

ICT Trends

Digital Healthcare | Mobile Payment | Assistive Technologies | Internet of Things (IoT)

5th Generation Mobile Networks (5G) | Artificial Intelligence and Machine Learning

Blockchain and Shared Ledgers | 3D Printing



ICT Trends

Mobile Payments

AP*i*CT

ASIAN AND PACIFIC TRAINING CENTRE FOR INFORMATION
AND COMMUNICATION TECHNOLOGY FOR DEVELOPMENT

ICT Trends

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ABOUT

The 2030 Agenda for Sustainable Development provides a plan of action for achieving an economically, socially and environmentally sustainable future. Information and communication technologies (ICTs) are recognized as enablers of the 2030 Agenda for Sustainable Development. Their diffusion and application in all sectors of society provide new solutions to persistent development challenges.

As new technologies, along with increased connectivity, spread rapidly and transform the ICT landscape around the world, it is important for policymakers and government officials to understand the current trends in order to fully leverage the potential benefits of ICT.

This publication aims to provide timely and relevant information on the major ICT trends and the implications of these trends. It serves as a knowledge resource for policymakers and government officials in Asia and the Pacific to increase their awareness and appreciation for the continuously evolving ICT landscape. It intends to present a broad understanding of how new and emerging ICT trends could be utilized to support sustainable and inclusive development.

This publication is a collection of brief write-ups on the following eight ICT trends:

1. Digital Healthcare
2. Mobile Payments
3. Assistive Technologies
4. Internet of Things
5. 5th Generation Mobile Networks
6. Artificial Intelligence and Machine Learning
7. Blockchain and Shared Ledgers
8. 3D Printing

This set of topics was selected based on their relevance to achieving the Sustainable Development Goals (SDGs). The topics selected also aim to provide a broadly representative sample covering a wide range of technology areas spanning hardware, networking, software and data, as well as application domains (i.e., healthcare, finance and disability).

Each write-up introduces the topic by first describing the technology features and components, and then proceeds to highlight potential application areas and use cases, with examples from the Asia-Pacific region and beyond. This is followed by a discussion on the policy implications involving regulatory aspects, standards and linkages to the SDGs. Each write-up may vary slightly to highlight relevant aspects.

The write-ups can be read independent of the other. Although the topics have been presented in a certain sequence, readers may start with any topic of interest and move on to any other topic that they find of relevance or interest. While going through the write-ups, readers may find multiple connections across application domains and technology areas. This has been intentional to foster

a better appreciation of the potential use of the new and emerging technologies for sustainable development. As these are brief descriptions, interested readers are advised to go through the references provided at the end of the write-ups for a more comprehensive understanding of the topics.

ACKNOWLEDGEMENTS

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II. Mobile Payments

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1. Introduction

An important component of any financial system is its payment system, which consists of platforms, mechanisms, rules and procedures to, “facilitate the clearing and settlement of monetary and other financial transactions”.¹ Cash is the traditional payment instrument. At the same time, there are many physical and virtual payment instruments, like debit cards and credit cards, that enable cashless transactions around the world. Developments in technologies, along with innovations in the financial sector, have influenced the way the financial system (especially the payment system) and its participants/stakeholders interact.

1.1 Benefits of Mobile Payment Systems

The goal of achieving a “cashless society” has received more impetus with the advent of digital payment technologies. Studies have shown the direct and indirect costs of dealing with cash to be high and a burden on society, especially the lower-income group.² This has been used to incentivize various cashless payments, especially using digital/mobile payment technologies. The existing means of cashless payments (like debit and credit cards) have also been integrated with the online and mobile payment systems.

Providing access to traditional financial services is costly, especially in the case of rural areas. However, the proliferation of mobile phones has provided an opportunity to take various financial services to the unbanked and the underserved groups, as well as to the larger population. For example, banks can make huge cost savings as the use of mobile phones for banking and money transfers reduces the investment in ATM kiosks and machines. Cross-border payments and sending of remittances have become cost-efficient and convenient through the adoption of mobile payment systems. Such money transfers are expected to promote growth through increased transactions and money transfers between countries. Mobile operators can also get cost benefits as tapping the potential for mobile payments market in the rural and developing regions is expected to improve their average revenue per user.³ The reduction in transaction costs and improved efficiency (that enables speed and liquidity of money) have been major factors in improving productivity.

1 World Bank, “Payment Systems”. Available from <http://www.worldbank.org/en/topic/paymentsystemsremittances>.

2 Bhaskar Chakravorti, “The hidden costs of cash”, *Harvard Business Review*, 26 June 2014. Available from <https://hbr.org/2014/06/the-hidden-costs-of-cash>.

3 Ernst & Young, *Mobile Money: An Overview for Global Telecommunications Operators* (2009). Available from [http://www.ey.com/Publication/vwLUAssets/Mobile_Money./%24FILE/Ernst%20%26%20Young%20-%20Mobile%20Money%20-%2015.10.09%20\(single%20view\).pdf](http://www.ey.com/Publication/vwLUAssets/Mobile_Money./%24FILE/Ernst%20%26%20Young%20-%20Mobile%20Money%20-%2015.10.09%20(single%20view).pdf).

Mobile payments are considered to be less prone to theft, loss and fraud than cash payments, as most of these platforms are equipped with relevant security features.⁴ This promotes adoption among both merchants as well as customers. Increased use of some mobile payment services can result in value-added services like loyalty and credit for both merchants and customers. Moving to mobile/digital payments is also expected to promote transparency and accountability as it leaves a clear trail of records.⁵

1.2 Financial Inclusion and the SDGs

The development of mobile financial technologies and mobile payment systems has been supported by the need to achieve the goal of financial inclusion. A large number of people especially in the developing regions do not have an account at any financial institution. These technologies are expected to help the efforts in taking banking and financial services to the “unbanked” population, in addition to improving the quality and accessibility of such services to the population in general.⁶ Financial inclusion is important for development, and helps in creating an environment that enables the achievement of the Sustainable Development Goals (SDGs). In this context, the role of digital (including mobile) payment technologies in achieving the SDGs is discussed below.

4 Kevin Donovan, “Mobile money for financial inclusion”, in *Information and Communications for Development 2012: Maximizing Mobile*, World Bank (Washington, D.C., 2012), pp. 61-73. Available from https://elibrary.worldbank.org/doi/abs/10.1596/9780821389911_ch04.

5 Ernst & Young, *Mobile Money: An Overview for Global Telecommunications Operators* (2009). Available from [http://www.ey.com/Publication/vwLUAssets/Mobile_Money./%24FILE/Ernst%20%26%20Young%20-%20Mobile%20Money%20-%2015.10.09%20\(single%20view\).pdf](http://www.ey.com/Publication/vwLUAssets/Mobile_Money./%24FILE/Ernst%20%26%20Young%20-%20Mobile%20Money%20-%2015.10.09%20(single%20view).pdf).

6 International Telecommunication Union, “Mobile Money Revolution Part 2: Financial Inclusion Enabler”, May 2013. Available from <https://www.itu.int/oth/T0B15000016/en>.

2. Mobile Payment Technologies and Services

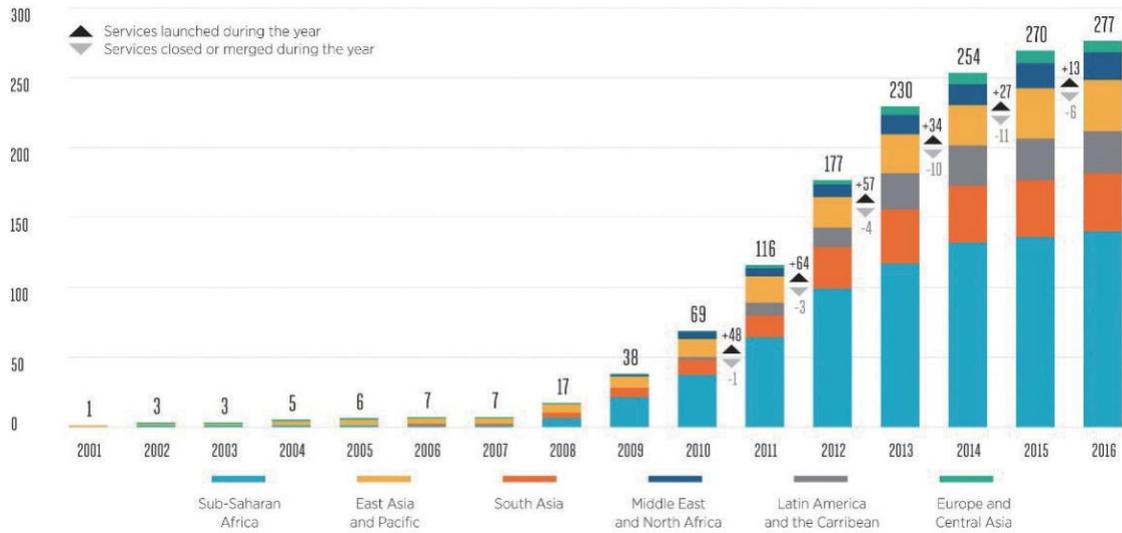
Mobile devices like mobile phones, smartphones or personal digital assistants can be used for making payments and other financial transactions, with the help of wireless and telecommunications technologies.⁷ The different kinds of mobile payments that are possible include: person-to-person, government-to-person, business-to-business and business-to-person/consumer.⁸ The number of mobile payment services that are being launched has increased over the past decade (Figure 1). This has mainly been due to the digitization in the banking sector and the rise of e-commerce. The growing penetration of mobile phones (especially smartphones), along with developments in telecommunications and other technologies have given an impetus to efforts in this direction.

There are various financial and monetary transactions that can be made using a mobile phone, covering scenarios like e-commerce, banking and money transfer (Figure 2). There are multiple stakeholders in the mobile payment ecosystem. Firstly, there are the users or consumers of mobile payment services, which could be individuals, merchants, businesses or governments. Secondly, there are providers of mobile payment services, which include banking and financial institutions, as well as non-banking institutions like mobile operators, mobile money stores and cryptocurrency exchanges. Thirdly, there are those institutions that provide the necessary infrastructure and support services to the providers and consumers. This typically includes the technology providers and regulators (Figure 3).

7 Tomi Dahlberg and others, "Past, present and future of mobile payments research: A literature review", *Electronic Commerce Research and Applications*, vol. 7, no. 2 (Summer 2008), pp. 165-181. Available from dl.acm.org/citation.cfm?id=1377314.

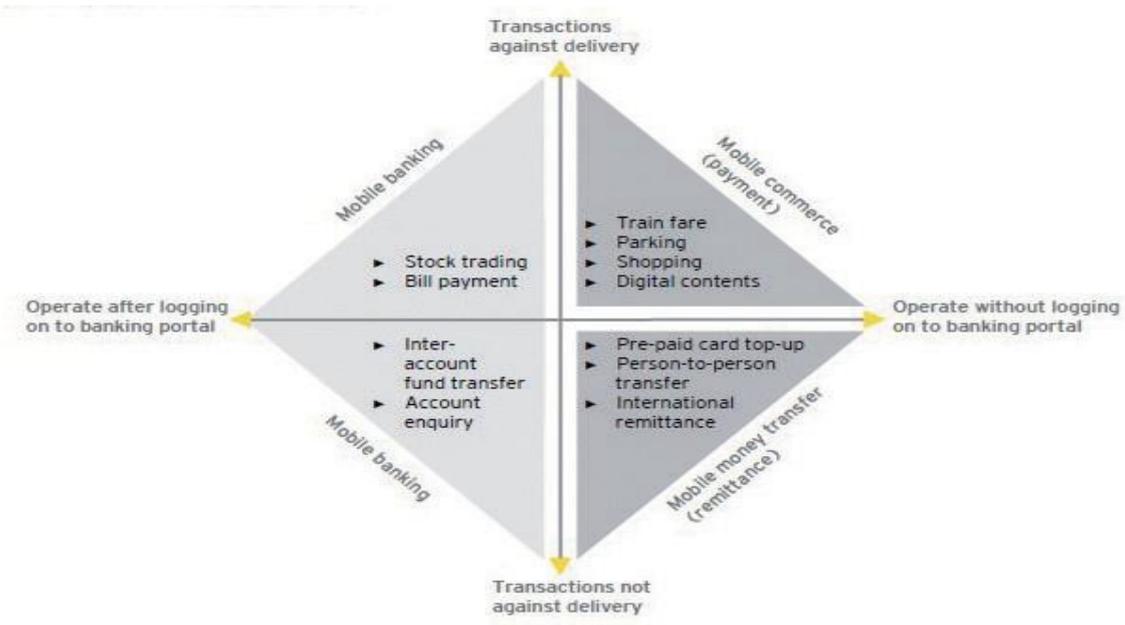
8 Kevin Donovan, "Mobile money for financial inclusion", in *Information and Communications for Development 2012: Maximizing Mobile*, World Bank (Washington, D.C., 2012), pp. 61-73. Available from https://elibrary.worldbank.org/doi/abs/10.1596/9780821389911_ch04.

Figure 1: Number of Live Mobile Payment Services by Region



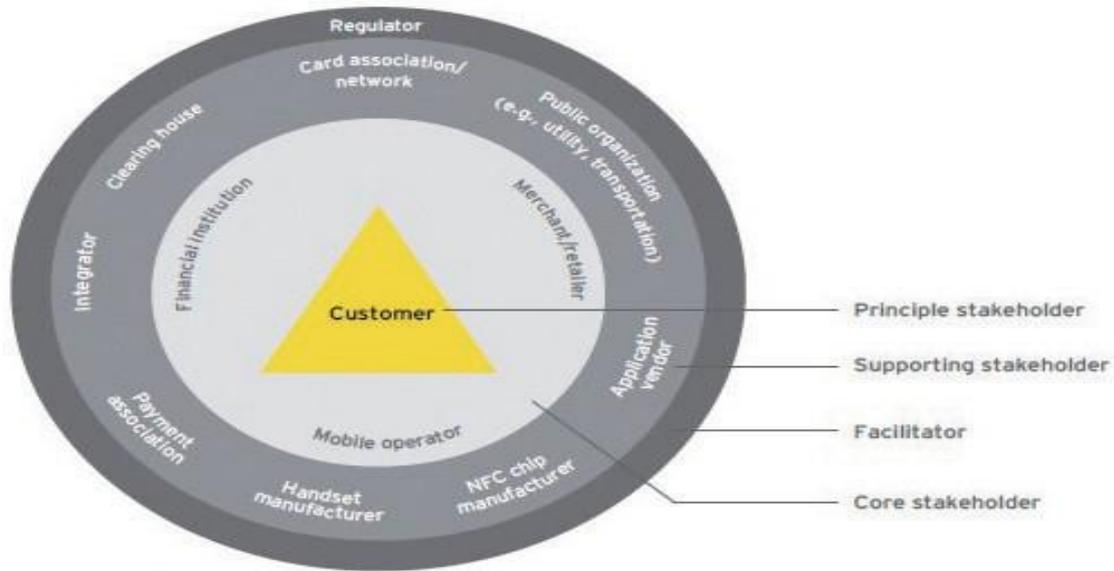
Source: GSMA, "Global Mobile Money Dataset", 2017.

Figure 2: Types of Mobile Payment Services



Source: Ernst & Young, *Mobile Money: An Overview for Global Telecommunications Operators* (2009). Available from [http://www.ey.com/Publication/vwLUAssets/Mobile_Money./%24FILE/Ernst%20%26%20Young%20-%20Mobile%20Money%20-%2015.10.09%20\(single%20view\).pdf](http://www.ey.com/Publication/vwLUAssets/Mobile_Money./%24FILE/Ernst%20%26%20Young%20-%20Mobile%20Money%20-%2015.10.09%20(single%20view).pdf).

Figure 3: Stakeholders in the Mobile Payment Ecosystem



Source: Ernst & Young, *Mobile Money: An Overview for Global Telecommunications Operators* (2009). Available from [http://www.ey.com/Publication/vwLUAssets/Mobile_Money./%24FILE/Ernst%20%26%20Young%20-%20Mobile%20Money%20-%2015.10.09%20\(single%20view\).pdf](http://www.ey.com/Publication/vwLUAssets/Mobile_Money./%24FILE/Ernst%20%26%20Young%20-%20Mobile%20Money%20-%2015.10.09%20(single%20view).pdf).

2.1 Mobile Banking

Mobile phones can be used to perform Internet banking on a website or a mobile application developed by the respective bank. Online services include deposits and withdrawals, bill payments, fund transfers, and viewing of balances and statements.

Case: Unified Payment Interface in India

India’s apex bank—the Reserve Bank of India—has released vision documents for payment systems for the years 2012-2015 and 2018, which state the goal of achieving a "less-cash" India. These documents recognize the growing volume of electronic transactions, especially the usage of mobile banking services and mobile payment applications.⁹ In this context, the National Payments Corporation of India¹⁰ developed the Unified Payments Interface—a system that enables easy and efficient transfer of funds between any two bank accounts (of participating banks) in the country.¹¹ The main features of this system include the following: it is open source, involves easy and secure authentication, integrates with Aadhaar—the national digital identification system, and captures banking credentials on smartphones.

9 Reserve Bank of India, “Payment System Vision Document (2012-15)”, 2012. Available from <https://rbi.org.in>; and Reserve Bank of India, “Vision 2018: Payment and Settlement Systems in India”, 2016. Available from <https://rbi.org.in>.

10 The National Payments Corporation of India was established by the Reserve Bank of India and a conglomeration of Indian banks to supervise retail payments.

11 National Payments Corporation of India, “UPI Product Overview”. Available from <https://www.npci.org.in/product-overview/upi-product-overview>.

2.2 Mobile Money

Although the term “mobile money” has been used to include a gamut of mobile payment systems, it typically refers to, “money stored using the subscriber identity module (SIM) in a mobile phone as an identifier, as opposed to an account number in conventional banking”.¹² As a result, mobile money can be transferred through short message service (SMS). In such a system, an important role is played by intermediaries at stores that sell vouchers for topping up calling balance. They act like banks by taking cash from mobile phone users and storing it in their mobile money account or a digital wallet. This can be sent to another user of the service through a text message. The receiver can convert the mobile money into cash at a similar voucher store. In the case of some mobile money services, the receiver need not be a registered user of the service, and can redeem the money using a code received in the text message.¹³

Case: Mobile Money Transfer Services – M-Pesa and Easypaisa

M-Pesa, where “pesa” is the Swahili word for money, is a mobile-based platform that allows easy transfer of money among mobile phone users without requiring customers to have a bank account. It involves the conversion of cash into digital money on the platform, which can be sent across as a simple SMS to a fellow subscriber, who can convert that to physical cash again. It was launched in Kenya in 2007 by Safaricom (part of Vodafone group), Kenya’s largest mobile network provider. The key users of this payment system are mobile phone users who usually do not have a bank account. The customers are required to register and open an electronic money account with an M-Pesa store, which enables them to convert physical cash to digital money and vice versa. Transfer of money is enabled through a secure, PIN-protected channel from one M-PESA user to another.¹⁴

Telenor Pakistan, in partnership with Tameer Microfinance Bank, established Pakistan’s first mobile-based money transfer platform called Easypaisa in 2009. Similar to M-Pesa, individuals can visit any of the Easypaisa outlets across the country to deposit or withdraw cash from their mobile accounts, make bill payments, and transfer money to other individuals. They need not have a mobile phone or an account with Telenor to use the service. The mobile phone with the merchant at the Easypaisa outlet can be used for the same. In 2013, Easypaisa introduced a mobile savings platform called Khushaal Munafa, which aimed to promote savings among the users and promised to earn them interest of up to 9 per cent.¹⁵

12 United Nations Conference on Trade and Development, *Mobile Money for Business Development in the East African Community* (Geneva, 2012). Available from unctad.org/en/PublicationsLibrary/dt1stict2012d2_en.pdf.

13 The Economist, “The power of mobile money”, 24 September 2009. Available from <http://www.economist.com/node/14505519>.

14 Vodafone, “M-Pesa”. Available from <http://www.vodafone.com/content/index/what/m-pesa.html>.

15 Telenor Group, “Easypaisa – banking services made easy”, May 2013. Available from <https://www.telenor.com/easypaisa-banking-services-made-easy/>.

2.3 Mobile Wallet Applications

Digital wallets are a place to, “store secure information necessary to authenticate a user and initiate an authorization process to make a transaction to purchase goods and services”.¹⁶ This involves linking an individual’s banking, credit card or debit card information to the wallet. In recent years, these wallets are being used for cryptocurrencies. In the same way, mobile wallets are, “transaction accounts managed by mobile devices”.¹⁷ It is a mobile-based application that can be used to store and use cash and other currencies in a digital format. For example, iTunes wallet on an iPhone can be used to pay for mobile commerce transactions through its application. The browser on the mobile devices can also be used for conducting transactions using mobile wallets.

2.4 Contactless Payments

Contactless payments or tap-and-go payments typically involve the use of debit, credit or smart cards. Payments can be made at point-of-sale (PoS) terminals by simply tapping or waving the card on a device. Now, even mobile devices can be used to make such contactless payments.

There are various technologies that enable such transactions to take place. Near-field communication (NFC) technology enables two electronic devices to interact (e.g., read or write information) through the use of short-range wireless technologies. For example, in the case of NFC-based mobile payments, a mobile device with a payment application can communicate with a device at a PoS terminal. The PoS device would read the payment information that is embedded in the mobile device and complete the payment. Apple Pay service uses NFC chips embedded in their latest iPhone devices, whereas Android devices use host card emulation technology that enables the creation of a virtual copy of one’s debit or credit card on the phone to make NFC-based payments.

Even Bluetooth technologies can be used to allow communication between devices and enable payments. Services like Samsung Pay use magnetic secure transmission technology that allows magnetic signals emitted from mobile devices to be read by the traditional swipe-and-pay PoS terminals. This means that the use of the magnet secure transmission technology does not require additional investment on PoS terminals by merchants.¹⁸

16 Gartner, “IT Glossary: Digital Wallet”. Available from <http://www.gartner.com/it-glossary/digital-wallet>.

17 International Telecommunication Union, “ITU-T Focus Group Digital Financial Services: The Digital Financial Services Ecosystem”, May 2016. Available from https://www.itu.int/en/ITU-T/focusgroups/dfs/Documents/09_2016/FINAL%20ENDORSED%20ITU%20DFS%20Introduction%20Ecosystem%2028%20April%202016_formatted%20AM.pdf.

18 Vivina Vishwanathan, “Contactless payment technology”, *LiveMint*, 17 April 2017. Available from <http://www.livemint.com/Money/Bsu06u3AF6KL3PYNPGCWfM/Contactless-payment-technology.html>.

2.5 Cryptocurrency

Digital currency is an umbrella term used for currencies that can be stored and transferred electronically. Some forms of digital currency have a corresponding physical form as they are digital representations of usual currency notes and coins, for example, the money in a mobile wallet or an online bank account. Technologies like blockchain have been used to create virtual currencies (e.g., Bitcoin, Ethereum) that enable peer-to-peer seamless and secure transactions using cryptography.¹⁹ Such cryptocurrencies are not pegged to an underlying asset, but can be used to purchase goods and services as many merchants and retailers are now accepting currencies like bitcoin. There are many companies that are developing mobile cryptocurrency payment platforms. These are either existing platforms/wallets (like Airbitz and Circle) that have been extended to cryptocurrencies, or are like Easbit and Coinbase, which are solely used for cryptocurrencies like bitcoins. In recent times, central banking institutions are also planning to issue their versions of cryptocurrencies.²⁰

Case: Bitcoins and Mobile Payments

Bitcoin is a digital currency that typically functions outside the financial system and uses cryptography to control its creation, administration and security. It was developed in 2009, but rose to prominence in 2013 as the world's first cryptocurrency. It is decentralized, in the sense that there is no central authority regulating its distribution and functioning. To make or receive bitcoin payments, one needs to install a mobile wallet that supports bitcoins. The wallet application generates a new address for which bitcoins can be acquired. The currency can be obtained from bitcoin exchanges directly or through platforms like BitInstant. In order to make a payment, the intended recipient will send his/her bitcoin address to which the payment has to be made (Figure 4). The transfer usually takes seconds, however, the verification process could take around 10 minutes.²¹ Bitcoins are gaining popularity over the past few years. Many payment platforms have begun to support bitcoin payments, including China's major payment platforms Alipay (Alibaba group), Wechat Pay (Tencent group) and Unionpay (People's Bank of China).²²

19 Boston Consulting Group and Google India, *Digital Payments 2020: The Making of a \$500 Billion Ecosystem in India* (2016). Available from http://image-src.bcg.com/BCG_COM/BCG-Google%20Digital%20Payments%202020-July%202016_tcm21-39245.pdf.

20 Bank for International Settlements, "Central bank cryptocurrencies", 17 September 2017. Available from https://www.bis.org/publ/qtrpdf/r_qt1709f.htm.

21 Investopedia, "How Bitcoin Works", *Forbes*, 1 August 2013. Available from <https://www.forbes.com/sites/investopedia/2013/08/01/how-bitcoin-works>.

22 Kevin Helms, "Bitpoint Adds Bitcoin and Ether Payments to Platform with Unionpay, Wechat Pay and Alipay", *Bitcoin.com*, 28 June 2017. Available from <https://news.bitcoin.com/bitpoint-bitcoin-ether-payments-platform-unionpay-wechatpay-alipay/>.

Figure 4: Bitcoin Transaction Window



Source: International Telecommunication Union, "Mobile Money Revolution Part 2: Financial Inclusion Enabler", May 2013. Available from <https://www.itu.int/oth/T0B15000016/en>.

3. Mobile Payments in Asia and the Pacific

Japan and the Republic of Korea are leaders in contactless payment solutions from the Asia-Pacific region with telecom company DoCoMo in Japan and various payment gateway service providers in the Republic of Korea implementing contactless payment systems as early as 2004. Mature markets like Singapore have developed and deployed NFC-based payment systems since 2007. At the same time, significant efforts towards financial inclusion through the use of mobile phones, especially basic phones, are evident in countries like Bangladesh, India and the Philippines that have large unbanked populations.²³

The Asia-Pacific region is expected to lead globally in the mobile payments market due to key drivers like increasing number of smartphones, supportive regulations, growth in e-commerce and remittances.²⁴

Case: Smart Money and GCASH Services, Philippines

The Philippines has a low banking penetration rate of around 30 per cent and high mobile phone penetration rate of around 72 per cent unique subscribers.²⁵ These factors along with the large number of non-bank institutions and the country's large remittances market have made the Philippines one of the leading mobile money markets in the world. In 2001, Smart Communications launched Smart Money, which enabled users to buy airtime and make domestic and international money transfers via mobile. Smart Communications became the first to deploy a one-way person-to-person remittance. In 2004, Globe Telecom launched an SMS-based mobile money transfer service called GCASH, in which users can create an account or a mobile wallet to send or receive money. The service can be accessed through SMS syntax or menus generated from the SIM toolkit integrated in users' SIM. Studies have shown a clear preference among users towards the use of SMS.²⁶ GCASH service has also been used to make bulk payments like government-to-person transfers. The Philippines' Department of Social Work and the United Nations World Food Programme have used the service for cash disbursement. They credited the GCASH accounts of the beneficiaries, which could then be withdrawn or used for making

23 Ernst & Young, *Mobile Money: An Overview for Global Telecommunications Operators* (2009). Available from [http://www.ey.com/Publication/vwLUAssets/Mobile_Money./%24FILE/Ernst%20%26%20Young%20-%20Mobile%20Money%20-%2015.10.09%20\(single%20view\).pdf](http://www.ey.com/Publication/vwLUAssets/Mobile_Money./%24FILE/Ernst%20%26%20Young%20-%20Mobile%20Money%20-%2015.10.09%20(single%20view).pdf).

24 Frost & Sullivan, *Asia-Pacific Mobile Payments: Spearheading Cashless Societies* (2016). Available from <http://www.frost.com/p903>.

25 Sophia Hasnain, Abigail Komu and Christopher Blackburn, "Mobile money in the Philippines: Market conditions drive innovation with Smart Money and GCash", *GSMA*, 23 June 2016. Available from <https://www.gsma.com/mobilefordevelopment/programme/mobile-money/mobile-money-philippines-market-conditions-drive-innovation-smart-money-gcash-philippines-becoming-mobile-money-innovation-hub>.

26 GSMA, "Mobile Money in the Philippines – The Market, the Models and Regulation", 2012. Available from <https://www.gsma.com/mobilefordevelopment/wp-content/uploads/2012/06/Philippines-Case-Study-v-X21-21.pdf>.

payments within the GCASH ecosystem.²⁷ Both Smart Communications and Globe Telecom have entered into partnerships with Western Union and other remittance providers to tap the international remittances market.

Case: Osaifu-Keitai Wallet Phone, Japan

Japan's NTT DoCoMo launched the Osaifu-Keitai (translated as mobile wallet) in 2004 and it grew to prominence as Japan's most frequently used payment technology. Osaifu-Keitai is basically a mobile phone embedded with a wireless smart card chip developed by Sony, called FeliCa. The mobile FeliCa payment technology is used for short-range contactless payments. FeliCa uses radio frequency identification (RFID), which enables the wallet phones to interact with other RFID-enabled devices (like vending machines and PoS terminals with FeliCa readers) to enable payments.²⁸ By combining existing smart card models with the mobile wallet, DoCoMo has expanded its services to scenarios like e-purchases and commuter pass at railway gates (provided by Suica smart card). DoCoMo and Sony jointly developed these FeliCa circuits/chips and provided them to rivals like Vodafone and KDDI, who in turn have launched their versions of mobile wallets.²⁹

27 eServ Global, "Bulk Payments", White Paper, 2015. Available from <https://www.eservglobal.com/wordpress/wp-content/uploads/2015/03/Bulk-Payments-White-Paper.pdf>.

28 Vodafone, "Tokyo drift: How Japan leads the way on m-payments". Available from <http://www.vodafone.com/business/global-enterprise/tokyo-drift-how-japan-leads-the-way-on-m-payments-2013-08-13>.

29 John Boyd, "Here comes the wallet phone", *IEEE Spectrum*, 1 November 2005. Available from <https://spectrum.ieee.org/consumer-electronics/portable-devices/here-comes-the-wallet-phone>.

4. Some Concerns and Challenges

The mobile financial services market is largely fragmented in nature as most companies/banks have their own wallet application or payment platform. It is a complex environment with rising number of innovations in mobile payments. In such a scenario, standardization and interoperability are some of the main concerns that need to be addressed.

The prominence of cash-based transactions in rural areas and in developing economies is both a challenge and an opportunity for mobile payment systems. The rural-urban divide plays a role in how technology is used by individuals. This implies that financial institutions and the non-financial stakeholders in the system need to put efforts towards devising relevant alternatives for the rural context.

While smartphone penetration and broadband connectivity is increasing across the globe, there are many regions, especially the developing economies, which fare quite poorly in these indicators. The development of required infrastructure, along with adoption of necessary technologies, is very essential for the uptake of mobile payment technologies.

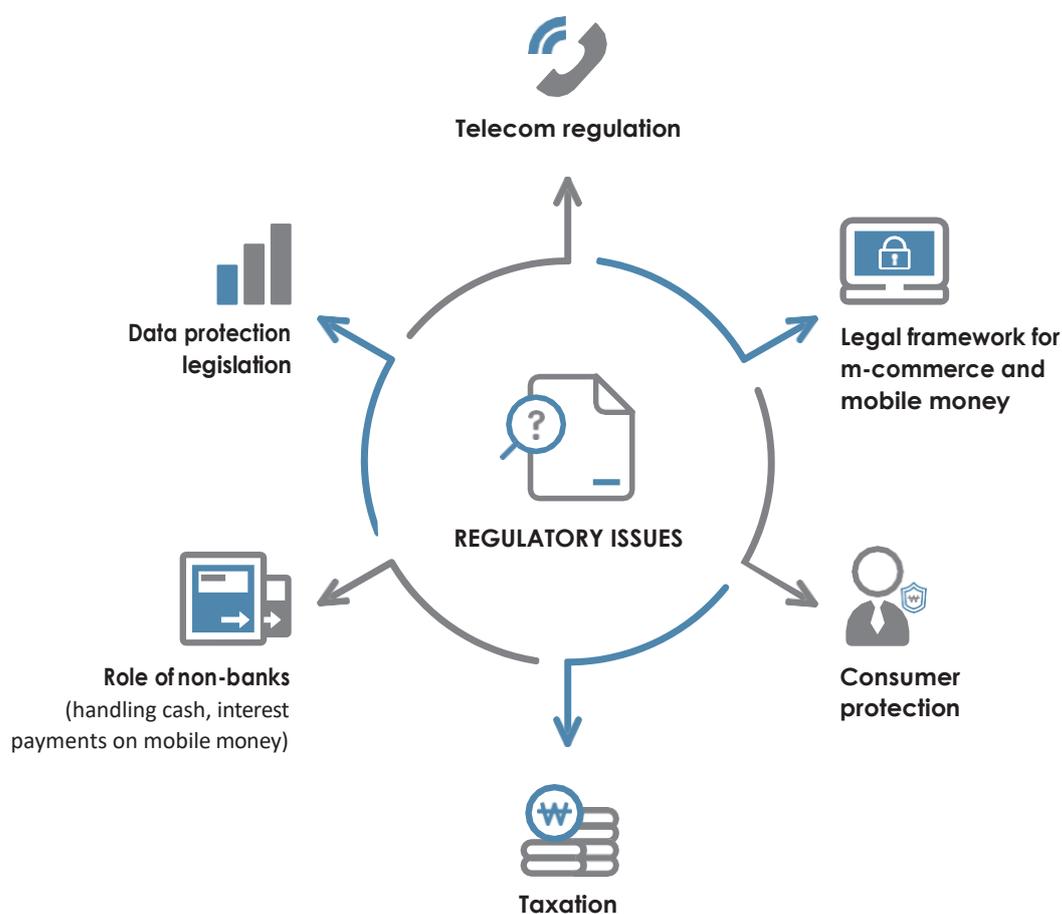
While mobile payment services are expected to provide cost benefits to the providers, decreasing costs are possible over time if the number of users and transactions increases. Moreover, certain technologies like NFC-based payments require huge investments, which are justified if they attract enough customers to be profitable.

Security and privacy are other issues to be considered while designing these payment systems. Confidentiality should be ensured for those involved in a transaction. The payment system should not be susceptible to modifications by outside parties. Without proper authentication and authorization mechanisms, mobile payment systems could be prone to denial-of-service attacks and other malicious software or code that could bring down the system. End-to-end encryption and authentication using PIN and Secure Sockets Layer are some ways of making the system secure.

5. Policies, Regulations and Global Initiatives for Mobile Payment Technologies

The mobile payment ecosystem lies at the intersection of banking and finance, telecommunications and information technology industries. The key regulatory bodies are the central banks and the telecommunications regulatory authorities. Some of the measures that need to be taken involve setting up a common payment infrastructure and establishing a framework for addressing grievances.³⁰

Figure 5: Regulatory Issues



Source: International Telecommunication Union, "Mobile Money Revolution Part 2: Financial Inclusion Enabler", May 2013. Available from <https://www.itu.int/oth/T0B15000016/en>.

30 Boston Consulting Group and Google India, *Digital Payments 2020: The Making of a \$500 Billion Ecosystem in India* (2016). Available from http://image-src.bcg.com/BCG_COM/BCG-Google%20Digital%20Payments%202020-July%202016_tcm21-39245.pdf.

Case: Regulatory Framework in the Philippines

With the goal to achieve financial inclusion, the central bank of the Philippines, Bangko Sentral ng Pilipinas, has created an enabling environment and level playing field for both non-banking and banking institutions to offer mobile money services. In 2009, Bangko Sentral ng Pilipinas released Circular 649, a set of guidelines on issuing e-money in the country. The non-bank entities are given licenses as e-money issuers, enabling them to perform cash in/out operations. In effect, the Philippines has used the test-and-learn approach to regulation, wherein the mobile money operators are given a no-objection certificate to test their mobile payment model. The test period helps the operators understand how the market is responding to the system. It is this approach that has played an important role in the success of Smart Money and GCASH services, discussed above.³¹

The Basel Committee on Banking Supervision of the Bank for International Settlements released Risk Management Principles for Electronic Banking in 2003 as a set of guidelines for banks across the globe. The intention was to raise awareness of the changes in risks and benefits that arise with the rapid innovations in financial technologies, and their subsequent effects on the payment systems.³²

The Telecommunication Standardization Sector of the International Telecommunication Union formed a focus group on digital financial services in 2014, and has released technical reports on issues like policy and regulation, interoperability, consumer protection, security, service quality and digital identity.³³ One report on the digital financial ecosystem looked at the products and services, as well as the stakeholders in the ecosystem. It also detailed the infrastructures, policies, laws and regulations that make up the system and enable accessible and efficient service delivery.³⁴ Their next report studied the digital payments value chain and explored various business models and structures that could improve merchant acceptance of digital payments.³⁵ Another study pointed out the increasing number of national biometric identity programmes and their role in providing digital financial services.³⁶ The quality of services provided in the digital financial ecosystem was the focus

31 GSMA, "Mobile Money in the Philippines – The Market, the Models and Regulation", 2012. Available from <https://www.gsma.com/mobilefordevelopment/wp-content/uploads/2012/06/Philippines-Case-Study-v-X21-21.pdf>.

32 Basel Committee on Banking Supervision of the Bank for International Settlements, "Risk Management Principles for Electronic Banking", 2003. Available from <https://www.bis.org/publ/bcbs98.pdf>.

33 International Telecommunication Union, "Digital Financial Inclusion", Issue Brief Series, Inter-agency Task Force on Financing for Development, July 2016. Available from http://www.un.org/esa/ffd/wp-content/uploads/2016/01/Digital-Financial-Inclusion_ITU_IATF-Issue-Brief.pdf.

34 International Telecommunication Union, "ITU-T Focus Group Digital Financial Services: The Digital Financial Services Ecosystem", May 2016. Available from https://www.itu.int/en/ITU-T/focusgroups/dfs/Documents/09_2016/FINAL%20ENDORSED%20ITU%20DFS%20Introduction%20Ecosystem%2028%20April%202016_formatted%20AM.pdf.

35 International Telecommunication Union, "ITU-T Focus Group Digital Financial Services: Enabling Merchant Payments Acceptance in the Digital Financial Ecosystems", May 2016. Available from https://www.itu.int/en/ITU-T/focusgroups/dfs/Documents/09_2016/FINAL%20ENDORSED%20Enabling%20Merchant%20Payments%20Acceptance%2030%20May%202016_formatted%20AM.pdf.

36 International Telecommunication Union, "ITU-T Focus Group Digital Financial Services: Review of National Identity Program", May 2016. Available from https://www.itu.int/en/ITU-T/focusgroups/dfs/Documents/09_2016/Review%20of%20National%20Identity%20Programs.pdf.

of their next report, which detailed some performance indicators for the purpose of evaluation.³⁷ In 2017, another focus group was created to discuss emerging questions about digital currency, especially digital fiat currency, like economic benefits, impact, interoperability, policy and regulation, and security and trust.³⁸ The International Telecommunication Union also released a two-part Technology Watch report on mobile money in 2013 that focuses on NFC mobile payments and the financial inclusion aspect of such payments.³⁹

The United Nations Capital Development Fund supports a global programme called Mobile Money for the Poor that aims to take the benefits of mobile money technologies to the poor. Its programme targets low-income and rural households in Benin, Lao People's Democratic Republic, Liberia, Malawi, Nepal, Senegal, Uganda and Zambia.⁴⁰

The International Finance Corporation of the World Bank Group has prepared mobile money scoping reports for a few countries in Asia and Africa. The reports assess the financial and telecom sectors and the policy and regulatory framework in place, and evaluate existing mobile financial services in order to identify opportunities for support.⁴¹

The rate at which innovations in these industries keeps changing makes the formulation of policies, laws and regulations a complex task. Governments, banking and financial institutions, mobile and telecom companies, regulatory bodies, and other stakeholders need to work together to ensure efficient functioning of the payment system.

37 International Telecommunication Union, "ITU-T Focus Group Digital Financial Services: QoS and QoE Aspects of Digital Financial Services", May 2016. Available from https://www.itu.int/en/ITU-T/focusgroups/dfs/Documents/09_2016/FGDFSQoSReport.pdf.

38 International Telecommunication Union, "Focus Group on Digital Currency including Digital Fiat Currency". Available from <http://www.itu.int/en/ITU-T/focusgroups/dfc/Pages/default.aspx>.

39 International Telecommunication Union, "Technology Watch: Mobile Money". Available from <http://www.itu.int/en/ITU-T/techwatch/Pages/mobile-money-standards.aspx>.

40 United Nations Capital Development Fund, "Mobile Money for the Poor". Available from <http://mm4p.uncdf.org/>.

41 International Finance Corporation, "IFC Mobile Money Scoping Reports". Available from http://www.ifc.org/wps/wcm/connect/industry_ext_content/ifc_external_corporate_site/financial+institutions/resources/ifc+mobile+money+scoping+reports.

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