



QR Code Merchant Payments

A growth opportunity for mobile money providers

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A close-up photograph of a person's hand holding a smartphone. A semi-transparent hand icon is overlaid on the phone, with fingers pointing towards the screen, suggesting a gesture-based interaction. The background is blurred, showing what appears to be a retail or service environment. The image has a color gradient from blue on the left to purple on the right.

Executive summary



Executive summary

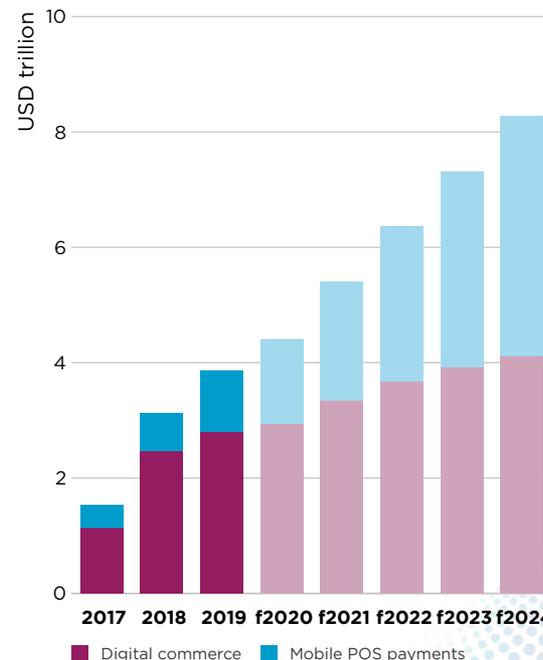
Mobile money providers (MMPs) are key players in the provision of financial services in emerging markets. MMPs now see QR code merchant payments as a potential adjacent opportunity to expand their products and services and target potential incremental revenue streams.

Globally, digital payments are expected to reach an annual transaction value of USD 4.4 trillion in 2020, with 17 per cent CAGR through 2024.* With growth rates like this, it is not surprising that merchant payments have captured the interest of many stakeholders, including MMPs.

QR code payments are enjoying significant but fragmented global growth, often competing with long-established payment methods, such as card payments. There are a number of QR code schemes around the world, but none more successful than the two primary Chinese players, Alipay and WeChat Pay.

In 2019, 640 million Alipay customers regularly transacted in two or more Alibaba Group ecosystem product/service categories. Another 190 million regularly transact in five or more categories.

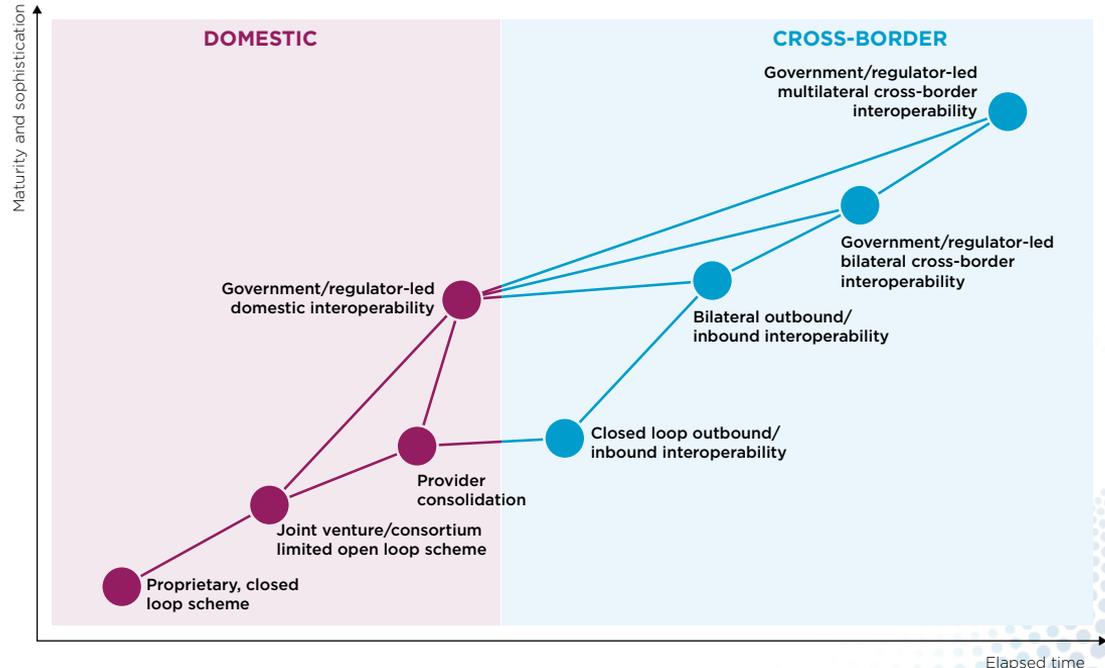
While this report does not advocate a “copycat” approach of the Chinese market and its players, we can learn much from events in China and many other schemes around the world, whether newly emerging, rapidly growing or somewhere in between.



To facilitate this, the report provides an insight into a wide range of QR code deployments and specifications globally – including the Chinese giants (Alipay, WeChat Pay) of course, but also other QR code specifications like EMV, JPQR, Bharat QR, HKQR, SGQR, QRIS, Prompt Pay, Mercado Pago and Pix, among others.

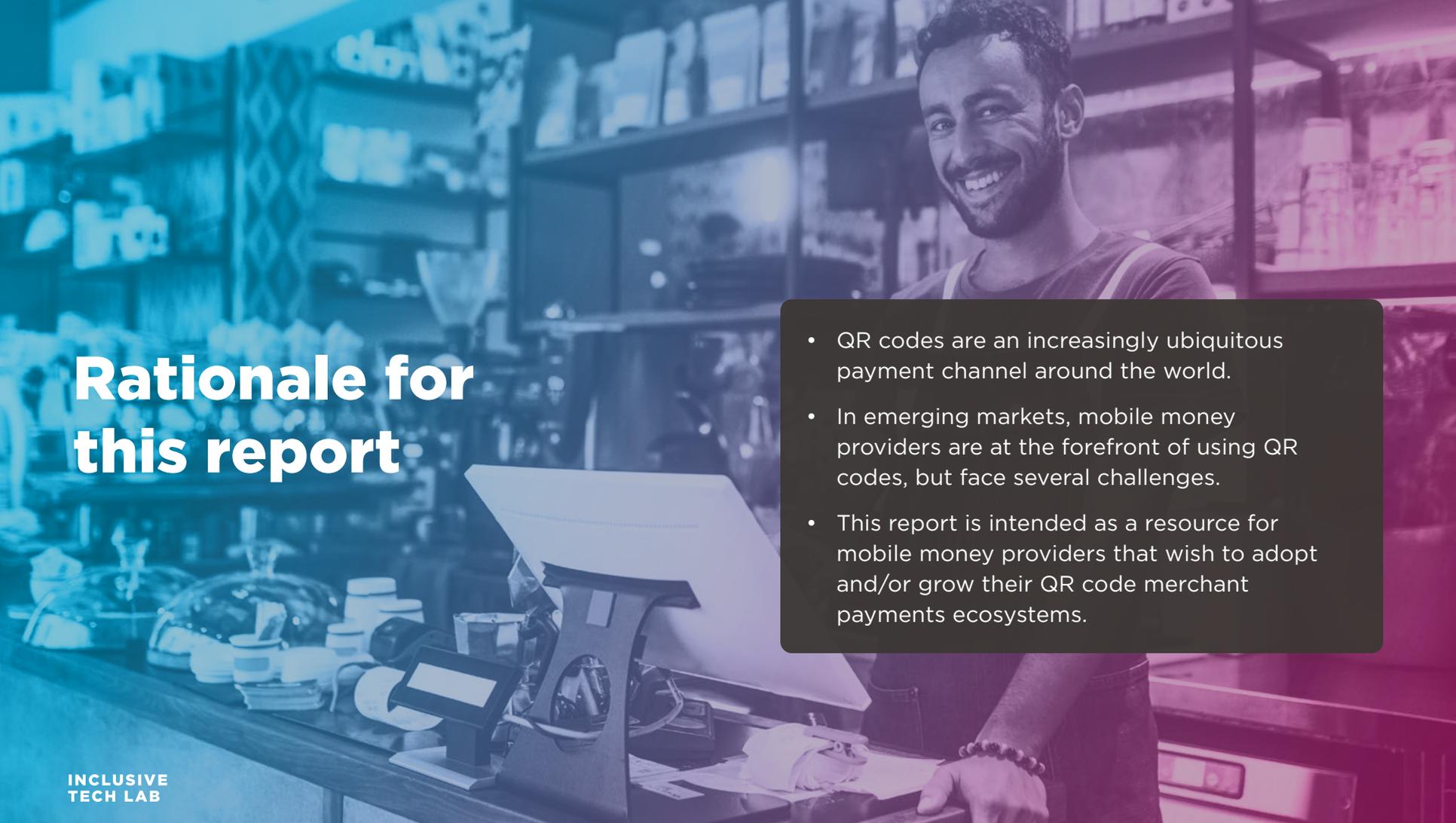
QR code merchant payments present a significant, but potentially complex opportunity for MMPs, and the challenges and strategic benefits must be considered carefully. In particular, interoperability is a crucial requirement for the industry to achieve a harmonised customer experience for QR code merchant payments, driving customer adoption, transaction volumes and overall profitability.

The interoperability journey



Key lessons

- MMPs with large and active **USSD** customer bases will need to carefully consider the best course of action to avoid excluding these customers from the QR code payments journey, while also recognising and addressing practical challenges, such as device affordability and connectivity.
- Having a **core ecosystem of products and services** that continues to drive high levels of customer engagement is crucial. (Payments should support these ecosystems; they are not the ecosystem).
- QR code merchant payments have several key **enablers and interdependencies**, most of which must be addressed to increase chances of success. For example: device affordability, internet connectivity, wallet/bank account penetration and merchant distribution.
- **Market dynamics and nuances** are important. While developing markets in Asia tend to have high smartphone and internet penetration, developing markets in Africa tend to have low smartphone and internet penetration. These call for fundamentally different approaches.
- **Regulatory approaches and interventions** differ between geographies, for example, African and Chinese regulators have played a limited role until now (although this is changing), while Southeast Asian and Indian regulators have played an extremely active role in QR schemes from the outset.
- On its own, a QR code merchant payments P&L is unlikely to be compelling. Rather, value will be derived from data. However, QR codes have the potential to significantly **accelerate digitisation of economic activity** in emerging markets, paving the way for additional tailored services to be provided to customers, leading to further revenue streams.

A smiling man with a beard and dark hair, wearing a dark t-shirt, stands behind a counter in what appears to be a shop or cafe. He is looking towards the camera. On the counter in front of him is a computer monitor on a stand, a small QR code scanner, and some papers. The background shows shelves with various items, possibly in a grocery store or a small business. The image has a blue and purple color overlay.

Rationale for this report

- QR codes are an increasingly ubiquitous payment channel around the world.
- In emerging markets, mobile money providers are at the forefront of using QR codes, but face several challenges.
- This report is intended as a resource for mobile money providers that wish to adopt and/or grow their QR code merchant payments ecosystems.



QR codes are an increasingly ubiquitous payment channel around the world

In 2018, Chinese consumer and business mobile payment volumes reached USD 41 trillion,* about 30 per cent (\$13 trillion) of which were QR code payments, primarily through Alipay (founded in 2004) and WeChat Pay (founded in 2011).

Other countries, such as Denmark, India, South Korea and Sweden, also have high mobile payments adoption rates, with the US, Canada, Norway and Japan not far behind.

Global mobile payments adoption is expected to grow by about 27 per cent (CAGR, 2020-2025).**

As a subset of mobile payments, consumer digital payments volumes are expected to top \$4.4 trillion in 2020.*** The top five countries account for almost 75 per cent of the total, but all of Africa contributes just 1.8 per cent of the total.

* All values are in US dollars

** This includes mobile-based NFC payments

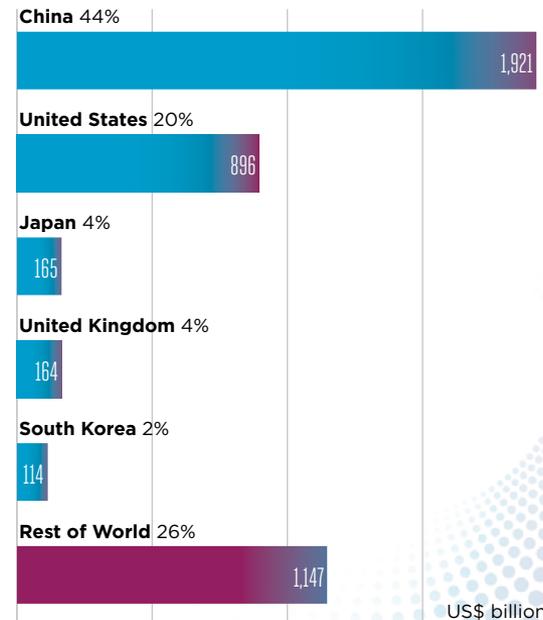
*** Statista, 2020 (adjusting for expected effects of COVID-19)

The rapid growth of mobile and digital payments around the world offers mobile money providers (MMPs) an opportunity to expand their mobile money ecosystems to provide mobile payment services to consumers and merchants.

Currently, the mobile payments market is being served by MMPs, fintechs, smartphone providers, e-commerce providers and banks. Within mobile payments, QR code merchant payments are growing rapidly across Asia, Africa and Latin America.

QR code merchant payments offer a significant opportunity for MMPs, but they are not without challenges.

Consumer digital payments Top five countries, volumes (f2020)



US\$ billions



In developing markets mobile money providers are at the forefront of using QR codes, but face several challenges

Developing markets, such as those on the African continent and Indian sub-continent, have for a long time been exploring the mobile money opportunity from different perspectives, typically to support basic use cases, such as mobile top-ups or person-to-person remittances.

Many of these initiatives have been successful despite many barriers. In these markets, adoption has been limited by, for example:

- **high unbanked populations;**
- **fragmented and unreliable mobile internet connectivity; and**
- **lack of affordable devices.**

Some markets, such as India, have managed to overcome many of these challenges, typically with concerted and sustained government-led initiatives. For example, India now has enviably high levels of bank account penetration across the entire population.

MMPs in developing markets are seeking to expand their mobile money ecosystems into merchant payments by building on core strengths established through their mobile money initiatives.

While QR code merchant payments are considered an attractive opportunity, many existing challenges remain and some new challenges have emerged. For example:

- Deep penetration of **feature phones that rely upon USSD** transaction dialogues and do not support scanning of QR codes;
- Many **divergent views and specifications** that have been developed globally as part of the core QR code ecosystem design.

With concentration around two key players, China is relatively unique. This is seldom the case in other territories, and **competition will therefore be aggressive**, but consolidation will likely result in only the most successful surviving,

especially as few users will tolerate having many wallets.

The approach that MMPs take to understanding and addressing these and other issues will define the nature and degree of their success in the QR code merchant payments ecosystem.





This report is intended as a resource for mobile money providers that wish to adopt and/or grow their QR code merchant payments ecosystems

Since MMPs will be at different stages in their QR code merchant payments journeys, this report is intentionally broad to support MMPs regardless of their current focus, whether it be basic QR code merchant payments acceptance, more sophisticated ecosystem interoperability or stages in between.

The objective of this report is to examine the opportunities and challenges of QR code merchant payments by:

- sharing insights on the QR code merchant payments ecosystem and various initiatives around the world;
- describing QR code merchant payments in the context of a journey to help MMPs identify where they are in their respective journey;
- highlighting key lessons that can be elicited from various initiatives around the world;
- sharing insights and perspectives on some of the fundamental technical considerations of QR code merchant payments, and
- sharing insights and perspectives on the impacts and implications of some of the major trends in QR code merchant payments.

All the above will be synthesised into a proposed call to action for MMPs as they move forward with their respective QR code initiatives.



The rise of QR codes in payments

- Originally a tool for tracking automobile machine parts, the rise of QR codes in payments was enabled by the widespread adoption of digital wallets.
- Uptake has been high in China, and their relatively inexpensive form factor and ease of use has helped make QR codes popular in other parts of the world.
- Today, prominent QR code merchant payments deployments are evident around the globe.

Originally a tool for tracking automobile machine parts, the rise of QR codes in payments was enabled by the widespread adoption of digital wallets

Types of QR codes



Invented by Denso Wave in Japan in 1994, the use of Quick Response (QR) code has grown in popularity from its origins in the automotive manufacturing industry through to today's merchant payments ecosystems.



Origins and history of QR codes

A QR code is similar to a bar code except it can store a larger amount of information per unit area. It is a two-dimensional code that is capable of 360-degree (omni-directional) high-speed reading.

Initially used in the automotive industry for production, tracking and shipping, QR codes expanded beyond the automotive industry into identification and marketing use cases and finally payments.

China has played a crucial role in the rapid growth of QR code mobile payment services, enabling businesses to accept digital payments without investing in any hardware, such as point of sale (POS) terminals.

The evolution of QR code payments

One of the core enablers of QR code payments has been the mobile wallet. Principally, mobile wallets can operate as:

- **A link to a primary value store**, such as a customer card/bank account. Transactions debit the value from the primary account via the wallet. No preloading of the wallet is required.



- **A virtual store of value**, such as digital/virtual/mobile money that is preloaded into the wallet. Transactions debit the value from the wallet balance.



Note: some wallets offer both models

Relatively inexpensive and easy to use, QR code payments are becoming popular in other parts of the world

QR code merchant payments

In merchant payments, QR codes have been used to replace or complement traditional POS devices and interact almost seamlessly with compatible ecosystem mobile wallets.

The form factor and presentation of a QR code differ depending on the merchant/transaction context, but the following are the primary dimensions to consider:

- **QR code model:** Model 2 is available on a free-to-use licence from Denso. It has sufficient data payload capabilities to effectively support payments transactions, and is therefore the most common form factor in QR code payments currently. Other models of QR codes are available from Denso, but are typically subject to a licence fee and often require specialised scanners.

- **Static QR codes:** Typically printed stickers found at merchant check-out locations or displayed on customer device screens. They hold specific data elements and do not change.
- **Dynamic QR codes:** Dynamically generated at the time of the transaction and require a merchant or customer screen to display. They are typically valid for a short period and contain several contextually unique data elements.
- **Merchant-presented mode (MPM):** The MPM transaction journey requires a customer to scan the merchant's static or dynamic QR code to initiate a transaction.
- **Customer-presented mode (CPM):** The CPM transaction journey requires the merchant to scan the customer's static or dynamic QR code to initiate a payment transaction.

Person-to-person (P2P) payments

QR codes can be used for P2P payments.

Biometric payments

Fingerprint and facial biometrics are enjoying a great deal of attention in payments and could ultimately replace QR code payments in certain circumstances. The scenario considered here extends beyond using a biometric to authenticate/authorise a card or QR code transaction.

For example, the facial recognition biometric becomes the payment token and, apart from the merchant's biometric scanner, no device (e.g. smartphone), card or QR code are required. Please see Appendix A for further insights.

Not just a Chinese phenomenon

There is significant focus on QR code merchant payments around the world, across developing and developed markets alike.

Adoption remains fragmented and, in some markets, typically Europe, the UK and North America, incumbent card-based merchant payments continue to dominate.

The primary drivers of adoption vary between markets, but with most developing markets focused on reducing the use of cash, improving financial inclusion and providing a relatively low-cost, non-cash merchant payments option.

Around the world, initiatives tend to be either proprietary or government/regulator-led, and each market has unique opportunities and challenges.

MMPs in Africa continue to explore QR code merchant payments in addition to their existing mobile money offerings.

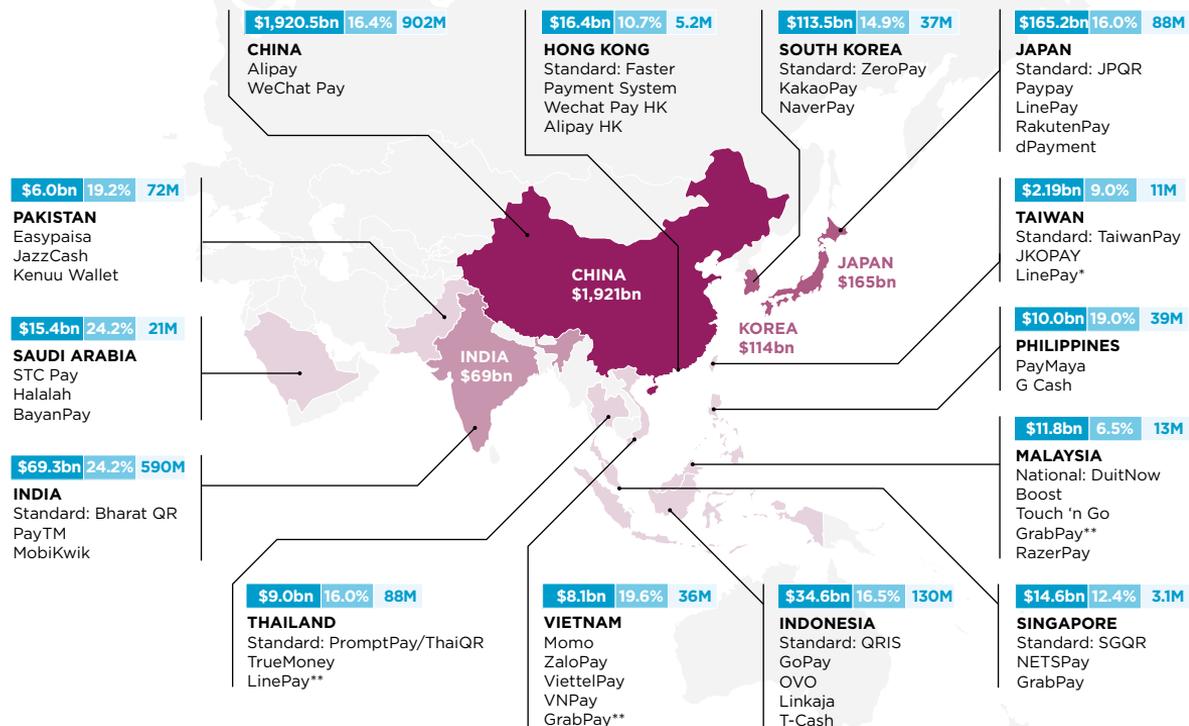
In mature Asian markets, such as China, Japan, Korea and Taiwan, regulators have ultimately taken the lead in pursuing domestic interoperability and, in some cases, cross-border interoperability.

Developing Asian markets, such as Indonesia, Thailand and other Southeast Asian countries, are also heavily regulator-led, with some seeking to avoid card payments entirely.

India's high levels of bank account penetration have enabled the regulator to pursue an ambitious, multi-faceted merchant payments strategy with QR codes and card payments operating side by side.

Today, QR code deployments are evident around the globe – some prominent regional examples

Asia and Middle East



- Expected total annual digital payments* transaction value in USD (f2020)
- Expected total annual digital payments transaction growth rate (CAGR, 2020-2024)
- Number of digital payments users (f2020)

Transaction value for digital payments (f2020)

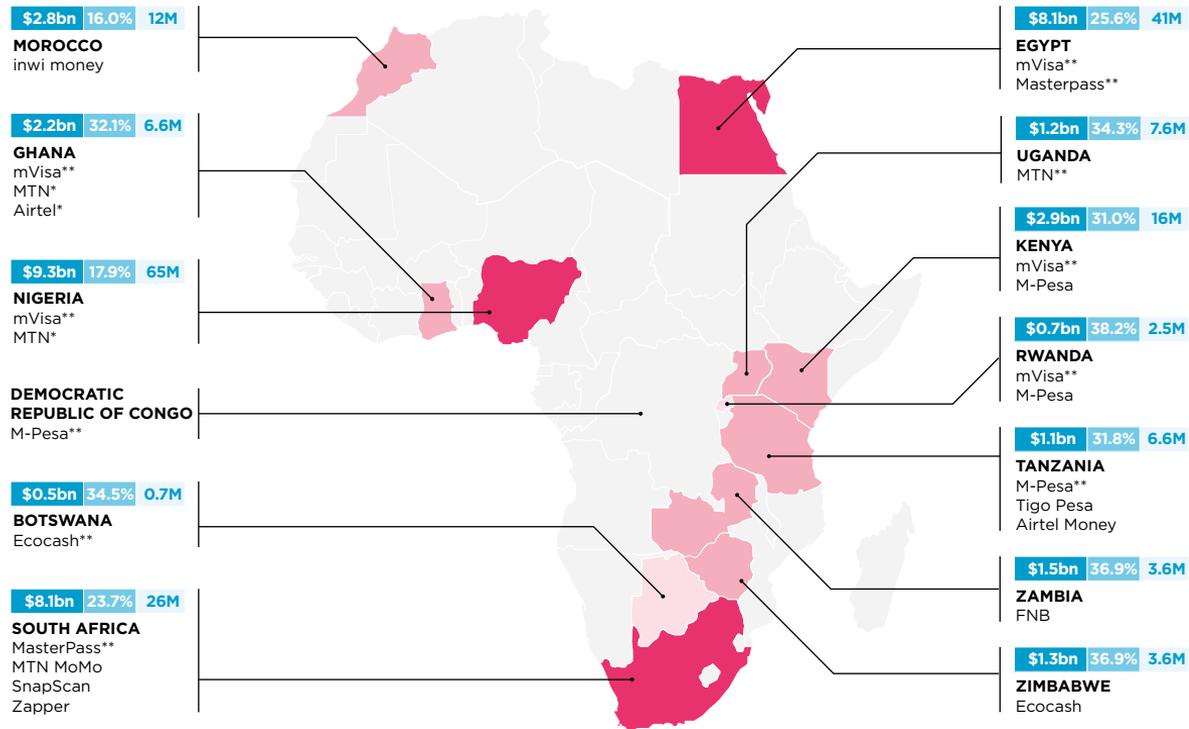
- \$1,001bn-\$2,000bn
- \$101bn-\$1,000bn
- \$50bn-\$100bn
- <\$50bn

* The digital payments market segment is led by consumer transactions and includes payments for products and services which are made over the internet as well as mobile payments at point-of-sale (POS) via smartphone applications. Includes: Online processed payment transactions, mobile POS payments processed via smart devices at point of sale, digital consumer commerce transactions (e.g. credit card, online payment providers, etc.). Does not include mPOS solutions (dongle payments) for card payments or mobile card readers, business-to-business payments, electronic banking (eBanking), provision fees from payment providers.

** Providers where headquarters located in other country

Today, QR code deployments are evident around the globe – some prominent regional examples

Africa



- Expected total annual digital payments transaction value in USD (f2020)
- Expected total annual digital payments transaction growth rate (CAGR, 2020-2024)
- Number of digital payments users (f2020)

Transaction value for digital payments (f2020)

- \$8.1bn-\$10.0bn
- \$4.1bn-\$8.0bn
- \$1.0bn-\$4.0bn
- <\$1.0bn

* The digital payments market segment is led by consumer transactions and includes payments for products and services which are made over the internet as well as mobile payments at point-of-sale (POS) via smartphone applications. Includes: Online processed payment transactions, mobile POS payments processed via smart devices at point of sale, digital consumer commerce transactions (e.g. credit card, online payment providers, etc.). Does not include mPOS solutions (dongle payments) for card payments or mobile card readers, business-to-business payments, electronic banking (eBanking), provision fees from payment providers.

** Providers where headquarters located in other country

Today, QR code deployments are evident around the globe – some prominent regional examples

Latin America



- Expected total annual digital payments* transaction value in USD (f2020)
- Expected total annual digital payments transaction growth rate (CAGR, 2020-2024)
- Number of digital payments users (f2020)

Transaction value for digital payments (f2020)

- \$41bn-\$52bn
- \$21bn-\$40bn
- \$10bn-\$20bn
- <\$10bn

* The digital payments market segment is led by consumer transactions and includes payments for products and services which are made over the internet as well as mobile payments at point-of-sale (POS) via smartphone applications. Includes: Online processed payment transactions, mobile POS payments processed via smart devices at point of sale, digital consumer commerce transactions (e.g. credit card, online payment providers, etc.). Does not include mPOS solutions (dongle payments) for card payments or mobile card readers, business-to-business payments, electronic banking (eBanking), provision fees from payment providers.

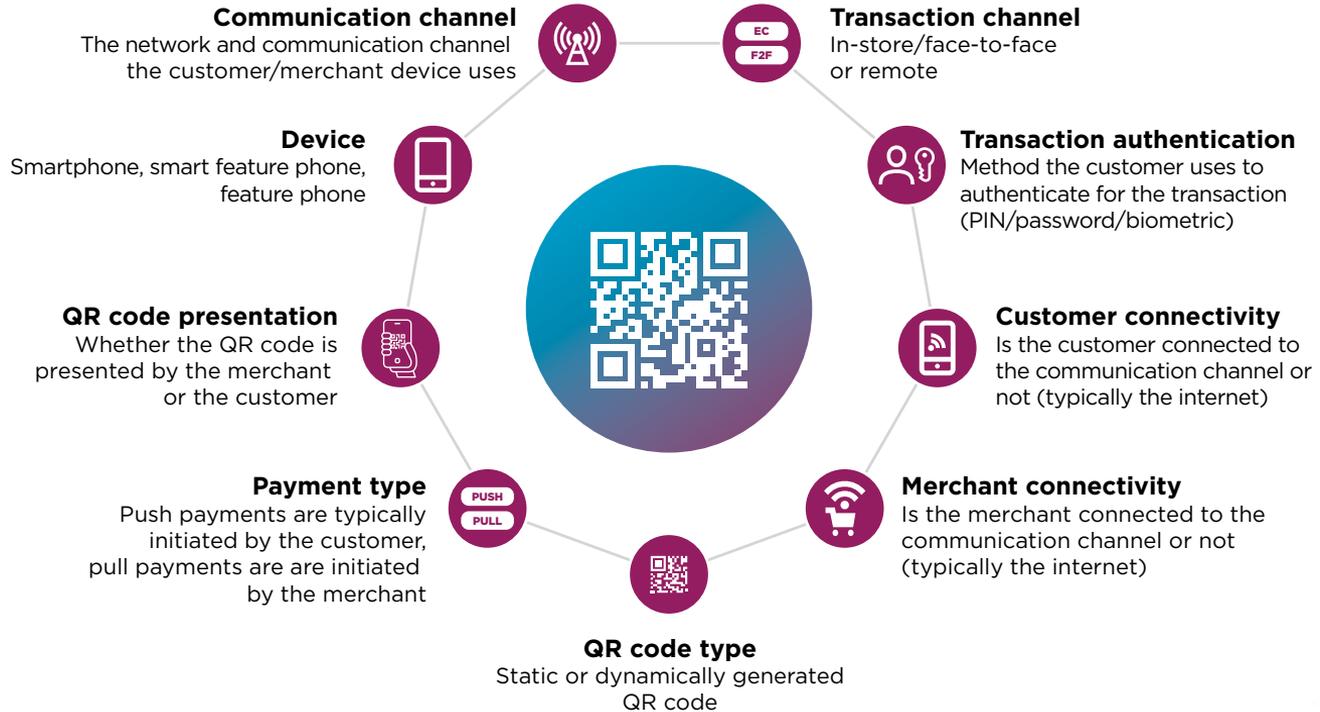
** Providers where headquarters located in other country



Three primary QR code merchant payments flows

- From a product flow perspective, a QR code payment solution can be understood as a combination of nine interdependent elements.
- Each element has several options under it to choose from.
- Three broad product flows are possible for QR code merchant payment solutions depending on how elements are grouped and the transaction characteristics.
- Each product flow results in a distinct experience for the payer and payee of a QR code solution.

From a product flow perspective, a QR code payment solution can be understood as a combination of nine interdependent elements



QR codes harness several key, interdependent elements to support successful, wide-reaching merchant payments. The adjacent diagram illustrates the top-down dependencies, with communication channels and device capabilities being the most fundamental elements to unlock the various modalities of QR code merchant payments.

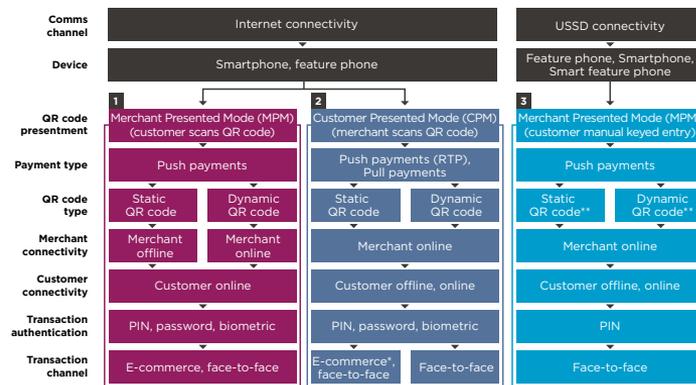
For example, USSD connectivity will take users along a route of manual data capture that typically excludes QR codes from this type of transaction.

Conversely, a smartphone coupled with internet connectivity enables both customer-scanned (i.e. merchant-presented mode) and merchant-scanned (i.e. customer-presented mode) QR code transactions. Additional options then appear depending on whether a static or dynamically generated QR code is used in the transaction.

QR code merchant payments require these key elements to work together as seamlessly as possible. The extent to which this is achieved will have a fundamental impact on factors such as:

- the customer and merchant payment types accepted;
- the customer and merchant payment acceptance rates;
- the channels in which customers can transact; and
- the overall merchant/customer transaction experience.

The following sections will delve into how these components work together to create various types of QR code merchant payment transaction flows and capabilities.

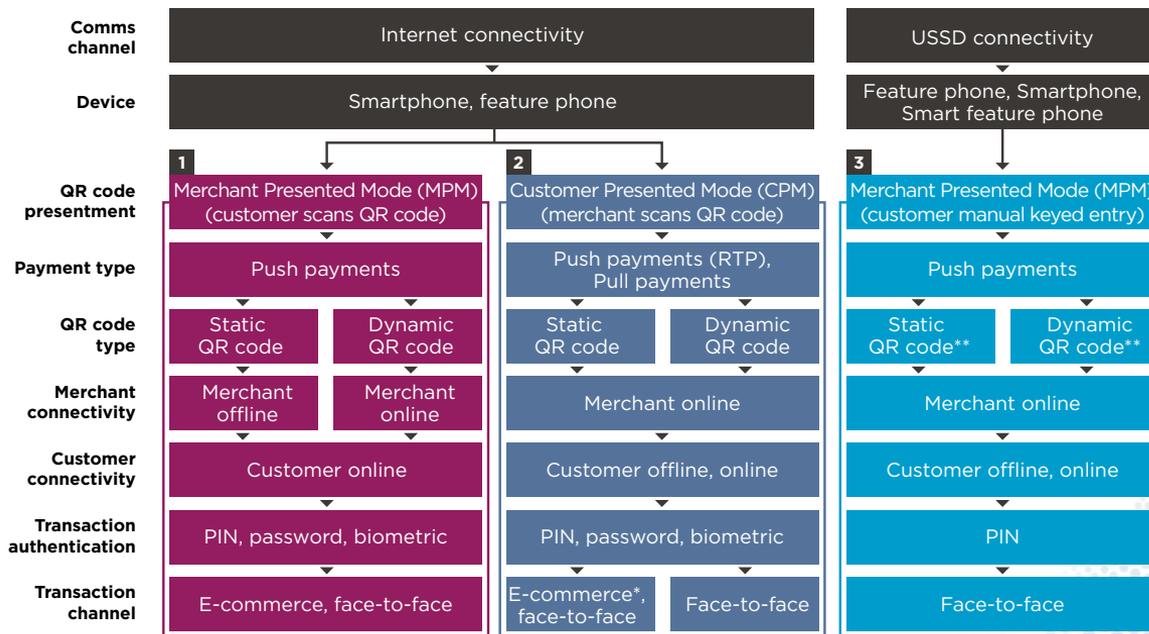


Three broad product flows are possible for QR code merchant payment solutions depending on how elements are grouped and the transaction characteristics

There are three primary interaction options between customers and merchants that have enabled QR code payments:

- Merchant-presented mode (MPM)
- Customer-presented mode (CPM)
- Merchant-presented USSD

These three product flows are illustrated below in the context of their interdependencies. The following pages will summarise the key entities and steps during an in-store purchase transaction.



* Only possible when customer is online

** Merchant identifier must be visible in human readable format, to be keyed in by customer

*** Refer to Appendix A for a description of each element

1 Each product flow results in a distinct experience for the payer and payee of a QR code solution: Merchant-presented QR code payment

QR code payment transaction type:

- Merchant Presented (MPM)
- Static or Dynamic QR code
- Push payment

MPM with a static QR code sticker is a typical implementation for micro-merchants where no/low payment acceptance costs are critical. These merchants are typically transitioning from cash-only acceptance.

MPM with dynamic QR codes is more typical of larger, more sophisticated merchants where they have the POS capability to generate and display a dynamically generated QR code

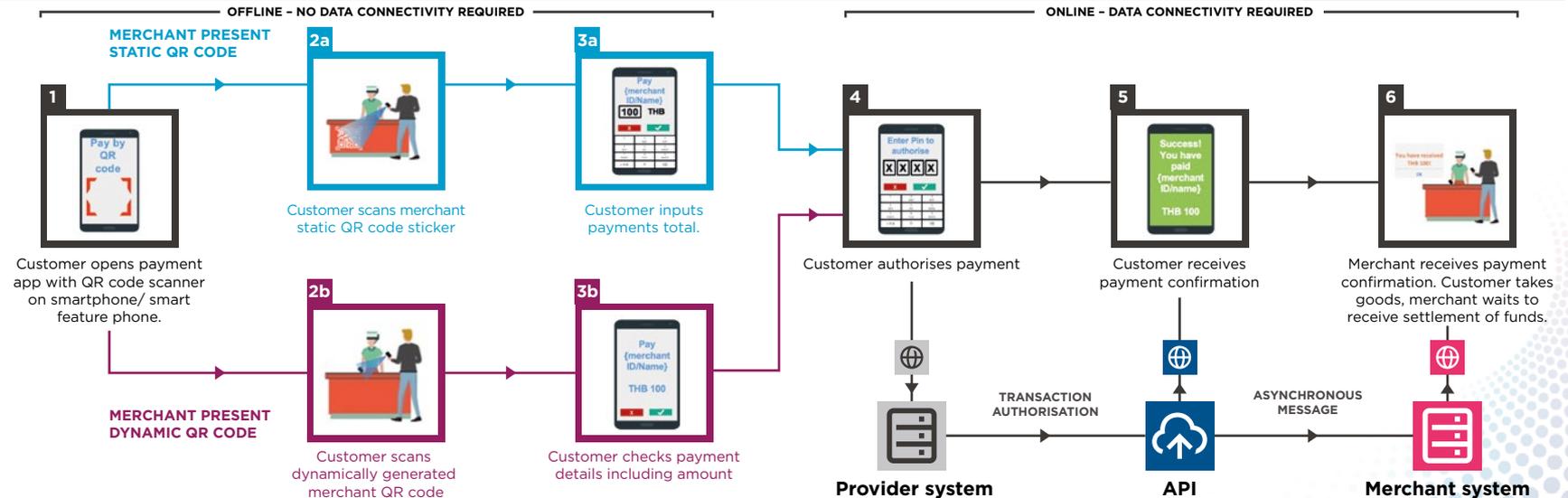
Applies to:



Smartphone



Smart feature phone



2 Each product flow results in a distinct experience for the payer and payee of a QR code solution: Customer-presented QR code payment

QR code payment transaction type:

- Customer Presented (CPM)
- Static or Dynamic QR code
- Push (RTP) or Pull payment

CPM with a static or dynamic customer QR code (on a smartphone or feature phone screen) relies on merchants having the capability to scan these QR codes at checkout.

CPM can either initiate a push or pull payment. In the case of a pull payment the merchant will seek authorisation against customer funds. In the case of a push, the merchant will send a Request To Pay (RTP) to the customer. The customer will then authorise this payment by initiating a push payment directly from a bank/wallet account.

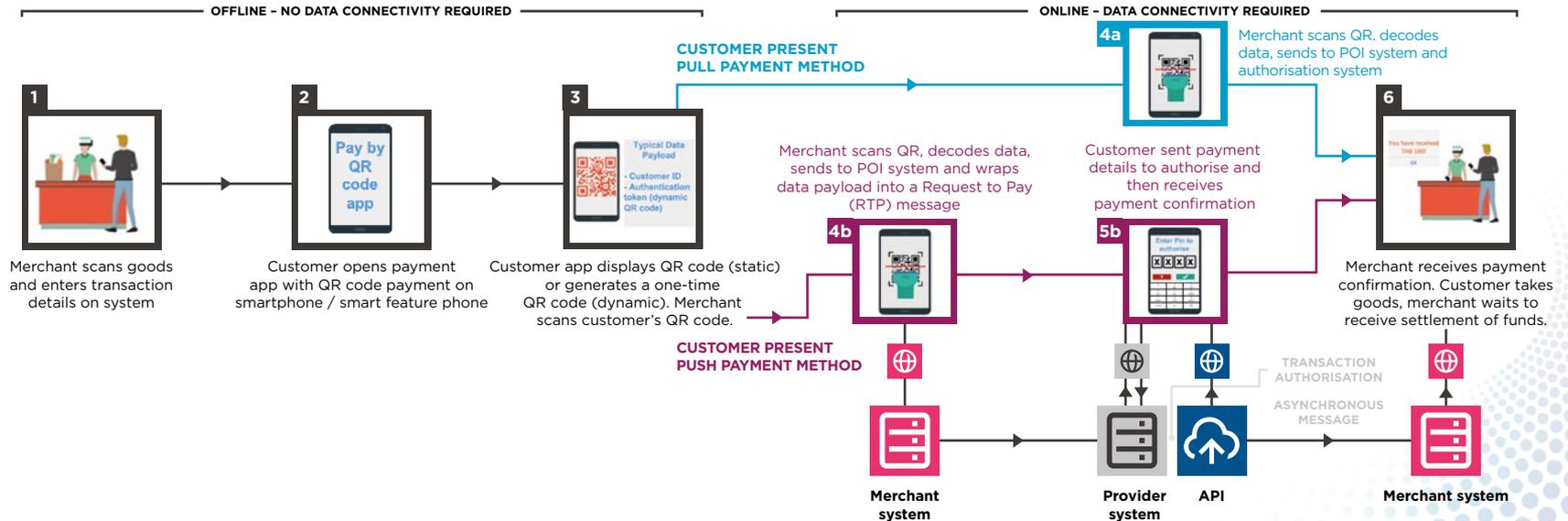
Applies to:



Smartphone



Smart feature phone



3 Each product flow results in a distinct experience for the payer and payee of a QR code solution: Merchant-presented QR code payment (USSD)

QR code payment transaction type:

- Merchant Presented (MPM)
- Static or Dynamic QR code*
- USSD payment

In this scenario, the customer uses a feature phone that cannot scan QR codes and is therefore required to manually key the number printed adjacent to the merchant's QR code sticker (e.g. Merchant ID) to initiate a USSD dialogue to complete the transaction.

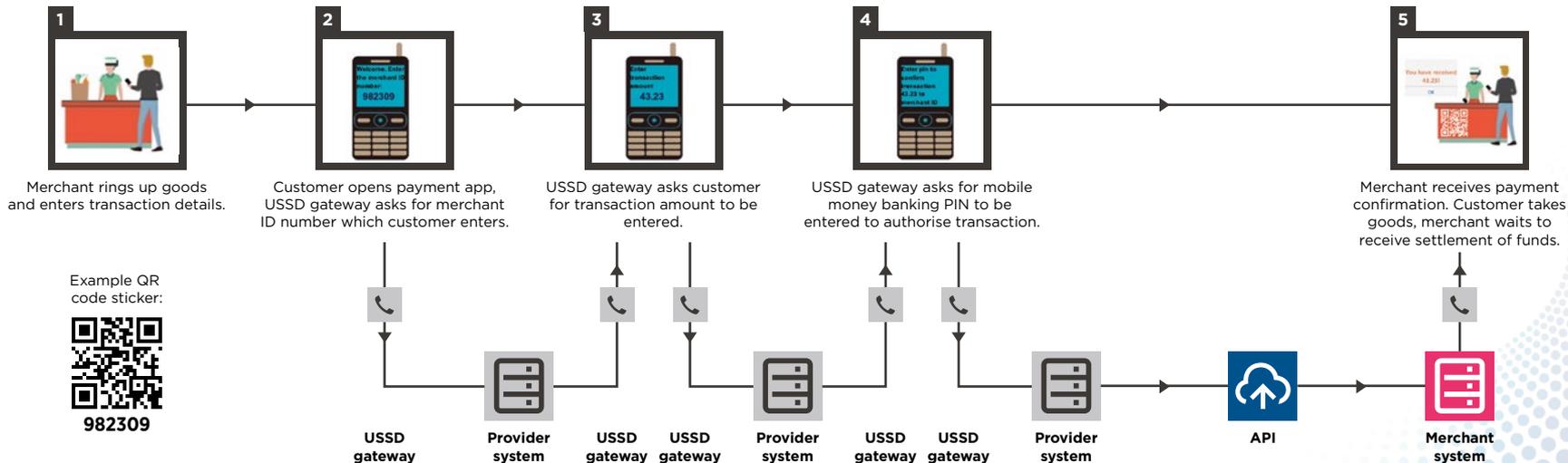
This is not strictly a QR code payment transaction as the QR code is not scanned. This type of transaction exists solely to enable feature phone payments within QR code payments schemes, i.e. backwards compatibility in feature phone dominated markets.

Applies to:



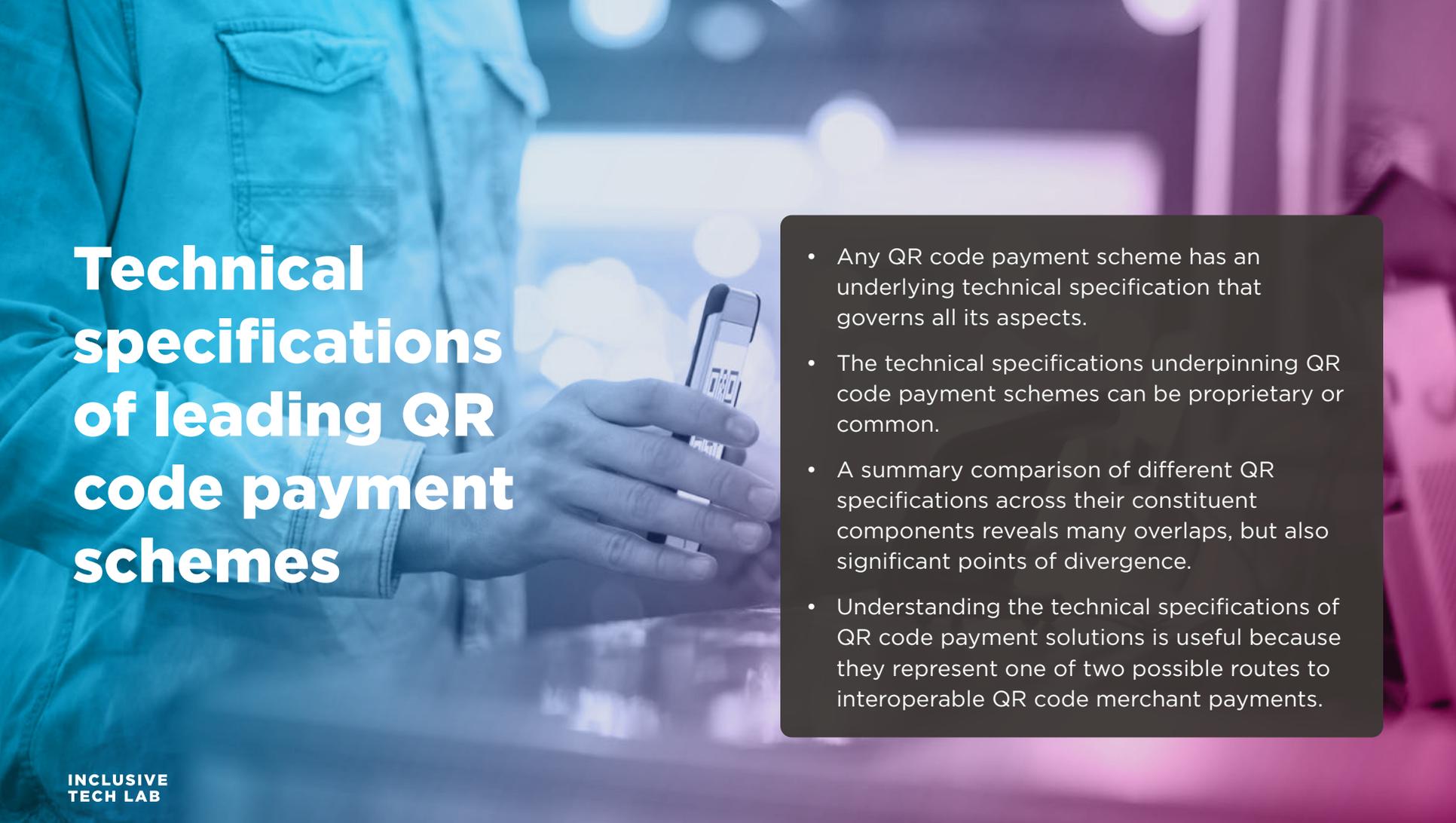
Feature phone**

OFFLINE - NO DATA CONNECTIVITY REQUIRED. PAYMENT THROUGH USSD CHANNEL



* Irrespective of whether a static or dynamic code is presented, a unique, human readable number is required to uniquely identify the merchant transaction. This number is typically the Merchant ID and is manually keyed into the feature phone by the customer to initiate a USSD dialogue.

** Technically possible on smartphones and smart feature phones, but unlikely to be provisioned as such apart from as an atypical fallback option.



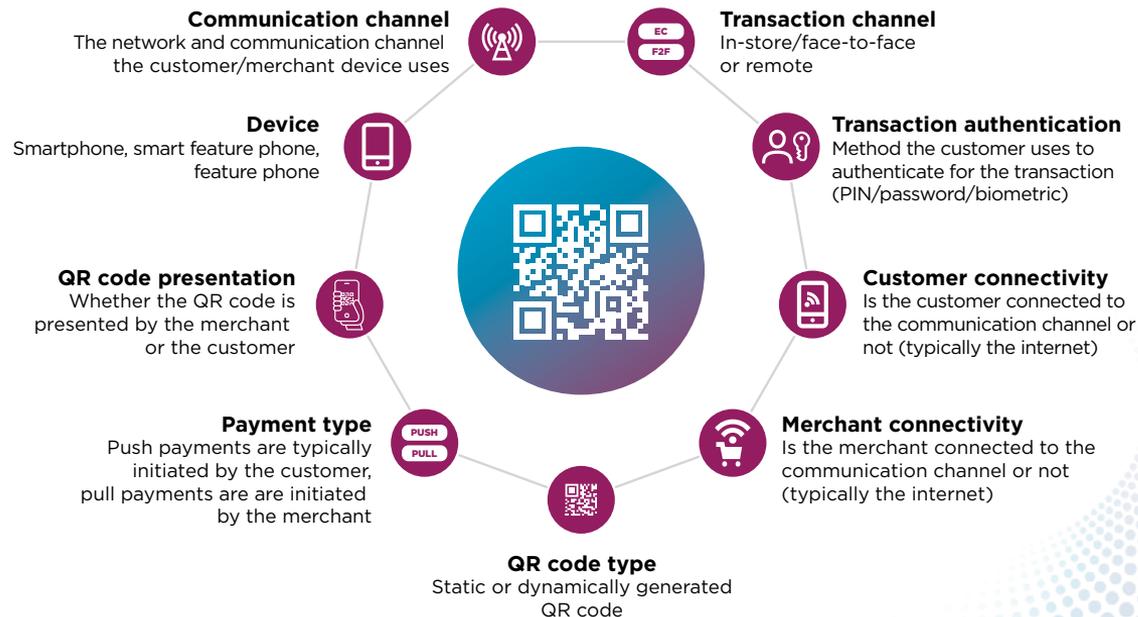
Technical specifications of leading QR code payment schemes

- Any QR code payment scheme has an underlying technical specification that governs all its aspects.
- The technical specifications underpinning QR code payment schemes can be proprietary or common.
- A summary comparison of different QR specifications across their constituent components reveals many overlaps, but also significant points of divergence.
- Understanding the technical specifications of QR code payment solutions is useful because they represent one of two possible routes to interoperable QR code merchant payments.

Any QR code payment scheme has an underlying technical specification that governs all its aspects

In addition to the payments components covered under product flow (see the diagram below), the technical specifications of a QR code solution also encompass:

- Authentication approach: various customer and merchant authentication approaches, from PINs and passwords to biometrics
- Data payload scope: the scope of data elements embedded within the QR code



The technical specifications underpinning the design of QR code payment schemes can be proprietary or harmonised

At the highest level, when designing a QR code payments scheme, providers can elect to adopt a proprietary approach or a more open, harmonised design approach.

The matrix below shows examples of major QR code ecosystem players that have chosen to develop and implement **proprietary specifications**, along with the QR code presentation modalities they support.

Proprietary specifications approach		
Example schemes	MPM	CPM
Alipay	Supported	Supported
WeChat Pay	Supported	Supported
MTN	Supported	Not supported
M-Pesa	Supported	Not supported
Mercado Pago	Supported	Not supported
Kakao Pay	Supported	Supported

Examples of major QR code ecosystem players that have chosen to develop and implement a more **harmonised approach**, some using EMVCo's EMV specification for QR code payments:

Harmonised specifications approach		
Example schemes	MPM	CPM
EMV QR code specs	Supported	Supported
Hong Kong Common QR Code (HKQR) (Hong Kong Interbank Clearing Limited)	Supported	Not supported
SGQR (Monetary Authority of Singapore)	Supported	Supported
JPQR (Payments Japan)	Supported	Supported
Bharat QR (National Payments Corporation of India (NPCI))	Supported	Supported
Thai QR Payment/MyPromptQR	Supported	Supported
Quick Response Code Indonesian Standard (QRIS)	Supported	Supported



A summary comparison of QR specifications across their constituent components reveals many overlaps, but also significant points of divergence

Summary: Core QR code payments components can be summarised across the example schemes as follows:

	Specification	Comms channel	Device	QR code presentment	QR code type	Txn channel
Harmonised specifications	EMV	Internet connectivity	Smartphone	MPM, CPM	Dynamic, static	Face-to-face
	JPQR					
	Bharat QR		Smartphone, feature phone	MPM		
	HKQR		Smartphone	MPM, CPM		
	SGQR					
	QRIS				MPM	
Proprietary specifications	Alipay	USSD connectivity	Smartphone, feature phone	MPM, CPM	Dynamic, static	Face-to-face, remote
	WeChat Pay					MPM
	Prompt Pay			Internet connectivity	Smartphone	
	M-Pesa					
	Mercado Pago					

A summary comparison of QR specifications across their constituent components reveals many overlaps, but also significant points of divergence

Summary: Authentication and **authorisation** approaches across the example schemes are as follows:

	Specification	Authentication approach	When*	Detail
Harmonised specifications	EMV	No mandatory requirements	—	EMVCo has not provided any mandatory requirements for authentication.
	JPQR	No mandatory requirements	—	JPQR does not specify any mandatory requirements, so the authentication varies by company. JPQR recommends PIN, fingerprint or facial recognition
	Bharat QR	Username and password	2) The app is launched	When a customer launches the app, they approve it with a username and password. There is no other form of approval and the customer cannot choose.
	HKQR	Password or biometrics	1) The mobile device is unlocked	*If the bill exceeds 1,000 yuan (-\$150), the user will have to enter his password in the complete transaction.
	SGQR	No mandatory requirements	—	SGQR has not provided any mandatory requirements for authentication.
	QRIS	No mandatory requirements x	—	QRIS has not provided any mandatory requirements for authentication.
Proprietary specifications	Alipay	Password and biometrics	3) Before payment	The most common payment authentication methods have been passwords and fingerprints. Some devices support facial recognition that the user can choose.
	WeChat Pay	Password and biometrics	3) Before payment	WeChat Pay requires the user to enter their payment password to confirm the transaction.
	Prompt Pay	Passwords	3) Before payment	Some companies let users use Face ID and fingerprints as an authentication method, but the common authentication method is typing passwords before settlement.
	M-Pesa	Passwords	3) Before payment	The authentication method is typing a PIN before settlements. The user can change the PIN on the M-Pesa app at any time.
	Mercado Pago	No mandatory requirements	—	Mercado Pago does not specify any mandatory requirements before or after settlement.

* Authentication is performed at 1) when the mobile device is unlocked, 2) when the app is launched, or 3) at the time of payment.



A summary comparison of QR specifications across their constituent components reveals many overlaps, but also significant points of divergence

Summary: Analysis of the scope and coverage of the QR code data payload across the example specifications:

	Specification	QR code data		
		Data for Merchant Presented Mode	Data for Customer Presented Mode	Data for linking up with different schemes*
Harmonised specifications	EMV	Defined in the specification	Defined in the specification	Not defined in the specification
	JPQR			
	Bharat QR		Not defined in the specification	
	HKQR	Defined in the specification		
	SGQR	No published QR code data information		
QRIS				
Proprietary specifications	Alipay	No published QR code data information		
	WeChat Pay			
	Prompt Pay	Defined in the specification	Not defined in the specification	Not defined in the specification
	M-Pesa			
Mercado Pago				

* For a more detailed comparative analysis of different QR code technical specifications, refer to Appendix E.

** Columns of data are provided to work with each scheme, such as a "Reserve for EMVCo"



A summary comparison of QR specifications across their constituent components reveals many overlaps, but also significant points of divergence

Summary: Analysis of the scope and coverage of the QR code data payload across the example specifications:

Specification	QR code data		
	Data for Merchant Presented Mode	Data for Customer Presented Mode	Data for linking up with different schemes*
Harmonised specifications	Understanding the technical specifications of QR code solutions is useful as they represent one of two possible routes to interoperable QR code merchant payments.		
Proprietary specifications			

* For a more detailed comparative analysis of different QR code technical specifications, refer to Appendix E.

** Columns of data are provided to work with each scheme, such as a "Reserve for EMVCo"



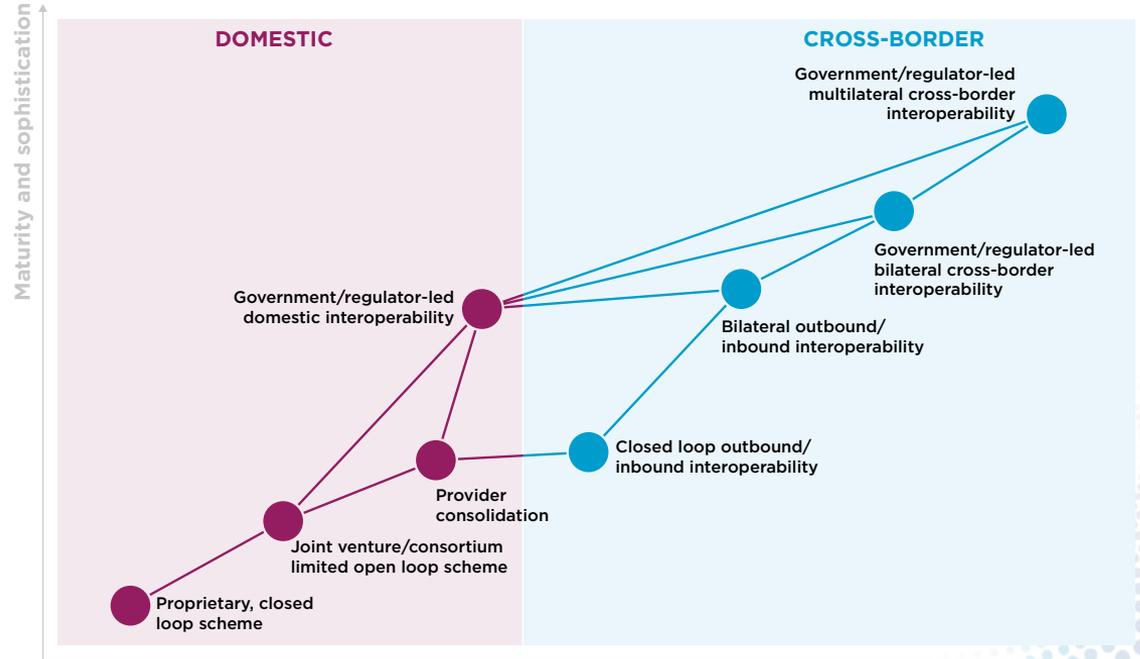
Charting a course for interoperable QR code merchant payments

- There appears to be a clear path for most QR code merchant payment schemes around the world.
- As QR code merchant payments schemes evolve, two primary dimensions of interoperability are typically encountered: domestic and cross-border.
- There are two primary approaches to QR code merchant payments interoperability: harmonisation of QR code specifications and harmonisation via API and/or back-end integration.

There appears to be a clear path for most QR code merchant payment schemes around the world

There are many QR code payments initiatives around the world, many of which are in different stages of development and maturity. Regardless of the stage, there appears to be a clear path for most QR code payment schemes, with an important focus on interoperability:

- Almost all schemes start with a domestic agenda.
- Initiatives evolve differently and follow different paths, but there is a clear progression from domestic to cross-border interoperability over time (see adjacent diagram).
- In many cases, initiatives will not only follow different paths, but also appear to double back as priorities change.



There appears to be a clear path for most QR code merchant payment schemes around the world

Examples of some primary drivers that could influence the path to interoperability are:

Business case priorities, e.g. domestic payments agenda at the outset, with some changing to a cross-border agenda over time.

Scaling, e.g. seeking options to scale the capability of existing QR code payments via partnership(s), e.g. joint venture/consortium, etc.

Market efficiencies, e.g. seeking options to consolidate offerings within domestic markets, across or even outside regions.

Government/regulatory intervention (domestic), e.g. Government or regulator taking an early lead to establish national QR code payments schemes, or becoming involved later to bring about market harmonisation. Government/regulator involvement tends to focus initially on a domestic agenda primarily due to obligations to the national population.

Government/regulatory cross-border support, e.g. where a significant proportion of the population will be well served by a joined-up approach to payments in territories where there is a mutual government-to-government interest, such as a major outbound tourist destination.

Progress towards interoperability is seldom linear and encompasses various dimensions. These will be examined in the following sections.

As QR code payments schemes evolve, two key dimensions of interoperability are typically encountered: domestic and cross-border interoperability

The diagram alongside illustrates the key dimensions of interoperability and how they lead to different outcomes based on the strategic ambitions and objectives of a scheme.

Geographic focus	Domestic interoperability			Cross-border interoperability	
Directionality	One way vs Dual interoperability			Inbound vs Outbound interoperability	
Agreement structures	Bilaterals	Multilaterals	National initiatives/ National scheme	National vs Proprietary scheme interoperability	
				Proprietary scheme to National scheme	National scheme to Proprietary scheme
Integration approach	Harmonised QR code				
	Back-end API				

Viewpoint	<p>The different dimensions of domestic interoperability</p> <ul style="list-style-type: none"> • One-way vs dual interoperability <ul style="list-style-type: none"> i. One-way interoperability (e.g. Scheme A customers can transact with Scheme B merchants) ii. Dual interoperability (e.g. Scheme A customers and Scheme B customers can transact with Scheme A and B merchants) • Agreement structures <ul style="list-style-type: none"> i. Bilaterals (i.e. proprietary scheme to proprietary scheme) ii. Multi-lateral agreements (i.e. JVs/consortium approach between multiple proprietary schemes) iii. National initiatives (i.e. National scheme) 	<p>The different dimensions of cross-border interoperability</p> <ul style="list-style-type: none"> • Inbound vs outbound interoperability between proprietary schemes <ul style="list-style-type: none"> i. Inbound: e.g. Scheme A (e.g. in Japan) enables Scheme B's customers (e.g. from China) to transact with it in Japan ii. Outbound: e.g. Scheme D (e.g. in China) enables its customers to transact with Scheme E merchants (e.g. in Indonesia) • National scheme interoperability vs proprietary scheme interoperability <ul style="list-style-type: none"> i. Inbound and/or outbound interoperability is enabled via interoperability between National Scheme J (e.g. in Japan) and proprietary Scheme C (e.g. from China) ii. Inbound and/or outbound interoperability is enabled via interoperability between National Scheme P (e.g. in Indonesia) and National Scheme Q (In Thailand)
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Two primary **integration approaches to interoperability**

1. Harmonised QR code specifications (i.e. interoperability enabled via front-end harmonisation)
2. Integrated APIs with differing/proprietary QR code specifications (i.e. interoperability enabled via back-end integration, typically APIs)

As QR code payments schemes evolve, two key dimensions of interoperability are typically encountered: domestic and cross-border interoperability

As schemes evolve and gain scale, strategic ambitions will typically fuel a desire to scale even further through some form of interoperability.

There are various dimensions of interoperability, which are generally grouped into the objectives being sought and how to achieve those objectives.

Objectives:

- Geographic focus:
 - Domestic interoperability versus cross-border interoperability
- Directionality of interactions
 - Inbound versus outbound interoperability

How to achieve these objectives:

Agreement structures

- Bilateral versus multilateral at proprietary or national levels
- Integration approach
 - Harmonised QR code versus back-end integration (typically API)

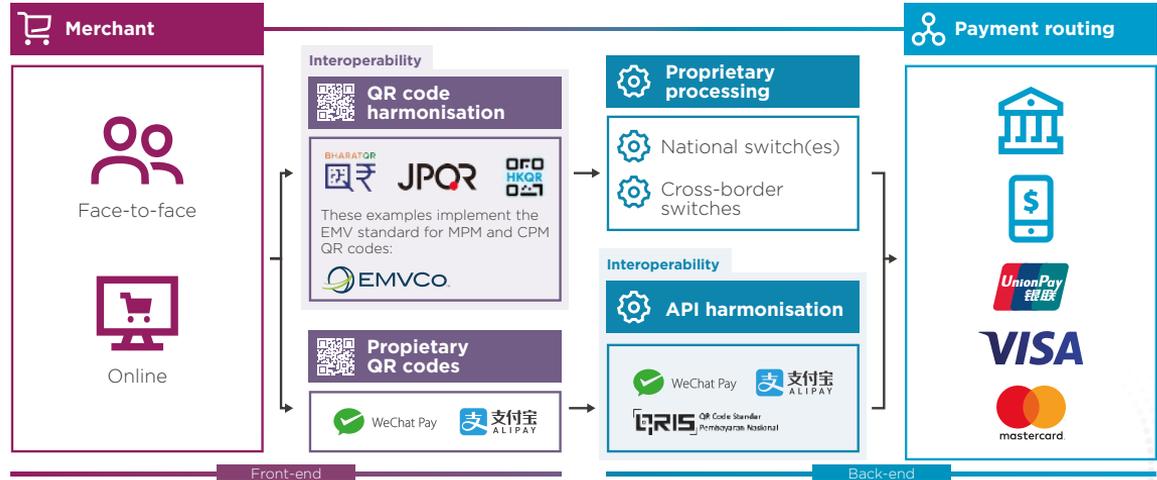
This document will now focus on the technical aspects of achieving interoperability, citing prominent examples of implementation approaches.



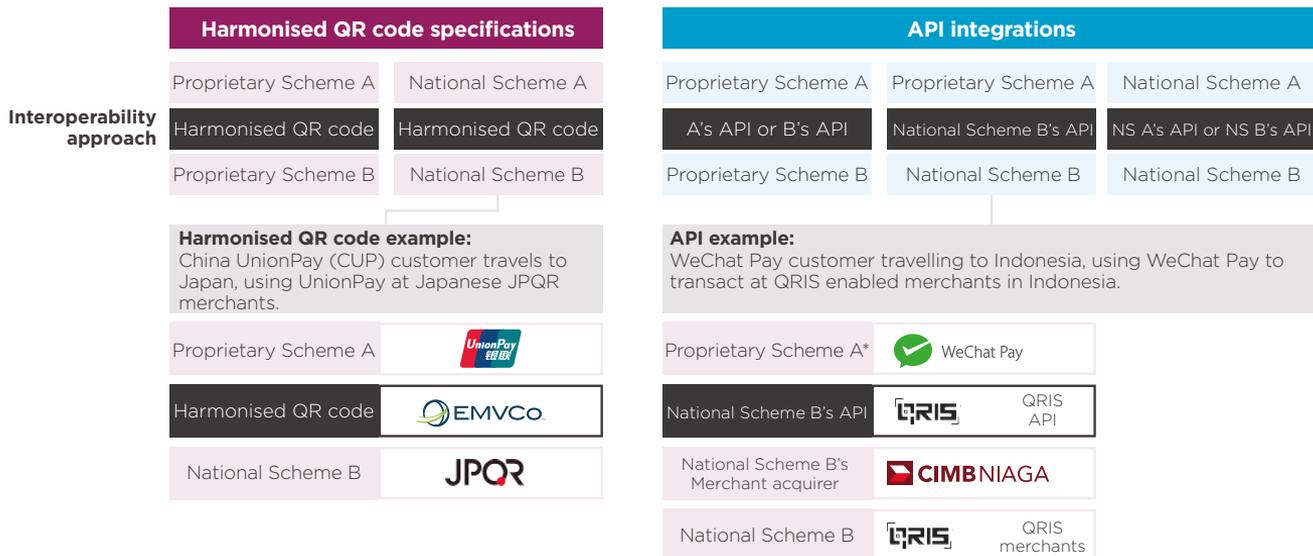
There are two primary approaches to QR code payments interoperability: harmonisation of QR code specifications and harmonisation via API and/or back-end integration

This diagram illustrates the two key approaches to interoperability, highlighting the differences between front-end (e.g. QR code) and back-end (API) harmonisation. It is important to note that:

- Interoperability schemes typically take either a harmonised approach to QR code specification OR involve some form of back-end integration via APIs.
- Interoperability does not require both QR code harmonisation and API integration, i.e. interoperability can be achieved using only one of these mechanisms.



There are two primary approaches to QR code payments interoperability: harmonisation of QR code specifications and harmonisation via API and/or back-end integration



For more insights and examples of QR code specification harmonisation, see Appendix D

* WeChat Pay in partnership with CIMB Niaga (using QRIS API). Similarly, Alipay has recently agreed to a deal with Indonesian state-owned banks, BRI and Bank Mandiri

The background image shows two young women with long dark hair, smiling and looking at a smartphone held by the woman on the right. She is also holding a grey payment terminal. The woman on the left is wearing a light blue cardigan over a white top. The woman on the right is wearing a light pink top. The image has a blue-to-purple gradient overlay.

Key trends, findings and call to action

- There are many different approaches to the adoption of QR code payments, and trends and lessons can be drawn from existing deployments around the globe.
- Mobile money providers are actively promoting the use of QR codes for merchant payments in emerging markets, but they must also lay the foundation for interoperability.
- Call to action for mobile money providers



As QR code merchant payments continue to grow in popularity, it is important to recognise not only the material trends, but also the impacts and implications of these trends

QR code merchant payments are not new, and there is a significant body of global knowledge and experience from providers operating in this ecosystem (with varying degrees of success).

Here, we examine some of the major trends in QR code merchant payments and their key impacts and implications.

Internet connectivity is required, but remains a challenge for many

- Some form of internet connectivity is required to support effective QR code merchant payments. Although there continues to be a keen interest in improving coverage, a number of regions still have limited or no coverage.

Government interest and intervention is growing

- Historically, governments and regulators have shown little inclination to intervene in the merchant payments segment. However, this appears to be changing around the world, particularly in developing regions where there is a desire to reduce the use of cash and counterfeit.
- Another key objective is to improve financial inclusion and literacy, which has fuelled efforts to increase the banked population.
- Regulators recognise that one way to achieve these goals is to reduce the cost of non-cash merchant payments to make digital payments more attractive.
- States benefit from all of the above through enhanced money traceability and, therefore, potentially higher tax revenues.

Smartphone penetration is increasing, but feature phone penetration remains high

- Smartphones are essential to the success of QR code merchant payments. Smartphone penetration is high in many of the regions where QR code merchant payments are popular (e.g. various Asian markets). However, this is not the case in many other markets (e.g. across Africa) where smartphone penetration is growing, but very slowly, and feature phone penetration remains high. In these regions, the affordability of devices is a critical challenge.
- Accelerating the penetration of affordable smartphones is vital, and pursuing a "bridge" smart feature phone platform in parallel, such as KaiOS, may help mitigate this challenge.



As QR code merchant payments continue to grow in popularity, it is important to recognise not only the material trends, but also the impacts and implications of these trends

Interoperability is crucial at various stages of the QR code merchant payments journey

- Various forms of interoperability become crucial considerations at certain points in the QR code merchant payments journey. This is rarely a consideration in the early stages, but becomes an important factor later. Late consideration of this aspect can pose material challenges to scale and growth.

Payment giants are continuing aggressive global growth

- Alipay and WeChat Pay continue to build on their domestic success and are adopting a flexible approach to cross-border acceptance interoperability to ensure their customers are supported when they travel.
- This has effectively applied tacit pressure on foreign bodies and value chain players to enable interoperability in their domestic markets for inbound Chinese travellers.

- Alipay and WeChat Pay have also begun to open their ecosystem in China to those travelling to China, which could bolster their already dominant position.

Downward pressure on payment acceptance fees and costs

- There is consistent downward pressure on the costs and fees associated with merchant payments acceptance, including POS hardware. QR code merchant payments are seen as a potential solution to this challenge, particularly for micro-merchants.

Material difference in market approaches

- There are existing and emerging material differences in market approaches to QR code merchant payments across geographies (e.g. some are heavily regulator-led, others are fintech-led while others are MMP-led). A one-size-fits-all approach is unlikely to be successful.

Biometric payments are becoming more feasible

- Biometrics could ultimately replace QR codes (and other payment tokens).
- Biometric payment methods are slowly gaining profile around the world. China leads on this and could pave the way for biometrics, such as fingerprint and/or facial recognition to replace payment tokens (e.g. QR codes) and their host devices (e.g. smartphones) for payments entirely.

QR code merchant payments: an interim step towards NFC payments?

- In some cases, QR code merchant payments are seen as an interim step or bridge to NFC payments.
- Major international payments schemes see the potential, but also recognise that this may not be the path some (non-card dominated) regions will take.



Findings: there are many different approaches to adopting QR code merchant payments, and lessons can be drawn from deployments around the globe

The impact of these approaches will vary depending on where the provider is on its QR code merchant payments journey.

Key headline findings:

Crucial enablers and interdependencies

- Components of the ecosystem are heavily interdependent. As a crucial first step, it is important that target customers have easy, affordable access to appropriate devices, connectivity and bank accounts. However, it takes time for a market to shift from feature phones to smartphones, as does convincing cash merchants to move to digital payments.

Evolutionary journey

- It has been demonstrated repeatedly that there are key milestones along the QR code merchant payments journey. These highlight the evolving, non-linear nature of the journey, and may require backtracking to ultimately gain forward momentum.

Geographic nuances

- A clear and deep knowledge of target markets is required, and a one-dimensional approach is unlikely to succeed. For example, it is important to recognise that different populations have different needs (e.g. payments challenges in rural areas will be different from those experienced in cities) and markets with deep smartphone penetration will behave differently from feature phone markets.

Education and trust

- Ecosystem participants must have trust and confidence in QR code ecosystems if they are to thrive. Robust and continued education of all stakeholders, especially merchants and customers, is necessary to build and embed trust. This can be achieved in a variety of ways, such as promotions by large and trusted retail brands, or enlisting government support (where the government is a trusted entity).



Findings: there are many different approaches to adopting QR code merchant payments, and lessons can be drawn from deployments around the globe

Key headline findings cont.

Regulatory intervention

- Increasing government and regulatory appetite for intervention requires careful consideration of their agenda and determining how to feasibly address these priorities in a proposition.

Distribution

- Distribution is key. Ubiquitous merchant and customer uptake is essential to the success of these types of payments initiatives. Providers will need to resolve the “catch-22” challenge of merchants waiting for customer demand before moving to support this demand, while customers wait for their favourite merchants to support the scheme before signing up for it.

Strategic objectives

- Clear, concise and executable strategic objectives are required throughout the journey, but these should be reviewed regularly and recalibrated when required. For example, if success is likely to depend on interoperability, do not leave interoperability until the last minute.
- One of the main perceived benefits of QR code merchant payments is the potentially low cost of entry and participation for merchants and customers. It is important not to lose sight of this to ensure that QR code merchant payments remain the most compelling option for stakeholders that place high value on affordability.
- On their own, QR code merchant payments are typically a difficult financial proposition for providers. These payments should support the consumption of high-value products and services that are the core drivers of revenue and profitability.



Mobile money providers are actively promoting the use of QR codes for merchant payments in emerging markets, but they must also lay the foundation for interoperability

QR code merchant payments have already been widely adopted in specific markets like China, but are still in an early part of their journey in other parts of the world, particularly emerging markets.

Mobile money providers are key players in the provision of financial services in emerging markets and are actively promoting the use of QR codes for merchant payments there.

They can leverage their leading position in these markets to capture the opportunity presented by QR code merchant payments, but should **adopt the lessons emerging from other QR code deployments globally.**

QR code merchant payments are a complex proposition with many moving parts in terms of their product flow and technical specifications, as shown in this report. It is important the mobile industry aligns on the specific aspects of a QR code merchant payment solution to achieve a harmonised experience for customers across providers.

To enable this, the mobile money industry may consider **adopting an existent harmonised QR code specification** that meets its needs or **developing a bespoke new one** that is tailor-made to address its requirements.





Conclusion

QR code merchant payments present a significant growth opportunity for mobile money providers.

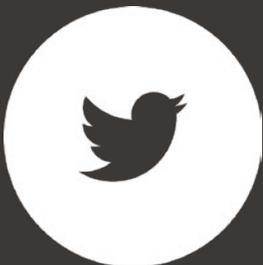
Longer term, sustainable growth will be underpinned by the industry's willingness to collaborate.

Non-telco players are already investing heavily in this opportunity.

There is currently an early-mover opportunity for the industry. This window of opportunity will not remain open indefinitely.



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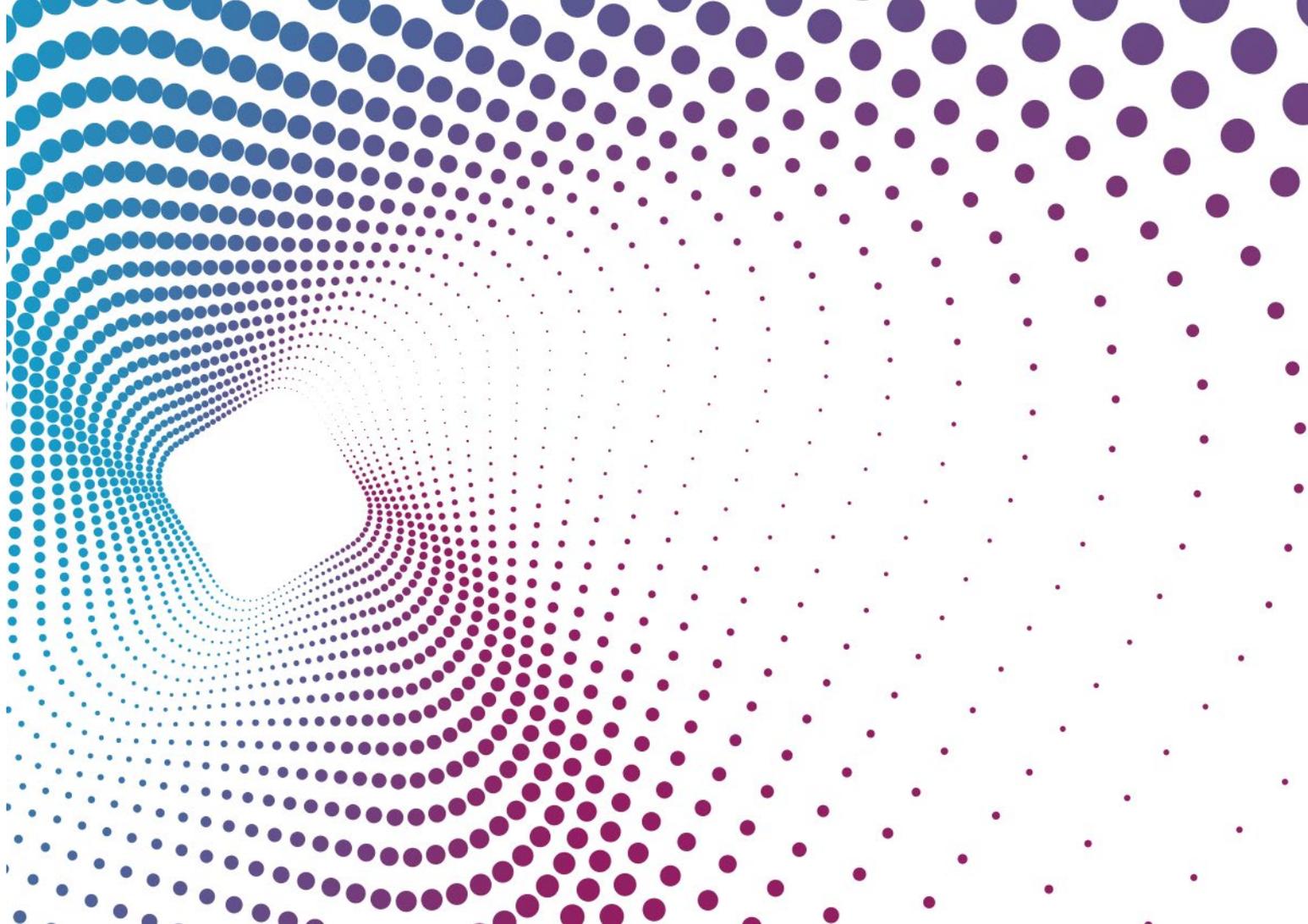
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Appendices

General

- A** Glossary of terms
- B** List of interview participants

A deep dive into QR code technology

- C** Push versus pull payments: technical flows
- D** QR code merchant payments: technical component analysis
- E** Comparisons of QR code specifications: select examples
- F** QR code merchant payments API component analysis
- G** QR code merchant payments: device affordability

QR code trends in leading markets

- H** What can we learn from China and other parts of the world?
- I** Facial recognition technology and its impact on QR codes in China
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QR code implementation

- K** Scheme specification design and implementation process
- L** Optimising implementation of QR code merchant payments
- M** Security and risk management



Appendix A

Glossary of terms

Element	Parameter	Description
Comms channel	Internet connectivity	TCP/IP-based internet connection
	USSD connectivity	USSD (Unstructured Supplementary Service Data) is a communications protocol used by GSM cellular telephones to communicate with the mobile network operator's computers. USSD messages are up to 182 alphanumeric characters long.
Device	Smartphone	Smartphones are a class of mobile phones and multipurpose mobile computing devices with touch screens.
	Smart feature phone	A smart feature phone is between a smartphone and a feature phone. It has a simple OS and a larger display than a feature phone, and supports basic applications such as social media and messaging.
	Feature phone	Feature phones are mobile phones that retain the form factor of early-generation phones, with button-based input and a small display.
QR code presentment	Merchant-presented mode (MPM)	"Merchant presented" is a style in which the QR code is displayed on the merchant side and scanned by the customer.
	Customer-presented mode (CPM)	"Customer presented" is a style in which the QR code is displayed on the customer side and scanned by the merchant.
Payment type	Push payments	Push payments rely on customers actively sending or "pushing" money to the merchant. The merchant requests the payment and then relies on their customer to send the amount owed.
	Pull payments	Pull payments allow the merchant to "block" or "pull" money from customers, providing there is a pre-existing agreement between both. In this way, the merchant has greater control over cash collection.

Element	Parameter	Description
QR code type	Static QR code	“Static” is a fixed, unchangeable QR code. In this type of QR code, the payments transaction payload is placed directly in the QR code
	Dynamic QR code	A dynamic QR code and its underlying data change depending on the transaction. In addition to payments, this code can also be used for access management, password protection, scan analysis and device-based redirection.
Merchant connectivity	Merchant online	A situation in which the merchant system is connected to the internet.
	Merchant offline	A situation in which the merchant system is not connected to the internet.
Customer connectivity	Customer online	A situation in which the customer device is connected to the internet.
	Customer offline	A situation in which the customer device is not connected to the internet.
Transaction authentication	PIN	Authentication using numbers.
	Password	Authentication using secret authentication information such as numbers and text
	Biometric	An authentication technology that uses biometric information such as fingerprints and facial recognition.
Transaction channel	Face-to-face	Represents in-store payments.
	Remote/ E-commerce	A situation in which a payment is made via remote digital channels.

Appendix B

List of interview participants

Organisation	Organisation Type	Regional scope
Denso	Inventor of QR codes	China, Global
MTN	MNO, QR code payments player	Middle East, Africa
Orange	MNO, QR code payments player	Middle East, Africa
Vodafone	MNO, QR code payments player	Middle East, Africa, Global
Telenor Easypaisa	MNO, QR code payments player	Pakistan
NTT DOCOMO	MNO, QR code payments player	Global
Bank of Ghana	Central bank, regulator	Ghana
Bank Indonesia	Central bank, regulator	Indonesia
Bank of Thailand	Central bank, regulator	Thailand
National Payments Corporation of India (NPCI)	National payments industry body and infrastructure operator	India
Payments Japan Association	National standards body	Japan
Asian Payments Network	Cross-regional standards body	Asia
KaiOS	Device OS (smart feature phones)	Global
PalmPay	Fintech, QR code payments player	Africa
GoPay	Fintech, QR code payments player	Southeast Asia

Organisation	Organisation Type	Regional scope
Bluecode, EMPSA	Fintech, QR code payments player, harmonisation organisation	Europe
CIMB NIAGA	Bank, QR code payments player	Southeast Asia
Visa	International payments player	Global
Mastercard	International payments player	Global
RPC (International law firm)	Payments, regulatory and legal	Global
Accourt	Global payments advisory	Global
NTT Data	Global technology organisation	Global

Appendix C

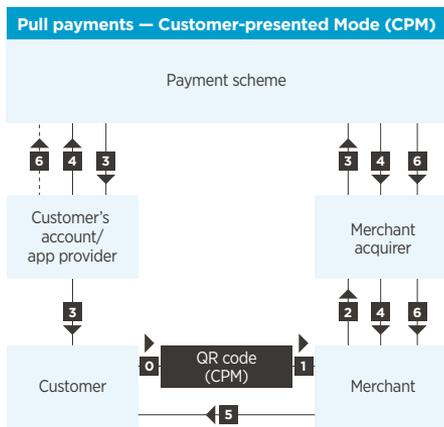
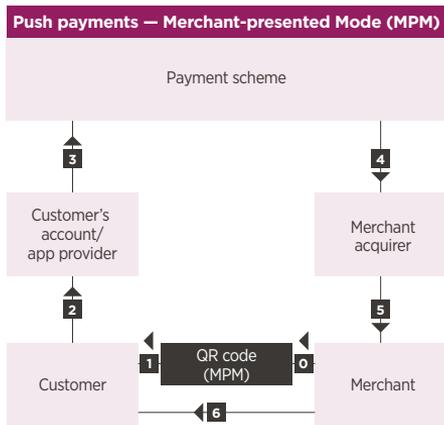
Push versus pull payments: technical flows

The following diagrams provide a brief, high-level summary of two primary approaches to executing and processing QR code merchant payments.

Push payments

- 0 Static/dynamic QR code presented by merchant
- 1 Customer opens app, authenticates (if required) and scans QR code
- 2 Customer authorises the transaction
- 3 Customer's account provider routes payment instruction from customer to payment scheme, funds are settled to the acquirer's account*
- 4 Merchant acquirer receives payment instruction
- 5 Merchant acquirer makes payment* into merchant's account
- 6 Merchant receives payment confirmation and funds;* hands goods to the customer

***Note:** this example illustrates a push payment in an immediate payments ecosystem. Some payments may take longer to reach the acquirer and the merchant.



Pull payments

- 0 Static/dynamic QR code presented by customer
- 1 Merchant scans QR code
- 2 Merchant requests payment authorisation against customer's account via merchant acquirer
- 3 Merchant acquirer routes authorisation request to payment scheme, which routes it to the customer's account provider (e.g. Mobile Wallet/bank account)
- 4 Customer's account provider authorises or rejects the payment authorisation and routes it back to the merchant via the acquirer
- 5 The merchant receives payment authorisation; hands goods to the customer
- 6 Payment Scheme facilitates payment from the customer's account to the merchant's account via the merchant acquirer (this settlement can happen any time between 1 and 60 days after the transaction)

Appendix D

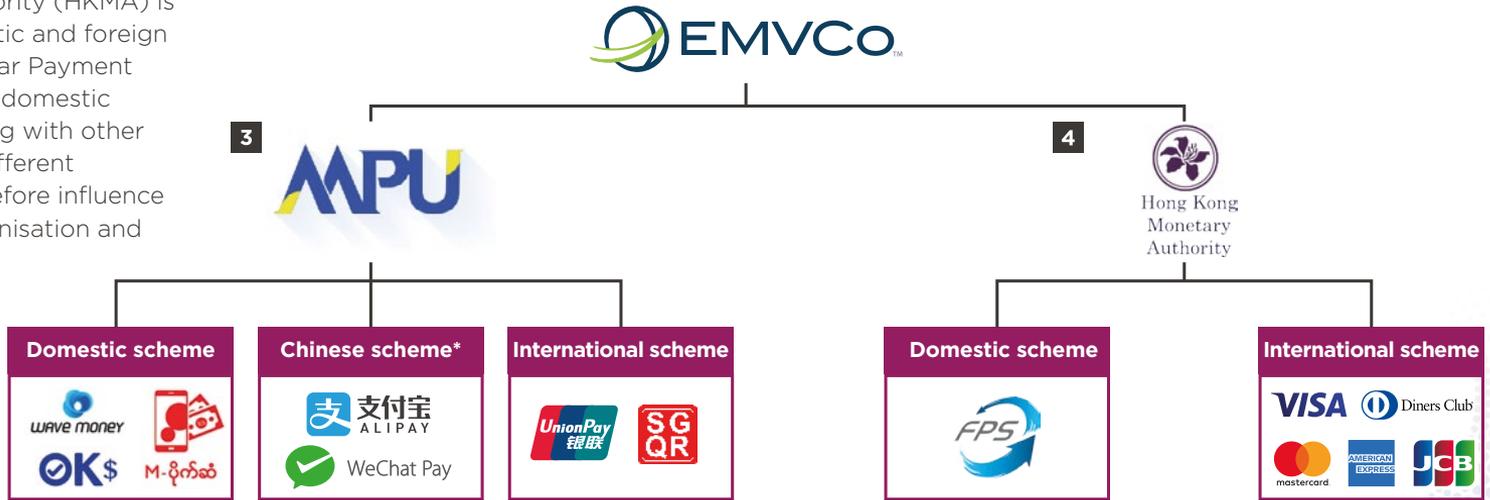
QR code merchant payments:
technical component analysis

The EMV specifications are the only harmonised QR code specifications currently, and several schemes have either elected to design to these specifications from the outset or reverse-engineer harmonisation with EMV at a later stage. Few schemes implement the EMV specifications verbatim, as these schemes have different characteristics and features they wish to support, depending on the country and regional context of the specification. Some examples of these dimensions and rationale are illustrated below.

		International interoperability	
		Not supported	Supported
Domesic interoperability	Not supported	<p>1</p> <p>Easypaisa is dominant in the QR code payments market in Pakistan and there is therefore no rationale currently to work with other schemes, either domestically or internationally (unless compelled to do so by the Regulator).</p>	<p>3</p> <p>Since there are few domestic payment schemes and many visitors come from overseas, and many people work in neighbouring countries, the government is considering working with overseas schemes in parallel with domestic standardisation.</p>
	Supported	<p>2</p> <p>They are not active in working with foreign countries and they are focused on aligning with domestic schemes. Because the size of the domestic economy is so large and the economy schemes are too many.</p>	<p>4</p> <p>There is a great deal of coordination between domestic and international payment schemes with QR codes, which suggests they want this coordination to add value.</p>

The insights were derived primarily based on the QR Code Elements analysis. Refer to Appendix E for more information.

As an example of the QR code harmonisation approach, the Hong Kong Monetary Authority (HKMA) is linked to both domestic and foreign schemes. The Myanmar Payment Union (MPU) has few domestic schemes, so is working with other overseas schemes. Different strategic drivers therefore influence approaches to harmonisation and interoperability.



* Initiative led by the Central Bank of Myanmar to enable domestic acceptance, via local banks, for inbound Chinese tourists using Alipay and WeChat Pay

** M-Pitisan by Ooredoo in Myanmar

Appendix E

Comparisons of QR code specifications: select examples

A comparison of the QR code data elements of each scheme using the EMV specification as the base:

QR code data			MPM					CPM		
#	Category	Data elements	EMV	JPQR	HKMA	Easypaisa	Jordan	EMV	JPQR	
1	Customer elements	Mobile Number	●	●	●	●				
2		Reference Label	●	●	●	●	●			
3		Customer Label	●	●	●	●	●			
4		Additional Consumer Data Request	●	●	●	●				
5		Application Dedicated File (ADF) Name						●	●	
6		Application Label						●	●	
7		Application PAN						●	●	
8		Application Specific Transparent Template						●	●	
9		Application Template						●	●	
10		Application Version Number						●	●	
11		Language Preference		●	●	●	●	●		
12		Application Definition File (ADF)Name)								●
13		Payment Account Reference							●	●
14		Cardholder Name							●	●
15		Loyalty Number			●					
16	Merchant elements	Terminal Label	●	●	●	●	●			
17		Country Code	●	●	●	●	●			
18		Merchant Name	●	●	●	●	●			
19		Merchant City	●	●	●	●	●			
20		Postal Code	●	●	●	●	●			

A comparison of the QR code data elements of each scheme using the EMV specification as the base:

QR code data			MPM					CPM	
#	Category	Data elements	EMV	JPQR	HKMA	Easypaisa	Jordan	EMV	JPQR
21	Merchant elements	Merchant Category Code	●	●	●	●	●		
22		Merchant Information - Language Template	●	●	●	●			
23		Merchant Name - Alternate Language	●	●	●	●	●		
24		Merchant City - Alternate Language	●	●	●	●	●		
25		Merchant Account Information	●	●		●			
26		Store Label	●	●	●	●	●		
27		Payment system operators			●				
28		Merchant Payment Address					●		
29		Geographical Location					●		
30		Merchant Tax ID					●		
31	Merchant Channel					●			
32	Transaction elements	Transaction Currency	●	●	●	●	●		
33		Transaction Amount	●	●	●	●	●		
34		Point of Initiation Method	●	●	●	●	●		
35		Bill Number	●	●	●	●	●		
36		Purpose of Transaction	●	●	●	●	●		
37		Common Data Transparent Template						●	●
38		Token Requestor ID						●	●
39		Tip or Convenience Indicator	●	●	●	●	●		
40		Value of Convenience Fee Fixed	●	●	●	●	●		

A comparison of the QR code data elements of each scheme using the EMV specification as the base:

QR code data			MPM					CPM	
#	Category	Data elements	EMV	JPQR	HKMA	Easypaisa	Jordan	EMV	JPQR
41	Transaction elements	Value of Convenience Fee Percentage	●	●	●	●	●		
42		Date and Time					●		
43	Rewards or equivalent								
44	Scheme elements	Payload Format Indicator	●	●	●	●	●	●	●
45		Payment network specific			●		●		
46		Issuer URL						●	●
47		Globally Unique Identifier	●	●	●	●	●		
48	Interoperability support elements	Reserved for Visa			●		●		
49		Reserved for Mastercard			●		●		
50		Reserved by EMVCo			●		●		
51		Reserved for Discover			●		●		
52		Reserved for Amex			●		●		
53		Reserved for JCB			●		●		
54		Reserved for UnionPay			●		●		
55		Reserved for the FasterPayment System for use in Hong Kong			●				
56		Reserved by the WG for use in Hong Kong			●				
57		Reserved for payment operators for use in Hong Kong			●				
58	Reserved for EMVCo			●					
59	Reserved for FPS			●					
60	Reserved for the WG			●					

A comparison of the QR code data elements of each scheme using the EMV specification as the base:

QR code data			MPM					CPM	
#	Category	Data elements	EMV	JPQR	HKMA	Easypaisa	Jordan	EMV	JPQR
61	Interoperability support elements	Reserved for Hong Kong			●				
62		RFU(Reserved for Future Use) for EMVCo	●	●	●	●	●		
63		Reserved for Jordan Payment Switches					●		
64	Transaction integrity elements	Cyclic Redundancy Check (CRC)	●	●	●	●	●		
65	Uncategorisable	Other template							●
66		Additional Data Field Template	●	●		●	●		
67		Common Data Template						●	
68		Unreserved Templates		●	●	●			
69		Last 4 Digits of PAN						●	●
70	Track 2 Equivalent Data						●	●	

The elements of QR code merchant payments data are categorised as follows:

Customer elements

- Language Preference

Merchant elements

- Terminal Label
- Country Code
- Merchant Name
- Merchant City
- Postal Code
- Merchant Category Code
- Merchant Information - Language Template
- Merchant Name - Alternate Language
- Merchant City - Alternate Language
- Merchant Account Information
- Store Label

Transaction elements

- Transaction Currency
- Transaction Amount
- Point of Initiation Method
- Tip or Convenience Indicator
- Value of Convenience Fee - Fixed
- Value of Convenience Fee - Percentage

Rewards or equivalent elements

- Bill Number
- Mobile Number
- Store Label
- Reference Label
- Customer Label
- Purpose of Transaction
- Additional Consumer Data Request

Scheme elements

- Payload Format Indicator
- Globally Unique Identifier

Interoperability support elements

- RFU (reserved for future use) for EMVCo

Transaction integrity elements

- Cyclic Redundancy Check (CRC)

No category

- Additional Data Field Template
- Unreserved Templates

The elements of QR code merchant payments data are categorised as follows:

Customer elements

- Language Preference

Merchant elements

- Terminal Label
- Country Code
- Merchant Name
- Merchant City
- Postal Code
- Merchant Category Code
- Merchant Information - Language Template
- Merchant Name - Alternate Language
- Merchant City - Alternate Language
- Merchant Account Information
- Store Label

Transaction elements

- Transaction Currency
- Transaction Amount
- Point of Initiation Method
- Tip or Convenience Indicator
- Value of Convenience Fee - Fixed
- Value of Convenience Fee - Percentage

Rewards or equivalent elements

- Bill Number
- Mobile Number
- Store Label
- Reference Label
- Customer Label
- Purpose of Transaction
- Additional Consumer Data Request

Scheme elements

- Payload Format Indicator
- Globally Unique Identifier

Interoperability support elements

- RFU (reserved for future use) for EMVCo

Transaction integrity elements

- Cyclic Redundancy Check (CRC)

No category

- Additional Data Field Template
- Unreserved Templates

The elements of QR code merchant payments data are categorised as follows:

Customer elements

- Language Preference

Merchant elements

- Terminal Label
- Country Code
- Merchant Name
- Merchant City
- Postal Code
- Merchant Category Code
- Merchant Information - Language Template
- Merchant Name - Alternate Language
- Merchant City - Alternate Language
- Merchant Account Information
- Store Label

Transaction elements

- Transaction Currency
- Transaction Amount
- Point of Initiation Method
- Bill Number
- Purpose of Transaction
- Tip or Convenience Indicator
- Value of Convenience Fee - Fixed
- Value of Convenience Fee - Percentage

Rewards or equivalent elements

- Bill Number
- Mobile Number
- Store Label
- Reference Label
- Customer Label
- Purpose of Transaction
- Additional Consumer Data Request

Scheme elements

- Payload Format Indicator
- Globally Unique Identifier

Interoperability support elements

- RFU (reserved for future use) for EMVCo

Transaction integrity elements

- Cyclic Redundancy Check (CRC)

No category

- Additional Data Field Template
- Unreserved Templates

The elements of QR code merchant payments data are categorised as follows:

<p>Customer elements</p> <ul style="list-style-type: none"> • Language Preference 	<p>Merchant elements</p> <ul style="list-style-type: none"> • Terminal Label • Country Code • Merchant Name • Merchant City • Postal Code • Merchant Category Code • Merchant Information – Language Template • Merchant Name – Alternate Language • Merchant City – Alternate Language • Merchant Account Information • Store Label 	<p>Transaction elements</p> <ul style="list-style-type: none"> • Transaction Currency • Transaction Amount • Point of Initiation Method • Tip or Convenience Indicator • Value of Convenience Fee – Fixed • Value of Convenience Fee – Percentage 	<p>Rewards or equivalent elements</p> <ul style="list-style-type: none"> • Bill Number • Mobile Number • Store Label • Reference Label • Customer Label • Purpose of Transaction • Additional Consumer Data Request • Loyalty Number
<p>Scheme elements</p> <ul style="list-style-type: none"> • Payload Format Indicator • Globally Unique Identifier • SGQR ID • SGQR ID number • Version • Miscellaneous • New version date 	<p>Interoperability support elements</p> <ul style="list-style-type: none"> • RFU(Reserved for future use) for EMVCo • VISA ID • Mastercard ID • Amex ID • UnionPay ID • Singtel Dash • LiquidPay • OCBC • Ezi-Wallet 	<p>Transaction integrity elements</p> <ul style="list-style-type: none"> • Cyclic Redundancy Check (CRC) 	<p>No category</p> <ul style="list-style-type: none"> • Additional Data Field Template • Unreserved Templates

Bold text indicates differences between elements across specifications

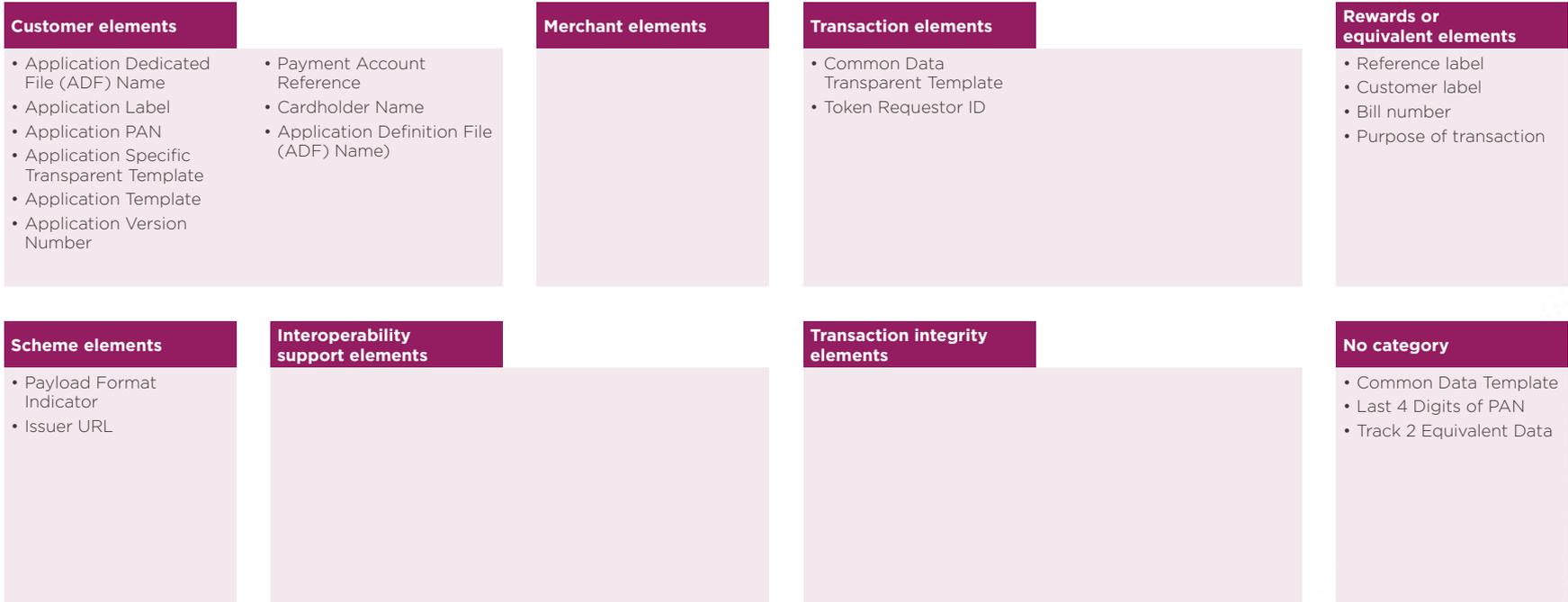
The elements of QR code merchant payments data are categorised as follows:

Customer elements	Merchant elements	Transaction elements	Rewards or equivalent elements
<ul style="list-style-type: none"> • Language Preference 	<ul style="list-style-type: none"> • Terminal Label • Country Code • Merchant Name • Merchant City • Postal Code • Merchant Category Code • Merchant Information – Language Template • Merchant Name – Alternate Language 	<ul style="list-style-type: none"> • Merchant City – Alternate Language • Payment System Operators 	<ul style="list-style-type: none"> • Transaction Currency • Transaction Amount • Point of Initiation Method • Tip or Convenience Indicator • Value of Convenience Fee – Fixed • Value of Convenience Fee – Percentage
<ul style="list-style-type: none"> • Bill Number • Mobile Number • Store Label • Reference Label • Customer Label • Purpose of Transaction • Additional Consumer Data Request • Loyalty Number 	<ul style="list-style-type: none"> • Payload Format Indicator • Payment Network Specific • Globally Unique Identifier 	<ul style="list-style-type: none"> • Interoperability support elements • Reserved for Visa • Reserved for Mastercard • Reserved by EMVCo • Reserved for Discover • Reserved for Amex • Reserved for JCB • Reserved for UnionPay • Reserved for the FasterPayment System for use in Hong Kong • Reserved by the WG for use in Hong Kong • Reserved for payment operators for use in Hong Kong 	<ul style="list-style-type: none"> • Transaction integrity elements • Cyclic Redundancy Check (CRC)
<ul style="list-style-type: none"> • No category 	<ul style="list-style-type: none"> • HKMA was designed with interoperability with other payment methods in mind. • It was and is a cards-centric territory and therefore requires advanced features • It's a small country with a lot of travel to and from other countries. 		

The elements of QR code merchant payments data are categorised as follows:

Customer elements	Merchant elements		Transaction elements		Rewards or equivalent elements
<ul style="list-style-type: none"> • Language Preference 	<ul style="list-style-type: none"> • Terminal Label • Country Code • Merchant Name • Merchant City • Postal Code • Merchant Category Code • Merchant Name – Alternate Language • Merchant City – Alternate Language 	<ul style="list-style-type: none"> • Store Label • Merchant Payment Address • Geographical Location • Merchant Tax ID • Merchant Channel 	<ul style="list-style-type: none"> • Transaction Currency • Transaction Amount • Point of Initiation Method • Tip or Convenience Indicator • Value of Convenience Fee – Fixed • Value of Convenience Fee – Percentage • Date and Time 		<ul style="list-style-type: none"> • Reference Label • Customer Label • Bill Number • Purpose of Transaction
Scheme elements	Interoperability support elements		Transaction integrity elements		No category
<ul style="list-style-type: none"> • Payload Format Indicator • Payment Network-Specific • Globally Unique Identifier 	<ul style="list-style-type: none"> • Reserved for Visa • Reserved for MasterCard • Reserved by EMVCo • Reserved for Discover • Reserved for Amex • Reserved for JCB • Reserved for UnionPay • RFU (Reserved for Future Use) for EMVCo 	<ul style="list-style-type: none"> • Reserved for Jordan Payment Switches 	<ul style="list-style-type: none"> • Cyclic Redundancy Check (CRC) • Additional Data Field Template 		

The elements of QR code merchant payments data are categorised as follows:



The elements of QR code merchant payments data are categorised as follows:

Customer elements

- Application Dedicated File (ADF) Name
- Application Label
- Application PAN
- Application Specific Transparent Template
- Application Template
- Application Version Number
- Payment Account Reference
- Cardholder Name
- Application Definition File (ADF) Name)

Merchant elements

Transaction elements

- Common Data Transparent Template
- Token Requestor ID

Rewards or equivalent elements

- Reference label
- Customer label
- Bill number
- Purpose of transaction

Scheme elements

- Payload Format Indicator
- Issuer URL

Interoperability support elements

Transaction integrity elements

No category

- Common Data Template
- Last 4 Digits of PAN
- Track 2 Equivalent Data

Appendix F

QR code merchant payments

API component analysis:

- API scope
- Transaction support comparison

Summary: Analysis of the scope and coverage of the example API specifications in support of QR code merchant payments

	Specification	API specification'		
		API for domestic merchant*	API for overseas merchant**	API for bank or issuer
Harmonised specifications	EMV	Public	Not public	Not public
	JPQR			
	Bharat QR			
	HKQR	No published API specifications		
	SGQR			
	QRIS			
Proprietary specifications	Alipay	Public	Public	Not public
	WeChat Pay			
	Prompt Pay	Public	Not public	Public
	M-Pesa			
	Mercado Pago			

Summary: Although the API suites are comparable, they vary in complexity and depth of features.

#	API name	Alipay Pay	WeChat Pay	JPQR	Bharat QR	PromptPay
1	Payment	●	●	●	●	●
2	Cancel	●				●
3	Modify	●				
4	Refund	●	●	●		
5	Query status	●	●	●	●	●
6	Register				●	
7	Download Reconciliation File API		●			
8	For money transfer	●	●			
9	Payment credit times		●			
10	Static QR	●	●		●	
11	Payment Notification	●	●			●
12	single_trade_query	●				
13	Notify Verify	●				
14	Connect to the Merchant System	●				
15	Short URL Conversion	●	●			
16	Report Speed Testing		●			
17	Query Exchange Rate	●	●			

Appendix G

QR code merchant payments:
device affordability

QR code payments are highly dependent on device capabilities, which makes affordable devices crucial.

While smartphone penetration is relatively good in some regions, in others, such as Africa, feature phones still dominate and smartphone penetration remains extremely low (despite MNO efforts to incentivise smartphone ownership).

Smart feature phones are emerging as an affordable “bridge” technology that **can support QR code merchant payments.**



OS		Feature phones	Smart feature phones	Smartphones
Generation and price bracket	2G	RTOS	KaiOS	Android, iOS, Harmony OS
	2.5G	\$7-\$170	n/a	n/a
	3G	\$9-\$190	\$12-\$45	n/a
	4G	\$10-\$270	\$14-\$120	\$25-\$1,000+
	5G	\$17-\$370	\$18-\$190	\$32-\$1,000+
		n/a	n/a	\$320-\$1,000+

Appendix H

What can we learn from China
and other parts of the world?

While there are many common drivers, some are unique to certain ecosystems and shaped by the primary objectives of key stakeholders.

Primary objectives of QR code scheme providers:

- To expand and further monetise mobile wallet services with merchant payments services;
- To leverage QR code merchant payments as a lower cost alternative to incumbent payment methods (attracting micro/informal merchants to digital payments);
- To use data from merchant payments to provide other products and services as incremental revenue opportunities; and
- To support financial inclusion agendas.

Primary objectives of governments/regulators:

- To reduce the use of cash and counterfeiting;
- To drive financial inclusion and literacy (and increase the banked population);
- To reduce the cost of non-cash merchant payments;
- To enhance traceability and generate potentially higher tax revenues;
- To avoid the proliferation of disparate and fragmented national payments schemes; and
- To leverage investment in instant direct-to-bank payments (i.e. non-card).

China

China's sophisticated payments giants originally developed to support already successful customer ecosystems. QR code merchant payments were developed in support of these digital ecosystems rather than as a primary strategy. After years of keeping its distance, the regulator has begun to intervene in these schemes. The regulator's main interest appears to be in the traceability of transaction funds and interoperability.

Key examples: Alipay, WeChat Pay, UnionPay Mobile QuickPass See the section dedicated to this market.

Mature Asian markets: Japan, Korea, Taiwan, Hong Kong

High levels of bank account penetration and sophisticated digital societies have been crucial to creating momentum for QR code merchant payments in these markets. The focus has typically been servicing payments for micro-merchants, but this gathering momentum has prompted regulators (e.g. China) to support domestic harmonisation and, in some cases, support for inbound travellers from other countries and schemes. While Japan, Korea and Taiwan have maintained a domestic focus, Hong Kong and Singapore, with their relatively small populations and high levels of inbound travellers, have a more international focus.

Key examples (national): JPQR, HKQR, SGKR

Key examples (proprietary): R Pay, d payment

Developing Asian markets: India, Indonesia, other Southeast Asian countries

High levels of cash penetration have galvanised a more proactive approach by regulators in these countries. Impressive levels of investment funding (e.g. private equity) have also accelerated the pace of fintech development. Many are adopting a copycat approach to the Chinese payments giants, and high levels of smartphone penetration continue to support the growth of QR code merchant payments. Interoperability is domestically focused, but with pockets of support for inbound travellers. India is in a unique position with extremely high levels of bank account penetration that can support uptake.

Key examples (national): Bharat QR, QRIS, Thai QR Payment

Key examples (proprietary): GrabPay, OVO, GoPay, Paytm

Africa

Like Southeast Asia, African countries are dominated by cash and extremely fragmented in their approach to QR code merchant payments. Unlike Southeast Asia, however, African countries have relatively low levels of smartphone and bank account penetration, which has a severe impact on the growth of QR code merchant payments. Large mobile money providers, such as MTN, Orange and Vodafone, have typically led key merchant payments initiatives, with ever-increasing, yet fragmented attention from central banks and regulators.

Key examples (national): GhQR

Key examples (proprietary): MTN MoMo, Orange Money, M-Pesa, Mowali (JV), SnapScan, PalmPay

Latin America

Latin American countries have fragmented approaches to payments, although cards and some localised methods (e.g. Boleto in Brazil) have emerged. QR code merchant payments are starting to gain renewed momentum, led primarily by MercadoLibre's Mercado Pago, which has been dominant for some time, and PayPal. There is also a growing desire by governments in the region to drive down the use of cash due to the risks associated with carrying it. Perhaps Brazil's new regulator-led PIX initiative will galvanise involvement by regulators in other Latin American countries.

Key examples (national): PIX (Brazil)

Key examples (proprietary): Mercado Pago, PayPal

UK and Europe

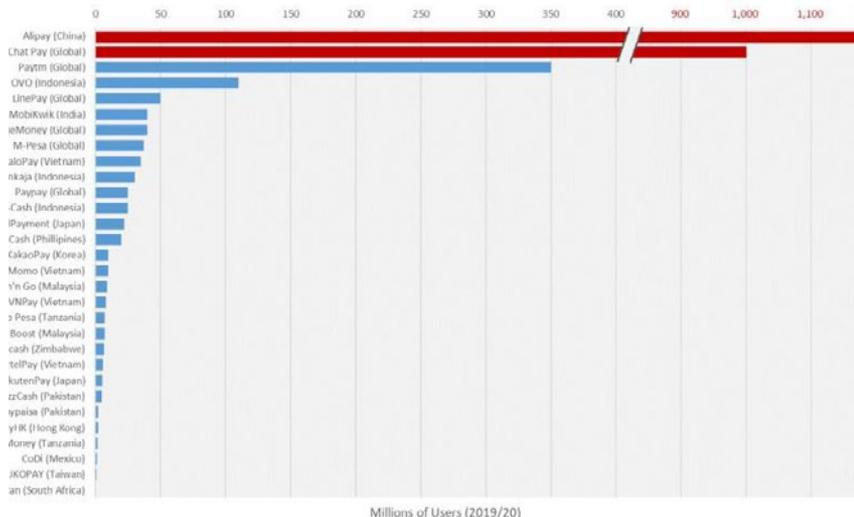
Like the US, the UK and Europe continue to be heavily dominated by payment cards and NFC, with many digital wallets also operating on card "rails". Traditional card ecosystem players are now moving to support steadily growing demand for QR code merchant payments, primarily from Chinese tourists. PayPal has also recently extended its QR code merchant solution to 28 countries across several continents. Interoperability initiatives for QR code merchant payments have been limited, however, EMPSA is well represented in Europe and leads the European interoperability agenda.

Key examples (national): EMPSA

Key examples (proprietary): PayPal, Pingit, Starbucks

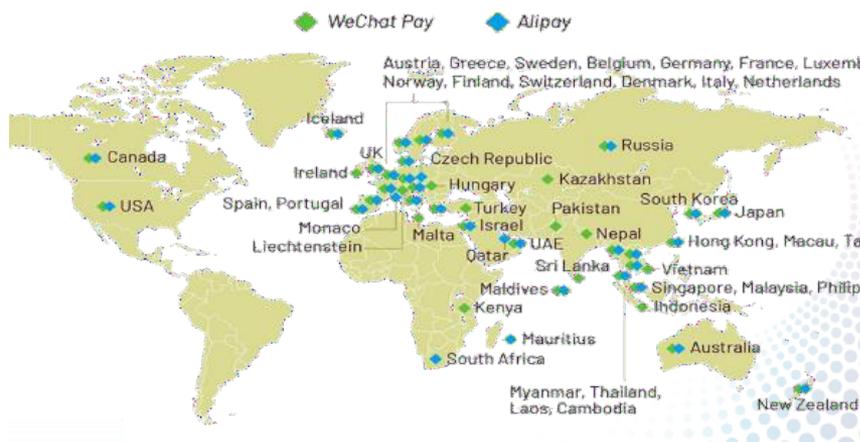
There are not yet many truly global QR code merchant payments schemes. China's two payments giants, Alipay and WeChat Pay, are leading examples of schemes that have dominated a domestic market and then moved to expand their acceptance beyond these borders, primarily with a "follow their customers" approach and providing payments acceptance in outbound markets.

China's two QR code payments giants, Alipay and WeChat Pay, lead other global players by a significant margin



These two players are leading the global expansion of QR code merchant payments, with international acceptance rates continuing to grow

Countries and regions that accept Alipay and WeChat Pay payments





What can we learn from China?

1 of 5

The world's QR code merchant payments ecosystem is dominated by two Chinese players, Alipay and WeChat Pay.

Origins of Alipay and WeChat Pay

Owned by Alibaba Group and Tencent, Alipay and WeChat Pay respectively are digital wallets embedded as smartphone apps within their respective, highly successful non-payment ecosystems. Alipay launched initially to support payments in the Alibaba marketplace (similar to Amazon), whereas WeChat Pay launched initially to support sending of 'red envelopes/packets' in the WeChat social media ecosystem (similar to Facebook/Whatsapp).

Today, most Chinese users have both apps and can transfer funds into these wallets and use these funds to pay others, including retailers, online or in-store. Alternatively, users can link their bank account or credit/debit card to the wallet and pay direct, i.e. without pre-loading their digital wallet with funds. Users typically present a dynamically generated QR code to the retailer who scans the code to initiate the payment transaction. This customer-presented



mode (CPM) of QR code dominates in China today, but QR code stickers are still used by micro-merchants in merchant-presented mode (MPM), whereby a customer opens their Alipay or WeChat Pay app and scans the merchant's QR code sticker.

Until recently, use of these two "super apps" has been limited to Chinese citizens. People travelling to and within China could not use these wallets as a Chinese bank account and/or credit or debit card was a prerequisite for registration. In late 2019, however, both Alipay (via TourPass) and WeChat Pay enabled travellers to sign up with their own bank/card details and use the international versions of their apps in China. Alipay requires travellers to preload funds into the wallet, whereas WeChat Pay supports a direct link to the user's credit or debit card without having to preload the wallet prior to transacting.

MARKET HIGHLIGHTS

Chinese population	1.4 bn (2020)
Annual mobile payments in China	> \$41 tn (2019)
Total non-B2B digital transaction value	\$1.9 tn (2020)
Chinese payment cards (6.9 bn debit; 686 m credit)	7.6 bn (2019)
Alipay users (launched 2009)	1.2 bn (2020)
WeChat Pay users (launched 2013)	1.0 bn (2020)

Approx. 70% of users use both Alipay and WeChat Pay (2019)

Over 90% of people in China's largest cities use WeChat Pay and Alipay as their primary payment method, with cash second and card-based debit/credit a distant third (card products in China are dominated by China UnionPay).

Over 92% of mobile payments in China are made over Alipay and WeChat Pay.

Alipay connects over a million restaurants, 40,000 supermarkets and convenience stores, a million taxis and 300 hospitals.



What can we learn from China?

The world's QR code merchant payments ecosystem is dominated by two Chinese players, Alipay and WeChat Pay.

The foundation of this success story

At launch, several market characteristics provided the foundation for successful market entry and growth:

- A high level of bank account ownership (around 79 per cent of the Chinese population);
- Very high levels of smartphone penetration and customer engagement in the app economy;
- Excellent mobile internet access, especially in cities where Alipay's and WeChat Pay's largest customer bases live;
- High levels of both base literacy and financial literacy; and
- Merchants that did not like card payments.

Consolidating and accelerating uptake

Given the favourable market factors and early signs of success, both Alipay and WeChat Pay were keen to press their advantage and focused on several key drivers:

- **Developing and continually enhancing a compelling value proposition** by offering a range of useful services to both customers and merchants. (Initially, merchants were incentivised by the providers to accept payments from their wallets, but these were phased out as customers began driving demand and merchants followed.)
- **Reducing on-boarding friction** with self-enrolment for both customers and merchants, enabling transaction acceptance almost immediately.
- **Reducing transaction friction** by using QR codes and highly responsive interfaces.
- **Low cost fee** structures for merchants with **no customer transaction costs** when they transact within the wallet ecosystem.
- **Leveraging loyalty rewards to shift spending away from cash.** In many cases, the preferred payment option had always been cash.
- **Adopting a long-term view of profitability.** Payments are not the core product, rather, payments support ecosystems of customer value, which in turn drive profitability.

What can we learn from China?

The world's QR code merchant payments ecosystem is dominated by two Chinese players, Alipay and WeChat Pay.

Arguably, the most important success factor was that both Alipay and WeChat Pay were developed to support already successful ecosystems with extremely large and highly engaged customer bases. These digital wallets therefore enabled Alibaba Group and Tencent to further monetise these ecosystems.

Low/no-cost model

Both players recognised the opportunity to incentivise customers and merchants to retain funds within their respective digital wallet ecosystems, hence the emergence of “free” transactions for customers (unless they were transferring funds out of the ecosystem, for example, to their bank account) coupled with very low transaction fee structures for merchants. For example:

			
Customer transaction fees	free	free	free
Customer fee threshold*	RMB 20,000	RMB 10,000	n/a
Merchant transaction fees**	around 0.6% (f2f)		

Domestic and international interoperability

Since these ecosystems have developed largely in competition with each other, there has been a limited focus on interoperability. If customers and merchants want to transact in both ecosystems, they must have both apps and connectivity to both. Customers have learned this easily and adopted this behaviour.

National regulators are also beginning to drive domestic interoperability initiatives (see the following regulatory section). Recently, Alipay and WeChat Pay have adopted a “follow-the-customer” strategy for cross-border expansion, actively working towards cross-border acceptance of digital wallet payments

in popular Chinese destination markets, such as Japan, Thailand, South Korea, Australia, the United States and Singapore.

A two-prong strategy to cross-border expansion is evident in this mature market, with both players appearing willing to work with incumbents, such as acquirers, schemes and central regulators. In developing markets, meanwhile, players are seeking to make strategic investments in promising fintech and payments organisations (there are exceptions, such as Tencent recently taking a stake in N26, a German neo-bank).



What can we learn from China?

The world's QR code merchant payments ecosystem is dominated by two Chinese players, Alipay and WeChat Pay.

Regulatory influences

Until relatively recently, the primary regulator in China, the People's Bank of China (PBoC), has had little inclination to become involved in Alipay's or WeChat Pay's affairs. However, in 2017 this began to change when the regulator became concerned about a lack of oversight of the huge volumes of transactions being conducted within these two ecosystems. This concern precipitated the PBoC's Wanglian initiative, which required non-bank institutions such as Alipay and WeChat Pay to process their transactions via a central entity.

The **Nets Union Clearing Corporation (NUCC)** or **Wanglian** (loosely translated as "non-bank internet payments union") is 37 per cent owned by PBoC and its subsidiaries. Alipay and Tencent both own 9.61 per cent of Wanglian. Other private company shareholders with smaller equity positions include Chinabank Payment (owned by

JD.com), Bestpay, 99bill.com, YQB.com and Ping An Insurance.

In late 2019, Alipay and WeChat Pay complied with the regulator's requirement, and 100 per cent of their transactions with bank accounts and credit/debit card accounts are now routed and processed through Wanglian. However, a significant amount of payments are still traffic routed within the Alipay and WeChat Pay ecosystems, not via Wanglian.

Another material intervention by the regulator came with the release of the **Fintech Development Plan (2019–2021)** in September 2019, which identified compatible and interoperable QR code merchant payments as a key objective. The aim is mutual scanning and recognition of all QR codes in the Chinese payments market, i.e. compatibility and interoperability across all vendors and apps. This process has already begun with various trials involving Alipay, WeChat Pay,

Bank of China, China UnionPay, Bank of Communications, Construction Bank and others.

What's next for China's payment giants?

It appears that the cross-border expansion remains high on the agendas of both players. This is accompanied by a relatively new goal to support travellers both to and within China, which is only expected to gain in strength.

Domestically, there appears to be a clear split between a compulsory regulatory agenda and a more commercially driven set of product and service enhancements.

What can we learn from China?

The world's QR code merchant payments ecosystem is dominated by two Chinese players, Alipay and WeChat Pay.

The regulator's focus on additional oversight and insight into formerly "black box" ecosystems is expected to continue, supported by an implementation agenda. Domestic interoperability is also expected to gain momentum from this regulatory push. The regulator appears to be increasingly interested in risk and dispute management within these ecosystems.

A relatively new, but extremely high-profile item on China's regulatory agenda is the Central Bank Digital Currency (or Digital Currency Electronic Payment/DCEP), which will undoubtedly have an impact on both Alipay and WeChat Pay.

Two other interesting initiatives:

Greater rural penetration - While both Alipay and WeChat Pay enjoy significant user penetration and engagement in Chinese cities, engaging with rural communities remains a challenge. Data connectivity and lack of bank accounts tend to call into question the need and usefulness of digital wallets and services in general.

Facial recognition payments - Both Alipay and WeChat Pay are pushing their respective facial recognition payments agendas. Crucially, their approach is centred on the customer's face being the payment token, which means no mobile or other device are required for payment. This differs from facial recognition being used in conjunction with a device (e.g. a smartphone) as a user/transaction authenticator. See Appendix I for additional background and insights on facial recognition payments in China.

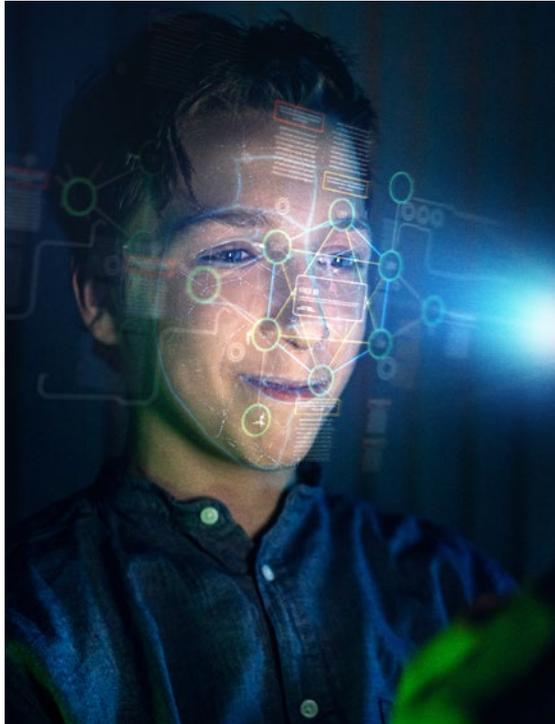
Regardless of their focus areas and an ever-encroaching regulatory agenda, Alipay and WeChat Pay seem keenly positioned to continue dominating digital payments in China and possibly even globally. Some expect QR codes to eventually disappear in favour of facial recognition, but privacy concerns in China, and especially in major international markets, may slow this transition dramatically.

Appendix I

Facial recognition technology and
its impact on QR codes in China

Facial recognition technology and its impact on QR code merchant payments in China

Facial recognition payments in China: the next frontier?



User and customer transaction authentication by facial recognition has been around for some time. Facial recognition payments take this concept a step further — instead of using a device like a smartphone to authenticate oneself, the customer's face becomes the payment token that is “scanned” by the merchant. Authentication and payment happen in one step without the need for a mobile device.

Facial recognition payments in China are generally associated with highly sophisticated, unstaffed, cashierless stores. However, the first step will likely be facial recognition in “traditional” stores, which is where Alipay and WeChat Pay are focusing initially with scale in mind.

How does it work?

Customers typically enrol by taking a photo or series of photos of themselves using a payment provider's app, for example, Alipay

or WeChat Pay. Enrolment is generally the most daunting part of the process for many users and is therefore a potential material barrier to rapid uptake. Experience shows that this blocker is significantly mitigated when enrolment is within an app ecosystem that the customer is already very familiar with, such as Alipay or WeChat Pay.

Once enrolled, the customer can go to a store that has enabled facial recognition payments as a customer payment method and pay for items at the checkout via a facial scan by the merchant's facial recognition camera(s).

The most robust systems typically use 3D cameras for facial recognition of customers, as these provide the most accurate results. However, this approach may limit e-commerce use cases due to the lack of 3D cameras in standard-issue smartphones and other customer devices (although some providers may build this in to their risk models).

Facial recognition technology and its impact on QR code merchant payments in China

Facial recognition payments in China: the next frontier?

Primary risks

There are a number of risks associated with less-than-robust implementation of this technology, but the primary risks tend to relate to:

- mistaken identity when a facial scan erroneously identifies the customer; and
- illegal collection and exploitation of facial recognition data (e.g. identity theft).

Privacy concerns

Facial recognition technologies have been challenged rigorously in many parts of the world due to privacy concerns. This is also a challenge in China, but only a small minority are attempting to slow the penetration of this technology into everyday life, including payments. Key privacy concerns relate to mass surveillance, government/other tracking and other monitoring of individuals with no apparent need.

Example implementations

- In 2019, China introduced regulations that require telecom carriers to scan the faces of users who are registering new mobile phone numbers. Prior to this, registration only required a copy of a person's identity card. This approach could have far-reaching consequences.
- Cities across China have been trialling face recognition payment systems for their subway networks. Zhengzhou, the capital of northeast Henan province, has become the first to roll out the technology on a wide scale. Between September and November 2019, nearly 200,000 commuters in Zhengzhou elected to authorise face-scan payments. While Zhengzhou is among dozens of Chinese cities to introduce such trials, it is the first to deploy the service across its entire subway network.
- In 2020, Beijing began trialling fast-track security checks by face scan at one of its subway stations.
- The 7-Eleven convenience store chain introduced facial payment technology in May 2020 in its stores, mainly in southern parts of China, including Guangdong Province. Approximately 1,000 7-Eleven outlets already use the system, which allows customers to make purchases by having their faces scanned by point-of-sale tablets with no smartphone required.





Facial recognition technology and its impact on QR code merchant payments in China

Facial recognition payments in China: the next frontier?

Penetration in China

Alipay has installed facial recognition payments capabilities in over 100 cities across China.

About 118 million Chinese signed up for facial recognition payments in 2019 compared to 61 million in 2018 (iiMedia Research, 2020). By 2022, iiMedia Research expects the number of users to exceed 760 million, about half the country's population.

ATM users at China's four major banks can perform transactions by having their faces scanned. Half of China Construction Bank's ATMs are equipped with facial recognition technology.

It has been found that new facial payment systems are linked primarily to Alipay and WeChat Pay apps. Alipay and WeChat Pay subscribers can use the systems by simply registering images of their faces.

Standardisation

In November 2019, the National Standardisation Group for Facial Recognition Technology was established to study and develop industry standards. Chinese AI start-up SenseTime is leading this initiative with the participation of Tencent, China Ping An, Ant Financial and iFlyTek. Since there is currently no regulatory involvement, this may increase the rate at which standards are developed and implemented ubiquitously.

Conclusion

Although facial recognition technology clearly enables a slick payment process, it has some ground to cover before it is ubiquitous in China (and it runs up against even more challenges outside China). Once it does gain traction, it could lead to the demise of QR code merchant payments in China.



Appendix J

Emerging QR code merchant payments:
examples from Latin America

- PIX
- Mercado Pago

Emerging QR code merchant payments in Latin America

Latin America is in the early stages of the QR code payments journey: two prominent examples:



In February 2020, Banco Central do Brasil (the central bank) launched the country's official instant payments system brand, PIX.

With a focus on instant payments, the scheme enables citizens, companies and government entities to make instant payments 24x7x365 through mobile phones, online banking and ATMs using QR codes or recipient information, such as phone numbers, emails and taxpayer identification.

PIX will run within a centralised settlement infrastructure, the Instant Payment System, operated and managed by the central bank. All financial institutions with over 500,000 accounts must adopt the system before mid-November 2020, when the system will be launched.

“The project will be the embryo of what I believe is a total transformation in the country’s future financial intermediation, and will consolidate what we understand as the new form of payment methods, with the new fintech industry and with open banking.”
 Roberto Campos Neto, President,
 Banco Central do Brasil

Participation is voluntary for entities that have not yet reached this number of accounts.

The government is seeking to demonstrate its commitment to PIX by ensuring that citizens and companies will be able to pay their federal taxes through PIX from November. The government also plans to use it to make payments, such as tax refunds and social benefits.

Payment institutions not licensed by the central bank will be able to use PIX by settling transactions through direct participants, similar to other schemes.



In February 2020, Banco Central do Brasil (the Mercado Pago is a digital payment platform available to consumers and businesses exclusively in Latin America. It was launched in 2003 and originally created as an integrated online payments solution to complement ecommerce platform MercadoLibre.

Mercado Pago processed \$19.72 billion worth of transactions between Q1 and Q3 2019, with the majority of these transactions offline (i.e. face to face).

Source: MercadoLibre, 2020

Appendix K

Scheme specification design and implementation process

- Proprietary vs harmonised specifications
- Integration approaches to national harmonisation

The technical specifications underpinning the design of QR code merchant payment schemes can be proprietary or harmonised

When designing a QR code payments scheme, providers can elect to adopt a proprietary approach or a more open, harmonised design approach.

The matrix below shows examples of major QR code ecosystem players that have chosen to develop and implement proprietary specifications, along with the QR code presentation modalities they support:

Proprietary specifications approach		
Example schemes	MPM	CPM
Alipay	Supported	Supported
WeChat Pay	Supported	Supported
MTN	Supported	Not supported
M-Pesa	Supported	Not supported
Mercado Pago	Supported	Not supported
Kakao Pay	Supported	Supported

Examples of major QR code ecosystem players that have chosen to develop and implement a more harmonised approach, some using EMVCo's EMV specification for QR code merchant payments:

Harmonised specifications approach		
Example schemes	MPM	CPM
EMV QR code specs	Supported	Supported
 Hong Kong Common QR Code (HKQR) (Hong Kong Interbank Clearing Limited)	Supported	Not supported
 SGQR (Monetary Authority of Singapore)	Supported	Supported
 JPQR (Payments Japan)	Supported	Supported
 Bharat QR (National Payments Corporation of India (NPCI))	Supported	Supported
 Thai QR Payment/MyPromptQR	Supported	Supported
Quick Response Code Indonesian Standard (QRIS)	Supported	Supported

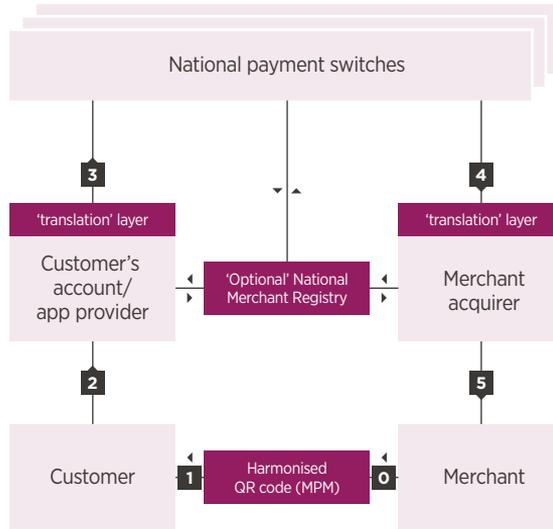
Domestic interoperability: example integration approaches to national initiatives with harmonised QR codes

Domestic interoperable schemes – push payments, smartphone-based

a) No changes to National Switch – interoperability at participant level

National initiative where the ecosystem participants are expected to make the changes required to enable QR code payments

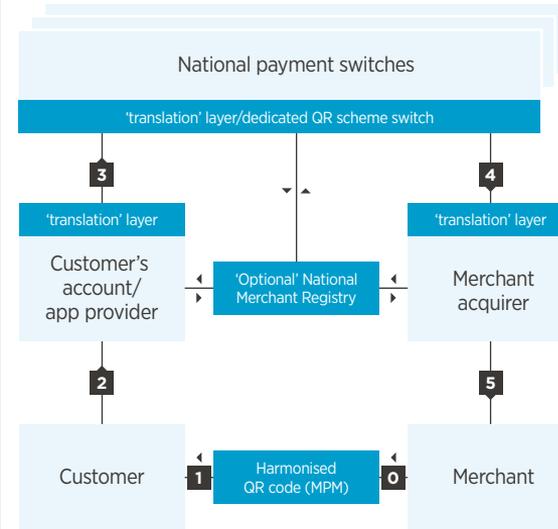
- 0 Harmonised static/dynamic QR code presented by merchant
- 1 Customer scans QR code
- 2 Customer authenticates for transaction
- 3 Customer's account provider converts QR code payment to native switch payment and pushes payment to merchant's acquirer/bank via the national switch
- 4 Merchant acquirer receives native switch payment and 'translates' into QR payment
- 5 Merchant receives payment confirmation; hands goods to the customer



b) Enhance the National Switch – interoperability at Switch level

National initiative where the National Switch(es) makes the changes required to enable QR code payments

- 0 Harmonised static/dynamic QR code presented by merchant
- 1 Customer scans QR code
- 2 Customer authenticates for transaction
- 3 Customer's account provider pushes payment to merchant's acquirer/bank via the national switch (switch translates QR payment or ahs dedicated QR scheme)
- 4 Merchant acquirer receives QR payment from switch
- 5 Merchant receives payment confirmation; hands goods to the customer



Appendix L

Optimising implementation of QR code merchant payments

- Customer experience
- Merchant device affordability
- Feature phone compatibility

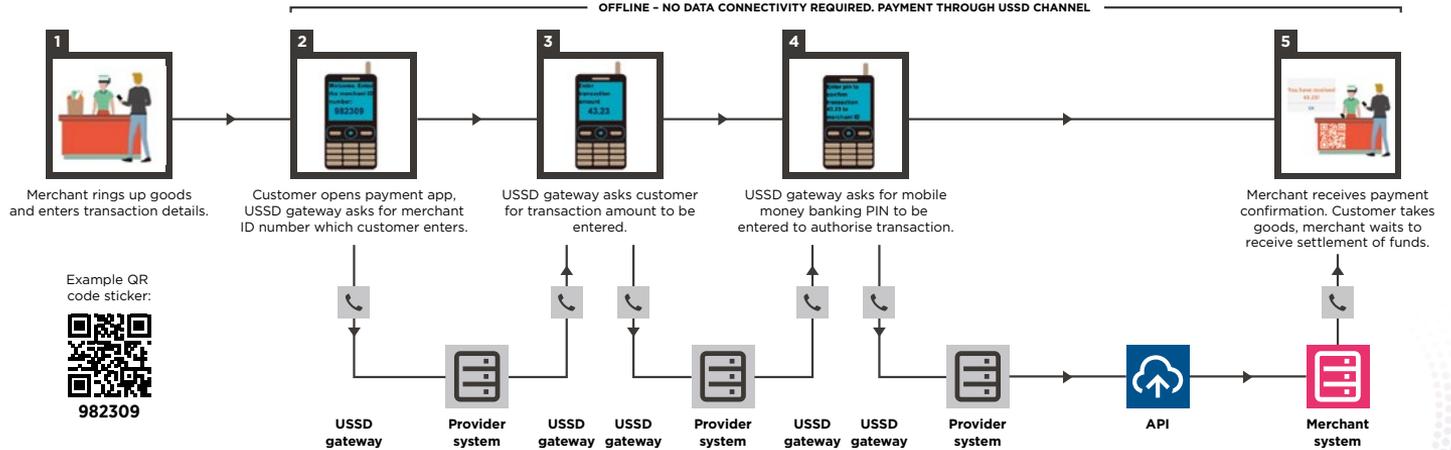
Schemes around the world have adopted different approaches to the customer experience. Typically, CPM appears to provide the optimal experience for medium and larger merchants while static MPM dominates the micro-merchant ecosystem.

Mode	Scheme example	Payment flow (pre-transaction ~ transaction complete)	Customer impact
MPM	Bharat QR	 <p>1 Enter your username and password to log in and click on Pay in Bharat QR option</p>  <p>2 The customer scans the QR code displayed</p>  <p>3 Enter the amount to be paid</p>  <p>4 Select the payment account</p>  <p>5 Receive a confirmation message after payment</p>  <p>6 Receiving a digital receipt</p>	High
CPM	WeChat Pay	 <p>1 Log in to WeChat, successful launch Quick Pay</p>  <p>2 The merchant scans the QR code displayed by the customer and sends the order information to the payment system on the WeChat payment server</p>  <p>3 If the payment system determines that it is necessary to enter a password, the password entry screen will be displayed and the user will enter the password</p>  <p>4 Display of a payment message if the payment settlement has been completed correctly.</p>	Low

Merchants will select their ideal POS solution and device typically based on their size, maturity and budget constraints. Static QR code stickers at the merchant's check-out location are the most common for micro-merchants.

Required merchant devices	Cost	MPM / CPM	Static / Dynamic QR code	Suitable circumstance
QR stickers 	Low -\$0	MPM	Static	<ul style="list-style-type: none"> • Small businesses in developing countries • Areas with inadequate internet access • Retailers, stalls, etc. that do not allocate a budget to implement portable and POS systems, but want to implement them inexpensively
Portable POS terminal 	Mid \$300	MPM/CPM	Dynamic	<ul style="list-style-type: none"> • Small and medium enterprises (SMEs) in developed countries • Those seeking to introduce QR code merchant payments as soon as possible without replacing their existing POS system • Mid-sized retail and food service outlets, etc. <p>*These require an internet connection for QR code merchant payments.</p>
POS system 	High \$1,000+	CPM	Dynamic	<ul style="list-style-type: none"> • Large chain stores, such as supermarkets, convenience stores and drug stores • The POS system is often bespoke and an internet connection is required for the system to operate • Large stores and chain stores that can allocate a large budget to implement such systems

Feature phones are typically unable to scan or display QR codes. This means that some QR code scheme providers have elected to include some form of human readable identifier alongside the merchant's QR code sticker/screen. This enables customers with feature phones to complete the transaction using manual key entry within the USSD channel instead of scanning the QR code.**



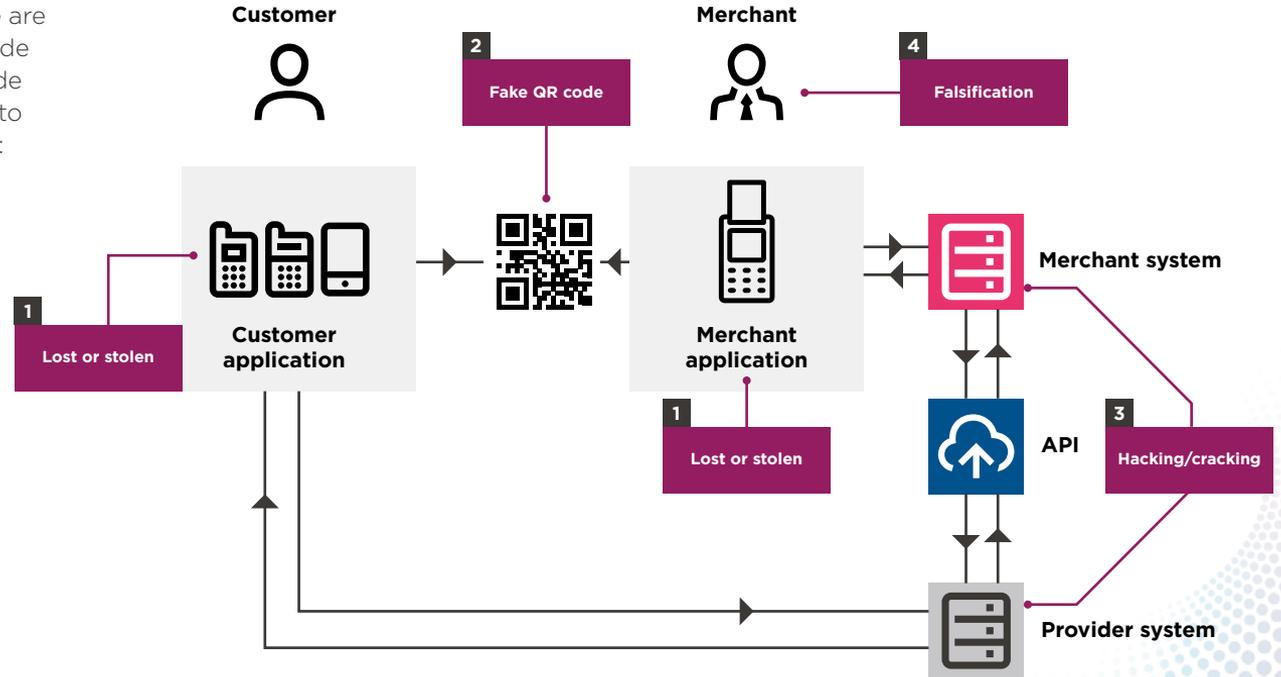
* A notification may be sent to the customer confirming various details, such as merchant name and amount, which the customer can either confirm or reject.

** Note: the exception would be a feature phone that has the screen graphics capability to display a QR code image and sufficient resolution for it to be reliably and successfully scanned by the merchant.

Appendix M

Security and risk management
— Approaches to mitigating primary
security risks

As with all payments ecosystems, there are a number of risks inherent in the QR code merchant payments ecosystem. QR code merchant payment providers will need to address the following key security risks:



* This diagram is based on an offline (in-store) payment and merchant-presented mode (MPM). Product flow can differ depending on the QR payment scheme.

Examples of appropriate risk mitigation responses:

Risk		Appropriate risk mitigation response	
Name	Detail	Approach	Detail
1 Lost or stolen	Unauthorized use can occur if a smartphone with a QR code payment app and the password were stolen.	Reduction	Add biometric authentication, such as facial recognition, fingerprint scanners and voice identification. A two-step verification system can also reduce the risk.
	QR code shoulder hacking If there is no time limit to use a QR code, QR code shoulder hacking may occur.	Reduction	To pay with a QR code, the app must have limits, such as a time limit on the validity of a QR code or trial.
2 Fake QR code	QR code phishing Attacker replaces original QR code and the fake QR code leads the user to malicious internet content.	Avoidance	The QR code payment app should not redirect the user to a website via the phone's browser, which would increase the number of victims of QR code phishing, or the QR code payment application should scan the vulnerability of redirected. It is preferable that merchants not use paper-printed QR codes because these are easy to replace.
3 Hacking/cracking	The information on the QR code payment system contains personal financial information that is targeted by the hacker.	Reduction	A QR code cannot be hacked (apart from fake QR codes), but the QR code payment system could contain vulnerabilities. Therefore, there should be unified security guidelines that all QR code payment system providers must follow. They should also be audited. Example: Japan began unifying QR code merchant payments in 2019, when the Ministry of Economy issued Guidelines for Unified Standard Code-Payment Technologies: CPM (Consumer-Presented Mode) and Guidelines for Unified Standard Code-Payment Technologies: MPM (Merchant-Presented Mode).
4 Falsification	Cashier may conduct fraud if the payer's QR codes are not generated every time they use it.	Avoidance	Time-limited QR codes should be generated every time customers present their QR codes to cashiers.

