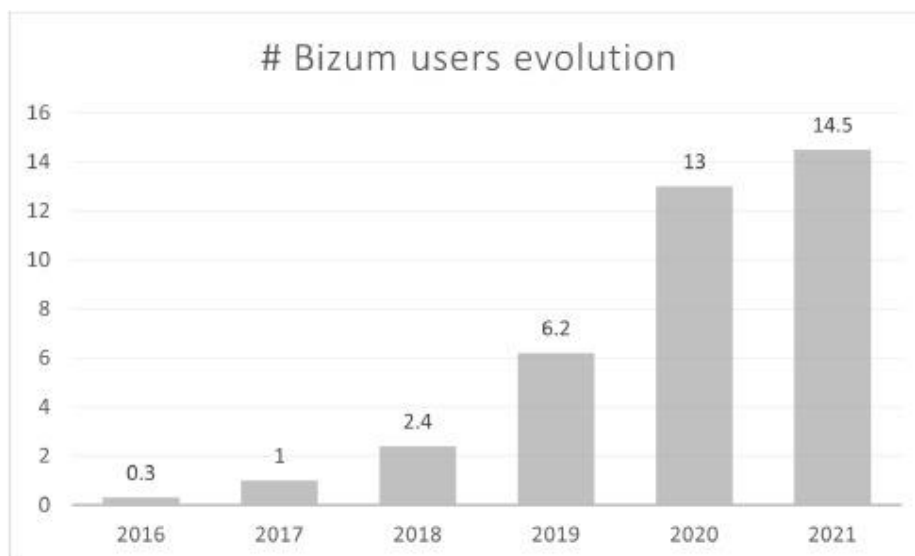
In contrast to the United States, the Spanish market does not have any major domestic competitors to Bizum other than PayPal, partially because the banks were proactive about launching their own system; this of course lessens the overall utility of applying the Bizum example to the U.S. market.

Lessons Learned for U.S. Market

The case of Bizum demonstrates the utility of bank-backing for a directory. Outsourcing the operation of the directory of directories to a joint company owned by the backers enables a small group to concentrate on things like securing the directory, expanding beyond the P2P use case, onboarding merchants, and adding functionality to the core payment service. Furthermore, having banks in charge of customer data limits the risk of having a centralized directory from a data protection perspective because no additional party has access to customer-level data.

Conclusion

In terms of the core attributes identified by the Work Group (safety, interoperability, and governance), the Bizum directory fulfills at a minimum of two (safety and interoperability), if not all three attributes. Going back to the eight characteristics, it fulfills at least seven (all but #3, supports multiple routes linked to payment alias).¹⁰



Summary of the System Profile



Interac¹¹ is a privately held, for-profit organization. Interac owns and operates the Canadian domestic card scheme switch and built the e-transfer service off this network and manages the messaging and settlement for the Canadian market for its card scheme. The degree to which Interac will be interoperable with the Real-Time Rail (RTR, the account-to-account instant payment system, which will be launched in 2023) is not completely clear as of now. Interac’s e-Transfer service posts to the recipient’s account in under five seconds. Interac is included to evaluate its directory capability.

Interac e-Transfer allows for P2P payments using an alias. This had over 20m users as of 2018 (more than half the Canadian adult population) and in October 2020 processed more than 70 million transactions, nearly one payment per week per user. While Interac’s service supports C2B payments either at the POS or for e-commerce, card rails are used here, not account-to-account. Interac’s e-Transfer service has expanded beyond consumer-based use cases into B2B and B2C, though the degree of usage is not clear. Interac was selected as the vendor for the messaging and exchange layers by Payments Canada.

Key Facts & Figures

Population (in millions, 2020)	38.03
Markets where service is active	Canada
Currency	Canadian Dollar (CAD)
Year service went live	1984
Number of users	30m+
Number of merchants onboarded	500,000+
Transaction values	CAD 0.01-3,000 in 24 hours and 10,000 in seven days
Payment rails enabled	Real-time A2A

Lessons Learned for the U.S. Context

Comparing Canada and the United States

Both Canada and the United States are very mature payment markets with high levels of electronification. The U.S. banking market is not as concentrated as the Canadian market and has thousands of banks, while the Canadian banking market only has a few banks which comprise the large majority. The United States is more fragmented with multiple service providers for P2P

services including wallets like PayPal/Venmo, Cash App, along with Zelle (owned by the major banks). In contrast, Interac e-Transfer is the de facto solution for P2P services in Canada, though competing solutions such as PayPal exist.

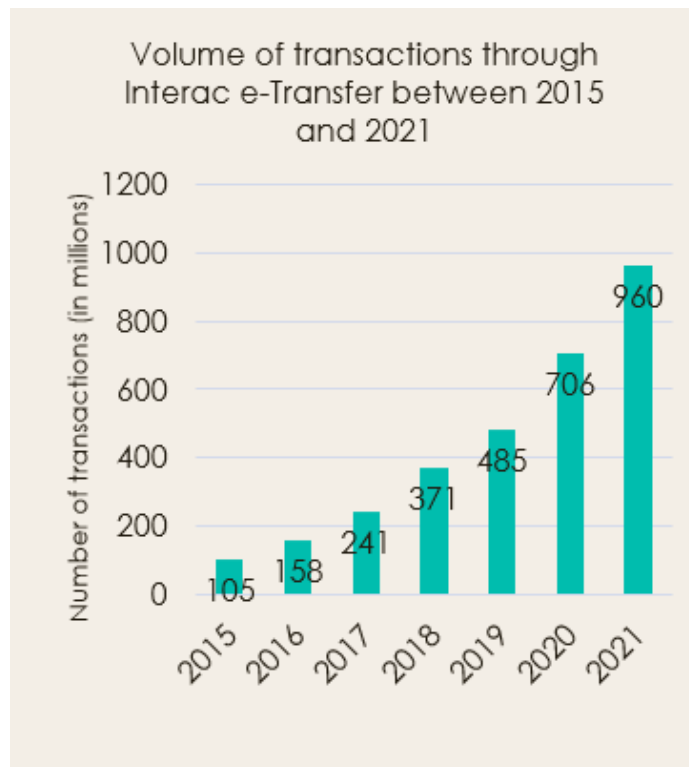
Lessons Learned for U.S. Market

Acxsys Corporation was created in 1996 by eight financial institutions who built the Interac network to develop new business partnerships and services, including Interac e-Transfer. This has allowed Interac to have a dominant share due to the early mover advantage and cooperation among banks in a concentrated banking market.

In the United States, there is no dominance in P2P by any single player. TCH's owner banks created RTP in 2017, but by that time, other P2P apps such as Square Cash were already in the market, so there is not a single dominant P2P service like in Canada. The lesson of Interac demonstrates the advantage of repurposing existing networks, such as the ATM network, to innovate. This bypasses the issue of reach because all banked Canadians have access to an Interac debit card.

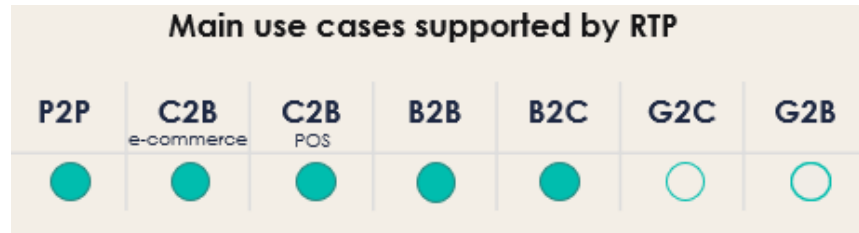
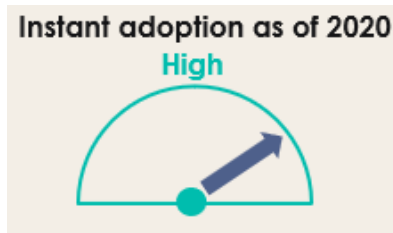
Conclusion

Going back to the eight characteristics, Interac fulfills at least seven (all but #3, supports multiple routes linked to payment alias). Interac is closed-loop, so interoperability is limited. This could change once the RTR goes live in 2023, though this is not yet clear.



Interac volume of transactions, source¹²

Summary of the System Profile



M-Pesa¹³ is owned by Safaricom (Kenya) and Vodacom (Africa-wide), both mobile companies. “Pesa” is Swahili for money while the “M” stands for mobile. M-Pesa is regulated by the Kenyan central bank and creates the scheme rules. It started around purchasing, storing, and reselling “airtime” phone data or minutes, and was instrumental in driving financial inclusion for the unbanked in mostly rural parts of Kenya.

M-Pesa holds a dominant position in Kenya with a 99% market share of the mobile money market. M-Pesa revenue in FY21 was 82,647 (KSHs Mn, approximately 700m USD). Individuals can have up to two accounts, with a maximum account balance of KSHs. 300,000 (about 2,500 USD). The maximum daily transaction value is KSHs.300,000, though the maximum value per transaction is KSHs.150,000 and the minimum is KSHs 1. Users cannot withdraw less than KSHs.50 at an M-Pesa agent outlet.

Key Facts & Figures

Kenya population (in millions, 2022)	55
Markets where service is active	7
Currency	Recipient receives funds in their country’s currency
Year service went live	2007
Number of users (one-month active)	28.3m
Number of merchants onboarded	301k
Transaction values	KSHs 1 – 150,000
Transactions (2021)	15.2bn
Payment rails enabled	Real-time A2A
Number M-Pesa agents	247k

Lessons Learned for the U.S. Context

Comparing Kenya and the United States

Kenya has a much higher unbanked population than the United States. Safaricom has significant market share and that, along with the first-mover advantage, is why M-Pesa was able to establish a dominant position in the market and meet a specific need for the unbanked. The United States is more fragmented with multiple service providers for P2P services including wallets like PayPal/Venmo, Cash App, along with Zelle (owned by the major banks).

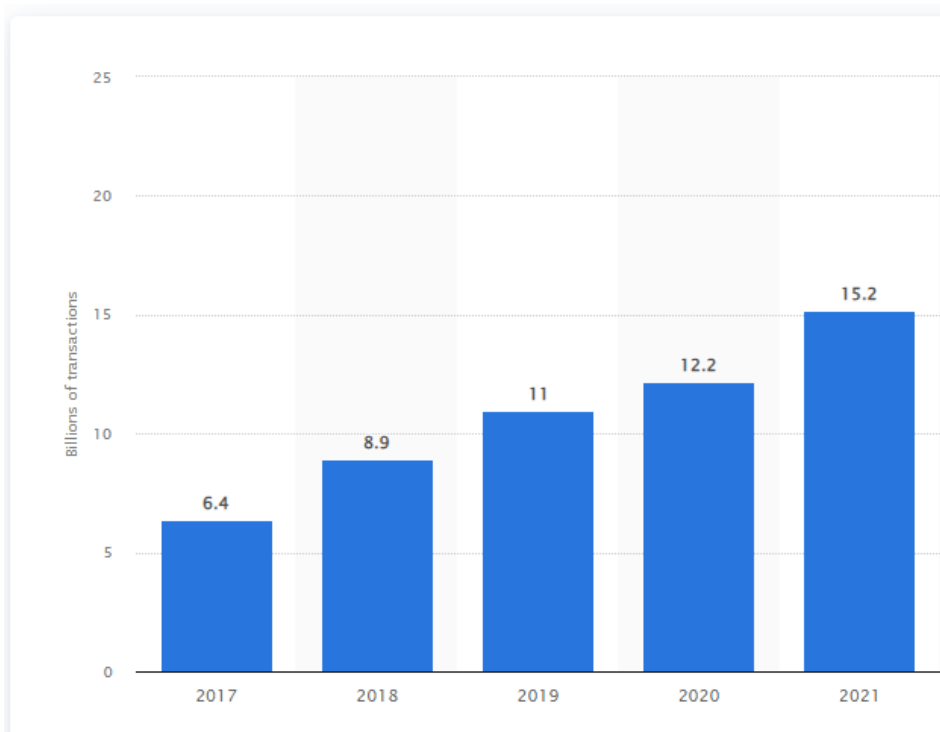
Lessons Learned for U.S. Market

Both M-Pesa and the U.S. P2P services tend to be closed-loops that leverage their own directory and money movement capabilities. Partnerships with banks and fintechs provide consumers with more flexibility and options to extend beyond P2P to other use cases. Interoperability is achieved through strong partnerships with banks, fintechs, and other networks.

Conclusion

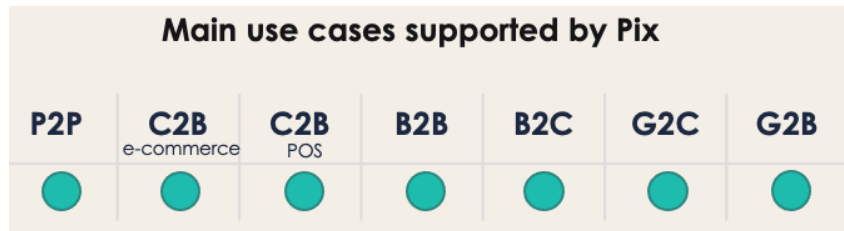
M-Pesa is a closed-loop with an associated directory, but through partnerships multiple use cases can be supported with consumers and businesses realizing significant benefits. M-Pesa does operate a directory that adheres to the three fundamental attributes including safety, interoperability, and governance, though it only supports one alias (mobile phone number). M-Pesa is a classic mobile wallet and does not utilize traditional bank accounts as a funding source like other solutions investigated during this project.

M-Pesa transaction volume from 2017 to 2021
(in billion transactions)



M-Pesa transaction volume, source¹⁴

Summary of the System Profile



Pix was developed and is owned and operated by Banco Central do Brasil (BCB, the Brazilian Central Bank). Pix is the combination of an Instant Payments System (SPI) and the Transaction Accounts Identifier Directory (DICT or Directory). SPI fits the BIS definition of instant payments – near real time, credit push, 24x7x365, and irrevocable.

Pix became available in November 2020. BCB provides governance for Pix – participation rules, operating rules, user experience rules, etc. BCB mandated that financial institutions with greater than 500,000 accounts support Pix.

Pix is accessed through any of over 775 “Participants” in the scheme. Direct Participants (~115) are directly connected to SPI and DICT. Indirect Participants (~660) access SPI/DICT via Direct Participants. Through these Participants, Pix is widely available to individuals, businesses, and government entities in Brazil. Pix has very high adoption for a wide range of use cases.

Individuals access Pix through their bank or payment institution. Aliases include phone number, email address, tax ID, and randomly generated UUID. QR codes are also leveraged to support transactions. Merchants can accept Pix for C2B payments via QR Code, payment link, or via a PSP. Pix is available for merchant transactions online or in person.

Payments made via Pix are processed over the SPI real-time payments network or “on us.” Over half of the population of Brazil and nine million businesses are active on Pix.

Key Facts & Figures

Population (in millions, 2020)	215.6
Markets where service is active	Brazil
Currency	Real (BRL)
Year service went live	2020
Number of users (2022)	129m
Number of merchants onboarded	75% of online
Transaction values	Variable
Payment rails enabled	SRI

PIX key facts and figures, source¹⁵

Comparing Brazil and the United States

Brazil, like the United States, has many different forms of financial institution (banks, credit societies, etc.) Brazil also has a class of providers called Payments Initiators. Payment Initiators are regulated entities that can process payments via direct access to the payment networks but cannot hold deposits. The total number of regulated entities in Brazil is still far less than in the United States (a few hundred rather than thousands.) The Brazilian banking sector is much more concentrated than in the United States, with the top five Brazilian financial institutions holding approximately 80% of deposits.

Competing systems for P2P payments have limited adoption in Brazil relative to the United States. This lack of competition, banking system concentration, and the central bank mandate meant that instant payments were available to an overwhelming majority of consumers and businesses when Pix was launched.

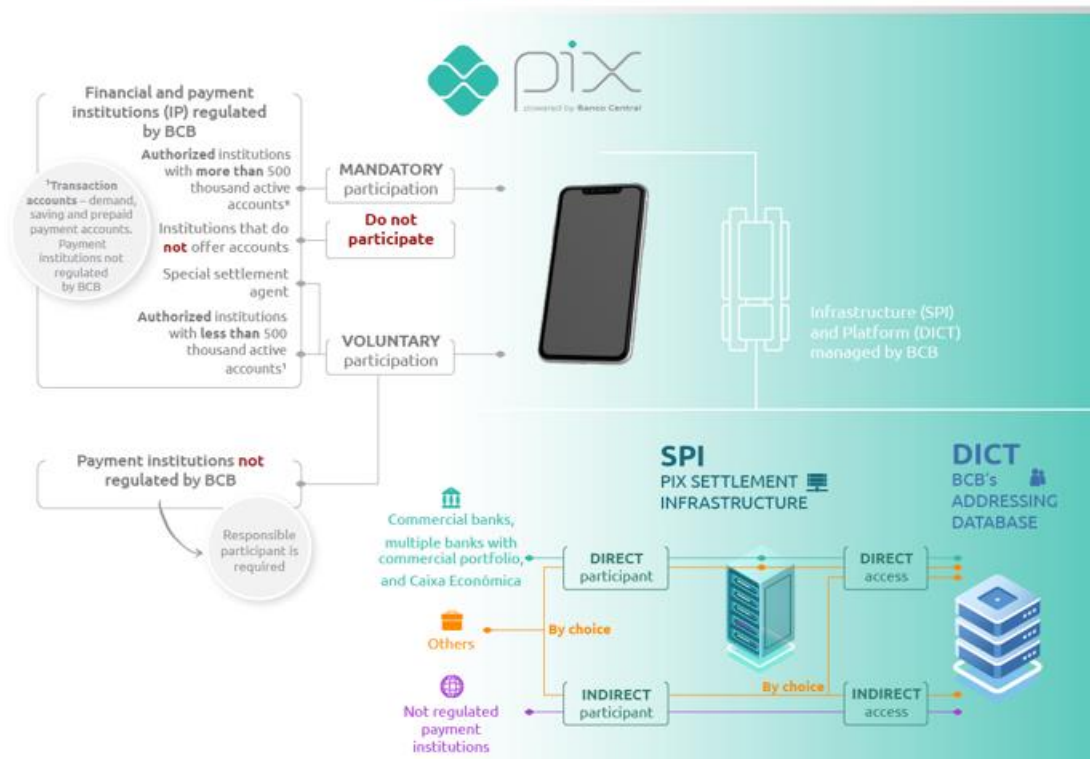
Lessons Learned for U.S. Market

Pix has been successful in accelerating the adoption of instant payments in large part due to a robust, broadly available directory capability. Customers (consumer and commercial) can have multiple aliases based on different data elements – up to 20 aliases in the case of businesses. The introduction of a randomly generated UUID alias has facilitated system generated payments (e.g., B2B). Regulated financial institutions remain responsible for protecting customer data.

QR code capability has made point-of-sale/e-commerce payments ubiquitous. The QR code capability has built in additional transactional information to make the end-to-end payment process “complete.” The QR code communicates a datagram is a URL which is unique to the transaction. The URL can be used directly to facilitate a payment, in the event a QR code cannot be scanned (e.g., a purchase scenario via a browser on a mobile device).

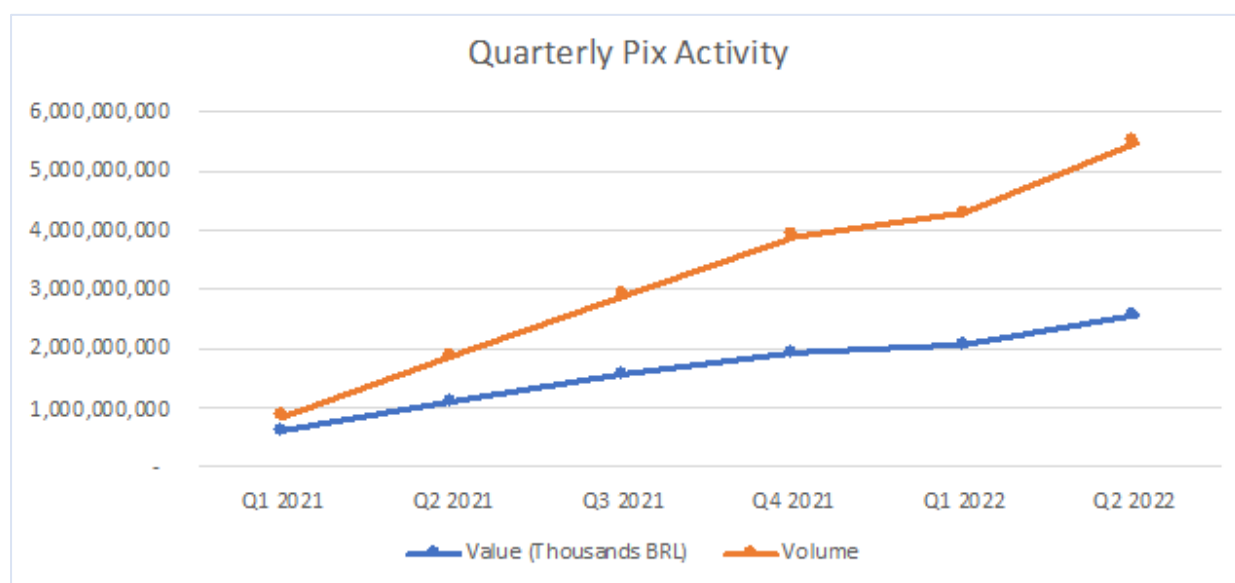
Pix allow non-bank payment service providers to be Participants in Pix. This expands the options customers have for utilizing Pix payments.

Participation in Pix



Conclusion

Pix provides capabilities to address the overarching characteristics of Interoperability, Safety and Governance. Pix supports most of the beneficial characteristics and provides a particular breadth of use case support. The native support in Pix for multiple aliases per person is unique and adds some interesting capabilities. Native support for point-of-sale and e-commerce transactions upon launch of Pix has driven rapid adoption of instant payments by consumers and businesses.



PIX activity, source¹⁶

SWISH

Summary of the System Profile



Swish¹⁷ is a money/movement service, owned by the largest banks in Sweden. Swedish consumers and merchants are the primary users of Swish, with over 90% of Swedish adults using the app. Banks enable individuals and businesses to connect their bank account to their Swish app.

Individuals download the app on their mobile phone and can use Swish for P2P or C2B payments. Mobile phone number is the primary alias leveraged. QR codes are also leveraged to support transactions. Swish does not charge consumers to make Swish payments. Merchants can similarly leverage to accept C2B payments; online, POS, invoice, and B2C payouts are all supported. Swish posts a list of certified enablers/PSPs that can aid merchants with Swish integration and tech setup/support.

Swish does not have a centralized directory of end-user information; rather, the service relies on participating banks to provide routing/account information during transactions. Payments made via the Swish app are processed over the BiR real-time payments network in Sweden. Much of the Swedish population uses Swish, though consumers still use card transactions for a large percentage of in-store purchases. Overall, real-time payments comprise roughly 11% of payment volume in Sweden.

Key Facts & Figures

Population (in millions, 2020)	10.35m
Markets where service is active	Sweden
Currency	Krona (SEK)
Year service went live	2012
Number of users (2021)	8.1m
Number of merchants onboarded	306,000
Transaction values	SEK 1-variable
Payment rails enabled	Real-time A2A

Comparing Sweden and the United States

Sweden has a much more concentrated banking market than the United States (just over a hundred rather than thousands), while total assets are highly concentrated in the largest financial institutions (four largest banks hold more than 80% of assets).

Swish is a bank-owned and bank-centric service, like Zelle in the United States. Swish, however, benefitted from being an earlier entrant to the market (five years earlier than Zelle), and as such, does not have any real competition in Sweden, particularly from a P2P perspective. Zelle on the other hand, has notable competition from firms like PayPal/Venmo and the Cash app.

Lessons Learned for U.S. Market

The case of Swish demonstrates the utility of bank-backing for a directory. Outsourcing the operation of a federated directory to a joint company owned by the backers enables a small group to concentrate on things like securing the directory, expanding beyond the P2P use case, onboarding merchants, and adding functionality to the core payment service. Furthermore, having banks in charge of customer data limits the risk of having a centralized directory from a data protection perspective because no additional party has access to customer-level data.

An opportunity to be considered is in interoperability, as the closed network prohibits broad interoperability with other faster payments schemes and directories. Swish, as part of the European Mobile Payment Systems Association (EMPSA) is currently working on establishing interoperability with other European mobile payment systems, including Vipps in Norway, Mobile Pay in Denmark/Finland, and Twint in Switzerland.

Conclusion

Going back to the eight characteristics, Swish fulfills at least seven (all but #3, supports multiple routes linked to payment alias). The biggest consideration from an advantage perspective is the federated directory model, which enables FIs to locally maintain and secure sensitive account information. From an opportunity perspective, the closed nature of the network means that interoperability is limited.

Pros:	Cons:
<ul style="list-style-type: none">• Scale and Reach• Security and maintenance from federated model	<ul style="list-style-type: none">• Closed network / directory model limits interoperability

UNIFIED PAYMENTS INTERFACE (UPI)

Summary of the System Profile



UPI¹⁸ is a mobile-based 24/7/365 system enabling users to send and receive money instantly using a Virtual Proxy Address (VPA). The unique feature of these VPA-based transactions is the secure UPI architecture that makes the need to share bank account details to the remitter redundant. UPI supports P2P and C2B payments and can be used via smart phone (app-based), feature phone (USSD-based), or at the merchant (app-based). UPI facilitates merchant payments, utility bill payments, QR code-based payments (scan and pay), etc., via either CT or DD. Non-financial transactions such as mobile banking registration, balance enquiry, etc., can also be conducted using UPI.

UPI transactions can have multiple funding sources within single applications from participating banks or Third-Party Application Providers (TPAPs). Funds can be transferred using VPA or account number with bank code (IFSC). UPI is an overlay layer that uses the IMPS rails for clearing and settlement, whereas NPCI is the system owner. Banks access UPI as PSPs, issuers, and beneficiaries; apart from TPAPs such as Google Pay, Truecaller, WhatsApp, etc. Non-bank Prepaid Payment Instrument (PPI) issuers are allowed to provide this facility in an interoperable manner to wallet holders.

Transactions are conducted through mobile devices with two factor authentication using device binding and a UPI PIN as security. The UPI PIN is encrypted using Public Key Infrastructure (PKI) technology while the transaction data is stored in encrypted format in the app provider's system.

There are many innovations extending UPI to desktops, feature phones, offline payments as well as recurring payments.

Key Facts & Figures

Population (in billions, 2021)	1.39
Markets where service is active	India, Nepal, Bhutan, Malaysia, UAE
Currency	INR
Year service went live	2016
Number of users	200m
Number of members	316
Transaction values	INR 200,000 in 24 hours
Payment rails enabled	Real-time A2A

Comparing India and the United States

India¹⁹ is still a very cash-heavy economy and has a comparably concentrated banking market to the United States (in 2017 India's CR5 was 47.03 compared to 46.2 for the United States). UPI was created by NPCI in conjunction with the RBI and general support from India's banking sector. The growth of UPI has been phenomenal, aided by demonetization and accelerated by the pandemic. In 2021 UPI processed more than 38 billion transactions, amounting to about USD 900 billion. UPI has become the go-to electronic payment method in India owing to interoperability and acceptance. UPI recently became available to feature phone users, therefore tapping into a sizable population without smartphones.

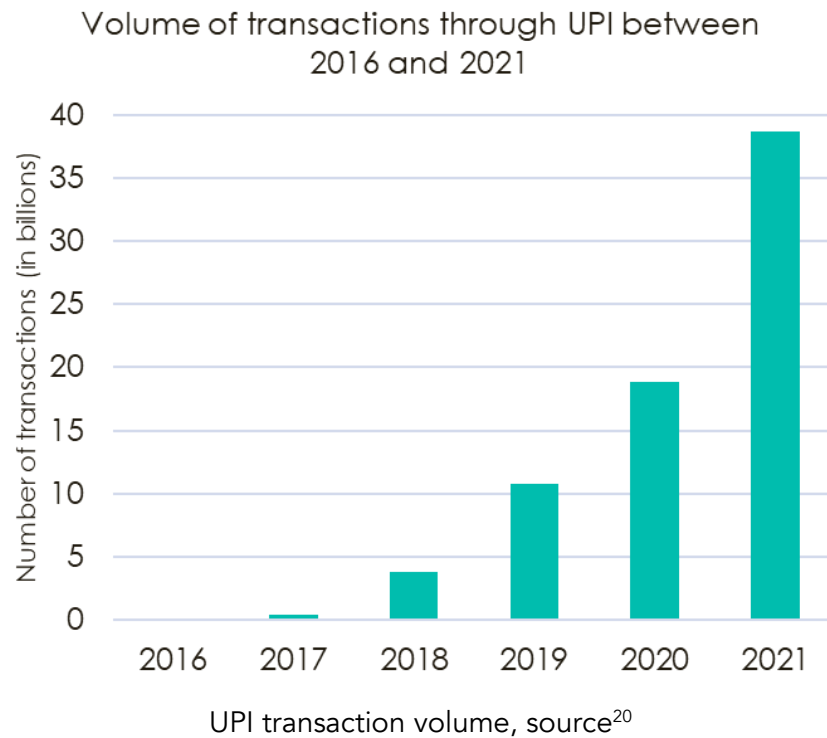
In contrast to the United States, the Indian market does not have any domestic competitors to UPI, partially due to the interoperability it provides. This demonstrates the utility of enabling third-party access and API integrations for fintechs offering payment services could have for the U.S. market given the level of decentralization in the banking sector and the number of non-bank third-party providers already active.

Lessons Learned for U.S. Market

The case of UPI demonstrates the utility of non-bank access for a directory to circumvent the issues a decentralized banking market and the widespread presence of non-bank payment apps can have on interoperability and reach. This provides for development of innovative services in conjunction with the payment offering by fast evolving fintech players and increased adoption by customers and businesses alike. Furthermore, enabling the PSP to oversee customer data limits the risk of having a centralized directory from a data protection perspective, though it does increase the number of potential access points for bad actors.

Conclusion

In terms of the core attributes identified by the Work Group (safety, interoperability, and governance), the UPI directory fulfills at a minimum of two (safety and interoperability), if not all three. Going back to the eight characteristics, it fulfills at least seven (all but #3, supports multiple routes linked to payment alias).



FULL REPORT AVAILABLE

This paper only presented parts of the research, including the summary page and the conclusion, and tried to draw relevant lessons learned for the U.S. market. The full report²¹, available only to FPC member organizations, goes into more detail around the types of aliases supported by each directory, the registration process, the transaction flow, and provides additional contextual information on payment volumes in the country and a brief analysis of how this is likely to change over the next few years. To find out more information on how your organization can join the Faster Payments Council, visit <https://fasterpaymentscouncil.org/>.

About the Faster Payments Council and the Directory Models Work Group

The U.S. Faster Payments Council's vision is a world-class payment system where every person or organization can safely and securely pay anyone, anywhere, at any time and with near-immediate funds availability. To further this vision, the Faster Payments Council established the Directory Models Work Group (DMWG) with the mission to identify and assess an approach for best practices across directory models and/or dependent platforms for the faster payments ecosystem.

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Thank you to the members of the FPC Directory Models Work Group who contributed to this research report.

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