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Some Lessons from Asian E-Money Schemes for the Adoption of Central Bank Digital Currency

Tao Sun and Ryan Rizaldy

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Some Lessons from Asian E-Money Schemes for the Adoption of Central Bank Digital Currency

Prepared by Tao Sun and Ryan Rizaldy

Authorized for distribution by Tommaso Mancini-Griffoli

June 2023

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ABSTRACT: This paper synthesizes four lessons from the experiences of six Asian e-money schemes for central banks as they consider adopting central bank digital currency (CBDC): (i) CBDC should embody four attributes: trust, convenience, efficiency, and security; (ii) CBDC service providers can facilitate CBDC adoption through four channels: leveraging digital technology, targeting use cases, developing business models, and complying with legal and regulatory requirements; (iii) central banks could incentivize CBDC service providers to develop these four channels when considering CBDC adoption; and (iv) central banks may be able to establish data-sharing arrangements that preserve privacy while leaving room for CBDC service providers to explore the economic value of data.

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Authors' E-Mail Addresses:	TSun@imf.org ; r_rizaldy@bi.go.id

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WORKING PAPER

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Prepared by *Tao Sun and Ryan Rizaldy*

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Abbreviations

API	Application Programming Interface
BIS	Bank for International Settlements
BoT	Bank of Thailand
CBDC	Central Bank Digital Currency
GPDR	General Data Protection Regulation
MDR	Merchant Discount Rate
PBC	People's Bank of China
POS	Point of Sale
PIN	Personal Identification Number
PSP	Payment Service Provider
QR	Quick Response
RBI	Reserve Bank of India
UPI	Unified Payments Interface

I. Introduction

The confluence of new technologies is making new digital money and digital payments possible. In more than 100 countries, the public sector is exploring the feasibility of issuing central bank digital currency (CBDC). Several central banks have already launched pilots or even issued a CBDC.¹

Most policy makers suggest that if issued, CBDC needs to coexist with and complement existing forms of money. The Bank for International Settlements (BIS) established this notion as its second principle (BIS, 2020a). Recently launched CBDCs (in the Bahamas and Nigeria, for example) and ongoing pilots (in China, for example) are consistent with this approach. Countries are exploring various approaches to CBDC adoption, but adoption has been slow,² possibly because of the requirements for, and consequences of, digitizing central bank money (Ponce, 2020).³

Some adoption of CBDC is critical for central banks to achieve policy objectives such as promoting financial inclusion and complementing declining cash use. Adoption benefits from a well-designed public-private partnership. Learning from past payment innovations and investigating incentives for adoption should play important roles in CBDC design (BIS, 2021c). Without a clear understanding of what underpins adoption, discussions about design, impact, and coexistence with private money will be of limited value.⁴

To date, little research has been conducted on the practical role of payment service providers (PSPs) in CBDC adoption.⁵ Most, if not all, CBDC experiments have adopted a two-tier architecture that includes “hybrid” and “intermediated” models.⁶ Central banks have designed fee structures and pricing models (Auer et al., 2022), but very little analysis has been conducted on the incentive structures and business models of second-tier PSPs, such as banks and non-banks.⁷ If PSPs do not have sustainable business models for CBDC provision, CBDC adoption will be too limited to allow central banks to achieve their policy objectives.

¹ CBDC is central bank-issued digital money denominated in the national unit of account. It represents a liability of the central bank. If the CBDC is intended to be a digital equivalent of cash for use by end users it is referred to as a “general purpose” or “retail” CBDC (Boar and Wehrli, 2021). This paper focuses on broadly available general purpose CBDC. The CBDC survey, conducted in 2021 by the BIS covered a record 81 central banks, representing close to 76 percent of the world’s population and 94 percent of global economic output. The survey found that 9 out of 10 central banks are exploring CBDC, with half developing or running experiments. It also showed that more than two-thirds of central banks were likely to issue a retail CBDC in the short or medium term (BIS, 2022).

² Adoption has been lackluster in countries in which CBDCs have been issued. Adoption of Nigeria’s e-Naira, the Bahama’s Sand Dollar, Jamaica’s JAM-DEX, and the Eastern Caribbean’s DCash did not take off (<https://techmonitor.ai/policy/digital-economy/nobodys-using-cbdcs-indias-piloting-one-anyway>; Ree, 2023; The Economist, 2023).

³ For instance, exchanging digital money between two parties necessarily requires third-party involvement in the form of an infrastructure, system, or mechanism supporting the transfers (Ponce, 2020).

⁴ Auer and Boehme (2021) summarize the lessons from adoption of payment services, highlighting M-Pesa and Swish as examples of successful adoptions and Avant, Paybox, and Digicash as examples of unsuccessful ones.

⁵ Cheng, Lawson, and Wong (2021) set out five preconditions for a CBDC: clear policy objectives, broad stakeholder support, strong legal framework, robust technology, and market readiness.

⁶ In a hybrid model, financial intermediaries provide retail services to end users; the central bank retains a ledger of all retail transactions and operates a backup of technical infrastructure and the payment system. Should a PSP fail, the central bank has the information it needs—the balances of the PSP’s clients—to substitute for the PSP and guarantee a working payment system. An intermediated model entails issuance by the central bank but a role for the private sector firms to interact with end users. In this model, the central bank does not record retail transactions, recording only the wholesale balances of individual PSPs. PSPs maintain the detailed records of retail transactions.

⁷ This paper uses the term *PSPs* to describe all intermediaries between the central bank and users. PSPs can include banks, non-bank financial institutions, mobile operators, and fintech or Big Tech companies.

This paper synthesizes some lessons from the experiences of six Asian e-money schemes run by technological companies or platforms (“Big Techs”) that are among the world’s most successful. Both consumers and merchants in Asia have been using e-wallets to make small-value transactions with app- or card-based products, known as electronic money (e-money).⁸ Large and successful e-money PSPs include Alipay and WeChat Pay in China; Paytm in India; and GoPay, GrabPay, and ShopeePay in Southeast Asia.⁹ These Asian e-money PSPs promoted e-money adoption by responding to unmet user demand for payment services. They have been successful because of their skilled exploitation of both economies of scale and economies of scope (e.g., integration of payments with e-commerce and social networks). However, they have also created challenges, such as data silos that result in market dominance. Firms may harness the data-network-activities (DNA) loop to exclude competitors (BIS, 2020b).

By drawing out lessons from the experiences of six Asian e-money schemes, this paper attempts to answer two questions for countries interested in promoting CBDC adoption:

- What are the key attributes and adoption channels of e-money schemes that could apply to CBDC adoption?
- How can countries take advantage of CBDC to promote contestability in the payment systems?

Four main lessons on CBDC adoption emerge from the analysis:

- CBDC should embody four key attributes: trust, convenience, efficiency, and security.
- CBDC adoption can be facilitated through four channels: leveraging digital technology (e.g., cell phones and the Internet); targeting use cases (e.g., e-commerce and social networks); developing business models (e.g., revenues sufficient to ensure cost recovery); and complying with legal and regulatory requirements (e.g., customer funds security and financial integrity requirements).
- Central banks can incentivize CBDC service providers to develop these four channels when considering CBDC adoption.
- Central banks can establish data-sharing arrangements that preserve privacy while leaving room for CBDC service providers to explore the economic value of data.

The paper is structured as follows. Section II describes the development of the six Asian e-money schemes. Section III presents the analytical framework. Section IV identifies the three stages of e-money adoption in Asia. Section V summarizes some lessons on e-money adoption. Section VI concludes with implications for CBDC adoption. Appendix A describes the volume and value of e-money transactions in India, Indonesia, and Singapore. Appendix B summarizes e-money policies and regulations in Asia. Appendix C describes data protection policies in Asia.

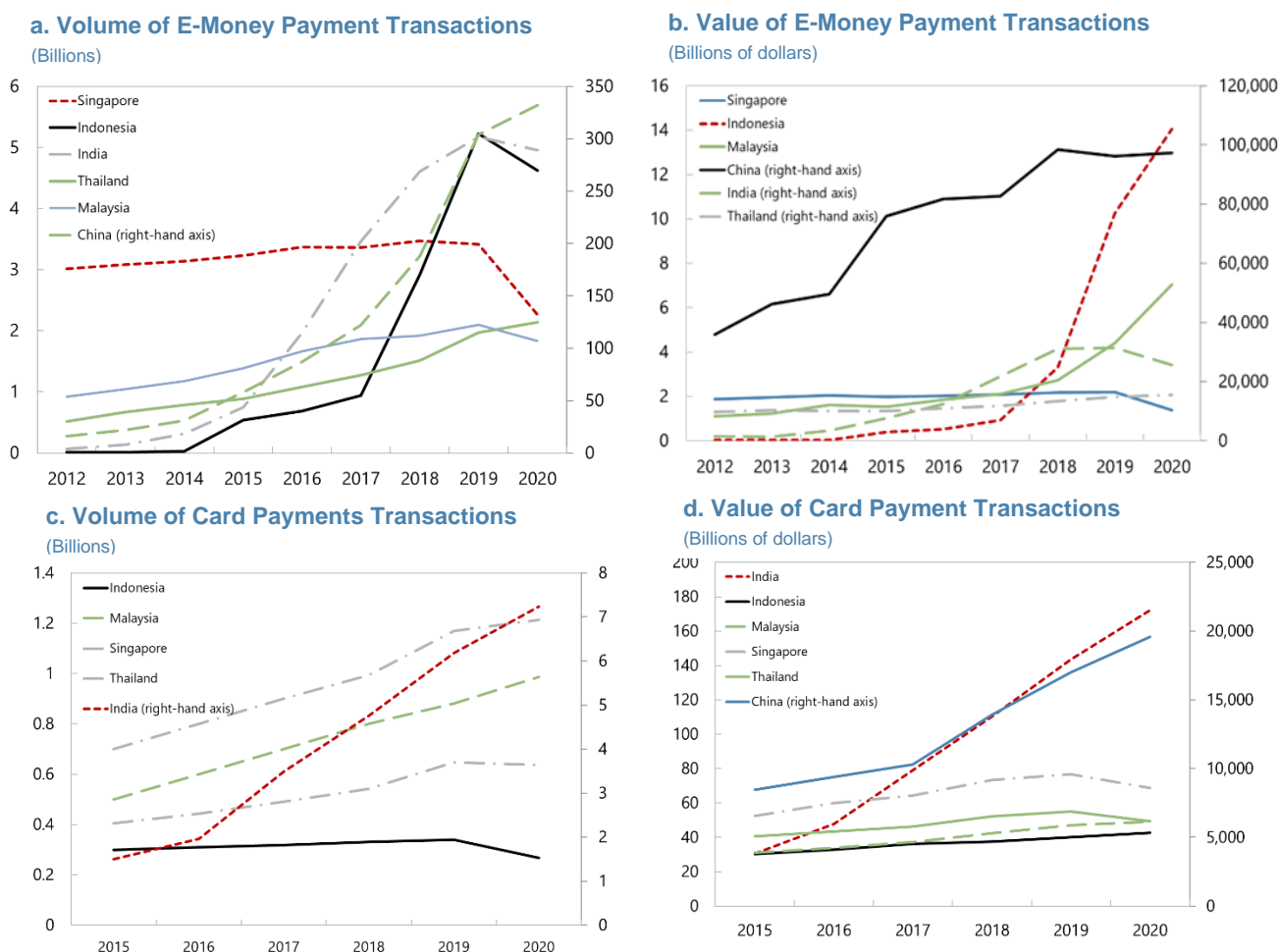
⁸ This paper uses the term *e-money* without making a distinction between e-money, mobile money, and e-wallets. The International Monetary Fund (IMF, 2018) defines e-money as monetary value represented by a claim on the issuer that is electronically stored on a card, device, or server and used for payments to third parties. E-money includes mobile money, prepaid cards, and web-based products. Mobile money (e-money stored in mobile phone accounts) is widely used in many emerging economies and developing countries. Although excluded from e-money, mobile phone payment applications that are linked to an account at a financial institution (by scanning a Quick Response [QR] code, for example) can be considered an extension of e-money. Banks, telecommunications firms (such as Safaricom and Vodacom), and other registered nonbanks can issue e-money. E-money accounts do not pay interest. They can be held by people who do not have bank accounts.

⁹ ShopeePay is also known as AirPay in some Asian countries.

II. E-Money Development in Asia

E-money schemes have grown rapidly in Asia, where a conducive environment—a young population, high population density in urban areas, a low financial inclusion/bank penetration rate, a rising middle class, and rapid technology (e.g., mobile phone) penetration—has led to the creation of many e-money schemes that leapfrogged payment hurdles. China, India, Indonesia, Malaysia, Singapore, and Thailand have witnessed a substantial increase in both the volume and value of e-money payments, which have eclipsed card payments (Figure 1 and Appendix A). China has the largest base of active users, followed by India (Figure 2). The penetration rate in China, as measured by percent of the population using smartphones, is the highest in the world.

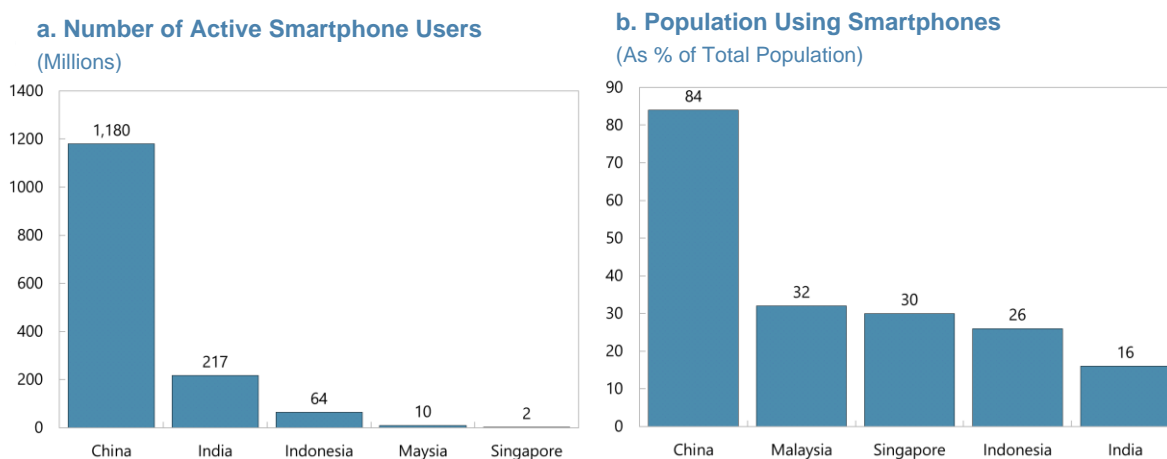
Figure 1. Volume and Value of E-Money Payments in Six Asian Countries, 2012–20



Source: Authors, based on data from the Bank for International Settlements (<https://stats.bis.org/statx/toc/CPMI.html>) and central bank websites.

Notes: For Committee on Payments and Market Infrastructures (CPMI) member countries (e.g., India, Indonesia, and Singapore), data are from the BIS Red Book (in which the data are standardized and thus comparable). For non-CPMI member countries (e.g., Malaysia and Thailand) and CPMI member country China, for which data are unavailable in the CPMI dataset, data are from the respective central banks. Data on the volume of transactions of card payments for China in panel c were not available.

Figure 2. Number and Share of Active Smartphone Users in Five Asian Countries, 2020

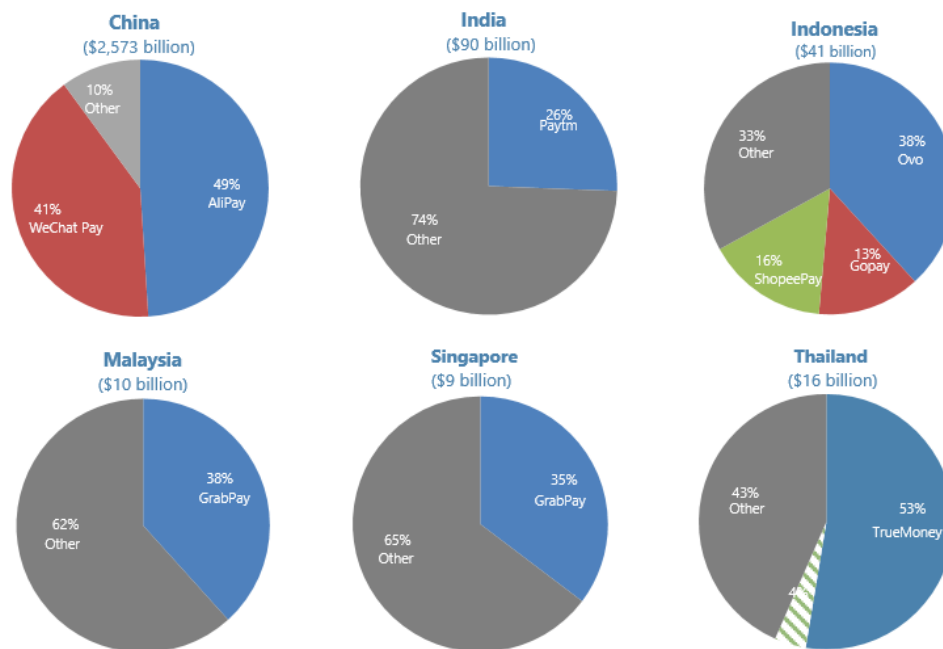


Source: Authors, based on data from Boku.

The six e-money schemes examined are major players in their respective countries. Alipay and WeChat Pay accounted for more than 90 percent of the Chinese market in 2020. GrabPay is a market leader in Singapore and Malaysia, with market shares of 35 percent and 38 percent, respectively. It also dominates the Indonesian market, through its partner OVO (Boku 2021).¹⁰ Paytm accounts for 26 percent of India's market (Figure 3).

¹⁰ Official data on the performance of e-money schemes in Southeast Asia are not publicly available. Data on market shares were therefore collected from independent surveys. The results depend on the scope and characteristics of the respondents surveyed as well as when the survey was conducted. The survey conducted by Ipsos (2020) shows that GoPay's market share in 2019–20 was 55 percent.

Figure 3. Mobile Wallet Market Shares and Size of Digital Payments in Six Asian Countries in 2020



Source: Authors, based on data from Boku survey conducted in April and May 2021 and Statista.

Note: The amount below each country name is the market size of digital payments in the country.

Despite concentration, competition in this market has been very tough. In China, for instance, the success of Red Envelope in 2014 prompted WeChat to provide payment services.¹¹ WeChat Pay's share of the mobile payment market increased from 7 percent in 2013 to 21 percent in 2015 and 39 percent in 2019 (IRResearch, 2019). To compete with WeChat Pay, at the end of 2013 Alipay launched ALL-IN, to promote daily mobile payments. In the following two years, Alipay updated its mobile apps with several new versions to support more use cases.¹² By improving services and providing multiple financial and technological services, Alipay/Ant Group was able to compete with WeChat Pay, which had the competitive advantage of high-frequency usage because of its social network services.

¹¹ Red Envelope is a service of WeChat Pay that enables users to send money to friends within their social groups in WeChat, one of the most popular instant messaging applications in the world. WeChat sent RMB 32 billion (\$5 billion) worth of digital red envelopes over the six-day Chinese New Year holiday in 2016.

¹² For instance, Alipay version 9.0 combined services of daily life (such as paying utility bills), online and off-line consumption, social networking, and digital finance.

III. Analytical (Demand and Supply) Framework

This section uses a demand and supply framework to show how demand for unmet payment services and limited supply by banks created opportunities for Asian e-money schemes.

Unmet Demand

He et al. (2017) describes the demand and supply framework to gauge the impact of new technologies and identify shortcomings of payment services. By harnessing this framework, this paper uses three factors—missing attributes, growing use cases, and diverse buying pattern—to analyze demand for e-money schemes in Asia:

- *Missing attributes.* In the early 2000s, payment services lacked key attributes, such as convenience, efficiency, and trust. China's bank-based payment systems, for instance, were inconvenient and inefficient. To place an e-commerce order, consumers had to repeatedly key in personal information (bank name, card number, customer name, and branch at which the account was opened). Systems were similar in Southeast Asia, where consumers cited reliability and cost as the most important attributes driving their preferences (Facebook and Bain & Co., 2020). Merchants were not attracted by services that charged more than the 1–3 percent transaction fees that credit card companies charged.
- *Growing use cases.* Demand for e-money payments in various use cases—e-commerce, social network, transportation, food delivery, streaming services, and on-line media (video streaming, music, and gaming)—increased rapidly in Asia. The value of ride-hailing transactions more than quadrupled between 2015 and 2019, for example, rising from \$3 billion to almost \$13 billion, as the number of users increased from 8 million to 40 million (Google, Temasek, and Bain and Company, 2019). The COVID-19 pandemic also increased demand for e-money payment services, creating new use cases. During the pandemic, demand for e-commerce soared, with 40 million people in Southeast Asia using the Internet for the first time in 2020 alone (Google, Temasek, and Bain & Company, 2020). New users bolstered the performance of ShopeePay, the e-wallet arm of on-line marketplace Shopee, driving demand for e-money payment services.
- *Diverse buying patterns.* Demand for payment services to meet a variety of buying patterns increased rapidly. In the 2000s, for instance, China's consumers could not easily compare the prices and quality of the same product offered by different sellers, and they could not evaluate the service quality of merchants. The diversity of buying patterns in many Asian countries demanded more efficient and tailored payment services.¹³

¹³ For instance, consumers want to compare and switch between different products and services in various platforms, such as ride hailing, e-commerce, and social networks.

Limited Supply

The Asian banking-based payment systems of the early 2000s could not provide convenient, efficient, safe, low-cost payment services. China's payment systems were characterized by an outdated payment-processing environment and the lack of a mature credit card market. In 2005, the value of credit card transactions in China was only \$43 billion (1.9 percent of China's GDP in 2005 and just 2 percent of the credit card transaction value in the United States) (Euromonitor International, 2005). Chinese on-line shoppers preferred to receive delivery of goods before they paid for them (to reduce goods settlement risk), whereas merchants preferred to receive payment before delivery of goods (to reduce funds settlement risk). Consumers had to use a post office or wire transfer, which was slow, costly, and exclusive (users in remote areas have no or limited access to bank or post office services). Inefficient and inconvenient supply in payment services, such as those provided by a post office, discouraged on-line shoppers. In Indonesia, which has a large consumer base, several factors—including the large share of unbanked adults, low merchant acceptance, and the limited range of digital banking use cases—constrained e-commerce growth early on.

IV. Stages of E-Money Adoption in Asia

Providing services that could be used in most use cases and reflected consumers' diverse buying patterns was a gradual process. To do so, all six e-money schemes went through three stages of development.

Stage 1: Promoting Financial Innovation to Build Trust and Confidence

To build trust and confidence, all six e-money schemes created mechanisms that safeguard customers' funds and transactions. First, they connected their e-wallets payment services through escrow accounts at banks, which are well regulated. Second, they created compensation schemes to build confidence and trust. In February 2005, for example, Alipay committed to reimbursing the full amount paid for fraud losses, adopting the policy of "you dare to pay, I dare to compensate." GoPay reimburses users for the full amount as soon as it receives a report of fraud.¹⁴ GrabPay reimburses on-line users if a purchased item does not arrive or malfunctions. ShopeePay provides similar guarantees through its parent company. Paytm has an instant refund scheme that both merchants and customers can initiate.

Stage 2: Leveraging Digital Technology, Targeting Use Cases, and Developing Business Models to Increase Convenience and Efficiency

To achieve network effects, the six e-money PSPs increased convenience and efficiency, by leveraging digital technology, targeting use cases, and developing sustainable business models.

Leveraging digital technology

E-money PSPs leveraged digital technology to reduce the payment costs of credit cards, for instance, using QR codes to serve merchants in on-line and off-line commerce markets. In 2011, for example, Alipay introduced almost zero-cost mobile app QR code. E-money PSPs in other Asian countries also introduced QR codes, allowing consumers and merchants to transact digitally. These codes removed the pain points of the

¹⁴ GoPay investigates suspected fraud. If it finds that the alleged loss was not the fault of the merchant or driver, it re-debits the user's account.

card reader at the point of sale (POS), which has higher installation costs and higher interchange fees than QR codes.¹⁵ QR code-based payments facilitate cheaper, faster, and more convenient transactions.

E-money PSPs also leveraged digital technology to strengthen security. They deployed innovative technology such as multi-factor authentication (personal identification numbers [PINs], passwords, security codes); face recognition; and biometrics to reduce the risk of fraud.¹⁶

Targeting use cases

E-money PSPs targeted clear use cases in which consumers and merchants can use e-money. These PSPs found various ways of bundling use cases to expand networks and build ecosystems:

- *On-line and off-line commerce.* Alipay is bundled with the Alibaba e-commerce platform, Paytm is bundled with off-line and on-line commerce platforms in India, and ShopeePay is bundled with the Shopee e-commerce platform.
- *Ride-hailing.* GoPay and GrabPay are bundled with ride-hailing and food delivery.
- *Social network and gaming.* WeChat Pay is bundled with the social network of Tencent (WeChat's parent company).
- *Other businesses.* Paytm is bundled with a business through which customers top up their mobile SIM cards.
- *Cross-border payments.* In 2015, Alipay set up a global payment network. In 2018, Alipay Financial Services (HK) Limited, together with Standard Chartered and Gcash, launched a blockchain-based cross-border remittance product for the Hong Kong SAR–Philippines corridor.¹⁷

Various use cases have promoted e-money adoption by increasing economies of scale and economies of scope. For instance, Alipay integrated vertically with Alibaba's e-commerce and horizontally with other business lines of the Ant Group (Alipay's parent company), such as lending, insurance, and wealth management. Vertical and horizontal integration have propelled Alipay to pass "critical mass," the point at which the value of new users participating in the platform exceeds the cost of participation (Moazed and Johnson, 2016).¹⁸ As a result, Alipay was able to set up a payment platform that services both on-line and off-line commerce markets. Alipay users can channel their money into Yu'e Bao to earn a higher return than they earn on Alipay wallet and

¹⁵ Most POS schemes adopt a four-party model with higher interchange fees involving the card-issuing institution, the acquiring institution, card schemes, and merchants, with the first three institutions sharing the merchant discount rate (MDR). However, the installation cost of a traditional POS device was high (\$40–\$50 in China), constraining wide use of POS schemes in rural areas. Dedicated POS terminals are used mostly by merchants in cities.

¹⁶ Biometrics allow account information to be encrypted, thereby preventing the account identity from being exposed in every transaction at the interface.

¹⁷ Several recently built payment corridors also allow Southeast Asian e-money PSPs to provide cross-border payment services. These payment corridors include those between Thailand (PromptPay) and Singapore (PayNow), between Thailand (PromptPay) and Indonesia (QRIS), and between Malaysia (Duitnow) and Singapore (PayNow), as well as the remittance corridor between Malaysia and the Philippines and between Singapore and the Philippines.

¹⁸ Because of high fixed costs, payment networks often need to sign up a minimum number of users ("critical mass") for the total value of the network to exceed its operating costs (CPSS, 2012).

demand deposits.¹⁹ Millions of merchants and billions of consumers interact and transact in these two-sided markets (Table 1).²⁰

Table 1. Core Products and Use Cases of Six E-Money Schemes

Company	Year Established	Core Product (Ecosystem)	Use Cases
Alipay	2004	E-commerce (Alibaba)	This lifestyle super-app allows users to hail a taxi, book a hotel, buy movie tickets, pay utility bills, make doctors' appointments, and purchase asset management products. In addition to on-line payments, Alipay processes in-store off-line payments inside and outside China.
WeChat Pay	2013	Social networking and gaming (Tencent)	This lifestyle super-app allows users to access social networking, play games, hail a taxi, book a hotel, buy movie tickets, pay utility bills, make doctors' appointments, and purchase asset management products.
Paytm	2014	Payment services to off-line and on-line markets (One97)	This app allows users to pay bills, top up mobile phones, manage wealth (Paytm Money), use Paytm Mall, and use payment gateway services.
GoPay	2016	Ride hailing and food delivery (Gojek)	This app allows users to purchase goods, groceries, and delivery services; pay bills; purchase healthcare and financial services; and receive social security insurance.
GrabPay	2012	Ride hailing and food delivery (Grab)	This super-app allows users to make cashless payments, including through credit/debit cards and partner wallets like PayPal.
ShopeePay/Air Pay	2014	Gaming and supermarkets (SEA)	This app allows users to collect game credits, top up mobile phones, pay bills, buy movie tickets, shop on-line, and use other lifestyle services within one app.

Source: Authors, based on information from company websites (as of November 2021).

Developing sustainable business models

The PSPs developed business models that generate sustained revenue and cover costs.

Fees

E-money PSPs build their networks by collecting fees mainly from merchants rather than from more price-sensitive consumers. In China, Alipay and WeChat Pay charge online payments merchants a 0.6 percent fee. In Singapore, GrabPay charges merchants a 0.8 percent fee—much less than the 1.5 percent the national payments system charges or the 1–3 percent credit card companies charge. In Indonesia, PSPs charge merchants a 0–2 percent fee, which is also less than credit card providers charge. Following the 2016

¹⁹ Yu'e Bao is a money market fund investment product run by Tianhong Asset Management, in which the Ant Group had a controlling stake. Rather than leaving money idling in their Alipay accounts without interest, Alipay users could put their money in Yu'e Bao and earn interest. There was no minimum investment threshold, and consumers could withdraw their money at any time. Its annual return reached 6.13 percent in March 2014, much higher than that of demand deposits, attracting users to use Alipay. In 2021 its annual yield was about 2 percent, six times that of demand deposits.

²⁰ A two-sided market is an intermediary economic platform in which two distinct user groups provide each other with network benefits (Rochet and Tirole, 2003).

demonetization policy, the Reserve Bank of India (RBI) capped the MDR at 0.25–0.5 percent, which was shared by card-issuing institutions, acquiring institutions, and card schemes.²¹

Interest revenue

E-money PSPs deposit their customers' funds with the central bank or commercial banks. PSPs, whether large or small, collect interest revenue and do not pass it on to users. The sources and level of interest revenue depend on countries' regulatory policies. For instance, Alipay and WeChat Pay deposit their customers' funds at the People's Bank of China (PBC). In Southeast Asian countries, e-money PSPs are required to safeguard their customers' funds at commercial banks and/or other specialized financial institutions (such as trust funds). In Indonesia, e-money is deposited in commercial bank accounts at market rates.²² India and Malaysia also allow their e-money PSPs to invest their customers' funds in high-quality liquid assets, such as government securities. For all these investments, e-money PSPs can earn interest revenue at market rates.

Cross-subsidies

E-money PSPs cross-subsidize services. In its rapid development stage, Alipay benefited from its synergy with other digital financial services (for example, lending, insurance, and asset management services) and technologically innovative services. It supports other financial services based on its knowledge of user behavior.²³ The growth of other financial services has reinforced Alipay's network effects as Alipay becomes more valuable to their users as Alipay grows. GrabPay collects data from three sources: wallet services, pay later services, and transaction history from a payment gateway company. It can analyze consumer and merchant behavior and provide its analysis to merchants, which can use it to improve their services and increase their revenue.²⁴ In Indonesia, GoJek partners with Moka, a POS start-up, allowing GoPay's merchants to leverage their payment data for bookkeeping and inventory to promote sales. Through its banking services arm (Bank Jago), GoJek provides loans to selected drivers and merchants. It uses a scoring system based on transaction history in GoPay that is based partly on customers' ratings of drivers and merchants. This business model not only provides incentives for drivers and merchants to use e-money, it also reduces default risks. Paytm allows users to pay school fees; top up metro cards; make utility payments; buy, store, and invest in gold (through Digital Gold); and make cross-border payments (Law, 2020). In these omni-channel ecosystems, data are analyzed and leveraged across services within the super-app, and consumers and merchants enjoy value added from using e-money in the cross-subsidized ecosystem.²⁵

Cost management

E-money PSPs need to manage their costs. Payment institutions' fixed costs—for equipment, marketing, customer acquisition, and office space—can be very high. At Visa, for example, they accounted for 89 percent of total costs in 2019 (Visa, 2019).

²¹ Merchants in Asia pay an MDR (also known as a service fee or a convenience fee) of 0–30 percent of the transaction value, depending on the jurisdiction, type of service, type of payment initiation, and value of the transaction. The e-money PSPs or the app originators can charge these fees. For example, GoJek (GoPay's parent), the app originator, charges GoPay's merchants an MDR fee. Merchants pay fees to join this ecosystem; consumers pay no fees.

²² In October 2021, the market rates were 0–0.11 percent.

²³ The Ant Group analyzes raw data to understand user behavior in order to better serve users. Based on data generated by transactions in Alibaba's trading platform, it is able to construct automated credit ratings and provide small loans to a large number of online shops while continuously monitoring credit risk (Hau et al., 2020).

²⁴ For example, a merchant can obtain an analytical evaluation of consumer and merchant behavior and then optimize it to personalize its advertisement or services.

²⁵ The share of non-payment-related financial services of the Ant Group reached over 60 percent in the first half of 2020, according to the *Financial Times* (<https://www.ft.com/content/935401f8-a374-4c15-ba8a-12c600ac3443>). Official data on these cross-subsidies in Southeast Asia are not available.

Changes in the demands of consumers and merchants can also be costly to PSPs. Consumers are increasingly technology savvy—using the Internet or mobile phones, looking for discounts or shopping privileges, accumulating redeemable points, and choosing between foreign and home currency when paying overseas. Merchants are increasingly cost-sensitive, choosing between credit cards and e-money when selling in on-line and off-line commerce markets.

To meet demand from consumers and merchants, the six e-money PSPs incur variable costs by offering promotions, discounts, and point-reward systems. GrabPay’s GrabReward system awards points that can be used to save on its services. Paytm has a subscription-based loyalty program (Paytm First) and provides options for paying with no fees. GrabPay does not charge merchants terminal fees or customers subscription fees. Shopee provides free deliveries and low commissions as part of its aggressive marketing efforts.

Digital technology has enabled PSPs to reduce their fixed costs. Alipay’s fixed costs are lower than those of banks and credit card companies. Its physical equipment cost is low, as evidenced by the near zero cost of QR codes. The declining cost of digital technology (such as cloud storage services) and the proliferation of digital activity have dramatically reduced marketing and customer acquisition costs. Alipay’s office cost is low because it does not need brick-and-mortar branches (its offices are in Hangzhou and Shanghai). By using their parent companies’ ecosystems, e-money PSPs can further lower their fixed costs, allowing them to provide payment services to consumers in wider geographical areas at lower costs.²⁶ The large transaction volume underpinned by digital technology has also reduced PSPs’ variable costs. For instance, banks typically charge Alipay lower service fees (0.05–0.08 percent) than they charge other clients, because of its large transaction volume.

The pricing strategies and cost advantages of e-money PSPs align their business models with those of merchants and customers to realize competitive advantages over traditional bank-based payment systems (Table 2).

Table 2. Payment Transaction Fees and Business Revenues of Six E-Money Schemes

Company	Examples of Payment Transaction Fees	Other Sources of Revenues
Alipay (China)	Online payments merchants pay 0.6 percent of the transaction value, and off-line merchants pay 0.3 percent. Consumers pay no transaction fees, except for a 0.1 percent fee if they redeem more than RMB 20,000 (\$3,000) of cash using an Alipay account, to compensate the bank for providing the redemption services.	Ant Group uses Alipay’s payment data to provide services such as lending, insurance, and wealth management.
WeChat Pay (China)	Online payment merchants pay 0.6 percent of the transaction value, and off-line payment merchants pay 0.3 percent. Consumers pay no transactions fees, except for a 0.1 percent fee if they redeem more than RMB 20,000 (\$3,000) of cash using a WeChat Pay account, to compensate the bank for providing the redemption services.	Tencent uses WeChat Pay’s payment data to provide services such as lending, insurance, and wealth management.
Paytm (India)	Most transactions are free. A fee of about 1.9 percent of the transaction value is charged to	Paytm handles a wide range of use cases, including the payment of

²⁶ The total cost savings over banks are huge. In 2018, for instance, the Industrial and Commercial Bank of China (ICBC)—the largest commercial bank in China (serving more than 600 million consumers)—operated 16,004 branches (<https://www.icbc.com.cn/icbc.htm>). Assuming the average cost of operating a branch was RMB 10 million (\$1.5 million) a year, ICBC’s total annual cost could be as high as RMB 160 billion (\$22 billion) (<http://money.people.com.cn/bank/n1/2016/0415/c202331-28277716.html>).

	merchants for transactions made through payment gateway services.	school fees and utilities; the recharging of metro cards; the buying, storing, and investing in gold (through Digital Gold); and the facilitation of cross-border remittances/payments.
GoPay (Indonesia)	Transaction fees to merchants are free, although Gojek (GoPay's parent) charges an MDR for certain product categories (such as food purchased through GoFood). Customers pay some small, fixed fees for on-line purchases.	Gojek (GoPay's parent) offers a loan program for drivers and merchant partners that is integrated with customers' ratings.
GrabPay (Malaysia and Singapore)	Transaction fees to merchants range from 0 to 2 percent—less than the 2–3 percent Visa and MasterCard charge or the 1.5 percent NETS (the Network for Electronic Transfer) charges. Slightly higher fees are charged for the use of payment gateway services, depending on the payment method. ^a	GrabPay introduced GrabPay Credit through its wallet and PayLater feature. The GrabPay app provides merchants with data services through its partnership with payment gateways (Adyen).
ShopeePay/AirPay (Thailand and Singapore)	Transaction fees vary. In Indonesia, Thailand, and Vietnam, merchants pay no fees. In the Philippines and Malaysia, they pay 1.5–2.0 percent of the transaction value. In Singapore, they pay 2.0–5.35 percent, depending on the product category, type of merchant, and program.	ShopeePay/AirPay integrates e-money payments with e-commerce.

Source: Authors, based on information from company websites (as of November 2021).

Note: A payment gateway is a merchant service provided mostly by an e-commerce application service provider that authorizes credit card or direct payments processing for e-businesses, on-line retailers, bricks and clicks, or traditional brick and mortar.

Stage 3: Complying with Legal and Regulatory Policy to Strengthen Security

E-money PSPs have benefited greatly from government support. In China, for instance, the government built a sound digital infrastructure that underlies e-money digital payments,²⁷ and financial regulators have adopted policies to promote digital finance in the early 2000s.²⁸ India's demonetization policy helped Paytm attract new customers. Malaysia's government stimulus during the COVID-19 pandemic was disbursed through popular e-wallets, which spurred GrabPay's development.

E-money PSPs complied with legal and regulatory requirements in two ways:

- *Applying for new licenses or acquiring existing licenses.* Following the PBC's requirement that nonbank on-line payment institutions obtain payment licenses, Alipay secured a payment license in May 2011, becoming a business unit of Ant Group, which won approval for more financial services licenses from various regulators in 2014.²⁹ GoPay acquired a license by acquiring an existing licensed e-money company in 2018; GrabPay acquired a digital banking license in Singapore through a consortium with Singapore Telecommunications. In August 2015, Paytm received a license from the RBI to launch the Paytm Payments Bank as a separate entity. Alipay, ShopeePay, and GrabPay acquired e-money licenses in many Asian countries.

²⁷ The Industry and Telecommunication Department in China has built up a network of Internet and mobile phone systems since the early 2000s. The PBC established Union Pay to integrate all banking card services in 2002.

²⁸ For instance, in July 2015, 10 central governmental departments issued the "Guiding Opinions on Promoting the Healthy Development of Internet Finance."

²⁹ The Ant Group secured banking and insurance licenses from the China Banking and Insurance Regulatory Commission (CBIRC; known as the CBRC and the CIRC before the two institutions merged in March 2018); fund and security licenses from the China Securities Regulatory Commission (CSRC); and microcredit licenses from local governments.

- *Complying with regulatory policy on customer funds, technology, and information.* Alipay transferred 100 percent of customer funds gradually from banks to its reserve account at the PBC by early 2019.³⁰ This move was intended to protect users against the risk of insolvency of the banks in which Alipay deposited customer funds and mitigated credit, liquidity, market, and operational risks.³¹ The NetsUnion Clearing Corporation (NetsUnion) has ensured the smooth information flow and data security.³² GoPay and GrabPay followed QR standards set by the Bank of Indonesia and engaged with regulators in supporting and preparing standardization (such as open Application Programming Interface [API] standard in Indonesia). E-money schemes complied with various regulatory requirements (see Appendices B and C).

V. Lessons from Asian E-Money Adoption

This section draws lessons from the experiences on e-money adoption from the six Asian countries.

PSPs Play a Vital Role in Facilitating E-Money Adoption

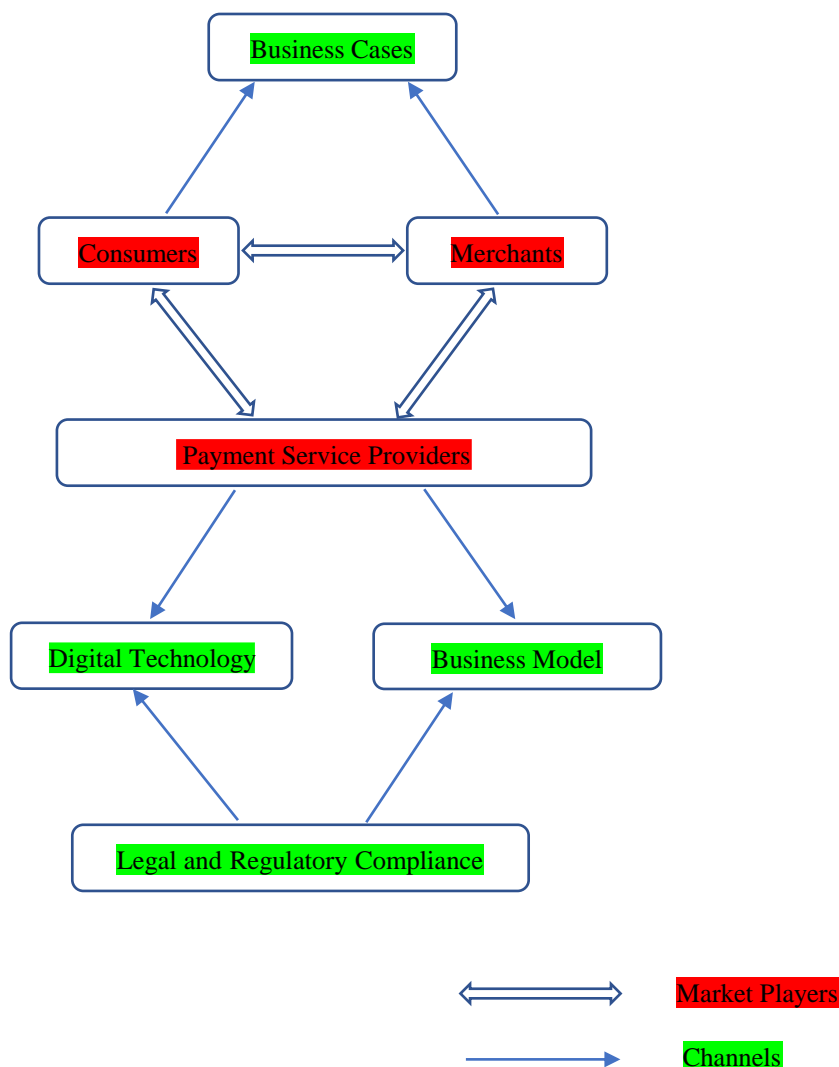
To promote the adoption of e-money adoption, PSPs leveraged digital technology, targeted clear use cases, developed business models, and complied with legal and regulatory requirements. Through these channels, they interact with consumers and merchants in the ecosystem (Figure 4). PSPs enabled e-money schemes to acquire four attributes: convenience, efficiency, security, and trust.

³⁰ The total balance of nonbank online payment institutions (including Alipay and WeChat Pay) in the PBC reached RMB 2.3 trillion (\$331 billion) in December 2022, equivalent to 6.4 percent of total reserves at the PBC.

³¹ This policy sought to reduce systemic risks by ensuring the security of customer funds and reducing the wholesale funding risk of banks. Alipay turns small retail deposits—typically a stable source of funding for banks—into potentially unstable wholesale funding. Management of customer funds can mitigate wholesale funding risks. Backed with central bank money, Alipay/WeChat Pay further gain the public trust.

³² NetsUnion was established in March 2017 to settle transactions by nonbank online payment institutions. It is responsible solely for the transaction information flow and platform operation; it does not provide payment services itself. NetsUnion helped nonbank payment institutions reduce counterparty risks, enhance the transaction information management, and strengthen settlement security.

Figure 4. E-Money Ecosystem and Payment Service Providers



Source: Authors.

Notes: Green boxes show the four channels PSPs develop for e-money adoption. Red boxes show the three market players that develop an ecosystem.

Data use is becoming an increasingly important driver of PSPs' business models

Technological advances have increased the connectivity of systems and their computing power and reduced costs, resulting in large volumes of newly created and usable data (Feyen et al., 2021). If personal data were collected thanks to an innovation or a significant investment, the company that innovated or invested ought to be able to profit from those data (Tirole, 2017).³³ PSPs that are capable of utilizing users' profiles and transactional data to improve services help create sustainable business models. These PSPs can harness the

³³ The company holding customer data does not necessarily have the right to make money from possessing that data, depending on how the data were collected and whether an investment was made in it. If the data were easy and cheap to collect, they ought to belong to the individual concerned, although the boundary between data and processing can be hard to establish in practice (Tirole, 2017).

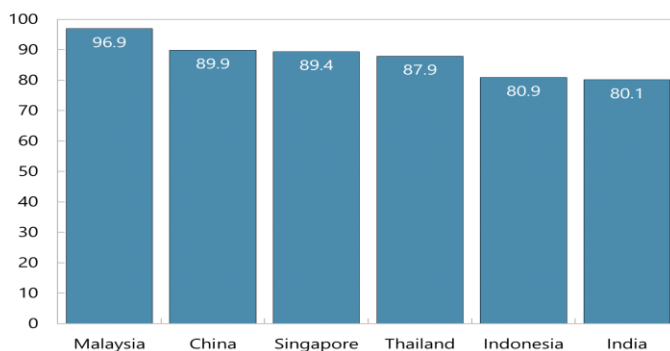
economic value of user data to achieve scale rapidly across different business lines, including a broad range of financial services, such as lending, insurance, and asset management (FSB, 2020).³⁴

Using data well while protecting privacy is not easy, for several reasons. First, not all PSPs can set up their own data-driven business models, because of the difficulty of keeping users in their ecosystems.³⁵ Second, for PSPs that can use data well, payment data can drive the formation of a monopoly (Garratt and Lee, 2021). Third, levels of privacy and restrictions beyond those required by the jurisdiction's data regulation may reduce these PSPs' revenue streams and their ability to add new innovative products, potentially reducing the diversity of participants in the system (BIS, 2021b).

Contestability matters

Market concentration comes from economies of scale and scope, as well as data advantages. The payment market in the six Asian countries is concentrated (Figure 5). To grow their customer bases, Asian e-money PSPs expanded through their parent companies, which can act as a barrier to entry for small firms. Some business actions aimed at expanding horizontally (for example, Gojek's acquisition of Midtrans to consolidate the payment chain by acquiring a payment gateway). Others aimed at expanding vertically (for example, the Ant Group's investment in Lazada, an e-commerce company, to enter the market in Indonesia and Singapore). All these acquisition and investment activities created larger platforms with data advantages that allow incumbents to hone and personalize their products in a way that is difficult for new entrants to replicate (Bank of England, 2023).³⁶

Figure 5. Market Shares of Four Largest E-Money Payment Service Providers in Six Asian Countries in 2020



Source: Authors, fintechnew.sg, Statista, Boku, and Lingyi Finance.

³⁴ None of the six e-money PSPs requires full anonymity as part of its adoption strategy. To support data-driven business models, e-money PSPs do not require full anonymity, but they nevertheless try to protect privacy. Both hard privacy-enhancing technologies (anonymous communication channels, selective disclosure credentials, zero-knowledge proofs, and secure multiparty computation) and soft privacy-enhancing technologies (cookie management tools, privacy dashboards, and advertising icons) can help protect privacy.

³⁵ Unlike users of physical spaces, users of digital services can engage in “multi-homing”—choosing different providers for similar services and spreading their data around the Internet.

³⁶ Competition between firms with large, established digital platforms characterized by scalability and a broad user base can tip in favor of a dominant player or a small number of dominant players that can achieve market power in payments very quickly. As the platform and its range of activities grow, the greater appeal of the platform fosters a data-network-activities loop. The dominant player can use its competitive advantage in data to cross-subsidize services and retain customers (BIS, 2020a).

Contestability matters. If e-money PSPs remain contestable (that is, entry into the market is free) and a healthy degree of competition exists among the limited number of participants, a certain degree of concentration does not necessarily indicate a lack of competition.³⁷ More new firms have entered into the e-money and e-commerce markets. In China, Pinduoduo entered the e-commerce market and has competed with Alibaba since 2015. ByteDance (the developer of TikTok) entered the social network market and has competed with Tencent since 2016. Friendster, initially a market leader in the social network industry, was quickly replaced by MySpace, which Facebook rendered almost completely obsolete. GoPay and GrabPay, which once dominated the Southeast Asian digital payment market, are now facing fierce competition from ShopeePay, especially since the onset of the COVID-19 pandemic. Competition from this new player is broad-based, as its rapid expansion is apparent in all the traditional markets of GrabPay and GoPay. In India, Paytm faces fierce competition from Google Pay, WhatsApp Pay, and PhonePe. These contestable markets allow PSPs to compete for users, reach critical mass, and expand their networks.

VI. Implications for CBDC Adoption

User needs and the strategies for managing CBDC adoption vary from jurisdiction to jurisdiction, reflecting different economic structures, forms of economic activity, and payment landscapes (BIS, 2021a). But the experiences of the six Asian e-money schemes yield common lessons that may also apply to CBDC adoption. This section draws implications for central banks as they reflect on, and attempt to manage, the adoption of CBDC.

CBDC should embody four attributes. To enhance user experience for CBDC payments, four attributes are key: convenience, efficiency, security, and trust.

Central banks could incentivize CBDC service providers to develop four channels when considering CBDC adoption:

- leveraging digital technology, to ensure low-cost access, provide convenience, and support scalability
- targeting use cases, to connect consumers and merchants in various use cases to achieve economies of scale and scope
- developing business models, to ensure that PSPs have sufficient revenues to cover costs
- complying with legal and regulatory requirements, to ensure security, confidence, and trust.³⁸

CBDC service providers need to support central banks to ensure that consumers and merchants are willing to use CBDC. They should be capable of collecting sufficient revenue to cover costs³⁹ while meeting legal and

³⁷ An alternative to competition in the market is competition for the market, namely “dynamic competition.” In theory, monopolies are not harmful to consumers as long as (a) incumbents compete in prices and innovation (which benefit consumers) and not through dirty tricks and (b) innovative firms enter the market. The market is then said to be contestable (Tirole, 2020).

³⁸ To mitigate the risks that CBDCs are used for criminal purposes, countries should implement measures in line with the international standards on anti-money laundering/combating the financing of terrorism (AML/CFT) issued by the Financial Action Task Force (FATF). Although it makes some general references to these measures, this paper does not address the financial integrity implications of CBDCs.

³⁹ Several options could cover costs for CBDC service providers. Making CBDC services free to individuals and inexpensive for merchants could be one option (Auer et al., 2022). Costs can also be covered by some subsidization through public funding, private cross-subsidy, or the granting of access to consumer data (BIS, 2020a).

regulatory requirements and implementing the authorities' requirements on AML/CFT and privacy protection.⁴⁰ The public sector must provide policy support and lay out clear regulatory policies.⁴¹

Table 3. Main Roles of Private and Public Sectors in CBDC Adoption

Role	Private Sector (Payment Service Providers)	Public Sector (Central Banks)
Leveraging digital technology	✓	✓
Targeting use cases	✓	
Developing business models	✓	
Complying with legal and regulatory policy	✓	✓

Source: Authors.

Central banks can use CBDC to address the data silo problem created by, for instance, existing e-money PSPs. Access to and treatment of payment data play a significant role in any ecosystem design (BIS, 2021b). Therefore, central banks may be able to establish a clear data-sharing arrangement and avoid discouraging PSPs from withholding investments in creative data-driven business models.⁴² The sharing of CBDC data based on consent can help integrate CBDC into existing payment systems (e.g., Big Tech ecosystems), break data monopolies, and harness the economic value of data (Figure 6). The sharing of data does not necessarily lead to a privacy breach, as privacy does not need to be synonymous with anonymity (Auer et al., 2021).⁴³ A range of choices exists regarding what type of information to keep private and whom to keep it private from, as well as the cryptographic techniques and operational arrangements that can support such decisions (Darbha and Arora, 2020).⁴⁴ More research is needed to develop well-designed policy and privacy-enhancing technologies to unlock greater economic value of data while maintaining privacy.

⁴⁰ Promising new developments in cryptography—such as zero-knowledge proofs, blind signatures, private decentralized networks, off-line smartcards, and the use of layered data management in payment systems—could enable a high degree of privacy while complying with AML/CFT regulations (Boar and Wehrli, 2021).

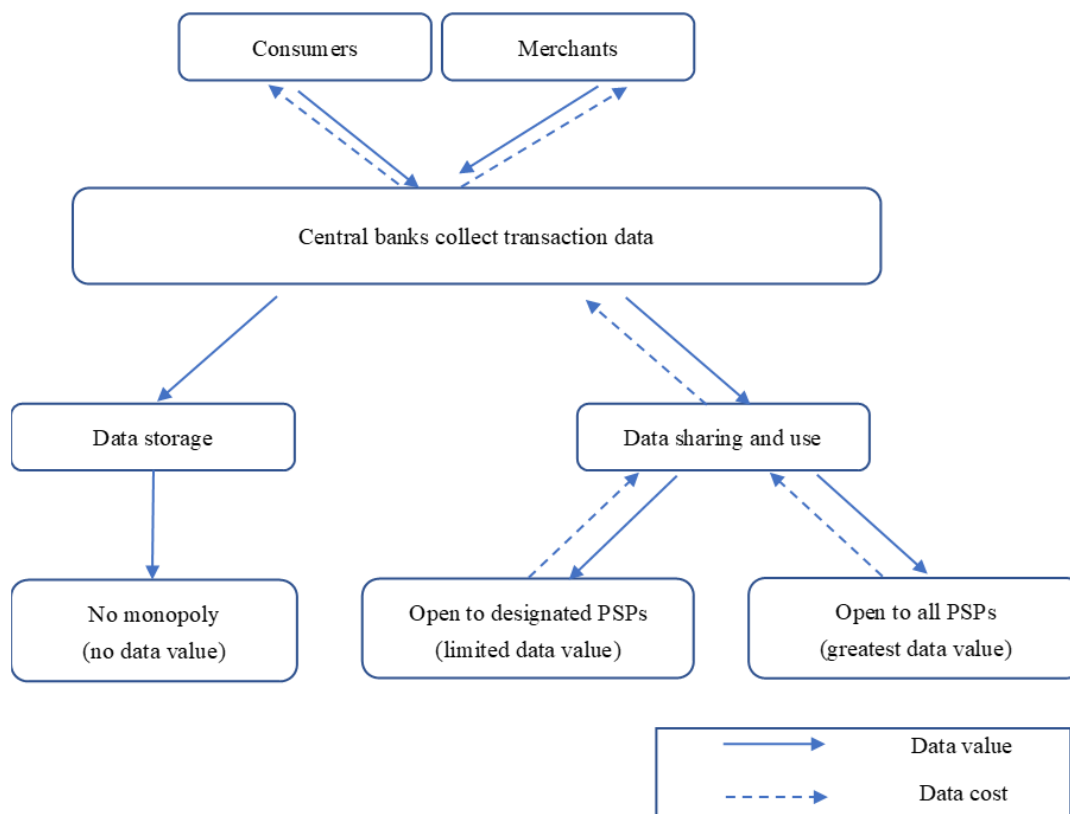
⁴¹ When helping the private sector develop business models, central banks could either license and establish new CBDC service providers (e.g., telecommunication firms) or team up with existing e-money PSPs. In the latter case, existing e-money PSPs may gain a new source of revenue. However, the incentives of e-money PSPs that provide CBDC services may not be the same as for their own e-money schemes, given that they “own” all the profits from expanding e-money adoption. In addition, network externalities that have resulted in the dominance of certain e-money providers could be a barrier for CBDC adoption in countries in which these providers already operate.

⁴² Whatever operating model it chooses—direct, hybrid, intermediated, and indirect—the central bank could consider building a public data architecture with APIs that ensure secure data exchange and interoperability between PSPs. This approach has already been adopted in retail fast payment systems (Auer and Boehme, 2021).

⁴³ Anonymity and privacy are different. An encrypted message may protect a user's privacy because no one other than the user and the recipient can read it. Encryption does not protect the metadata—and thus the person's anonymity—however, as PSPs can augment user data with mobile phone, social media, psychometric, and geospatial data. Privacy is not an intrinsic characteristic of the record-keeping system; it must be engineered (Auer and Boehme, 2021). True anonymity for any digital form of money will be very difficult to achieve. Current CBDC solutions can be regarded pseudo-anonymous at best (Kiff et al., 2020). Most central banks describe a system in which privacy will be maintained without full anonymity (Auer et al., 2022), as full anonymity is not feasible (BIS, 2020a). For instance, the digital pound would not be anonymous because, just like bank accounts, the ability to identify and verify users is necessary to prevent financial crime (Bank of England, 2023).

⁴⁴ APIs in a CBDC system can constrict data exchange to only the necessary information for any given transaction, giving users greater control over the data they generate (BIS, 2021c)

Figure 6. Data-Sharing Arrangements



Source: Authors.

Notes: Data value refers to the harnessing of the economic value of data by PSPs. Data cost refers to the cost PSPs would incur to protect privacy if central banks are able to establish clear data-sharing arrangements.

Central banks can also consider using CBDC to increase contestability and bring private money under their regulatory umbrella. Trade-offs exist between PSPs' concentration and the risks they pose for competition and consumer protection. Changing market structure brings challenges: Big Techs and stablecoin arrangements, including DeFi, are not regulated in the same way that traditional financial institutions are, increasing regulatory complexity. Central banks can consider using CBDC to create a venue to strengthen contestability.⁴⁵ They could, for example, use CBDC to encourage data sharing between public and private sector ecosystems, discipline the market, enhance competition, reduce dependency on private sector solutions, and strengthen regulation across public and private solutions.

⁴⁵ CBDC can equip central banks with more analytical capabilities and policy toolkits to ensure contestability by managing over-extensive network effects. Regulatory coordination on competition, financial integrity, consumer protection, privacy protection, and financial stability is therefore needed, not only within but also across jurisdictions.

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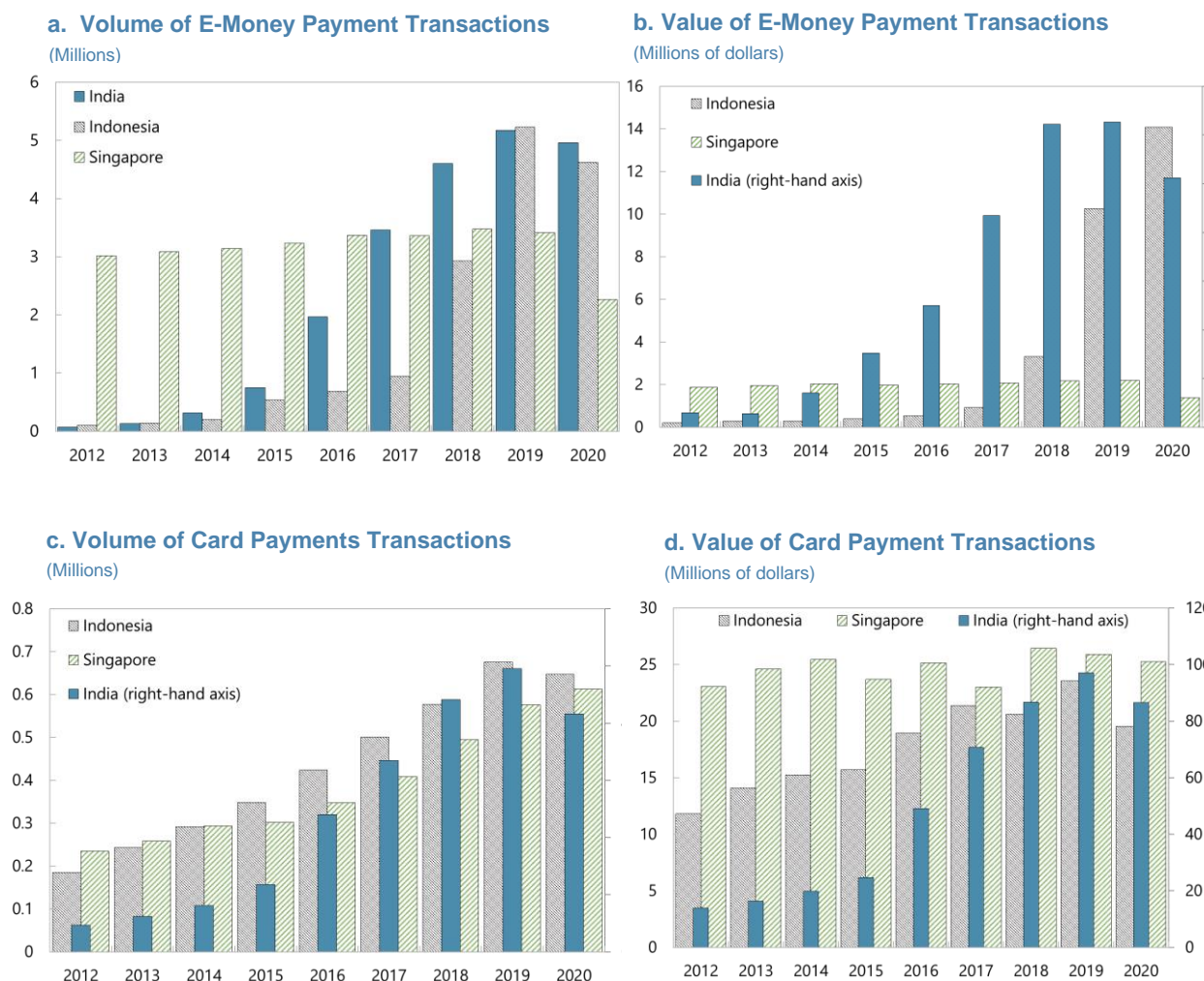
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Appendix A. Volume and Value of E-Money Transactions in India, Indonesia, and Singapore

Data from the Bank for International Settlements show the volume and value of e-money transactions in India, Indonesia, and Singapore (Figure A.1). The volume of e-money transactions in Singapore was high between 2012 and 2020, when it fell 33 percent, because of the COVID-19 pandemic. In Indonesia and India, the dip in 2020 was more modest (12 percent and 4 percent, respectively). The value of transactions in India has been high, especially since 2018. In 2020, it dropped 18 percent in India and 37 percent in Singapore but rose 37 percent in Indonesia.

Figure A.1 Volume and Value of E-Money Transactions in India, Indonesia, and Singapore, 2012–20



Source: Authors, based on data from Bank for International Settlements.

Note: Electronic money products are defined here as stored value or prepaid products in which a record of the funds or value available to the consumer is stored on a device in the consumer's possession.

Appendix B. E-Money Policies and Regulations in Six Asian Countries

Asian countries have adopted various policies and regulatory measures to promote the development of e-money (Table B.1).

Table B.1. E-Money Policies and Regulations in Six Asian Countries

Country	Year	Policies/Regulations
China	2010	<ul style="list-style-type: none"> Adoption of administrative measures for payment services provided by nonfinancial institutions
	2013	<ul style="list-style-type: none"> Adoption of measures on custody of clients' reserves at payment institutions
	2015	<ul style="list-style-type: none"> Promulgation of guiding opinions on promoting healthy development of Internet finance
	2016	<ul style="list-style-type: none"> Adoption of regulations on payment service business by nonfinancial institutions
	2017	<ul style="list-style-type: none"> Announcement of regulations on custody of clients' reserves at payment institutions
	2017	<ul style="list-style-type: none"> Notice on migrating on-line payment business of nonbank payment institutions from direct connection mode to on-line platform processing
	2018	<ul style="list-style-type: none"> Notice by General Office of the People's Bank of China on matters concerning the complete centralized deposit of funds of pending payments of clients of payment institutions
India	2010	<ul style="list-style-type: none"> Launch of Aadhar unique ID, a verifiable 12-digit identification number issued by the Unique Identification Authority of India (UIDAI) to residents of India free of charge
	2014	<ul style="list-style-type: none"> Introduction of payment bank license
	2016	<ul style="list-style-type: none"> Release of the Bharat QR, a QR code standard for payments Release of the Unified Payment Interface (UPI), an instant real-time payment system developed by the National Payments Corporation of India (NPCI), intended to facilitate interbank peer-to-peer (P2P) and person-to-merchant (P2M) transactions Withdrawal of specific bank notes by the Reserve Bank of India (demonetization)
	2018	<ul style="list-style-type: none"> Release of Payment Systems Vision 2018 Release of Master Direction on Non-Banking Financial Corporation Account Aggregator (NBFC-AA) Release of Master Direction on Access Criteria for Payment System Release of Master Direction on Prepaid Payment Instruments (PPIs)

		<ul style="list-style-type: none"> • Release of Operational Guidelines on PPI Interoperability
	2019	<ul style="list-style-type: none"> • Release of Payment System Vision 2019–21
	2021	<ul style="list-style-type: none"> • Release of E-rupee, a government-sponsored electronic voucher promoting digital payment solution • Linkage of Unified Payments Interface with Paynow Singapore
Indonesia	2009	<ul style="list-style-type: none"> • Release of e-money regulation, including introduction of licensing and oversight regime
	2016	<ul style="list-style-type: none"> • Introduction of PSP regulation and license • First amendment of e-money regulation, increasing maximum balance limit and adding measures to improve security and ownership arrangements
	2017	<ul style="list-style-type: none"> • Establishment by Bank Indonesia of fintech office and regulatory sandbox
	2018	<ul style="list-style-type: none"> • Second amendment of e-money regulations, providing access guidelines for foreign PSPs
	2019	<ul style="list-style-type: none"> • Release of Indonesia Payment System Blueprint 2025 to establish fast payments (BI-FAST), integrated payment interface, and nonbank PSP access • Launch of the Indonesian Standard Quick Response Code (QRIS), a standardization of payments using the QR code method from the Bank of Indonesia intended to make the transaction process with a QR code easier, faster, and better safeguarded
	2021	<ul style="list-style-type: none"> • Launch of the National Open Application Programming Interface (API) Payment Standard • Sandbox trials of Quick Response Code Indonesian Standard (QRIS) and Thai QR Payment (PromptPay) • Issuance of Regulation No. 23/6/PBI/2021 concerning PSPs (PBI PJP) and Regulation No. 23/7/PBI/2021 concerning Payment System Infrastructure Operators (PBI PIP)
Malaysia	2008	<ul style="list-style-type: none"> • Issuance of guidelines on e-money by Bank Negara Malaysia (BNM)
	2010	<ul style="list-style-type: none"> • Passage of the Malaysia Personal Data Protection Act 2010
	2011	<ul style="list-style-type: none"> • Launch of Financial Sector Blueprint 2011–20
	2016	<ul style="list-style-type: none"> • Issuance by BNM of Financial Technology Regulatory Sandbox Framework
	2017	<ul style="list-style-type: none"> • Launch of PayNet and DuitNow
	2018	<ul style="list-style-type: none"> • Issuance by BNM of Interoperable Credit Transfer Framework, to promote interoperability and healthy competition between bank and nonbank e-money issuers • Launch of Real-Time Retail Payment Platform, including National Addressing Database
	2019	<ul style="list-style-type: none"> • Establishment of DuitNow QR, under the Interoperable Credit Transfer Framework

		<ul style="list-style-type: none"> • Issuance by BNM of policy document on Publishing Open Data using Open API
	2020	<ul style="list-style-type: none"> • Issuance by BNM of license framework for digital banks
	2021	<ul style="list-style-type: none"> • Release of exposure draft of policy document on e-money
Philippines	2009	<ul style="list-style-type: none"> • Issuance by Bangko Sentral ng Pilipinas (BSP) of e-money circular that opens e-money issuance to nonbanks
	2012	<ul style="list-style-type: none"> • Release of Republic Act 10173–Data Privacy Act of 2012
	2017	<ul style="list-style-type: none"> • Launch by BSP of PESONet (a new electronic fund transfer service that enables customers to transfer funds to another customer in the Philippines) • Launch by BSP of the National Retail Payment System Framework (NRPS)
	2018	<ul style="list-style-type: none"> • Launch by BSP of InstaPay (fast payment system)
	2019	<ul style="list-style-type: none"> • Launch by BSP of e-Gov Pay (electronic bill presentment and payments platform) • Launch by BSP of National QR code standard
	2020	<ul style="list-style-type: none"> • Release of BSP's Digital Payments Transformation (DPTR) Roadmap 2020–2023
Singapore	2006	<ul style="list-style-type: none"> • Introduction of Payment Systems (Oversight) Act, to oversee payment systems and stored value facilities
	2013	<ul style="list-style-type: none"> • Passage of Personal Data Protection Act (PDPA)
	2016	<ul style="list-style-type: none"> • Launch of fintech regulatory sandbox by the Monetary Authority of Singapore (MAS)
	2017	<ul style="list-style-type: none"> • Introduction of PAYNOW, to enable consumers to send and receive money using National Registration Identity Card (NRIC) and mobile phone numbers
	2018	<ul style="list-style-type: none"> • Introduction of the Singapore Quick Response Code (SGQC), which allows merchants to use a single QR code to accept mobile payments from customers
	2019	<ul style="list-style-type: none"> • Introduction of nonbank fast access to bring nonbank PSPs onto Fast and Secure Transfers (FAST), encouraging competition and interoperability between e-wallets and bank accounts • Passage of Payment Services Act, to address risks posed by specific payment activities while promoting innovation in payments • Issuance by MAS of Payment Services Regulations 2019 (Exemption Regulations) • Posting by MAS of sandbox express guidelines
Thailand	2016	<ul style="list-style-type: none"> • Launch of PromptPay, accommodating multiple payment applications and allowing consumers to link their e-wallet IDs to their bank accounts • Launch of regulatory sandbox by the Bank of Thailand (BoT) • Establishment of the Thai FinTech Association

	2017	<ul style="list-style-type: none">• Enactment by BoT, in collaboration with the Ministry of Finance, of Payment Systems Act 2017 (B.E. 2560), and issuance by BoT of comprehensive digital payment regulations• Launching of Thai QR code payment standard
	2019	<ul style="list-style-type: none">• Issuance by BoT of Payment Systems Roadmap No. 4 (2019–2021)• Issuance by BoT of Policy Guidelines: Standardized Thai QR Code for Payment Transaction
	2020	<ul style="list-style-type: none">• Issuance by BoT of Notice of the Competent Officer permitting nonbank operators to apply for foreign exchange e-money licenses• Passage of Personal Data Protection Act (PDPA)

Source: Authors, based on information from central bank websites, company websites, and [Gadget360](#).

Appendix C. Data Protection Policies in Asia

Data protection policies in Asian countries vary. China, India, Malaysia, the Philippines, Singapore, and Thailand all have regulations protecting personal data.⁴⁶ Brunei, Cambodia, Indonesia, Lao People's Democratic Republic, Myanmar, and Vietnam lack overarching data protection frameworks. Personal data protection laws in countries in the Association of Southeast Asian Nations (ASEAN) are not as strict as the General Data Protection Regulation (GDPR), which regulates data usage, privacy, security, and transparency in the European Union and in regions that process or hold the data of EU residents.

Data protection laws in ASEAN countries impose security obligations on data processors to protect personal data. The Philippines and Thailand impose reporting obligations on data breaches that might cause public concern or harm a group of individuals. In both countries, data controllers must notify regulators and data subject to data breach within 72 hours of a breach.⁴⁷ In India, the Information Technology Rules of 2011 impose certain obligations and compliance requirements on entities that collect, process, store, and transfer sensitive personal data or information of individuals. These requirements include obtaining consent, publishing a privacy policy, responding to requests from individuals, disclosing data, and transferring restrictions.

Not all ASEAN countries require that companies inform the authorities and data subjects of any data breaches. In Singapore, organizations are advised to notify the Personal Data Protection Commission (PDPC) of data breaches.⁴⁸ In Indonesia, there are no requirements to notify the authority of data breaches, although the electronic system provider must inform the data owner in written or electronic form within 14 days of the breach.

All e-money providers establish data protection policies for their users' protection.⁴⁹ The policies describe how each e-money provider collects, stores, uses, transfers, discloses, and protects users' personal information through the system and website. The degree to which the privacy policy applies is subject to the law applicable within the jurisdiction in which the e-money provider conducts its operation. An e-money provider operating in multiple jurisdictions may therefore be subject to different privacy policies.

In general, privacy policies recognize individual ownership of personal data and information collected. E-money providers collect data from registration, transaction, and communication processes and notification of updates on system and services. They collect certain technical data concerning user usage, such as the Internet protocol (IP) address, information on webpages previously or subsequently viewed, the duration of every visit/session, the Internet device identity (ID), the mobile advertising ID or media access control address, and other information regarding the manufacturer, model, and operating system of the device the user used to access the system or website. This policy also applies to personal information collected from third-party e-money service providers.

⁴⁶ The Personal Information Protection Law of the People's Republic of China was adopted on August 20, 2021 and went into force on November 1, 2021. More policies and laws would help guide privacy protection for PSPs, including Alipay and WeChat Pay.

⁴⁷ See <https://www.dlapiperdataprotection.com/index.html?c=PH&c2=TH&go-button=GO&t=law>.

⁴⁸ See <https://www.dlapiperdataprotection.com/index.html?t=law&c=ID> and <https://www.pdpc.gov.sg/>.

⁴⁹ A unique privacy policy applies to service providers connected with e-money providers. It is outside the scope of this paper.

The use of personal data and information is subject to users' consent.⁵⁰ Upon users' consent, the privacy policy allows e-money PSPs to use their personal information. Personalized services offered by e-money PSPs to their users are enabled largely by personal data and information. Policies include users' system personalization, activities, and demographic monitoring and analysis, including trends and usage analysis and personalized marketing and promotion.

E-money providers are entitled to use users' personal information to comply with their obligations under any applicable law, including, but not limited to, responding to regulatory enquiries, investigations, or directives; complying with statutory or regulatory filing and reporting requirements; and conducting audit checks, due diligence, and internal investigations. Money providers may also disclose to or share with affiliates and other parties' users' personal information for purposes as permitted by applicable law. Some use cases allow e-money providers to cross-subsidize data and information, although the privacy protection policy prevents them from selling or leasing users' personal information to third parties.⁵¹

Users' personal information may be transferred to, stored, used, and processed in jurisdictions other than the users' home jurisdiction. Regulatory challenges may occur in countries that impose data sovereignty and localization requirements. The degree to which regulatory enforcement can be contested differs across countries, depending on the scope of localization required (C.1).

Table C.1. Data Localization Policies across Countries

Type of policy	Description	Country Examples
Local-only storing, transmission, and processing	Policy generally refers to obligation to locally manage data or prohibition on international data transfers. It is the strictest type of localization policy, often found in countries seeking broad control over citizens' activities.	China, Indonesia, Russia
Local copy required	Policy requires that companies keep a copy of data at local servers or data centers. It allows for easier access to these data for regulation and law enforcement purposes, as it is easier for local law enforcement agencies to access data that are stored locally rather than in another jurisdiction.	India
Narrower, conditional restrictions	Policy allows transfers of data outside the country only if the transferee and/or the recipient country meet certain conditions.	Brazil, European Union

Source: Wu 2021.

⁵⁰ User consent is defined mostly as the event in which users registered their accounts in the previously available system and agreed that by registering or creating the account and continuing it they consent to allow the e-money provider to use their personal information for the provision of services via the current available system in accordance with this privacy policy.

⁵¹ Trade-offs may exist between data use and privacy protection. CBDC service providers could consider data-driven business models to explore economic value of data while ensuring privacy protection.

E-money providers in the six Asian countries can hold users' personal information only for as long as necessary to fulfill the purpose for which it was collected, depending on the applicable law. All providers grant users the rights to access and/or correct personal information. However, the terms and conditions under which users have the right to be forgotten are unclear. In contrast, the GDPR clearly indicates the terms and conditions under which users can request blocking, rectification, completion, or erasure of their personal data in the event of a breach of statutory duties in personal data protection. The GDPR holds the data controller or processor liable for the breach.



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