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# DIGITAL PAYMENTS IN THE UAE: CURRENT LANDSCAPE, LESSONS LEARNED AND OPPORTUNITES FOR FUTURE GROWTH USING BLOCKCHAIN

*FULL PAPER*

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# 1 Foreword

*The ADGM Academy Research Centre commissioned a team of university student researchers to explore the emergence and importance of digital payments in the UAE economy. Jayaprada and Muna from Abu Dhabi University and Salwa from the Abu Dhabi School of Management undertook this research as they embarked on their own exploration to understand digital payments. In this paper they provide an overview of the global landscape of digital payments as well as the UAEs journey of digital transformation. They explore both the opportunities and challenges that a digital environment presents and define the optimal infrastructure necessary to support digital payments. They take a close look at the role of blockchain and conclude with a six-step process for introducing a digital payments system into an economy.*

*We thank Andrew McCollum, Senior Manager, Banking & Insurance Authorisation, ADGM Financial Services Regulatory Authority, for his support and guidance of the students throughout this project.*

*We thank Jayaprada, Muna and Salwa for their tireless efforts and are proud to publish this research paper on their behalf.*

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Professor Charilaos Mertzanis is a professor of finance in Abu Dhabi University. His current research interests include the role of institutions in corporate decision-making across countries and the effect of crises episodes on global financial transactions. Dr. Charilaos Mertzanis, you have been an excellent guide, and we want to convey our gratitude for all you've done in helping us to accomplish this white paper, despite your own busy schedule.

We would like to thank ADGM Academy for giving us this opportunity to research and write this paper. Nothing would have been possible without the handholding of Jassim Yehya Mohamed AlMarzooqi, Associate Director, Business Enablement of the Academy, who has been an immense support during our journey at the academy.

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# 2 Introduction

## 2.1 Purpose of the white paper

The purpose of the paper is to present a brief overview of the emergence and importance of digital payments for the UAE economy's competitiveness and growth, outline the technological developments that underlie the emergence and growth of digital payments, present the key requirements for the success of the digital payment systems, and outline the inherent risks as well as potential ways for mitigating these risks. Finally, the paper presents successful case studies of implementing digital payment systems.

There is no commonly accepted definition of digital payments. A payment can be fully or partially digital. For example, a partially digital payment is one in which both payer and payee conclude a transaction with cash via third party agents, based on digital interbank transfers. A primarily digital payment might be one in which the payer initiates the payment of the transaction digitally to an agent who receives it digitally and subsequently transmits the cash to the payee digitally too.

The characterization of digital payments must therefore be qualified. It could emphasize the payer-payee interface as the core element, or the payment instrument, or some other element. These characterizations are particularly relevant when the policy goal is to estimate the number or share of digital payments in a specific set of conditions. The characterization of digital payments determines their measurement.

The adoption of digital payments offers clear benefits to people, corporates, governments, and international development organizations. Some of the benefits can be summarised as:

- Cost savings, through greater speed and efficiency of transactions. Like everyone else, SMEs too save a lot of time and money when they use digital payment options since they incur lower business costs;
- Transparency and security through the enhancement of traceability and accountability of transactions, thereby reducing financial crime;
- Increased financial inclusion through greater access to a variety of financial products and services; and
- Enhance inclusive economic growth and reduce poverty.

Cumulatively, the benefits help to open financial opportunity for the economically disadvantaged and permit a more effective flow of resources within the economy. There has been an exponential rise in the consumption of digital payments. Maintaining these solutions must be a top primary focus for organizations working to make financial services accessible to everyone. In the bid for digital payments to be more accessible, regulators should take cues from those who are at the forefront of advancing new technologies.

For these reasons this paper provides an anatomy of the digital payments landscape and identifies key implementation consideration and policy directions for implementing an efficient digital payments system.

## 2.2 Structure of the paper

The paper is organized in a way that identifies the key issues and dimensions of the digital payments system and highlights possible opportunities.

First, we analyse the importance of the digital payments system including the landscape of digital payment services. Next, we look at global trends and the UAE's digital transformation. We explore the challenges facing the digital payments sector. Next, we look at technological developments and their impact on the growth of the payment system. Continuing with technology we explore the benefits new technologies including blockchain. Finally, we offer conclusions and outlines the way forward for deciding on and implementing a successful digital payments system.

# 3 Background: The Importance of Digital Payments

## 3.1 The landscape of digital payment services

Financial technology and digital payment services have prompted policymakers globally to consider their financial stability benefits and risks. Payments, clearing and settlement are activities where material payment service developments have rapidly evolved. This includes retail and wholesale, large-value, and cross-border payments. So far changes in the retail payment space are among the most visible. The key drivers include the promotion of cashless transactions, competition, financial inclusion, financial integration, and innovation to addressing banking relationships (IMF, 2017). While there are some financial stability risks, given the small size of digital payment services relative to the financial system as a whole, growth in such activities and the supervisory and regulatory issues have attracted policy attention (IMF, 2019; FSB, 2019).

Authorities regulate payments systems and service providers to maintain the integrity of the monetary system, safeguard financial stability by ensuring final settlement of monetary transfers, and protect financial consumers with respect to non-currency money (e.g. commercial bank book money and e-money) that entail credit risks. The impact of digital payment services on financial system growth and stability may be affected by the market entrance of large technology (e.g. BigTech) firms into payment services.

As the market structure evolves, advances in digital payment services indicate that regulatory frameworks and their legal foundations must shift from entity-based to activity-based regulation. Financial regulation has traditionally been based on the regulation of types of entities or intermediaries performing broad functions, such as payments systems (He et al., 2017). Licensing regimes will need to be redesigned to bring new types of service providers within the regulatory perimeter, where appropriate, including digital payment services and BigTech (BIS, 2019; FSB, 2019; Frost et al., 2019; Restoy, 2019).

Some countries like Singapore and Canada have modernized their legal and regulatory framework for payment services, using an activity-based and risk-focused approach. Modernization efforts have aimed at fostering efficiency, innovation, safety, and competition. New business models for payment services have blurred the lines of payment-related products that may, for example, require licensing as an e-money issuer and a e-money remittance business, leading to overlapping regulation. New business models have also highlighted gaps in regulation if the product is licensed as one but not the other. In modernizing the regulatory oversight framework there is a need to amend the scope of regulated activities and align relevant regulations to facilitate new business models and payment entities. At the same time, these new business models present new risks, which may not be adequately addressed, under current regulatory regimes.

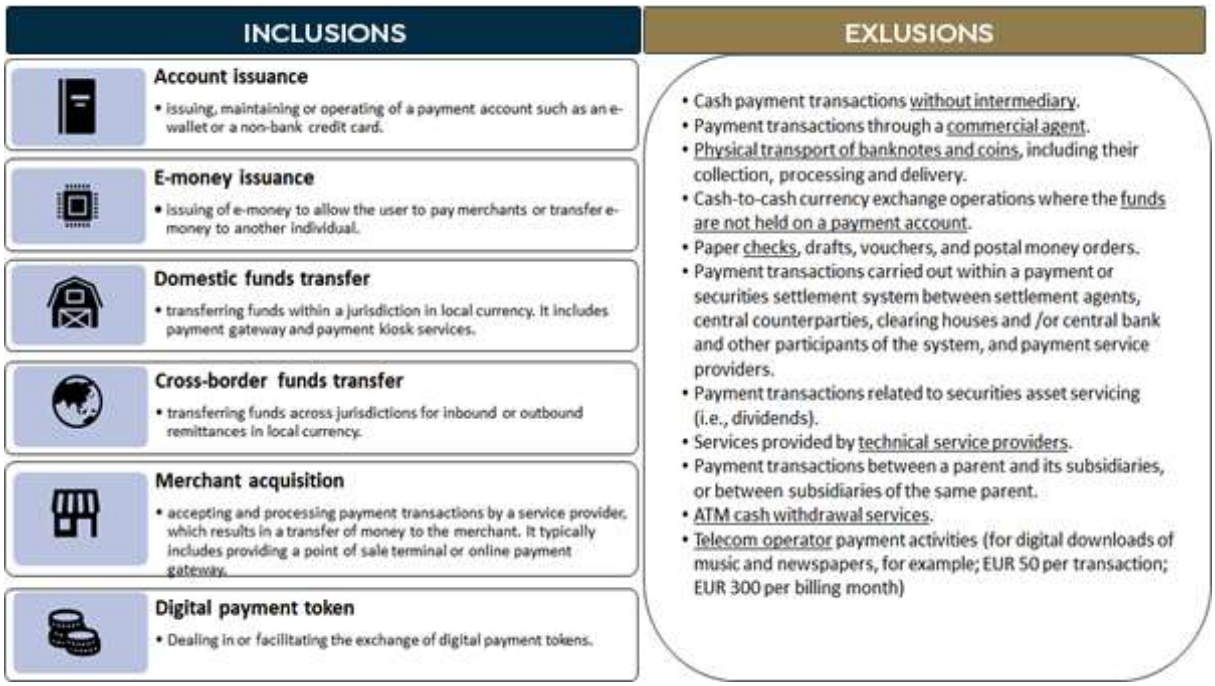
## 3.2 Digital Payments – A Global View

The first step of the framework is to identify if an economic activity undertaken by the entity is a payment service. The proper identification of payment activities helps to design effective oversight and supervisory frameworks, while avoiding unnecessary overlaps and/or duplication of regulatory efforts. International best practices suggest that such activities could be organized into six groups (Figure 1):

- account issuance
- electronic money issuance
- domestic funds transfer
- cross-border funds transfer
- merchant acquisition
- digital payment tokens

These primarily relate to services delivered to payment-service users rather than the payments systems themselves.

*Figure 1. Taxonomy of Payment Services (EU Payment Services Directive 2; Singapore Payment Services Act)*




The list of payment activities in Figure 1 could differ by country. Some countries have introduced regulatory sandboxes, whereby new payments services and new providers (e.g. FinTechs) can be tested within a more relaxed regulatory environment. Other forms of payment services include third party initiation, tokenization, payment gateways, payment aggregators, and white label ATM / POS providers, which are also not considered core payment activities.

Explicit payment service legislation helps clarify the activities involved. For instance, the EU Payment Services Directive 2 (PSD2/2015, Article 4) defines payment services as any commercial activity related with eight specified types of activities listed in the annex-I of the Directive. Specifically, the EU PSD2 (Annex 1) classifies payment services as follows: (1) services allowing cash to be positioned on a payment account along with all operations necessary to operate a payment account; (2) services empowering cash debits from a payment account and all operations needed to run a payment account; (3) doing payment transactions, with transfers of funds on an account with the user's PSP or with another PSP; (4) execution of financial transactions where the funds are secured by a payment service user's credit limit; (5) payment instrument issuance and/or payment transaction acquisition; (6) transfer of funds, payment initiation; (7) and account data services. In addition, Singapore's Payment Services Act classifies payment activities into seven categories for licensing purposes (PS Act 2019, Part 2, Section 6; Part 1 of the First Schedule). These include (1) the account issuing service; (2) the local money transfer system; (3) the international money transfer service; (4) the merchant acquiring service; (5) electronic money issuance; (6) digital payment token facility; and (7) the money-changing service.

Certain payment operations may be exempt from payment service legislation. The EU PSD2 (Article 3) exempts 15 categories of payment activities, including cash, paper-based payment vehicles (cheques, drafts, money orders), and cash withdrawal services from ATMs. The Singapore PS Act (Part 2, Section 13) excludes certain persons and businesses from the necessity to get a license to engage in the trade of providing any payment service, and expressly outlines actions that do not qualify as payment services. The valuation of some payment services may differ from country to country. For instance, the prevalence and utilisation of mobile payments may be greater in some nations than in others.

In addition, Big Tech corporations manage payment services for e-commerce (Table 1). Some provide payment services as separate businesses. Their business strategies use strong data analytics, network effects, and intertwined operations, in addition to separate payment processing and settlement platforms. These include: (1) an overlay system (utilising third-party facilities such as credit card payments systems); and/or (2) a proprietary system (utilising the company's infrastructures) (BIS, 2019). Among the most frequent business uses are digital wallets, internet banking, and local and international money transfers.

*Table 1. Payment services provided by selected Big Techs (IMF) - Note: Other examples include Africa (M-Pesa) and the Nordic countries (Swish, Vipps, MobilePay). Availability varies by country.*

| Payment Service | Approximate Offerings | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Google Pay | Amazon Pay | Facebook Pay | Line Pay | Apple Pay | Baidu Wallet | Alipay | Tencent We Chat Pay |
| Account issuance | Y | Y | Y | Y | Y | Y | Y | Y |
| E-money issuance | N | N | N | Y | Y | Y | Y | Y |
| Domestic funds transfer | N | Y | Y | Y | Y | Y | Y | Y |
| Cross-border funds transfer | N | N | N | N | N | Y | Y | Y |
| Merchant acquisition | N | Y | N | Y | Y | Y | Y | Y |
| Digital payment token | N | N | N | N | N | N | N | N |

## 3.3 Digital payment structures and underlying technology

In both open and closed loop open payment systems[1], merchants are required to acquire specific hardware to facilitate digital payments (e.g. for in-person retail transactions):

- Point of Sale (PoS) equipment, a mobile payment option, or a wireless credit card reader supported by a payment handler or merchant service vendor to verify, handle, and settle the transaction.
- To secure payments and to protect consumer data information, payment security services are necessary such as CardSecure that ensures encryption of data during and after transactions and ensures data management is malware resistant.

For online transactions the following structures and technology are typically required:

- Consumer requires a credit or debit card, or increasingly, an e-wallet. The latter is a digital wallet that is the online version of cash or physical wallet. Bank information and card details are securely stored in this system and can be utilized for online purchases as well as user authentication. Some commonly used e-wallets are PayPal, Apple Pay, Android Pay, and Samsung Pay.
- A payment gateway is the online equivalent of a PoS machine. It acts as the bridge between online merchants' website and the card acquirer or bank.
- A payment processor provides all payment processing services and functions as a middleman between the online store and the card acquirer or bank. It can also act as a payment gateway or payment intermediary. When acting as intermediary it provides a full payment service from technical payment process through to payment collection.
- Payment intermediaries such as Visa and Master Card are payment processing networks. Although credit and debit cards carry their network logos, these companies do not issue cards directly. They are typically issued by banks or financial institutions that partner with them and allow them to process digital transactions to a cardholder's account.

[1] Open loop cards can be used anywhere. Credit, debit, gift, and prepaid cards can be open loop. Open loop card partnership structures can vary. Closed loop cards can only be used at one business or seller, like a retail store.

# 4 Global Trends and the UAE's Digital Transformation

The global market for digital payments has made significant strides. The latter is dominated by consumer payments and consists of online payments for goods and services, mobile payments conducted at the point of sale (PoS) through smartphone applications, and online cross-border money transfers (digital remittances). Table 2 lists digital payment transactions, such as online and mobile POS payments processed using smart devices at a point of sale, consumer commerce e-transactions (such as credit cards), online international payments and remittances, and money transfers handled entirely by online players (e.g., Wise). It excludes payments made between companies (business-to-business transactions) and payments made at the point of sale using mobile card readers (terminals).

Globally the digital payments market had a transaction value of USD $5.4 trillion in 2021. China was the biggest market with a transaction value of USD $2.9 trillion, followed by the USA with USD $1.5 trillion and the UK with USD $352 billion). In the MENA region in 2021 Saudi Arabia was the largest market (USD $24.9 billion), followed by the UAE (USD $18.1 billion). These trends have continued for the most part during the pandemic and are expected to continue in the next few years.

*Table 2. Value of digital payments, realized and projected, in selected countries (USD bn) - Digital payments report, 2021. Statista. Notes. * Indicates estimated values.*

| Country | 2017 | 2018 | 2019 | 2020 | 2021 | 2022* | 2023* | 2024* | 2025* | 2026* |
|---|---|---|---|---|---|---|---|---|---|---|
| **Panel A. MENA** | | | | | | | | | | |
| Algeria | 1.326 | 1.744 | 2.413 | 2.844 | 3.666 | 4.272 | 4.847 | 5.332 | 5.788 | 6.292 |
| Bahrain | 0.861 | 0.942 | 1.048 | 1.253 | 1.463 | 1.727 | 1.938 | 2.167 | 2.401 | 2.596 |
| Egypt | 4.311 | 4.574 | 5.948 | 8.064 | 11.64 | 14.07 | 16.14 | 18.09 | 20.1 | 22.45 |
| Iran | 5.326 | 6.929 | 8.826 | 11.93 | 17.81 | 21.54 | 26.38 | 32.95 | 41.17 | 51.7 |
| Iraq | 2.181 | 3.173 | 4.23 | 5.209 | 6.348 | 7.643 | 9.119 | 10.65 | 12.32 | 14.17 |
| Israel | 5.266 | 6.275 | 7.713 | 9.451 | 14.64 | 19.4 | 24.77 | 31.04 | 37.68 | 43.77 |
| Jordan | 1.332 | 1.854 | 2.518 | 3.887 | 5.117 | 6.238 | 7.377 | 8.524 | 9.753 | 11.12 |
| Kuwait | 3.262 | 3.909 | 4.761 | 6.129 | 8.024 | 10.08 | 12.43 | 14.81 | 17.42 | 20.28 |
| Lebanon | 1.894 | 2.079 | 2.3 | 2.785 | 3.463 | 4.203 | 4.858 | 5.538 | 6.238 | 6.982 |
| Morocco | 2.102 | 2.5 | 2.832 | 2.965 | 3.93 | 4.874 | 5.814 | 6.771 | 7.743 | 8.744 |
| Oman | 1.512 | 1.871 | 2.444 | 3.698 | 5.124 | 6.514 | 7.932 | 9.445 | 11.07 | 12.85 |
| Qatar | 2.746 | 3.113 | 3.424 | 3.79 | 4.534 | 5.457 | 6.425 | 7.334 | 8.294 | 9.285 |
| Saudi Arabia | 8.898 | 12.12 | 15.85 | 19.76 | 24.98 | 30.66 | 36.28 | 42.06 | 48.04 | 54.46 |
| UAE | 7.269 | 8.858 | 10.65 | 13.71 | 18.12 | 20.15 | 22 | 23.95 | 26.05 | 28.41 |
| **Panel B. Other Countries** | | | | | | | | | | |
| Singapore | 4.038 | 5.196 | 6.748 | 8.614 | 13.43 | 17.18 | 21.68 | 26.7 | 32.3 | 38.37 |
| Malaysia | 4.843 | 6.704 | 8.424 | 9.664 | 14.38 | 18.22 | 22.34 | 27.04 | 32.2 | 37.9 |
| India | 42.16 | 51.3 | 66.79 | 88.52 | 116.9 | 137.4 | 158.8 | 181.1 | 205.7 | 233.7 |
| Indonesia | 13.63 | 19.26 | 28.5 | 40.01 | 62.92 | 71.41 | 80.15 | 89.71 | 100.5 | 113 |
| China | 1360 | 1754 | 1989 | 2568 | 2997 | 3318 | 3645 | 3952 | 4292 | 4666 |
| UK | 172.9 | 198.2 | 214 | 269.3 | 352.5 | 436.4 | 514.2 | 596.2 | 685.6 | 782.1 |
| USA | 740.1 | 867.5 | 1019 | 1252 | 1527 | 1801 | 2090 | 2417 | 2787 | 3200 |

## 4.1 China

China's success in the digital payment revolution can be attributed to its investment in physical infrastructure through its Digital Silk Road (DSR) program as part of its Belt and Road Initiative (BRI). Through DSR / BRI the country offers other nations with aid, political support, and resources to help in the development of telecommunications networks, AI (artificial intelligence), cloud computing, e-commerce, mobile payment systems, surveillance technology and smart cities. This will boost China's

economy by supporting its technology exporters. China's initiative to foster cooperation as well as technology knowledge transfer both benefits the country and its counterpart nations[2].

The extent of DSR reached 137 countries, 16 of which have already signed a memorandum of agreement, allowing Chinese technology in the recipient nation's marketplace, and entering the education sector by launching research together[3].

Additionally, China is working to revolutionize digital payments first within the Asia Pacific region, where increased adoption of smartphones is possible, and more than two-thirds of the population are unbanked. Digital payments adoption can connect people to new online products and services, promote greater financial inclusion, and provide small and medium-sized enterprises (SMEs) greater access to both domestic and global markets.[4]

China's two companies in the forefront of the digital commerce revolution, Alibaba and Tencent, have created significant market share and influence in the Southeast Asian digital economy. The companies' success is attributed to their technology advancement initiative in digital payments since 2011 when they launched their own mobile phone app while telecommunication companies began developing online payment systems and eventually introduced easy-to-use, low-cost, real-time, mobile payment applications to 550 million customers (retail and corporate). This resulted in market dominance of Alibaba and Tencent with a focus on creating edge sales rather than digital payment transaction fee profits. As a result, diversity in digital market solutions expanded to more product and service offerings including financial services and bill payment services. Over 1 million restaurants, 40,000 supermarkets and convenience stores, 1 million taxis, and 300 hospitals are connected to the Alipay app[5].

## 4.2 USA

In America the digital economy accounted for 6.9% of GDP in 2017. The digital economy grew 4.3 times faster than the overall economy from 1997-2017[6]. McKinsey's 2021 Digital Payments Consumer Survey[7] saw the continuation of several behavioural trends from previous years. Digital payments have become popular among the population, especially among millennials whose smartphones or tablets are the most essential shopping tool. The country's technological advancement and improved digital payment experience resulted in an increased consumer comfort with online shopping.

Digital payment solutions, software and services have made significant impact on the economy as well. Google has introduced the UPI model of digital payments for the US Federal Reserve. San Francisco-based AppsFlyer, a software-as-a-service (SaaS) mobile analytics and attribution platform, saw a 22% increase in in-app purchases in March 2020. Apple introduced Tap to Pay on iPhone with no additional hardware or payment terminal[8].

[2] https://www.cfr.org/china-digital-silk-road/
[3] https://www.defenseone.com/technology/2021/02/how-chinas-digital-silk-road-leading-countries-away-united-states/172219/
[4] https://chinafocus.ucsd.edu/2020/07/16/chinas-digital-silk-road-progress-influence-in-southeast-asia/
[5]https://chinafocus.ucsd.edu/2020/07/16/chinas-digital-silk-road-progress-influence-in-southeast-asia/
[6] https://www.interanetworks.com/blog/digital-economy-of-usa/
[7]https://www.mckinsey.com/industries/financial-services/our-insights/banking-matters/new-trends-in-us-consumer-digital-payments
[8] https://mordorintelligence.com/industry-reports/digital-payments-market

## 4.3 MENA

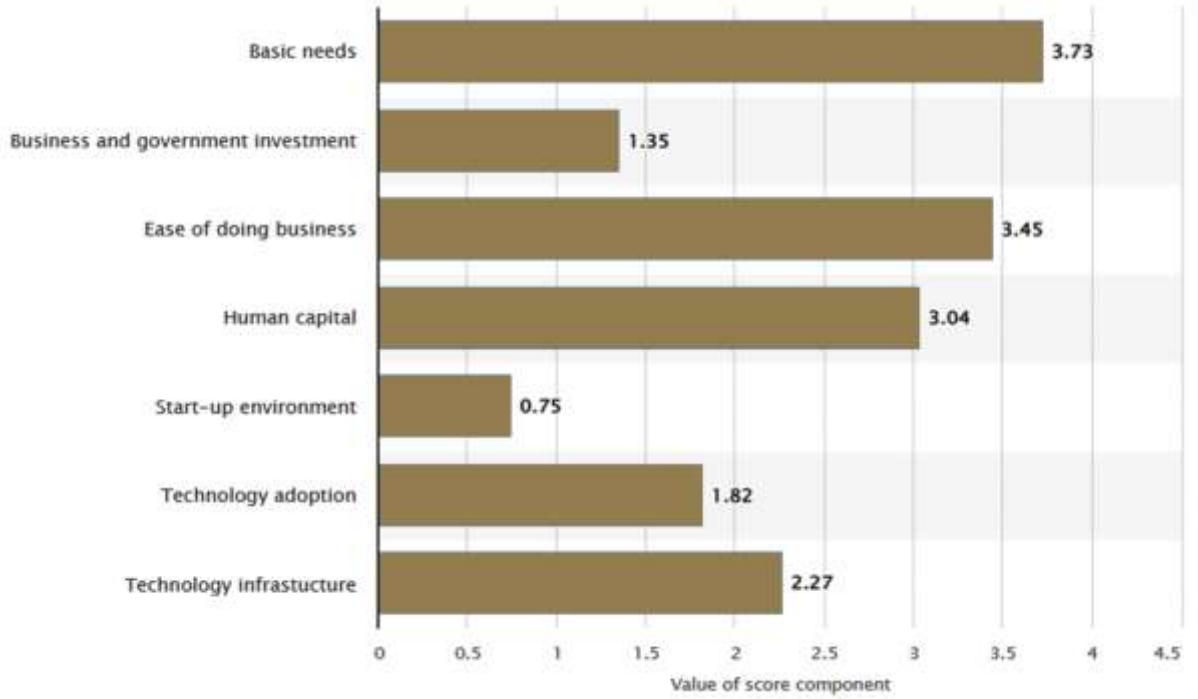
In 2018, MENA's three most preferred online shopping payment methods were credit card with 37% usage, followed by 34% for cash-on-delivery and 12% for bank transfers.[9]

However, the Covid-19 pandemic created a major market trend in digital payments in the region with an expected growth of CAGR 15.39% for 2016-2021[10]. This development is due to the proliferation of digital technology such as smartphones, mobile broadband connection, and household subscription to internet connection services. Furthermore, the digital payment revolution launched by telecommunication companies such as digital wallets, has transformed e-commerce in the MENA region, and was strengthened by the collaboration between e-commerce platforms and payment gateway platforms, thereby benefitting from real-time payment transactions.

## 4.4 The UAE's Digital Transformation

The UAE has exhibited considerable transformation in recent years. As of 2019, the UAE reached a total digital readiness score of 16.42 out of 25, indicating that the country is in the Amplify stage (Figure 2[11]). Countries that have achieved substantial strides in their digital journeys are included in this stage. Seven important factors that improve the nation's digital journey are measured by the digital readiness score. However, the distribution of the transformation differed among the components. The basic needs, the ease of doing business and the human capital development components exhibited stronger digital transformation, whereas the start-up environment and the business and government investment exhibited weaker transformation.

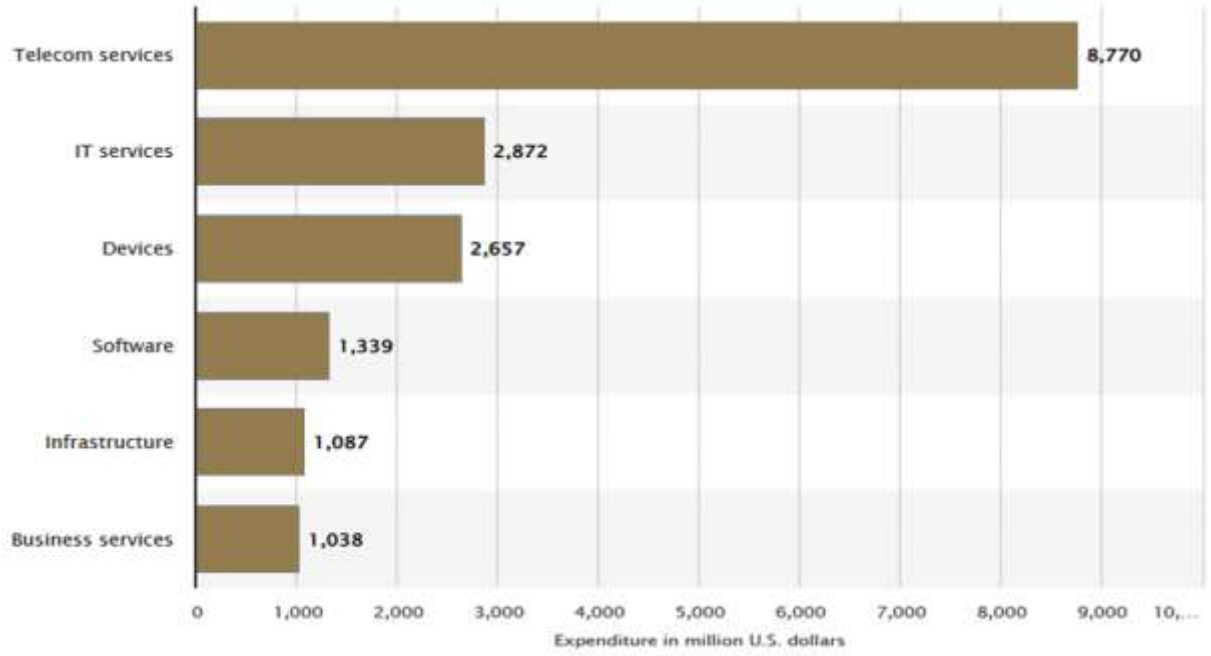
*Figure 2. Digital readiness score in the United Arab Emirates in 2019, by score component*




[9] https://www.digitalmarketingcommunity.com/indicators/preferred-online-payment-methods-mena-region-2018/
[10] https://www.mordorintelligence.com/industry-reports/middle-east-and-north-africa-digital-payments-market
[11] https://www.statista.com/statistics/1180845/uae-digital-readiness-score-by-component/#:~:text=In%202019%2C%20the%20United%20Arab,is%20in%20the%20Amplify%20stage.

Moreover, as of 2019, ICT (information and communications technology) spending in the UAE increased considerably (Figure 3[12]). The telecom services sector accounted for the highest spending, at 8.77 billion U.S. dollars, which was around half of the country's total ICT spending in the same year.

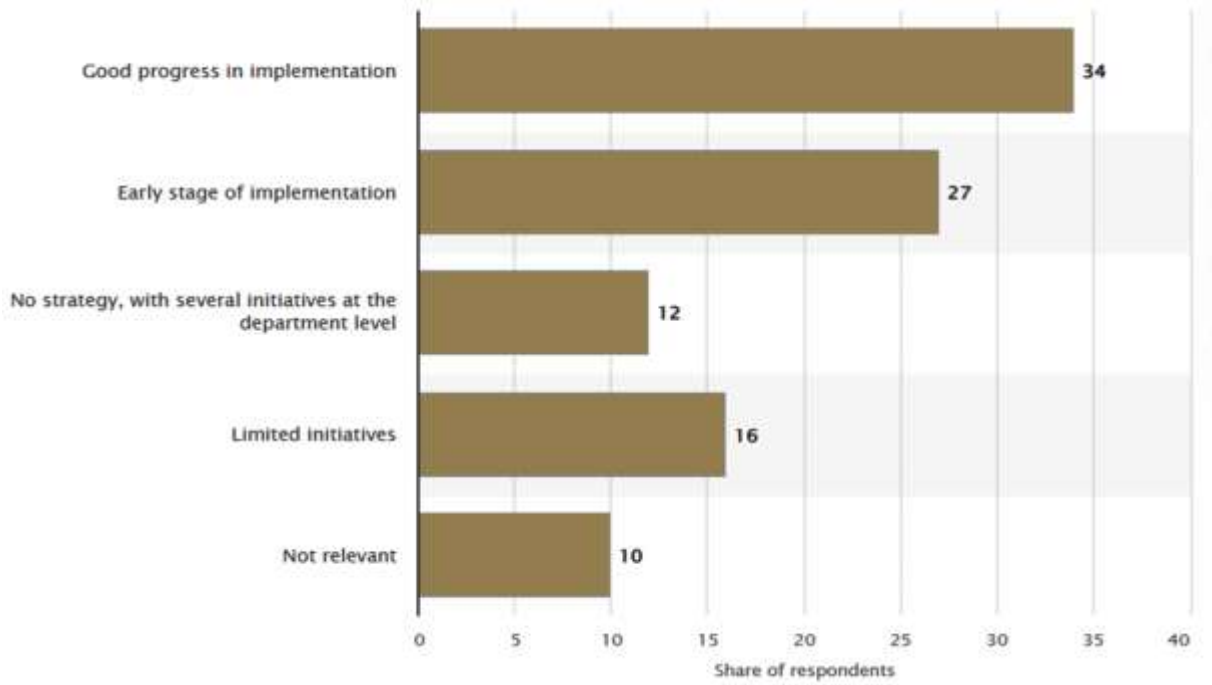
*Figure 3. Information & communications technology spending in UAE, 2019, by segment (USD ml)*




Furthermore, the share of digital transformation adoption among institutions also changed (Figure 4[13]). As of 2019, 34% of firms had a company-wide digital transformation strategy already in implementation. 90% of firms were undergoing digital transformation initiatives, and 61% were running a company-wide digital transformation strategy.

[12] https://www.statista.com/statistics/1114784/uae-ict-spending-by-segment/#:~:text=In%202019%2C%20the%20telecom%20services,spending%20in%20the%20same%20year.
[13] https://www.statista.com/statistics/1184407/uae-share-of-organizations-adopting-digital-transformation-by-stage/

*Figure 4. Digital transformation adoption among organizations in the UAE, 2019, by stage*




The UAE has a considerably high banked population with 83% along with 37% card penetration. Moreover, the UAE has recorded a significant growth in digital payment adoption due to its dynamic and liberal financial industry with 85% of the population between the ages of 15 and 64 deemed technologically savvy. The country also has one of the world's highest smartphone penetration levels (78%), a significant factor contributing to the fast-rising use of digital payments[14].

The UAE Government has actively promoted digital payments in the country by introducing several initiatives such as the Wage Protection System and the Dubai Smart City initiative. Financial inclusion for the unbanked population was also included in the government drive to revolutionize finance digitalization by offering mobile wallet solution called "Trriple." Digital payment transformation has led UAE banks to become more competitive and innovative in their services and product offerings.

The distribution of digital payment methods for e-commerce transactions in the UAE shows considerable diversification. As of 2020, the most popular online payment method was by card at approximately 49%. It was followed by E-wallets at 18% in that year. Visa was the most widely used card system in that year.

Finally, the volume of non-cash transactions in the UAE is highly skewed. As of 2018, PoS transactions accounted for the highest volume among non-cash transactions reaching 649 million. POS card transactions drove payment transactions with a CAGR of 20% from 2014 to 2018. PoS transactions accounted for 91% of payments in 2018.

[14] https://www.tekedia.com/united-arab-emirates-uae-digital-finance-payments-trends/

# 5 Digital Payments Challenges

The digitisation of payment services brings significant benefit and presents many opportunities. The payments sector, however, has many challenges to overcome.

## 5.1 Financial Crime and Cybersecurity

Technological advancement places digital payments at the forefront of financial technology wherein payment transactions in this complex digital ecosystem rely on intermediaries. However, security of electronic payments has been a priority issue among end users despite state-of-the-art payment tools and ever-increasing number of digital payment platforms. The global shift to digital payments has brought about new players and innovation in this digital payment space and as cross-border payments become high-speed and real time, consumers data information has greater exposure to potential risks of account hacking, money laundering and fraud.

Cybersecurity threats constantly exist as digitization of payments has expanded. Customers' data are open to malicious attacks and damage due to unauthorized access[15]. Some forms of those threats are Advanced Persistent Threats (APTs), Internal Threats, Distributed Denial of Service Attacks (DDoS), Account Takeovers, and Supply Chain Breaches.

## 5.2 Speed and efficiency of transactions

Speed of payment is the time spent from payment initiation to payment completion. End-users are increasingly demanding notification and confirmation that their transaction is complete; either their payment has been successfully made or fund they are expecting are in their account.

End-to-end efficiency in the payments system involves innovation bringing key players in digital payment ecosystem in closer proximity to end-users (between payment providers and customers, and between merchants and consumers. Efficiency improvements will require digitizing business-to-business (B2B) and person-to-person (P2P) payments, while keeping the cost of payment transaction low.

As consumer demand for faster payments increases, financial technology development and speedy payment settlement need to be enhanced. Thus, investment in financial technology have had a significant increase as efforts for fast digital payments are not primarily driven by central banks or commercial banks but rather by entrepreneurs, technology firms and venture capitalists.

Fast and efficient digital payments require technology advancement and infrastructure, thus increased investment costs for intermediaries and payment service providers.

In the current trend of payment digitization, speed of transactions matters, and real-time payments is considered a vital component. Financial institutions are looking for advanced technologies and partnering with financial technology providers to utilize application programming interfaces (API's) to meet customer needs. Financial institutions are also moving away from in-person signatures and the need to meet customers in a physical branch. This acceptance of digital signatures and digital documents will require regulatory processes to protect the consumers data information and reduce the risk of fraud and money laundering.

[15]https://opensourcepaymentgateway.com/payment-gateway-articles/cyber-security-threats-electronic-payment-system/

## 5.3 The organization of fast payment provision

The issue of how the digital payment industry organizes faster payment systems, whether it operates as a single or multiple systems, or whether it could be a closed or open system, generally affects the level of coordination and nature of competition.

Digital payments have the goal of meeting the modern customer's demands to make payments in a seamless, secure and simple way (e.g., digitally, fast and easy to use). In a single system of faster payments (closed system, operated by a non-financial entity or open system, participated in by a bank or financial institution), requirements are catered for through the provision of clearing and settlement services that enable a variety of payments to be made between different parties including P2P, C2B, C2G, G2C, B2C, B2B, B2G, A2A.[16]

*Table 3. Payment types by parties involved*

| Term | Explanation | Example |
|---|---|---|
| P2P | Peer-to-Peer | Bank transfer |
| C2B | Consumer-to-Business | Google AdSense |
| C2G | Consumer-to-Government | Government website (e.g. utility bills) |
| G2C | Government-to-Citizen | State pensions |
| B2C | Business-to-Consumer | PayTm, Pay Lah |
| B2B | Business-to-Business | Alibaba |
| B2G | Business-to-Government | (Public building) maintenance services |
| A2A | Ask-to-Answer | Quora |

In an ecosystem of faster payments, whether it is closed or open, a key issue of interoperability may arise where multiple systems are in use. Multiple systems must be compatible and interoperable with each other to offer the best service to the end-user.

In general, the coordination level and type of competition will be impacted by how rapidly payments are organized. A single open system needs a high degree of coordination to achieve economies of scale in production (i.e., through shared infrastructure) and network effects in demand (i.e., through increased coverage), with PSP-level competition predominating for end users. Multiple incompatible open systems could introduce inter-system competition for PSPs with a lesser degree of coordination but may involve duplicative investments in infrastructure and face limits in terms of coverage (e.g., individual systems could fail to achieve a critical mass of end users). Multiple interoperable systems could enhance coverage while maintaining inter-system competition but would require additional coordination to enable the exchange of payments across systems. Closed systems could provide inter-system competition for end users without requiring coordination but with potential limitations in coverage[17].

## 5.4 Clearing and settlement issues

Although both real-time and deferred clearing and settlement can support faster payments to users, the various clearing and settlement methods between PSPs could result in diverging outcomes in terms of risk and efficiency.

*"As the AFP 2022 Payments Fraud Survey and Control notes, while the overall number of firms suffering payment fraud in 2021 is well off the peak of 81% recorded in 2018, nearly 30% of organizations reported an uptick in payment fraud in 2021, with 63% reporting it as unchanged versus 2020."*[18]

[16] https://www.frbservices.org/financial-services/fednow/instant-payments-education/faster-payments-transactions.html
[17] https://www.bis.org/cpmi/publ/d154.pdf
[18] https://www.theglobaltreasurer.com/2022/06/20/process-automation-key-to-protecting-against-payment-fraud/

In the digital payment ecosystem, verifying payment requests has become a challenge as it led to increasing payment fraud due to a reliance on virtual communication for payment information.

## 5.5 Ease of access / financial inclusion

Advancement and innovation in digital technologies will pave the way to financial inclusion and expand access to digital financial services (DFS). Due to convenience and easy access to new technology, with the use of mobile phones or other digital devices, financial inclusion can increase.

Digital financial inclusion is a key aspect of the World Bank's agenda[19] with the goal of reaching billions of people who are financially excluded and underserved, and to build on the digital revolution to improve access channels. With this goal, the World Bank specifies the essential components of digital financial inclusion as:

- Digital transactional platforms that connect users with financial institutions or other entities authorized to store electronic value, allowing them to send and receive money electronically and store value digitally.
- Customer-facing technology can take the shape of information-transmitting digital gadgets like smartphones or point-of-sale (POS) terminal-compatible payment cards and terminals.
- Customers can "cash-in" cash in exchange for electronic value stored on a computer or other digital device, then "cash-out" their stored value into cash using the same device ("cash-out").
- Additional financial services via the digital transactional platform that may be offered by banks and non-banks to the financially excluded and underserved — credit, savings, insurance, and even securities — frequently using digital data to control risk and target customers.

## 5.6 Regulatory Balance

Regulators are working with the payments industry to find an appropriate balance between regulatory controls and opportunities for electronic payment intermediaries to enter the market and innovate. For example, the Financial Services Regulatory Authority ("FSRA"), the financial services regulator in the Abu Dhabi Global Market ("ADGM"), has issued Consultation Paper No. 1 of 2020 regarding the proposed widening of the regulatory framework pertaining to Money Services Business (MSB) to accommodate the evolution of new business models and methods of fund transfer within the payments industry. This enables clients to convert currencies or transfer funds to individuals and corporations worldwide. It includes, but is not limited to, forex services, payment services, and intermediary payment solutions via traditional methods, plus through the Internet and mobile tech, and innovative FinTech solutions.

In 2017, the Central Bank of the UAE issued a new regulation for "stored value digital payments" with the objective of mandatory licensing and other compliance requirements among Payment Service Providers (PSPs) to improve and facilitate a secure digital payment in the country. The Regulatory Framework for Stored Values and Electronic Payment Systems covers licensing and data protection and consumer service agreements.

## 5.7 End-user convenience

Customer demand for convenience in digital payment systems calls for interoperability among intermediaries where exchange of information occurs and where security and privacy risk are at stake.

[19] https://www.worldbank.org/en/topic/financialinclusion/publication/digital-financial-inclusion

# 6 Technology Developments: Growth of Payment Systems

The payment methodology used in most countries evolved from early banking payments systems and still retains structural characteristics from those roots. By trading inherently valued objects such as gold coins, early payments were made. When goldsmith banks first appeared in the 1600s, they kept records of the money that their clients had deposited, making it possible to make payments by adjusting the records rather than physically swapping the assets. Only clients of the same bank could use this. Over time, the need to make inter-bank payments led to the emergence of a central clearing bank through which all member banks could hold accounts, making interbank payments simpler.

In standard payment systems, payments are facilitated by reducing the balance in a customer's account and increasing the balance in the user's account by the same amount. The difference is in the evolution of technology used for recording balances and transfer them between banks.

Technological developments over the past several decades have impacted payments systems in two major ways. First, the records and ledgers have moved from paper to electronic form, thereby increasing the speed of transactions and reducing operational risks. Second, the emergence of cheaper and faster technology has enabled new payment schemes to emerge (e.g. mobile money schemes).

Regardless of the use of new technology, the basic structure of centralized payment systems remains unchanged. A central ledger is at its core, and settlement occurs across the books of an organisation that serves as a clearing point (a function typically carried out by the central bank). Each participant to a transaction, usually a commercial financial institution, holds a balance at the central bank, which is recorded in the latter's ledger, and also reflected in the participant bank's own (internal) ledger. Individual customers, branches, or even other (smaller) banks hold balances at the participant bank, which would again be recorded in their own ledger.

In recent years, numerous innovations in payment systems and alternative money have emerged. Some focus on making payments more accessible to a wider range of users (i.e., mobile phone payments) while still depending on a trusted central entity. Recent innovations have introduced a fundamentally different, decentralized structure to payments systems by relying on cryptography rather than a central bank. The ability to provide 'wrapper' services to improve the user interface and accessibility of existing payments systems architecture represents neither a new currency nor a new core payments system. The core motivation can either be to attract new entrants seeking to capture a segment of the market or encourage incumbents seeking to improve market share and reduce consumer use of other, more expensive payments systems. Examples include Apple Pay, Google Wallet, and Paym, which improves on the current system to enable users to link their bank accounts to their mobile phone numbers to make payments.

In areas where access to traditional banking infrastructure is limited, development and adoption of new payments systems serve to fulfil unmet demand. In more developed economies, new payments systems are probably developed in response to the high operational margins associated with incumbent systems and adopted based on their ease of use. The development of mobile money schemes represents new payment systems with money stored as credit on a smart card or a system-provider's books, while continuing to use national currencies (e.g. M-Pesa in Kenya, which grants access to financial services to anyone with a mobile phone).

The development of the distributed ledger ('block chain') is a key technical innovation underlying the emergence of digital currencies that solves the problem of 'double spend' in a decentralized payments system. The distributed ledger emerged because of several earlier innovations, including the internet. It rests on concepts originating in cryptography, peer-to-peer networking and game theory. A key problem for any electronic payments system is to ensure that money cannot be spent twice. If a payee has a single $1-coin, s/he cannot pay the $1 both to counterparty 1 and also counterparty 2. The physical act of exchange prevents the payer from spending the same money twice. In a payments system that relies on digital exchange, records must have a way of preventing double spending, since it is easy to do that by copying and editing digital records.

The emergence of digital currency schemes incorporates both a new decentralized payments network and a new currency. All the schemes exhibit a publicly visible ledger that is shared across a network of computing participants. The method through which a cryptocurrency's users reach consensus on modifications to the ledger is a defining element of each different digital currency scheme. Most digital

currencies are ‘cryptocurrencies’, in that they seek consensus through means of techniques based on cryptography (rather than central bank backing). However, it is possible to have a digital currency with a centralized ledger. There are also digital currencies (e.g., Ripple), that seek consensus through other, non-cryptographic means.

In the conventional banking system, which today uses computerized replications of earlier paper-based records, the ‘double spend’ problem is dealt with by specialized entities (typically banks) maintaining master ledgers that serve as the official record of each person's financial holdings. In turn, these entities hold accounts recorded in the ledger of one central body (i.e., the central bank). Any transaction that the owners of the ledgers believe to be invalid may be stopped. People must have faith that these centralised ledgers will be kept up-to-date in a trustworthy, timely, and honest manner in order to utilize the system. An alternative approach to solving the problem is to implement a fully decentralized payments system, in which copies of the ledger are shared among all participants, and to establish a process by which users agree on changes to the ledger (that is, on which transactions are valid and shall be recorded on it). Since anyone can check any proposed transaction against the ledger, this approach removes the need for users to have confidence in the integrity of any single authority. Thus, the key feature of the distributed payments system is how consensus is reached about any proposed changes to the ledger (transaction recording).

But the required consensus poses serious integrity challenges. Achieving widespread consensus among actors in a network when no one can be sure who can be trusted has long been acknowledged as a problem in computer science and game theory[20]. It is not sufficient to offer comprehensive acceptance to all statements, for example, because this creates an incentive to lie in order to gain an advantage.

It is also not sufficient to have users vote on acceptance of a proposed change in the ledger because it is generally easy for a single actor to generate many nodes on a computer network in order to distort the vote. Instead, digital currencies make use of game theory and recognize that, on its own, any proposed change to the ledger is ‘cheap talk’: since it was effectively free to issue, the change should receive very little weight. In order for a proposed change to be accepted as true, those proposing the change (i.e., the ‘miners’ who serve as transaction verifiers) must demonstrate that it was costly for them to issue the proposal for change. As a result, in order for users who contribute to the verification procedure (miners) to have their ideas accepted, they must produce a cryptographic "proof of work" to prove that they have expended a value in computation time. Some digital currencies impose a cost in the form of a small amount of currency that is destroyed as part of the transaction.

## 6.1 Digital payments infrastructure

Innovative digital payment mechanisms require the development of reliable and efficient infrastructures for offering user-friendly, secure, and cost-effective services. Such infrastructures have the potential to increase financial access, expand financial inclusion and support the digital payments system. The implementation of a functional digital payments system requires four foundational infrastructures. First, there must be a consistent supply of electricity. Digital payments depend on a constant supply of adequate power, which is often not secured in urban and rural settings. Second, the information and communications technology (ICT) infrastructure must be robust. Third, the basic payment structure (i.e., automated clearing houses, payment switches, system interoperability, etc.) must be in place. Fourth, identification infrastructure (i.e., digital ID) is required for digital payment service providers to carry out their due diligence and enable digital access.

### *6.1.1 Electricity supply*

Digital payments require a steady supply of electricity. Power supply interruptions negatively impact payment services. A lack of power to operate ATMs, especially in rural areas, is among the main reasons cited by PSPs for not deploying ATMs widely. Geographic areas with the highest rate of

[20] https://www.tandfonline.com/doi/pdf/10.1080/00051144.2018.1492688

financially under and unserved people are generally those without reliable access to electricity. Private vendors must be incentivized to offer solutions that minimize the impact of power outages on ATMs.

### *6.1.2 ICT Infrastructure*

The quality and affordability of ICT (information and communication technology) infrastructure has direct effects on payment services. In 2020 there were 8.27 billion mobile phone subscriptions globally, up from 6.3 billion in 2012 (World Bank). Each connection has the potential to enable digital payments. It is necessary to have a sufficient network coverage for mobile payments. Based on population density and mobile coverage data, about 12.7% of the world population lived in areas without mobile coverage in 2018. More than 90% of those without network coverage live in rural areas, often characterized by low population density, poor road networks, difficult geography, and lack of proximity to electricity grids. As a result, there is often little incentive for mobile network operators (MNOs) to expand into these areas (Biscaye et al., 2015). Some countries mitigate this problem by issuing operator licenses to several MNOs and making certain minimum areas of network coverage a condition of license. Depending on the country, MNOs on their own or via their subsidiary might not only provide access to telecommunication infrastructure but act as a payment service provider on their own.

Internet use is strongly correlated with income. Since 2005, internet users in developing economies have grown from 8.1% to 57% (percentage of population accessing the internet), but the low-developed countries only reached 27% (Statista, 2022). It is estimated that in the 20 countries with the largest offline populations in 2013, 64% lived in rural areas. The income of half of the offline population fell below the poverty threshold in their nation. 28% of the offline population is illiterate and 52% is female.

Lack of network coverage is a major obstacle in adoption of digital payment services. MNOs need to ensure the reliability of GSM networks in order to give customers confidence in mobile money (Gilman et al., 2013). Such reliability is particularly important for low-income groups who are especially reliant on their mobile money wallets and have no alternatives for making digital payments.

### *6.1.3 Payment infrastructure*

To operate effective financial services proper infrastructure must be in place. This includes payment infrastructure (e.g., payment switches, clearing houses, large-value settlement systems), and data-sharing and information systems (e.g., credit reporting systems, collateral databases). Moreover, certain institution-level infrastructure, such as centralized account management systems (e.g. core-banking systems), improves the commercial viability of providing financial services to lower income groups.

Interbank systems for retail payments (automated clearing houses and/or cheque clearing houses) and payment switches (typically for card transactions but increasingly for mobile money as well) facilitate the processing of a large number of payments in a fast, secure and cost-efficient way. For processing interbank transactions, a central clearing facility or switch (or multiple interoperable ones) serves as a hub. This lifts the quantity and efficiency of those transactions, and effectively expands the network of access points (e.g., ATMs, POS terminals, agents, or branches) for individual customers. While access to systems may be restricted for various reasons, such restrictions must be transparent, proportionate, and non-discriminatory. Since the main reason for restricted access relies on risk control, an adequate protection from risk according to the services provided should reduce the urgency (although not the general necessity) of access restrictions to clearing and settlement (World Bank, 2012e).

In some countries, it is often not lucrative for financial institutions to expand their infrastructure beyond major urban areas. The challenge of commercial viability as well as technological advance are often compounded by human resource issues (e.g., lack of staff with basic IT skills). Collectively, these problems frequently leave certain geographic areas and client segments unserved or underserved.

Legal, regulatory, and governance issues can add to these challenges. For example, certain service providers such as non-bank mobile financial service providers, credit cooperatives, savings and credit cooperatives and micro-finance institutions sometimes struggle to meet the technological and risk management requirements of participating in key payment infrastructures.

Specialized mobile financial service (MFS) providers need a core system to support activities (i.e., mobile transactions) carried out by clients. Such a system needs to support the activities of MFS tied agents. These systems must be able to interface with other payment infrastructures (e.g., payments switches). Inefficient payment infrastructure can have adverse effects on business operations and MFS confidence. For smaller licensed payment service providers (banks, non-bank institutions, MFIs, etc.), substantial start-up and/or ongoing costs for direct participation in payment infrastructures often prevent them from offering efficient payment services.

Finally, regulatory and operational payment infrastructure system rules might prevent some providers from participating directly, even if they could afford the necessary infrastructure investments and/or participation costs. By partnering with commercial banks, technical service providers can provide authorized and/or regulated non-bank payment services (e.g., depending on the country MNOs or their subsidiaries) using the country's payments system infrastructure, which they would be legally restricted from accessing (Almazán and Frydrych, 2015; Navajas, 2015). Banks and MNOs can interact on designated platforms, on which mobile payment transactions are converted into card transactions and processed like any payment card transaction at the automated clearing house (Faragallah et al., 2015).

### *6.1.4 Identification infrastructure*

Adequate identification (ID) infrastructure that can be efficiently accessed by financial institutions enables financial inclusion. If it is difficult to provide proof of identity, the requirement of identity credentials as a condition to access financial services, can create access barriers. The possibility to quickly validate ID is crucial from a know-your-customer (KYC) perspective.

Lack of an official ID record hampers access to financial services. Driven by the rapid growth of mobile phone ownership, digital IDs can help meet the needs of previously isolated and impoverished populations. ID infrastructure can use electronic and biometric technologies to confirm user identities and boost access to financial services.

# 7 Benefits of New Technologies: The Role of Blockchain

Digitisation of any process requires technology. While technology provides process automation, reduces manual processing errors, and speeds up processing times, it also presents opportunities for new cyber risks. Here we look at blockchain technology in the context of cyber risks for digital payments.

Cybersecurity vulnerability threats advance at the same pace as new technology developments. Considering the complexity and risk associated, there is an urgent need to protect the entire digital payments system. Because of the development of sophisticated ransomware and the growing threat posed by specialized cyber organizations, cyberattacks have grown increasingly complex. In addition to the potential benefits of increased transparency and speed, blockchain-based solutions are gaining momentum because of their potential to mitigate cyber-attacks. Both controlled and decentralized blockchains are possible. It's crucial, though, to distinguish decentralized from distributed. A blockchain is intrinsically distributed but is not inherently decentralized (multiple parties retain copies of the ledger). The rights of members on the ledger determine if a blockchain is centralized or decentralized, hence this is a design feature. Anyone can join in and conduct transactions on the ledger in a decentralized network. To protect against the flaws in this architecture and guarantee that transactions are accurate, measures must be in place. Blockchains that are decentralized, like Bitcoin, are common. On the other hand, parties in a centralized network are those whose identities are recognized. Because only trustworthy and respected individuals are allowed to post to the ledger, the system is therefore legitimate. Participants' transactions may be audited because it is known who they are. To reduce vulnerability, a centralized distributed ledger must be utilized in any tightly regulated industry, such as financial services.

## 7.1 Authentication and authorization control

One of the typical problems for organizations is limiting access to the right task to the right people. In a publicly available blockchain, there is no need to control network access as everyone has the right to participate and access the entire network. In contrast, private blockchains need robust security measures in place to prevent unwanted users from gaining access to the network. Advancements in technology incorporate authentication and authorization controls to secure encryption to adequately guard data access. In the face of cyberattacks aiming to get third-party data, proper encryption-driven authorization will prevent reading or retrieving information stored on the blockchain network. Thus, the solution appears to rest on the use of proper technology that maintains confidentiality by utilizing cryptographic algorithms.

## 7.2 Use of threat intelligence

Threat intelligence involves acquiring information about a potential or actual cyberthreat. However, a major obstacle in benefiting from threat intelligence practices is that providers of digital services spend significant time researching the same threats, while others are left unnoticed. Blockchain, with its peer-to-peer oriented architecture, could help in maintaining synchronization between different parties, thereby transforming the threat intelligence process. Blockchains decentralized infrastructure also acts as an anti-tampering structure that helps detect everything in real-time. Even if an attacker tries to delete every proof of their presence by deleting every log which can link him/her with an incident, the blockchain's immutable design does not let it happen.

## 7.3 Data consistency and integrity

Maintaining data consistency and ensuring data integrity is crucial for all organizations. Data integrity can be maintained as a result of a blockchains immutability and transparency. Blockchain technology makes use of sequential hashing and cryptography, making data tampering almost impossible. The technology ensures that records are digitally signed and time-stamped, implying that users can trace back each transaction and identify the corresponding party whenever required. The blockchain structure also serves to ensure non-repudiation (e.g. transactions are undeniable), further supporting the reliability of the data system.

## 7.4 Accuracy and quality of information

Blockchains helps to ensure accuracy and maintain the quality of information. While it cannot guarantee or enhance data quality, blockchains are responsible for maintaining data accuracy and durability after it has been entered into itself. If the initial data input is reliable, blockchain technology can act as a tool for transforming it into data output, as its near real-time capabilities allow digital service providers to validate transactional data quicker and take more constructive measures.

## 7.5 Timely and reliable access

Several cyberattacks focus on disrupting the availability of internet services (distributed denial-of-service attacks - DDoS). Blockchains can provide a feasible solution in dealing with this risk. Notably, DDoS attacks on blockchains are not usual occurrences because they are too costly as they strive to defeat the entire blockchain network that comprises large volumes of small transactions.

Overall, while underlying the emergence and trading of cryptocurrencies, blockchain technology is much more than that. It has the potential to be used as a trusted infrastructure by multiple industries. Blockchain's capabilities and possibilities range across a vast spectrum of functionalities and cover various cases. Its true potential remains to be unlocked.

# 8 Conclusion and Way Forward

The adoption of digital payments offers benefits to individuals, companies, and governments. These benefits include greater speed and efficiency of transactions, higher transparency and security of transactions, expanded financial inclusion opportunities that extend to women and social minorities, and broader and more robust economic growth and poverty reduction.

To achieve these benefits, the introduction of a digital payments system must take place responsibly and in ways that protect and promote the well-being of end-users. Moreover, it requires the understanding of global trends in the sector, the risks and challenges that exist in the implementation of digital payments and the necessary interventions that help mitigate these risks.

The first step of the digital payment framework is to properly identify the range and nature of payment activities that shall be designated as digital payments, subject to effective monitoring and oversight while avoiding unnecessary overlaps and/or duplication of regulatory efforts.

The second step is to introduce a proper and efficient infrastructure that provides the basis for offering user-friendly, secure, and cost-effective services. Such infrastructures must focus on the provision of reliable power supply, adequate and efficient information and communications technology services, payments functionalities, and identification/access credibility.

The third step is to identify the causes that might limit the active use of digital payment technologies based on the users' experiences and perceptions of associated digital payment risks. These consumer risks include the inability to transact due to network or service unreliability, insufficient liquidity availability through digital means, complex user interfaces and payment processes, lack of recourse/redress mechanisms and, importantly, targeted fraud.

The fourth step is to contextualize and understand the nature, incidence, and consequences of digital consumer risks. Adhering to the basic principles of data/process reliability, communication, and monitoring, provides the core background for policy development to mitigate digital payment risks. While adherence to these principles is only a basic requirement for offering trustworthy digital payment services, getting them right in specific contexts is critical for digital consumer risk mitigation and for achieving the social protection goals and financial inclusion potential.

The fifth step is to develop specific policy interventions that ensure the reliability of the payments experience making the customer interface user-friendly, ensuring agent service quality, training, and digital liquidity management, as well as effective risk mitigation governance. Policy interventions should also improve the communication channels between users and providers of digital payment services by establishing transparency, information-sharing and redress mechanisms. Further, policy interventions should strive to institutionalize monitoring and customize implementation by allowing for flexible partnership structures to make required adjustments and quickly rectify problems.

A key sixth step would be to explore the benefits of new technologies, and especially the role of the blockchain, for mitigating digital consumer risks. Due to its decentralized, immutable, and transparent nature, blockchains could improve cyber defence and prevent fraudulent activities. For the potential blockchain benefits to materialize, policy intervention should focus on establishing proper data/information authentication and authorization control structures, use threat intelligence processes to gather valuable insights about cyber threats, maintain data consistency and ensure data integrity for all digital payments agents, ensure the accuracy and quality of information managed by the blockchain structure, and secure, timely and reliable user access to blockchain-supported internet services.

Blockchain has surfaced as a remarkable technology in the field of information technology. It is a transparent distributed public ledger, accessed by multiple parties involved in a transaction and serves as a repository for transactions between parties. Increasing acceptance of cryptocurrencies is one of the primary reasons driving market expansion. Banks globally are utilizing blockchain technology to process payments.

However, like any other innovation, blockchain-based payment systems have a few challenges, which can be overcome by taking a few steps. The fragmented acceptance of blockchain comes with its own range of obstacles that can impede its operation, such as higher costs, failed standards, and a lack of interoperability. Interoperability is necessary for the easy integration of blockchain payments into

existing systems. To address this difficulty, a concentrated effort must be placed on a small number of components, such as improvement of network scale efficiency and the deployment of a standard form of communication. Also, blockchain provides consumers with utmost transparency, both positive and negative. On one hand, it enhances payment systems by streamlining payment flows. On the other hand, it is a worry for users who do not wish to reveal their payment information with everyone. Recommended actions to address these issues include: (a) establishing stringent security standards; (b) informing users about preserving their user credentials; (c) conducting frequent scans and bug-checks on blockchain payment systems; and (d) thoroughly testing solutions that require integration with the assistance of third-party vendors or businesses.

When transitioning from one technological solution to another, there will always be obstacles to overcome. As blockchain in finance/payments is still a developing business, it is normal to encounter a few issues and concerns. However, with the right measures and care, one may swiftly overcome these obstacles and proceed on to relish the technology's many benefits.

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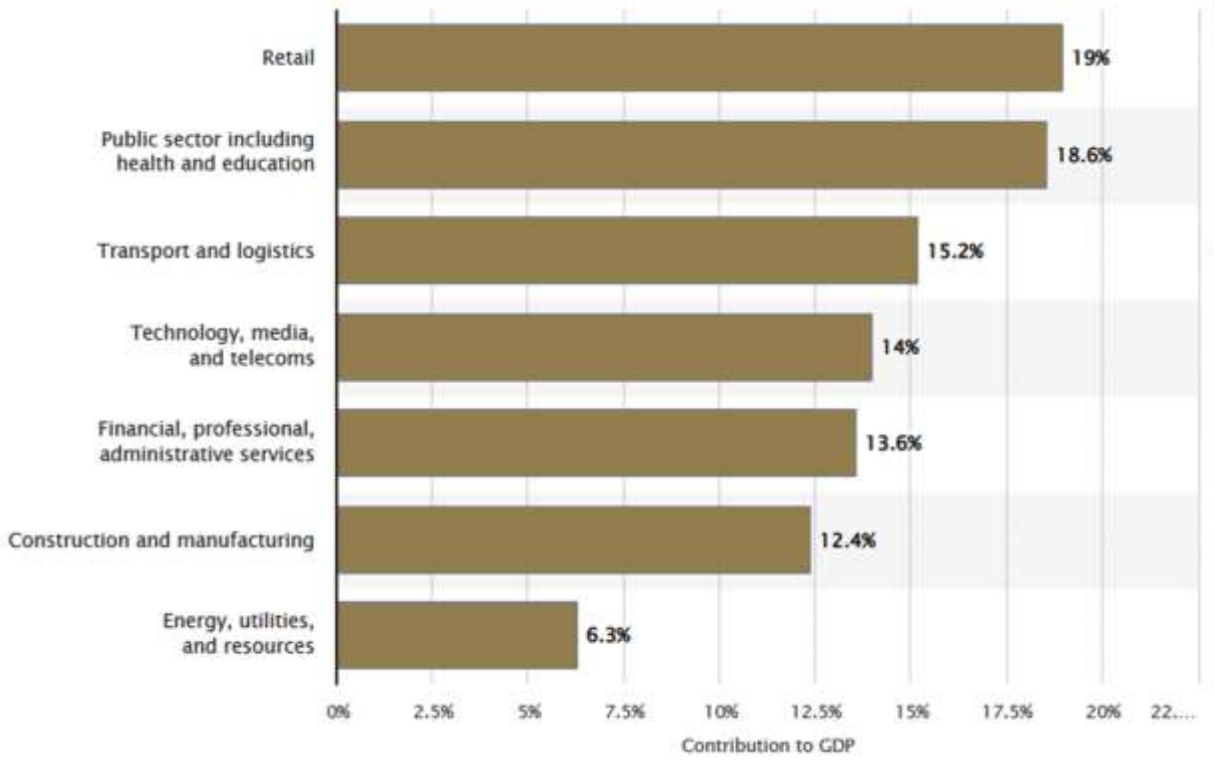
# 10 APPENDIX 1: AI Contribution to GDP in the MENA Region

Figure 5 shows the forecasted contribution of artificial intelligence (AI) to GDP in 2030 across different industry sectors. The financial, professionaland administrative services industry is expected to see a nearly 14% contribution from AI.

*Figure 5. Forecasted contribution of AI to GDP in the MENA region in 2030, by industry*[21]




# 11 APPENDIX 2: Case Study - China

China has experienced considerable digital transformation in its economic conditions in recent decades (Zheng et al., 2022). However, digital transformation risks have been considerable, and they originated in the embedded socio-economic environments within which business operate in China. Containment of contextualized digital transformation risks is just as critical as controlling for general risks, especially in high-risk, high-uncertainty, and low-trust markets, such as China. Proper risk management has been instrumental in overcoming some of those risks. Several successful examples of effective digital risk management policies have been highlighted.

A first user-case is Alipay in digital finance, which coped with the pervasiveness of online fraud in China by offering escrow services to mitigate the impact of digital risks for Consumer-to-Consumer (C2C) transacting parties. This allowed Alipay to influence consumers' payment habits and expand its business despite the challenges posed by its local economy. (Liu, 2015).

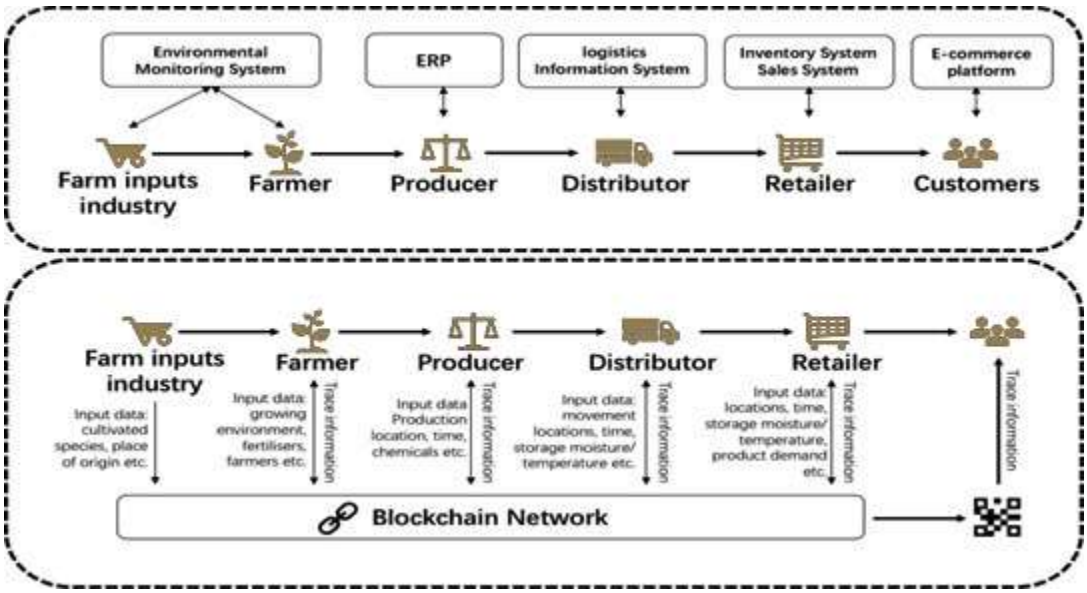
A second user-case from China concerns asset-backed security (ABS) business scenario (Zheng et al., 2022). ABS are financial securities collateralized by a pool of assets, such as loans, credit card debts, and receivables. Issuing ABS involves three main parties: the seller, the originator (issuer of ABS), and the investor. Sellers are mainly the banks who issue loans and then, to recover cash to issue more loans, sell existing loans with various maturities to the ABS originators (which are also financial

[21] https://www.statista.com/statistics/1272197/mena-ai-contribution-to-gdp-by-industry/

institutions mainly or special purpose vehicles - SPV) who act as the servicer that collects (based on the transferred rights) the principal and interest payments from borrowers. Normally, the originators turn acquired loans into marketable securities through a process known as securitization. ABS is a popular financing approach chosen by enterprises for various reasons. Securitization opens new sources of funds and enables the issuing enterprise to remove debt items from its balance sheet to gain greater flexibility to pursue new businesses. Investors purchase ABS as tailor-made products that enable them to get additional yield and augment their portfolio diversification. However, the ABS are high-risk products, and they need effective supervision and widespread consumer awareness as to their risk, both of which has been lagging in China. Moreover, the ongoing progress in digital technology and the rapid growth of the financial ABS market superseded supervisory capacity and allowed new opportunities for price manipulation because the ABS products are opaque and non-transparent with multi-layer designs. The ABS is issued based on the repackaged cash receivables from many micro-loan borrowers and compounded them into a single ABS product for public investors. Getting, authenticating and analysing asset information digitally from all those micro-loans was a tedious process. This creates predatory risk when issuing ABS. Predatory risk captures the possibility in gaming structure that each participant tries to gain superior power by exploiting vulnerabilities (e.g., inadequate supervision). Blockchain technology was introduced to help control predatory risk. Specifically, taking advantage of the shared authenticity features of blockchain, the issuers were able to build an inter-institutional distributed digital data storage and query platform and create an ecosystem that allows participants to achieve better process automation and better risk management. Once the ABS is recorded in the blockchain ledger, the true information would be co-maintained by the blockchain's partners. Therefore, information transfer friction is erased, and manipulation is no longer allowed. In this platform, asset value is calculated based on its historical price, and trust among the participants is achieved through the blockchain technology.

A third case involves a Chinese agricultural company that developed a blockchain-based agricultural product traceability system to meet price competition. The company is an agriculture giant that owns more than fourteen million acres of farmland in northeast China, producing fine quality rice. But due to weather conditions, production was possible for only once a year. This created a competitive disadvantage with other countries. Although the extended growth cycle and prolonged exposure to sunshine produce better-quality agricultural goods, they also result in lower yields than places that can sustain cultivation close to 2/3-times per year. As a result, the cost of agricultural goods made in northeastern China is always higher than that of their rivals. To maintain the regional advantages and ensure high quality of rice production, the company has invested massive resources. Their blockchain solution provider equipped the farms with hundreds of sensors and handheld devices, which enable the digitalization of all its production processes. As a result, production investment on improving infrastructure building, employing of agricultural technologies to enhance its productivity, while taking place annually, succeeded in improving on cost-saving thereby making prices competitive.

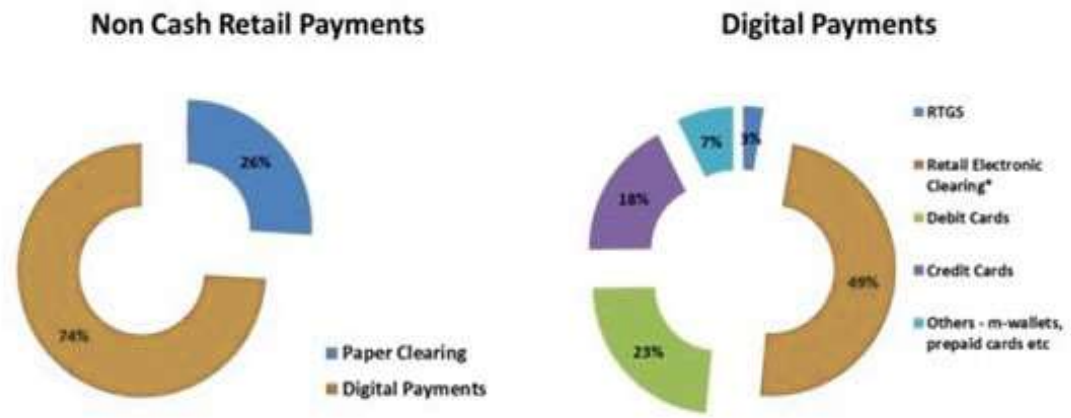
*Figure 6. Blockchain-based rice traceability system*



# 12 APPENDIX 3: Case Study - India

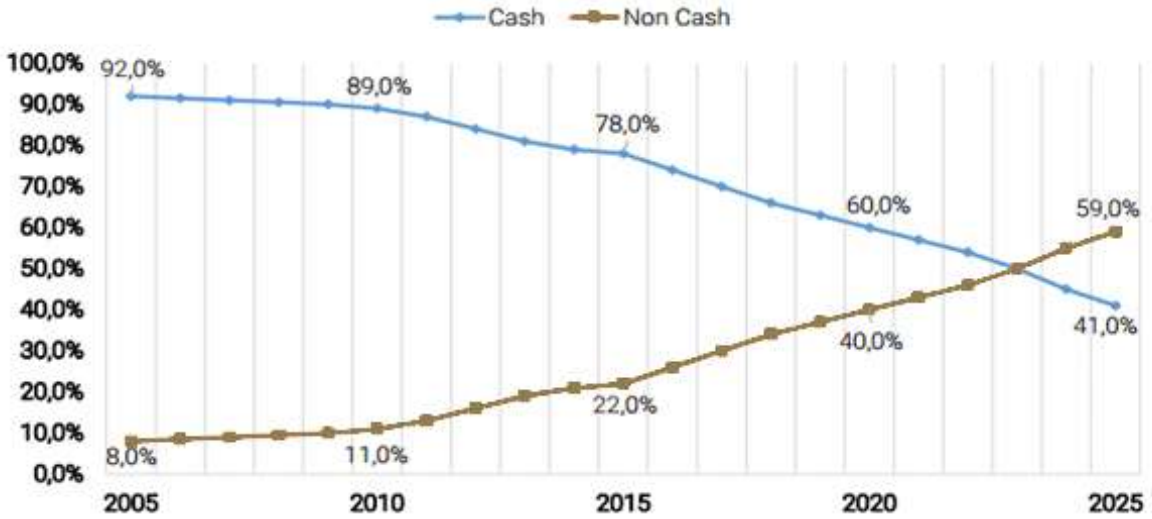
In 2020 India's digital payment system was valued at USD $500 billion. The digital payments sector has contributed 15% of India's GDP in four years' time. Official policies and behavioural trends are the primary drivers of this shift towards a cashless economy (Riju, 2016; Mahesh and Bhat, 2021). Enhanced internet connectivity and a high rate of smartphone penetration has shifted India's payments landscape to be digital. Flagship government initiatives, such as Digital India, have been key drivers of this change. India represents one of the largest market opportunities for digital payments. With a population of 1.3 billion, India accounts for 19% of the global population. India has 1.2 billion mobile phone subscribers and about 650 million internet users. 88% of the population prefer digital to cash payments, with 48% using digital payments for more than 75% of their transactions. More than 50% of India's internet users have adopted digital payments as of 2020, with the top 100 million users driving 70% of the digital payments Gross Merchandise Value (GMV). Ease of doing payments is one of the key factors of users to move towards digital payments.

*Figure 7. Changes in the digital payments landscape in India (RBI annual report)*




The digital payment landscape has seen substantial shifts in recent years. In 2016, the government announced a process of demonetization of INR500 and INR1000 paper bills. The percentage of cash transactions has since seen a rapid decline. In 2010, cash represented 89% of transactions compared with 60% in 2020 (Figure 8). This rapid decline is a result of an increased adoption of non-cash instruments, such as credit cards and digital payments such as mobile wallets and electronic transfers.

*Figure 8. Evolution of cash and non-cash transactions in India (RBI Annual Report 2020)*




There are four significant trends that are expected to change the digital payment landscape in the Indian scenario: going digital, promising regulatory conditions, rising NextGen payment service providers, and improved customer experience. Indeed, India is speedily evolving into a digital giant. Rising smartphone

penetration and internet access have meant that Indian users' stay connected. The expansion of digital financial payments is another indicator of this. The promising' regulatory conditions involve a continuous changing of the payment gateway space. The regulators have recognized the need for keeping pace with a constantly changing environment. More is required for the nation to flourish in the payments sector. Moreover, key regulatory interventions that have assisted the development of digital payments in India include the relaxation of KYC requirements for small transactions, the exception of some of the population from the two-factor authentication (2FA) requirement, the use of the Aadhaar-based mobile payment platform in making KYC easier, the implementation of a Unified Payments Interface (UPI) and the adoption of the Bharat Bill Payment System (BBPS)[22].

The Unified Payments Interface (UPI) has been an especially important innovation in India. In accordance with 'The Payments and Settlements System Act' of 2007's requirements to manage retail payments and settlement mechanisms in India's payment ecosystem, the Reserve Bank of India (RBI) plus the Indian Banks Association (IBA) formed the umbrella organisation known as the "National Payments Corporation of India (NPCI)". To facilitate digital payments NPCI developed the UPI. UPI is a digital payment mechanism created to carry out different banking tasks and retail company payments through any member bank's mobile application. "Peer to Peer (P2P)" blockchain technology collects payment requests, which can be arranged and charged according to need and convenience. Initially, the UPI was operationalized as a pilot launch with 21 banks, and included 227 banks as of June 2021, with a monthly volume of 2,807.51 million rupees. One can use any UPI client app, and a single app can be connected to multiple bank accounts using digital mechanisms.

Further, the increase in NextGen payment service providers represents a drastic change in the last three to four years in digital payments. The competitive digital payment landscape in India now involves telecom, banks, mobile wallets, and e-commerce with technology firms expected in the near future. Finally, enhanced customer experience means that Indian consumers are now used to a loftier experience owing to the popularity of e-commerce and are demanding a related experience in financial service providers as well. This includes unified access to bank account and payments, combined with rewards and fidelity.

# 13 APPENDIX 4: Case Study - Singapore

Singapore is one of the most advanced digital payment economies. In 2021 66.9% of Singapore's 5.6 million population shopped online. The Covid19 pandemic accelerated this trend with one-third of Singaporeans making their first online purchase in recent years. Singapore's distinctive character is a key driver of digital growth. It's a very small size country, of whose population 20% are ex-pats. Digital trends spread quickly, and everyone is educated in the same way and exposed to the same market conditions. Collectively, these things promote influencer trends, which are key e-commerce drivers.

Payment by QR code is the predominant payments form in the country. PayNow provides peer-to-peer (P2P) funds transfer and is available to customers of ten participating banks and three participating non-bank financial institutions. With QR codes, funds are made immediately available in the receiver's account. Businesses put QR codes on their tills for people to scan with a bank app. The result - instantaneous payment. You can use your smartphone if you do not have your card, and you can make use of the bank app if you do not have Apple or Google Pay. About 70% of online shoppers in Singapore usually shop via mobile app. Multi-use digital applications are also very popular. For instance, the Grab platform has a wallet payment called GrabPay, which can be used for multiple uses, such as taking taxis and ordering food. Additionally, there is a wallet option where you may store your credit cards, similar to Google Pay and/or Apple Pay.

In addition to regular card payments, there are many local payment methods. Customers can scan QR codes from street food market vendors as well. Payment is made right away and there are zero merchant fees or bank account links to wait for. In order to meet competition in order flow, Singapore-based merchants are keen to offer as many payment methods as possible and to make purchases fast

[22] https://www.firstpost.com/tech/news-analysis/industry-stakeholders-call-bhim-app-a-game-changer-for-cashless-payments-in-india-3695133.html

and simple. Because retailers compete on adaptability and straight-through processing, prospective purchases may be lost if a retailer does not accept a customer's preferred mode of payment. Thus, striving for competitive edge, merchants in Singapore want to offer the latest payment methods as soon as they appear and optimize payments to suit local businesses. Each region has unique local payment practices and preferences. Grab, PayNow and other alternative digital payment methods all have their place. Seeing a website, such as GrabPay, domestically or abroad, offering payment methods in local currency inspires local trust.

Singapore was named the nation with the best cryptocurrency policies by Cubcoin. The country has become particularly responsive to cutting-edge technologies as well as new corporate endeavours and initiatives as it has grown into a global financial centre. It is currently a tax haven and a major financial hub in the area as a result of banks and international firms entering the nation and tax rates being cut. Naturally, this has attracted fintech start-ups. Moving into crypto has been a logical step for Singapore and part of its financial ethos. The strength of Singapore is finance and being a centre for cryptocurrencies is an investment for the future. It should be noted that Singapore has neither any natural resources or agriculture. Traditional merchants have accustomed themselves extensively with digital payments and are moving fast to the adoption of cryptocurrencies as means of payment, which is also the case when they see crypto merchants based in the US.

A key innovative digital payment policy is “buy digitally now and pay later -BNPL” (Tan, 222). While still not widely practiced, it has a strong momentum. For instance, the Atome and Hoolah platform is very active with BNPL marketers, pushing their payment methods and creating demand. Similar to credit card 0% interest instalment plans, BNPL services let you split big ticket purchases into multiple small payments. Given rising global uncertainty, these digital means of payment become very attractive, as even if the trader can afford the full amount of the transaction, s/he might still want to pay by instalment just to free up cash flow for urgent use.

The BNPL policy uses the idea of ‘platform ecologies’ that combines the relational focus of financial ecologies with the logic of platform finance. It uses algorithmically driven modes of operating, which allows a flexible use of digital payment. It also allows the use of automated technologies of risk assessment and debt collection to govern borrowers and keep them digitally attached to their debts, where creditworthiness is continuously evaluated in response to user transaction and repayment data. However, there are inherent risks. The strategic use of psychological affect in framing BNPL services to satisfy immediate materialist consumption masks the fundamental nature of BNPL as debt, while the extensive use of BNPL services by unaware individuals with no credit history diving into opaque techniques of credit and risk management exacerbates the debt obligations. The implications of such data-driven practices in producing flexibility but also greater indebtedness needs proper supervision.

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